R&S®MR300xH/U
Tactical Radio
Operating Manual

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ROHDE&SCHWARZ

Radiocommunications Systems

Operating Manual

The documentation describes following tactical radios:

R&S® MR3000H — 6118.3000.yy — SW Rel. 190 / 09.0x (x = 0 to 9)
R&S® MR3001H — 6137.9300.yy — SW Rel. 190 / 09.0x (x = 0 to 9)
R&S® MR3002H — 6137.9400.yy — SW Rel. 190 / 09.0x (x = 0 to 9)
R&S® MR3003H — 6137.9500.yy — SW Rel. 190 / 09.0x (x = 0 to 9)

R&S® MR3000U — 6118.3500.yy — SW Rel. 190 / 09.0x (x = 0 to 9)
R&S® MR3001U — 6137.9600.yy — SW Rel. 190 / 09.0x (x = 0 to 9)
R&S® MR3002U — 6137.9700.yy — SW Rel. 190 / 09.0x (x = 0 to 9)
R&S® MR3003U — 6137.9800.yy — SW Rel. 190 / 09.0x (x = 0 to 9)

yy: see explanation of models

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Abbreviations

+J3E	single sideband, upper sideband, suppressed carrier
-J3E	single sideband, lower sideband, suppressed carrier
4285	STANAG-4285
4529	STANAG-4529
4539	STANAG-4539
A+D	audio (X4) and DAT (X5) connector, softkey
A1A	amplitude change signalling, no modulation, Morse telegraphy
A3E	amplitude modulation, double sideband and carrier
A3E WB	amplitude modulation, double sideband and carrier, wideband
A2G	automatic link establishment 2nd generation
A3G	automatic link establishment 3rd generation
ABD	autobaud, softkey
AC	alternating current
ACC	accept, softkey
ACK	acknowledgment
ACS	automatic channel selection
ACT	activity, softkey
ADD	address, softkey
AGC	automatic gain control
AGR	packet aggregation setting
AHS	advanced hopset, softkey
AIND	audio indication, softkey
AL	application level
ALE	automatic link establishment
ALE-2G	automatic link establishment 2nd generation
ALE-2G LP	automatic link establishment 2nd generation with linking protection
ALE-3G	automatic link establishment 3rd generation
ALM	automatic link maintenance
ALME	automatic link maintenance enable
ALQ	acceptance LQA
ALR	alert, softkey
ALT	altitude
AM	amplitude modulation, double sideband and carrier

AM WB	amplitude modulation, double sideband and carrier, wideband
AMBE	advanced multi-band excitation
AMD	automatic message display
AME	amplitude modulation, single sideband and carrier
ANE	automatic net entry, softkey
ANT	R&S designator for antenna connector
APP	approve
APR	auto push configuration request
APR	auto push request, softkey
APT	auto push time
ARQ	automatic repeat request
ASYN	asynchronous
ATU	antenna tuning unit
AUTH	authentication, softkey
BAT	battery, softkey
BAU	baud rate, softkey
BC	broadcast
BCA	broadcast, softkey
BER	bit error ratio threshold, softkey
BFO	beat frequency oscillator, softkey
BI	break-in, softkey
BIE	break-in enable, softkey
BIT	built-in test, softkey
BIT	BITE operation
BITE	built-in test equipment
BW	bandwidth, softkey
BYP	bypass, softkey
c	channel settings are changed
C	configuration
CA	collision avoidance
CAL	calibration, softkey
CALL	call, softkey
CB	continuous built-in test
CBIT	continuous built-in test

CCT	changing the call channel type, softkey
CFG	configuration, softkey
CCIR	Comité Consultatif International des Radiocommunications
CFGxC	CONFIG: global radio parameters
CFGxK	CONFIG: managing option keys
CFGxV	CONFIG: inquiring software version
CH	channel, softkey
CHN	channel, softkey
CHN	channel scanning
chnPs	channels per second
CHU	channel usage, softkey
CLF	clarifier, softkey
CLR	clear
CMT	comment, softkey
CNR	combat net radio
COMSEC	communication security
CON	connection, softkey
CON	continue, softkey
CONFIG	configuration
CR	connect request
CRP	controller reports position, softkey
CSCI	computer software configuration items, softkey
CSG	call scan group, softkey
CSMA	carrier sense multiple access
CTR	coarse time synchronization, softkey
CTR	controller
CTS	clear to send
CTT	continuous tone coded subaudio squelch, softkey
CVSD	continuously variable slope delta-modulation
CW	amplitude change signalling, no modulation, Morse telegraphy
CWH	CW holdtime, softkey
D	depth
DAQ	de-acquire, softkey
DAT	R&S designator for data connector
DAT	date

DC	direct current
DCK	docking, softkey
dd	day format
DDC	digital down converter
DDS	direct digital synthesizer
DEL	delete, softkey
DELA	delete all, softkey
dF	delta frequency, softkey
DFF	digital fixed frequency, softkey
DIG	digital
DIN	Deutsche Industrienorm
DLDxD	DOWNLOAD: loading pre-configured radio parameters
DLDxS	DOWNLOAD: loading software procedure
DLT	data link timeout, softkey
DLV	default link voice, softkey
DM	data modem
DPS	data / parity / stop, softkey
DR	data rate, softkey
DRF	draft, softkey
DSC	disconnect, softkey
DSP	digital signal processor
DT	date, softkey
DT	loading pre-configured radio parameters, softkey
DTE	data terminal equipment
DTMF	dual tone multi frequency
DTT	Doppler tracking time, softkey
E	error
E	even parity
E2PA	external power amplifier 2
E3PA	external power amplifier 3
EATU	external antenna tuning unit
EB	extended built-in test
EBIT	extended built-In test
EDT	edit, softkey
EMC	electromagnetic compatibility

EN	enable, softkey
ENT	enter
EOM	end of message, softkey
EPA	external power amplifier
EPM	electronic protection measures
EPS	external power supply
ESC	escape
ESSI	enhanced serial synchronous interface
ETH	Ethernet
ETHIF	Ethernet interface, softkey
EUROCAE	European Organization for Civil Aviation Equipment
EUROCOM	European communications
EXCH	exchange
EXL	exchange LQA, softkey
F/C	frequency / channel, softkey
F1D	frequency modulation, FSK (frequency shift keying), modem operation
F3E	frequency modulated carrier, voice transmission
F3E WB	frequency modulated carrier, wideband
FCS	free channel search, softkey
FE	fatal error
FE	frontend
FEC	forward error correction
FED-STD	Federal Standard
FF	fixed frequency
FH	frequency hop mode
FHS	free hopset search, softkey
FLM	FastLink mode
FLW	flow, softkey
FM	frequency modulated carrier, voice transmission
FM WB	frequency modulated carrier, wideband
FMT	format, softkey
FP	front panel
FRQ	frequency, softkey
FRQ	frequency scanning
FSK	frequency modulation, FSK (frequency shift keying), modem operation

FTR	fine time synchronization, softkey
G.711	ITU-T standard for audio companding
G/N	gateway/netmask, softkey
GB2PP	GB2 platform protocol
GEO	geographical
GHL	general hailing
GPS	global positioning system
GRP	group, softkey
GWY	gateway, softkey
H	high
H	high power consumption
H3E	amplitude modulation, single sideband and carrier
HAS	high-speed asynchronous
HDL	high data rate link protocol
HDP	HDL packets, softkey
HF	high frequency
HFM	HF modem
HGH	high
hh	hour format
HI	high
HLC	hailing channel
HLG	hailing general, softkey
HNG	hang, softkey
HOP	hopset, softkey
HTH	hailing threshold
IANA	Internet Assigned Numbers Authority
IB	initiated built-in test
IBIT	initiated built-in test
ICMP	internet control message protocol
ICNIRP	International Commission on Non-ionizing Radiation Protection
Ident.	identification
IETF	Internet Engineering Task Force
IF	intermediate frequency

IGMP	internet group management protocol
IL	interleaver, softkey
ILV	interleaver, softkey
IMP	immediately push, softkey
IN	input, softkey
INDV	individual, softkey
INS	insert, softkey
INT	internal
INT	interval, softkey
INTV	interval
INV	inverted
INV	invalid, softkey
IP	IP over Air
IP	internet protocol
IPA	air IP address, softkey
IPL	immediately pull, softkey
IPoA	IP over air
IPP	IP point-to-point, softkey
IPv4	internet protocol version 4
IQ	inphase/quadrature (modulation)
ISDN	integrated services digital network
ITU	International Telecommunication Union
ITU-T	Telecommunication Standardization Sector
J2D	single sideband, upper sideband, modem operation
KID	key seed ID, softkey
LAN	local area network
LAT	latitude
LBT	listen before transmit, softkey
LED	light-emitting diode
LBD	LDL bytes, softkey
LDL	low data rate link protocol
LDV	last ditch voice, softkey
Li	lithium

LIN	line
$LiSO_2$	lithium-sulfur dioxide
LKD	linked
LLE	late link entry
LLL	link on lower level, softkey
LM	link mode, softkey
LNE	late net entry, softkey
LNG	long
LO	local oscillator
LO	low
LOG	login operation
LON	longitude
LPL	linking protection level, softkey
LPM	linking protection, softkey
LQA	link quality analysis
LQM	LQA mode
LRN	learn, softkey
LSB	single sideband, lower sideband, suppressed carrier
LST	list, softkey
LSU	link setup, softkey
LTE	late traffic entry
LTH	link threshold
M	message service
M3SR	multiband multimode multirole surface radio
M3TR	multiband, multimode, multirole tactical radio
MAN	preset page selector: fixed frequency operation
MAX	maximum, softkey
MBL	message block length, softkey
MC	multicast
MCA	multicast call, softkey
MD	mission delete, softkey
MDE	mode, softkey
MDL	middle
MED	medium
MELP	mixed excitation linear prediction voice encoder

MELPe	enhanced mixed excitation linear prediction voice encoder
MEM	memory, softkey
MGC	manual gain control
MGRS	military grid system
MIL110-A	MIL-STD-188-110A
MIL110-F	MIL-STD-188-110F
MIL-STD	US Military Standard
MIN	minimum, softkey
MIX	combination of FH and FCS
mm	minute format
mm	month format
MMBE	modified multi-band excitation
MOD	modulation
MS	mobile sub-system
MS	master slave, softkey
MSG	message
MSS	maximum segment size
MST	maximum session time, softkey
MTU	maximum transmission unit
N	no parity
NATO	North Atlantic Treaty Organization
NCS	network control station
NE	net entry
NET	network
NHL	net hailing
NM	netmask, softkey
NMA	air netmask, softkey
NOT	notch, softkey
NRM	normal
NSYN	not synchronized
NTP	network time protocol
NXT	next, softkey
no.	number
O	odd parity

OBH	out of band hailing, softkey
OD	occupancy detection, softkey
OFDM	orthogonal frequency division multiplexing
OP	operation, softkey
OPM	operation mode, softkey
OPT	option, softkey
OSI	open systems interconnection
OUT	output, softkey
P	phone
P/S	PTT/squelch, softkey
P2P	point to point
PA	power amplifier
PABX	private automatic branch exchange
PAUS	pause, softkey
PB	power-on built-in test
PBIT	power-on built-in test
PBT	passband tuning, softkey
PC	personal computer
PDU	protocol data unit
Pend.	pending
PHB	phonebook, softkey
PHN	phone, softkey
PLL	phase locked loop
POL	polarity, softkey
PPP	point-to-point protocol
PRE	preamplifier, softkey
PRF	performance mode
PRIO	priority, softkey
PRT	port, softkey
PRV	previous
PRV	provider
PS	power supply
PSH	push
PSK	phase shift keying
PSTN	public switched telephone network

PTA	passive time acquisition, softkey
PtM	point to multipoint
PtP	point to point
PTRU	primary time reference unit
PTT	push to talk
PU	participating unit
PUL	pull, softkey
PWM	power management, softkey
PWR	power, softkey
R&S	registered trademarks of Rohde & Schwarz GmbH & Co. KG and their subsidiaries
R/F	rear/front, softkey
R/FT	rear/front threshold, softkey
R/S	run/stop, softkey
RAL	Reichs-Ausschuß für Lieferbedingungen
RAP	radio access point
RAU	radio access unit
RBC	rebroadcast application
RC	radio controller
RCB	radio control bus
RCD	re-connect delay
RCL	recall, softkey
RDL	remote device loader
Rebro	rebroadcast
RES	response, softkey
RET	retune, softkey
REN	range extension node
REQ	request
RF	radio frequency
RFC	request for commands
RFU	radio frequency unit
RGA	radio global address, softkey
RIT	relative idle timeout
RNG	range, softkey
RNMS	radio network management system
ROB	robust mode
ROL	role, softkey

RPT	report, softkey
RSS	received signal strength
RSSI	receive signal strength indication
RT	routing table, softkey
RTC	real-time clock
RTO	response timeout, softkey
RTP	real-time transport protocol
RTS	request to send
RTT	round-trip time
RTY	retry, softkey
RX	receive, receiver
S4285	STANAG-4285
S4529	STANAG-4529
S4415	STANAG-4415
S4538	STANAG-4538
S4539	STANAG-4539
S/N	signal-to-noise ratio
SA	standard asynchronous
SACK	selective acknowledgment
SAT	satellite
SC	scan
SC	sub carrier, softkey
SCG	scan group, softkey
SCH	SECOM-H
SCN	scanning, softkey
SCP	SECOM-P
SCV	SECOM-V
SCV	service, softkey
SDFF	secured digital fixed frequency
SDM	short data message
SDP	session description protocol
SDV	secure digital voice
SEC	secure, softkey
SECOM-H	for voice and data communication in the HF range which is protected by COM-SEC and TRANSEC procedures

SECOM-P	for voice and data communication in the VHF range which is protected by COMSEC and TRANSEC procedures
SECOM-V	for voice and data communication in the VHF/UHF range which is protected by COMSEC and TRANSEC procedures
SECU	security key
SEL	preselector
SEL	SELCAL, softkey
SEL	selection, softkey
SEL	selective, softkey
SEN	sensitivity, softkey
SELCAL	selective calling
SELCOM	selective communication
SF1	shift (F1D), softkey
SF3	shift (F3E), softkey
SFCS	secured free channel search
SFH	secured frequency hopping
SHT	short
SHW	show, softkey
SIG	signal, softkey
SIL	silent, softkey
SIN	signal-to-noise and distortion ratio, softkey
SINAD	signal to noise and distortion ratio
SIP	session initiation protocol
SMB	smart battery bus
SMIX	combination of SFH and SFCS
SND	sounding, softkey
Snd	sender
SNR	signal-to-noise ratio
SOD	synchronization on data, softkey
SP	search pattern, softkey
SPC	spacing, softkey
SQL	squelch
SQT	squelch type, softkey
SRC	source, softkey
ss	second format
SSB	single sideband modulation
SSG	scanning scan group, softkey

SSL	secure sockets layer
STANAG	NATO Standardization Agreement
STD	standard
STN	station
STO	store, softkey
STP	stop
STR	stream
STRT	start, softkey
STS	status, softkey
SUB	subtone, softkey
SVC	service, softkey
SYL	syllabic, softkey
SYN	synchronization, softkey
SYNC	synchronization
SYNT	synthesizer
TAQ	time acquisition, softkey
TB	time beacon, softkey
TCP	transmission control protocol
TCXO	temperature-compensated crystal oscillator
TDMA	time division multiple access
TERM	terminal
THD	threshold data, softkey
THV	threshold voice, softkey
TIM	time, softkey
TLC	transmitter level control, softkey
TM	time, softkey
TON	tone, softkey
TOS	type of service
TR	time synchronization
TRANSEC	transmission security
TRI	time request interval, softkey
TRM	terminate, softkey
TRS	transparent
TRU	time reference unit, softkey
TS	time server, softkey

TSC	time source, softkey
TTL	time to live
TUN	tune, softkey
TX	transmit, transmitter
UDP	user datagram protocol
UHF	ultra high frequency
USB	single sideband, upper sideband, suppressed carrier
UTC	coordinated universal time
UTM	universal transverse Mercator
UTR	unprotected time synchronization, softkey
UUF	user unique function
VAL	valid, softkey
VC	voice compression, softkey
VDE	Verband der Elektrotechnik, Elektronik und Informationstechnik eV
VEL	velocity
VER	version, softkey
VHF	very high frequency
VIL	voice interleaver
VOC	vocoder, softkey
VOI	voice
VoIP	voice over IP
VOX	voice operated transmission, softkey
VP	voice priority over IP data, softkey
VPA	VHF/UHF power amplifier
VPoIPD	voice priority over IP data
VSWR	voltage standing wave ratio
W	warning
W	width
WAN	wide area network
WARC	World Administrative Radio Conference
WAS	wide area subsystem
WF	waveform, softkey
WGT	weight, softkey

WLD	wildcard, softkey
WGS84	World Geodetic System 1984
xDL	ARQ protocols, x = H or L
XDM	xDL mode
XDP	xDL port setting
yyyy	year format

List of Terms

Check	In appropriate measurements by means of the specified test equipment, proper functioning of a unit or module is established.
Discolouration	Components such as connectors and printed circuit boards are examined if they have changed colour due to temperature effects and thus differ widely from their normal condition.
Disconnect	Pull off connector.
Examine	In case of trouble the unit / module or components such as e.g. connectors, are to be thoroughly checked for obvious mechanical damage.
Functional check	This means that components / modules / units are checked for proper functioning while installed.
Hazardous voltages	Voltages > 30 V_{rms} or 50 V_{pp} (AC) or 50 V (DC)
Make sure	Ascertain whether all mentioned requirements are met or all measures are taken to establish the required condition.
Open	Access is to be gained to the unit / module by observing the given instructions and safety precautions.
Perfect condition	This means that a component / module / unit has to be in a state which does not give cause to complaints.
Replacement	In case of trouble the replacement of modules is carried out in order to localize and eliminate the fault.
Replace	Components / modules / units which - due to damage and / or other defects - no longer meet the respective requirements or components / modules / units which during troubleshooting were identified as the cause of fault, are to be replaced.
Visual examination	This is a visual inspection of the outer appearance and completeness of a component / module / unit without manual interference by the examiner. This does not include the necessary preparations and finishing work such as opening and closing of covers or similar.

Safety Instructions

See the basic safety instructions (part of this documentation).

The three signal words used in this documentation have the following meaning:

WARNING

This heading is used to indicate that inaccurate observance or nonobservance of instructions or methods can cause injury or even fatal accidents or during an operation described hazardous material can be set free in the unit or system.

CAUTION

This heading is used to indicate that inaccurate observance or nonobservance of instructions or methods can cause damage to the unit.

NOTICE

This heading is used to draw the reader's attention to a particular fact.

Documentation Overview

The user documentation for the radio is divided as follows:

- Instruction Card
- Getting Started
- Operating Manual
- Service Manual (Intermediate Level, on separate order only)

NOTICE

The system delivered has the configuration as confirmed in the order.

NOTICE

Please use the ADOBE® Acrobat Reader® for PDF files.

Instruction Card

delivered with the radio

on separate order only

-/-

The Instruction Card provides basic information needed to operate the radio.

The Instruction Card is delivered with the radio in printed form.

Getting Started

delivered with the radio

on separate order only

-/-

The Getting Started manual provides the information needed to set up and start working with the radio. The Getting Started manual includes general information (e.g. Basic Safety Instructions) and the following chapters:

- Unpacking, Checking, Packing, Transport and Storage
- Installation
- Connect Procedures
- Pre-Operation
- Post-Operation

NOTICE

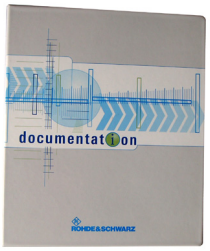
The Getting Started Manual is part of the Operating Manual!

This manual is delivered with the radio in printed form.

Operating Manual

delivered with the radio

on separate order only



In the Operating Manual, all radio functions are described in detail. It provides the information needed to maintain organizational level of repair.

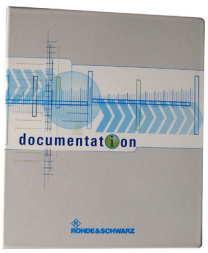
The manual includes the following chapters:

- User Information
- Getting Started
- Operation
- Operation in Special Communication Modes
- Services
- Malfunction
- Maintenance
- Technical Information
- Drawings

This manual is available in PDF format on the CD-ROM delivered with the radio.

The printed manual can be ordered from Rohde & Schwarz GmbH & Co. KG.

Service Manual (Intermediate Level, on separate order only)

delivered with the radio	on separate order only	
-/-		The Service Manual provides all information the service staff need to maintain intermediate level of repair. The manual includes the following chapters: • General Data • Construction • Function • Fault Isolation • Disassembly • System / Equipment Configuration • Spare Parts • Appendix
-/-		This manual is available in printed form and in PDF format on the CD-ROM. The printed manual and / or CD-ROM can be ordered from Rohde & Schwarz GmbH & Co. KG.

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1 User Information

This description deals with the following tactical radios:

- R&S MR3000H HF/VHF Tactical Radio
- R&S MR3000U VHF/UHF Tactical Radio
- R&S MR3001H HF/VHF Tactical Radio
- R&S MR3001U VHF/UHF Tactical Radio
- R&S MR3002H HF/VHF Tactical Radio
- R&S MR3002U VHF/UHF Tactical Radio
- R&S MR3003H HF/VHF Tactical Radio
- R&S MR3003U VHF/UHF Tactical Radio

The difference between the tactical radios are shown in the Table 1.1.

Table 1.1 Difference between the Tactical Radios

	R&S MR3000H	R&S MR3000U	R&S MR3001H	R&S MR3001U	R&S MR3002H	R&S MR3002U	R&S MR3003H	R&S MR3003U
Housing	X	X	X	X	X	X	X	X
Front Panel	X	X	X	X	X	X	X	X
Power Amplifier HF/VHF	X		X		X		X	
Power Amplifier VHF/UHF (6096.1101.03)		X[2 3 4 5]		X[4]		X[4]		X[4]
Power Amplifier VHF/UHF (6140.7340.02)		X[6]		X[6]		X[6]		X[6]
ATU3	X[2]							
ATU4	X[3 4 6]		X[4 6]		X[4 6]		X[4 6]	
RF Unit	X	X	X	X	X	X	X	X
Radio Controller (6098.9200.02)	X[2 3]	X[2 3]						
Radio Controller (6126.4877.02)	X[4]	X[4]	X[4]	X[4]	X[4]	X[4]	X[4]	X[4]
Radio Controller (6140.7240.02)	X[6]	X[5 6]	X[6]	X[6]	X[6]	X[6]	X[6]	X[6]
Line Interface	X[2 3]	X[2 3]						
Power Supply	X[2]	X[2]						
Power Supply II	X[3 4 6]	X[3 4 5 6]	X[4 6]	X[4 6]	X[4 6]	X[4 6]	X[4 6]	X[4 6]
Protection Processor			X	X			X	X
DSP Extension Board					X	X	X	X

[2] = model 02

[3] = model 03

[4] = model 04

[5] = model 05

[6] = model 06

In this documentation, "tactical radio" refers to the whole MR300x series. Differences are pointed out whenever necessary.

1.1 General Features

The tactical radio (general view: Figure 1.1) belongs to the series R&S M3TR (Multiband, Multimode, Multirole Tactical Radio), a completely new generation of high-performance digital radios. The R&S M3TR series represents a revolutionary change, both technically and economically, in the tactical communications sector. R&S M3TR offers solutions to all aspects of tactical communications as well as uniform and reduced inter-service logistics.

Figure 1.1 Tactical Radio

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With additional accessories the tactical radio provides data routing, switching capability and interfacing to tactical analog and digital networks, LAN and WAN networks, as well as to PCs and other data terminal equipment. It is therefore the ideal choice for multiple roles, network functions as well as subscriber stations for mobile command and control systems.

The tactical radio can be used in portable, vehicular and stationary applications including installations in movable containers and shelters. The rugged hardware complies with the relevant MIL standards dealing with environmental conditions. For the different applications a great variety of antennas is available. All functions of the radio station can be remote-controlled by a remote control unit or a PC.

The user interface is menu-oriented and easy to use. Its 11-step rotary switch for the operating mode provides direct access to the 10 most often used presets of the tactical radio. In position MAN only fixed frequency mode is possible. The presets assigned to positions 1 to 9 can be firmly programmed by the administrator. They contain a complete parameter setting of the selected net and net-specific adjustments. In switch position MORE, another 90 administrator-programmed settings are available. These presets are selected by using the keypad. All presets are comfortably prepared with a PC, using the R&S RNMS Radio Network Management System, and are loaded into the radio over the Ethernet interface before a mission starts. The link establishment thus is convenient and easy. The operator selects a mode (network), synchronizes all tactical radios in the net and activates the push-to-talk key or data transmission mode on the terminal. Other functions are available via hierarchically structured menus and context-sensitive softkeys. The control philosophy and the arrangement of control elements allow the radio to be controlled intuitively and under difficult conditions.

1.2 Explanation of Models

Model 02:

HF/VHF tactical radio, 0.5 to 10 W (HF: 20 W), internal GPS receiver, internal ATU (Antenna Tuning Unit), RS-232-C and Ethernet interface

VHF/UHF tactical radio, 0.5 to 10 W , internal GPS receiver, RS-232-C and Ethernet interface

Model 03:

HF/VHF tactical radio, 0.5 to 10 W (HF: 20 W), internal GPS receiver, internal ATU, RS-232-C and Ethernet interface, without software

VHF/UHF tactical radio, 0.5 to 10 W , internal GPS receiver, RS-232-C and Ethernet interface without software

Model 04:

HF/VHF tactical radio, 0.5 to 10 W (HF: 20 W), internal GPS receiver, internal ATU, RS-232-C and Ethernet interface, without software, with radio controller (6126.4877.02)

VHF/UHF tactical radio, 0.5 to 10 W, internal GPS receiver, RS-232-C and Ethernet interface without software, with radio controller (6126.4877.02)

Model 05:

VHF/UHF tactical radio, 0.5 to 10 W, internal GPS receiver, RS-232-C and Ethernet interface without software, with radio controller (6140.7240.02) and power amplifier VHF/UHF (6096.1101.03)

Model 06:

HF/VHF tactical radio, 0.5 to 10 W (HF: 20 W), internal GPS receiver, internal ATU, RS-232-C and Ethernet interface on front and rear (switchable), without software, with radio controller (6140.7240.02)

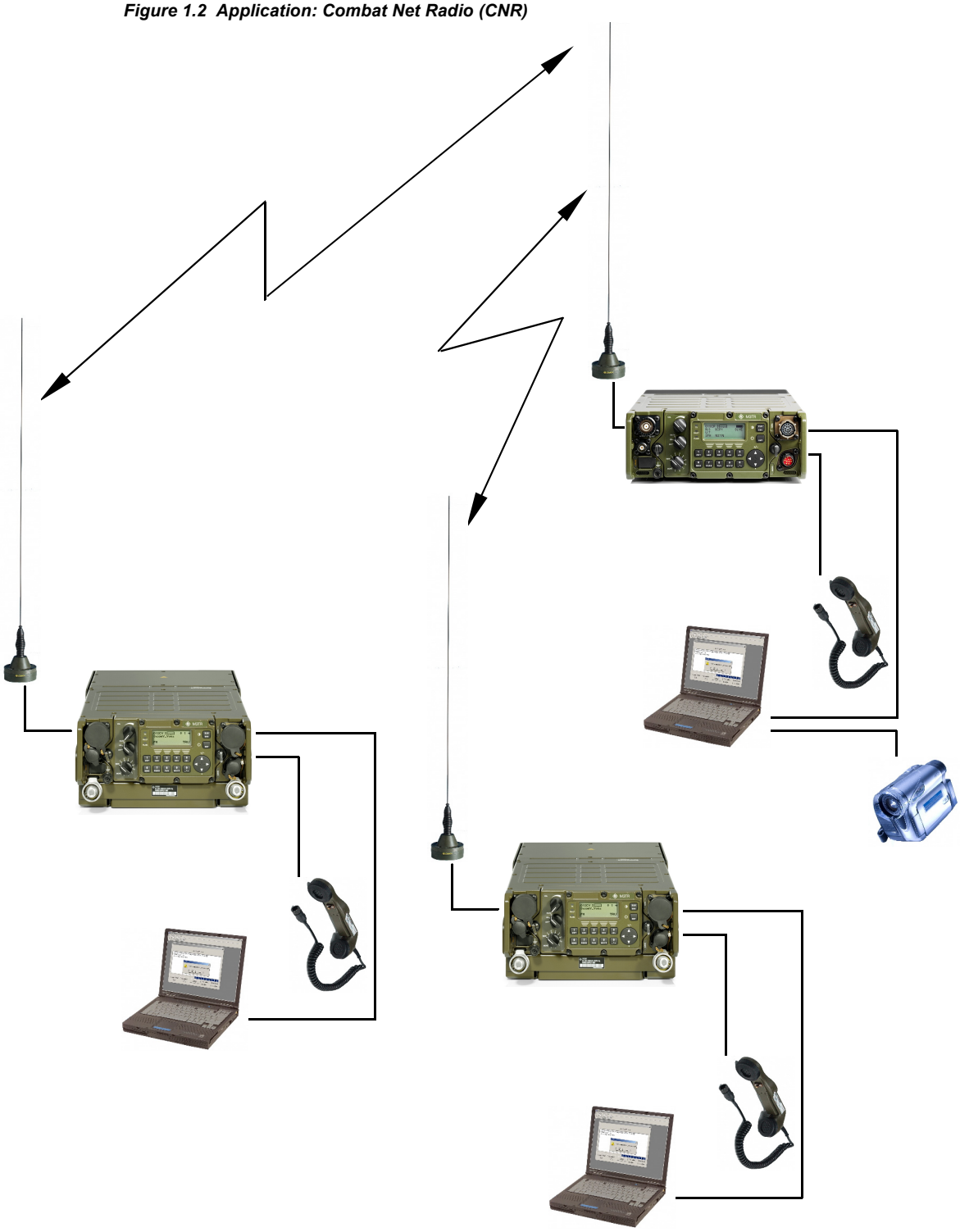
VHF/UHF tactical radio, 0.5 to 10 W, internal GPS receiver, RS-232-C and Ethernet interface on front and rear (switchable), without software, with radio controller (6140.7240.02) and power amplifier VHF/UHF (6140.7340.02)

1.3 Applications and Scenarios

Thanks to its functionality the tactical radio can perform the tasks of the participating units (PU) in a Mobile Sub-System (MS) such as

- Combat Net Radio (CNR) Figure 1.2 e.g. as terminal equipment for tactical use

Figure 1.2 Application: Combat Net Radio (CNR)



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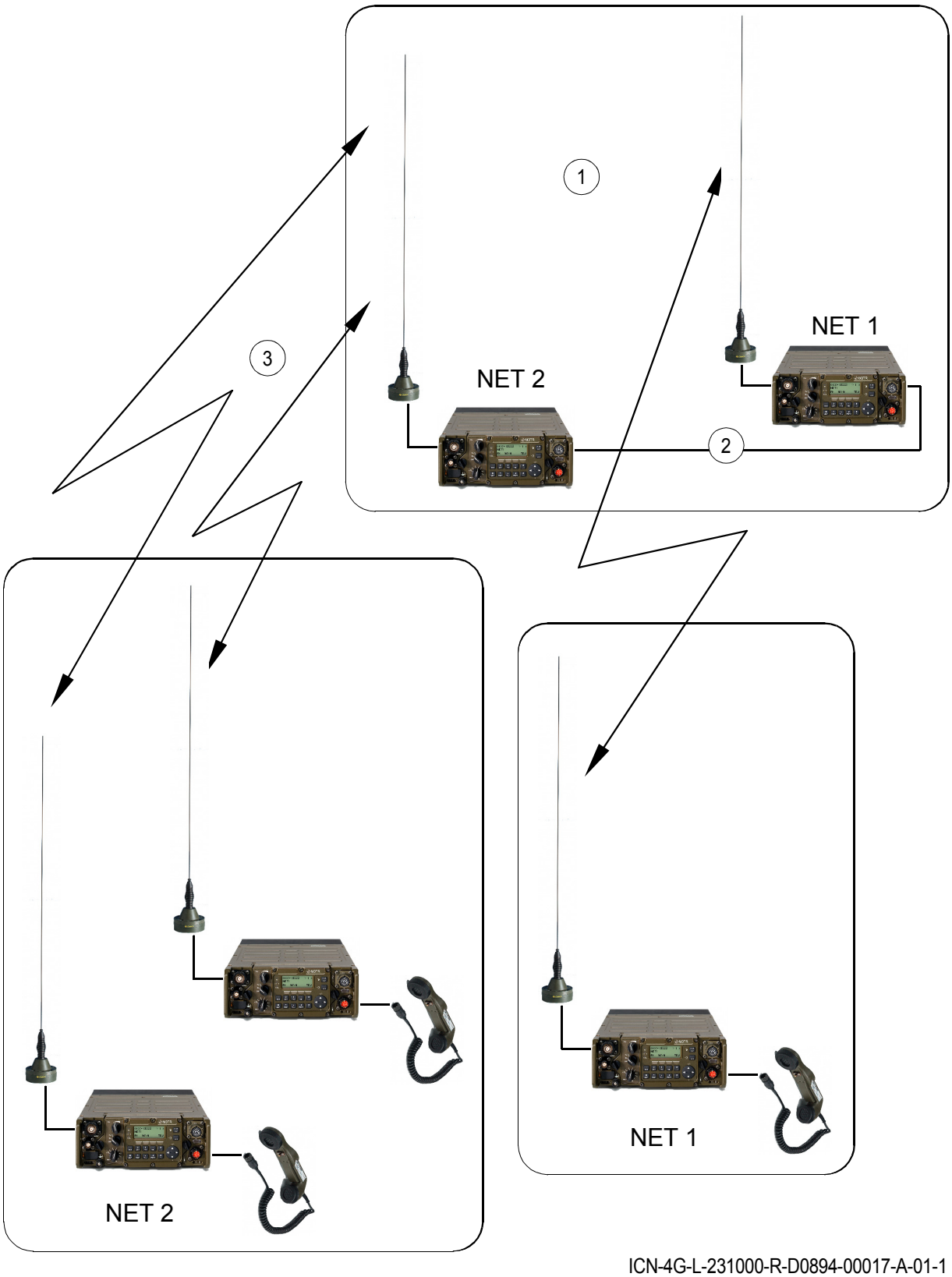
- Rebroadcast Application (RBC) Figure 1.3 e.g. for communication between two different nets

The tactical radio in net 1 is able to communicate with the tactical radios in net 2. Communication is possible in either direction.

Figure 1.3 Application: Rebroadcast Application



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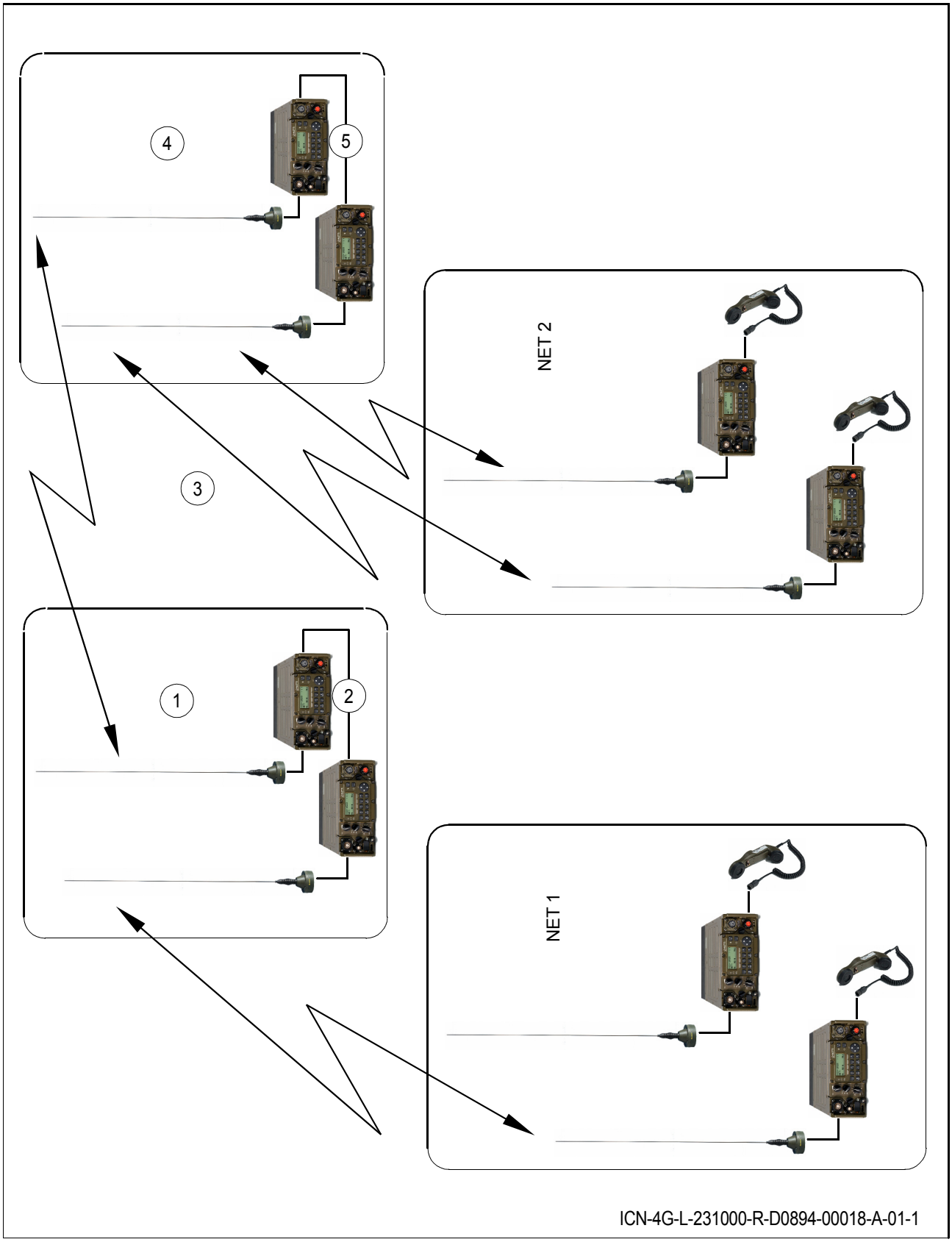
1 RBC station
2 Data link
3 Broadcast only

- Chain Rebroadcast Application Figure 1.4 — e.g. for communication between different nets with two RBC stations

All tactical radios in net 1 are able to communicate with the tactical radios in net 2. Communication is possible in either direction.

To keep matters as clear as possible, only a simplified connection is shown.

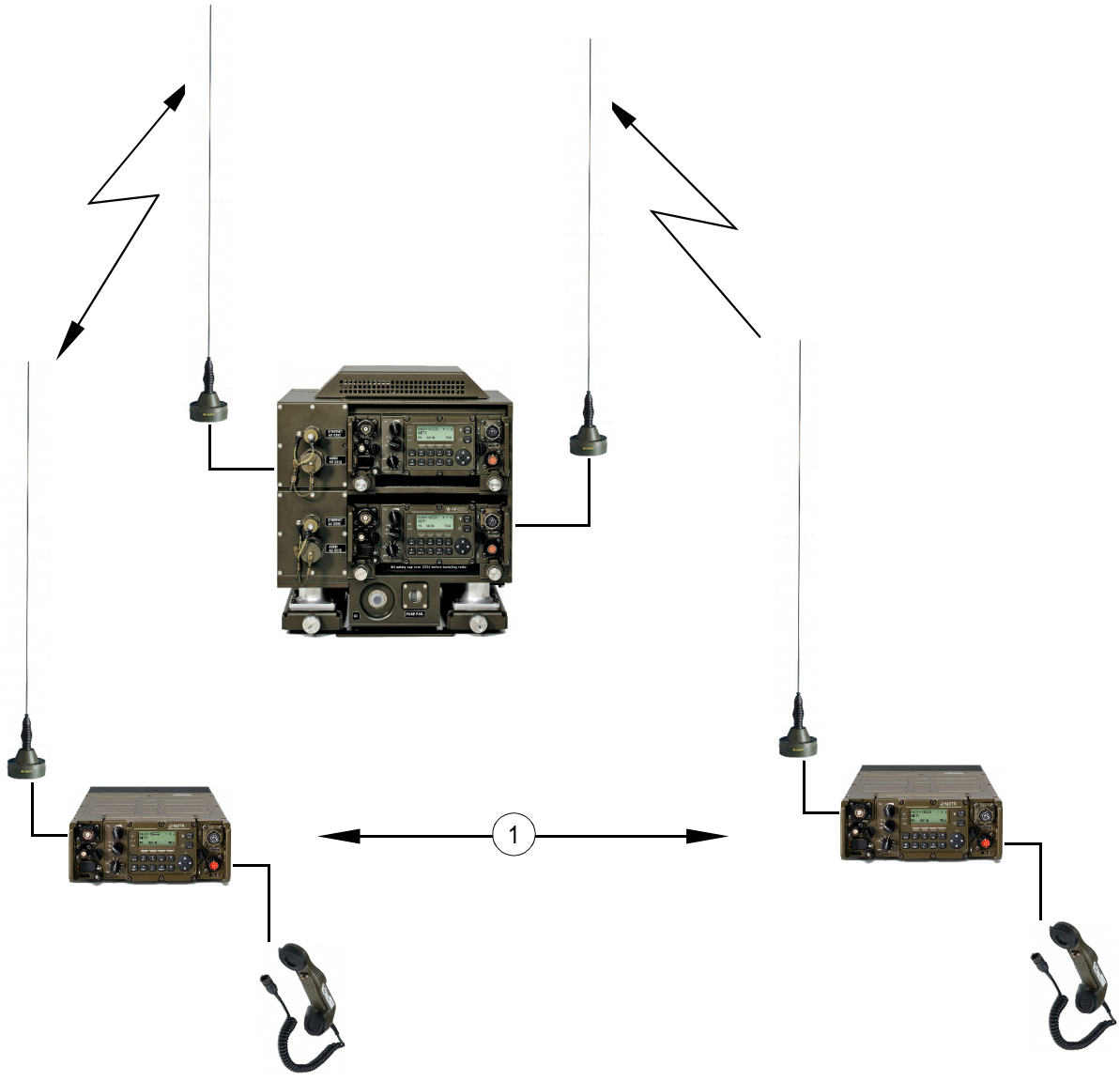
Figure 1.4 Application: Chain Rebroadcast Application



1 RBC station 1
2 Data link
3 Broadcast only
4 RBC station 2
5 Data link

- Range Extension Node (REN) Figure 1.5 e.g. to relay the communication within the same net

Figure 1.5 Application: Relay, Range Extension Node (REN)



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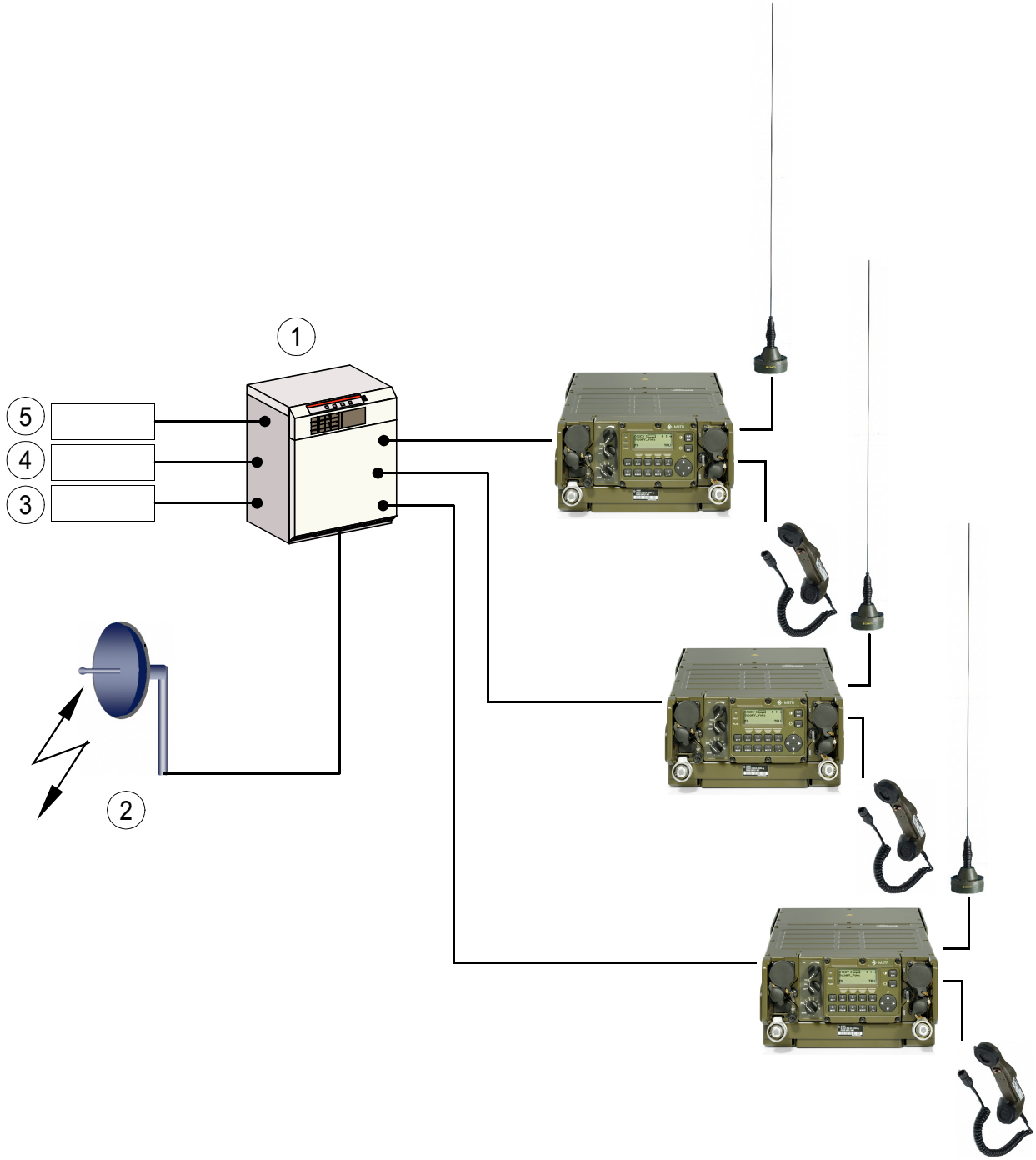
1 Long distance connection

- Radio Access Point (RAP) Figure 1.6 e.g. as base station within the net

Figure 1.6 Application: Radio Access Point (RAP)



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1 RAU (Radio Access Unit)
2 WAS (Wide Area Subsystem)
3 PSTN telephone net
4 EUROCOM (European Communication)
5 ISDN telephone net

1.4 Required Personnel

There are two different access levels for programming and operating the tactical radio, requiring different knowledge:

- Administrator level

  The administrator configures the radio. He needs to have good knowledge of the Radio Network Management System (RNMS), Fixed Frequency (FF), R&S SECOM-V, R&S SECOM-H, R&S SECOM-P, ALE (automatic link establishment), Fast Data and LAN applications

- Operator level

  The operator uses the pre-configured tactical radio. Only a short introduction is necessary.

1.5 Available DC Power Supply

The tactical radio is operated on a DC supply voltage in the range of 16 V DC to 33 V DC (19 V DC to 33 V DC fully specified).

1.5.1 Batteries

Two different types of batteries (general view: Figure 1.7) can power the tactical radio:

- R&S IB3002 Combat Battery ($LiSO_2$, non rechargeable, ident. no. 6118.0253.03) with 7.5 Ah
- R&S IB3001 Battery Pack (Li ion, rechargeable, ident. no. 6118.0201.03) with 5.5 Ah

The two batteries have the same size and volume, but different mass.

Combat battery:	1500 g
Battery pack:	1800 g

The operating time of the tactical radio depends on the battery and the mode of operation used in the frequency range. Assuming a duty cycle of 1:1:8 (receive:transmit:standby) at an RF power of 5 W for example F3E (VHF), an operating time of at least 20 h is achieved with the combat battery at 25 °C.

The batteries are equipped with an internal processor, which submits battery status parameters to the control processor of the radio via a standard Smart Battery Bus (SMB).

Figure 1.7 R&S IB3001 Battery Pack Li-ION

1.5.2 Battery Chargers

Two types of battery chargers are available, one for mainly stationary applications with 230 V AC supply, the second for vehicular applications with 10 V DC to 33 V DC supply voltage.

1.5.2.1 R&S IC3000 Fixed Installation Charger

(general view: Figure 1.8)

Supply voltage:	100 V AC to 240 V AC ±10% / 50 Hz to 60 Hz
Number of chargeable batteries:	up to 8
Chemistry of chargeable battery:	lithium ion
Dimension (H x W x D):	250 mm x 430 mm x 285 mm
Mass without battery:	11 kg
Ident. no.	6098.2257.02

Figure 1.8 Fixed Installation Charger

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1.5.2.2 R&S IC3001 Portable Charger

(general view: Figure 1.9)

Supply voltage:	10 V AC to 33 V DC
Number of chargeable batteries:	1
Chemistry of chargeable battery:	lithium ion
Dimension (H x W x D):	120 mm x 232 mm x 95 mm
Mass without battery:	2.2 kg

Figure 1.9 Portable Charger

1.5.3 Alternative Power Supply

In the vehicular version the tactical radio is installed for example in the R&S IV3001 Power Supply Unit (ident. no. 6149.3002.xx). Power is provided by the vehicular onboard mains.

In order to operate the system on a 230 V AC supply, a Power Supply of the type R&S IN2100 (ident. no. 6050.1996.xx) or R&S IN4000A (ident. no. 6105.5800.02, Figure 1.10) and the cable R&S GK3009 PS - Radio (ident. no. 6118.1608.xx) is required.

Figure 1.10 Power Supply

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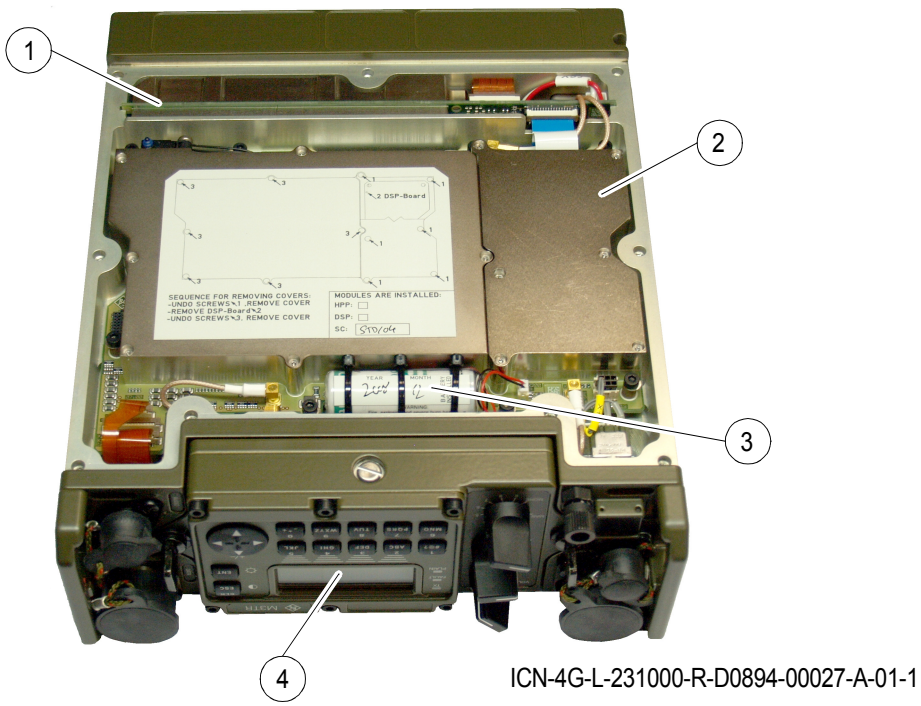
1.6 Design

The tactical radio consists of the following modules (Figure 1.11):

- Radio Controller (RC)
- HF/VHF Power Amplifier (PA, only R&S MR300xH)

  or VHF/UHF Power Amplifier (PA, only R&S MR300xU)
- Radio Frequency Unit (RFU)
- Front Panel (FP)
- Power Supply (PS)
- Line Interface (only models 02 and 03)
- Housing
- Antenna Tuning Unit (ATU, only R&S MR300xH)
- Protection Processor (only R&S MR3001H, R&S MR3001U, R&S MR3003H, R&S MR3003U)
- DSP Extension Board (only R&S MR3002H, R&S MR3002U, R&S MR3003H, R&S MR3003U)

Figure 1.11 Bottom View of Tactical Radio (without Cover)



1 Power Supply
2 Radio Controller with Protection Processor (only R&S MR3001H, R&S MR3001U, R&S MR3003H, R&S MR3003U) and/or DSP Extension Board (only R&S MR3002H, R&S MR3002U, R&S MR3003H, MR3003U)
3 Backup Battery
4 Front Panel

1.7 Functioning

The **Radio Controller** as a central module of the tactical radio (block diagram: Figure 1.12) controls the entire radio and handles all user voice and data services. The RC consists of a microcontroller with external memory, and two DSPs, control logic and GPS module. The control interface to the RF modules is the parallel Radio Control Bus (RCB). The control interface to the external modules is the serial radio control bus. The ESSI (Enhanced Serial Synchronous Interface) is the digital interface between digital IF processing on the radio controller (DSP1) and IF sampling/IQ modulation in the frontend.

The **HF/VHF Power Amplifier (only R&S MR300xH)** amplifies the transmit signal in the frequency range 1.5 to 108 MHz and filters out harmonics of the transmit signal. The **Antenna Tuning Unit (ATU)** as a part of the PA is responsible for antenna tuning in the frequency range 1.5 to 30 MHz.

The **VHF/UHF Power Amplifier (only R&S MR300xU)** amplifies the transmit signal in the frequency range 25 to 512 MHz and filters out harmonics of the transmit signal.

The **Radio Frequency Unit** consists of the synthesizer and the frontend. The synthesizer, which is controlled by a 10-MHz Temperature-Compensated Crystal Oscillator (TCXO), provides all necessary Local Oscillator (LO) and clock signals for the entire radio. The first LO is based on a Direct Digital Synthesizer (DDS) driven Phase Locked Loop (PLL) concept, providing extremely fine frequency resolution, whereas the second one is a PLL-based type. The frontend works with digital IQ modulation of the TX signal as well as with digitization of the second intermediate frequency. The TX signal generated and modulated at 455 kHz is mixed up in two steps to the required TX frequency. Afterwards it is amplified and filtered to attenuate spurious signals as well as noise. The RX signal is filtered, amplified and mixed down in three steps. The last down-conversion from 455 kHz to 48 kHz is done fully digitally by a Digital Down Converter (DDC).

The module **Front Panel** is a removable control unit. It consists of a keypad, a display, three rotary switches and a control circuit for the communication with the radio. The main function is to realize the MMI (Man Machine Interface) and an optional audio interface. The front panel can be taken off for detached operation, then using Extension Cable R&S GK3005.

The module **Power Supply** provides the required voltages with very high efficiency. It consists of synchronized low-distortion DC/DC converters to deliver the supply voltages for the internal modules including the power amplifier, the switch for power-on, the logic for control of voltages and filters for the supply voltages. EMC filters on the power supply are needed for all power supply and control lines to the rear connector.

In special operation modes, **Protection Processor R&S GP3001 (only R&S MR3001H, R&S MR3001U, R&S MR3003H, R&S MR3003U)** controls the tactical radio as regards frequency information and transmit/receive switchover.

The so called **DSP Extension Board (DSPx, (only R&S MR3002H, R&S MR3002U, R&S MR3003H, R&S MR3003U)** is located on the Radio Controller and is used for providing additional HF house functionality as e.g. ALE-3G or STANAG 4539.

Figure 1.12 Tactical Radio, Block Diagram

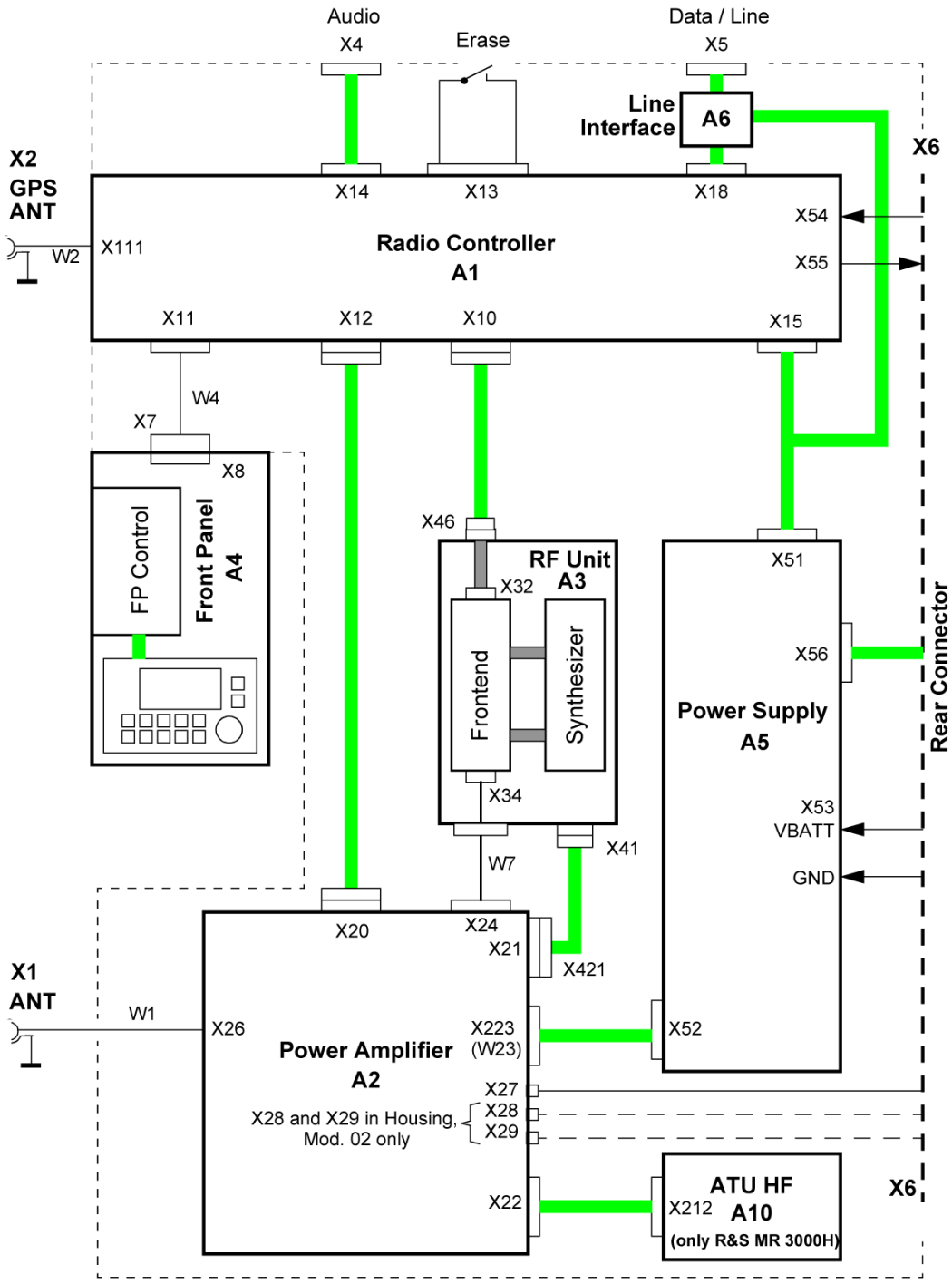


Fig. 1.14 Block Diagram

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1.8 General Description

1.8.1 Voice Communication

Voice transmission is possible in both digital and analog mode. Depending on the software configuration, the radio is able to transmit and receive the following signal modulations in the RF band (emission designators according to CCIR): Table 1.2

Table 1.2 Signal Modulations

Type of emission	Abbreviation (old)	Abbreviation (new, acc. to WARC 1979)
Amplitude change signalling, no modulation, Morse telegraphy	CW	A1A
Amplitude modulation, double sideband and carrier	AM	A3E
Amplitude modulation, single sideband and carrier	AME	H3E
Amplitude modulation, single sideband and reduced carrier	A3A	R3E
Amplitude modulation, double sideband and carrier, wideband	AM WB	A3E WB
Single sideband, upper sideband, suppressed carrier	USB	+J3E
Single sideband, lower sideband, suppressed carrier	LSB	-J3E
Single sideband, upper sideband, modem operation	Modem operation	J2D
Frequency modulated carrier, voice transmission	FM	F3E
Frequency modulated carrier, wideband	FM WB	F3E WB
Frequency modulation, FSK (Frequency Shift Keying), modem operation	FSK	F1D

Squelch Modes

The following squelch functions are incorporated:

- Carrier squelch RSSI (Receive Signal Strength Indication)
- 150-Hz tone squelch (according to STANAG 4292, VHF/UHF only)
- Signal squelch (like 150-Hz tone squelch, tone frequency selectable from a list)
- Syllabic squelch (voice operated squelch)
- Squelch off

Embedded Digital Voice Services (only in EPM mode)

For digital voice transmission four vocoders with code rates from 600 bit/s to 16 kbit/s, adapted to frequency bands and bandwidth, are implemented.

- AMBE
- MMBE
- MELP
- CVSD

1.8.2 Data Communication

The software-loadable modems provide for data communication in five modes:

- Fixed Frequency (direct FSK)

  The data interface provides adjustable data rates in steps of 150, 300, 600, 1200, 2400, 4800, 9600, 14400, 16000 bit/s. The data interface works in transparent mode.

- Optional R&S SECOM-V (16 kbit/s)

  R&S SECOM-V supports data rates of 600, 1200, 2400, 4800, 9600 and 16000 bit/s. FEC (Forward Error Correction) is used at all data rates below the maximum.

- Optional R&S SECOM-H (2.4 kbit/s)

  R&S SECOM-H supports data rates of 75, 150, 30, 600, 1200 and 2400 bit/s with FEC (Forward Error Correction).

- Optional OFDM (Orthogonal Frequency Division Multiplexing) modem

  The OFDM data modem with variable data rate (between 16 kbit/s and 72 kbit/s) and bandwidth is available for the VHF/UHF band. This modem operates in fixed frequency mode.

- Optional HF Data Modem (HF4285)

  The optional HF data modem in accordance with STANAG 4285 supports data rates of 3600, 2400, 1200, 600, 300, 150 and 75 bit/s, the higher rates being selectable with and without FEC. There are two interleaver length options (long, short).

1.9 General Data

See data sheets (sect. 9 Drawings)

1.10 Recommended Accessories

Refer to catalog 'The World of Radiocommunications' (part on the CD delivered with the radio).

2 Getting Started

2.1 Unpacking, Checking, Packing, Transport and Storage

2.1.1 Unpacking and Checking

After delivery carry out the following steps:

1. Check the packaging for damage.
2. Unpack the delivered goods.
3. Check the delivered goods (including accessories) against the delivery note.
4. Check the delivered goods for signs of transport damage.
5. Contact the shipping agent immediately, if damage is found.
6. Keep the packaging (box etc.) for later use, e.g. if the radio is to be sent to Rohde & Schwarz for service. You can find the current address of your representative on our homepage www.rohde-schwarz.com. Navigate to Service & Support / Service Locations.

2.1.2 Packing

Prior to any transport carry out the following steps:

1. Use the original package (box etc.) and packaging material, if possible, to prevent mechanical and electrical damage. Make sure that the stability of the packaging is adequate to the contents.
2. Put the unit in the plastic bag (protection against moisture and dust).
3. Put the unit in the package by using the packaging material. Avoid direct lateral contact between unit and packaging.
4. Seal the package.
5. Affix a HANDLE WITH CARE label on the package.
6. Remove the old address and shipment labels from the package and affix the new ones.

2.1.3 Transport

For data such as permissible altitude for air transport see the data sheet.

During transport provide sufficient mechanical and antistatic protection of the unit (see ”Packing” on p. 2.1)!

2.1.4 Storage

For data such as permissible storage temperature see the data sheet.

Store the unit in a dry dust-free place. Otherwise pack the unit (e.g. seal it in antistatic foil).

Unless otherwise specified, we recommend to put the unit into operation once a year for at least three hours. This helps to extend the unit's service life, in particular the durability of the electrolytic capacitors contained therein (by preventing disintegration of dielectric).

The unit contains a lithium battery which should be replaced once every three years. For further information see the Service Manual (to be ordered separately).

2.2 Installation

See interface descriptions (sect. 9 Drawings)

2.2.1 Installation for Vehicular or Stationary Applications

For details on how to install the tactical radio into the R&S KG3131A (R&S KG3031A) Single Docking Station or R&S KG3132A (R&S KG3032A) Double Docking Station refer to the relevant system description.

2.2.2 Installation of a Battery

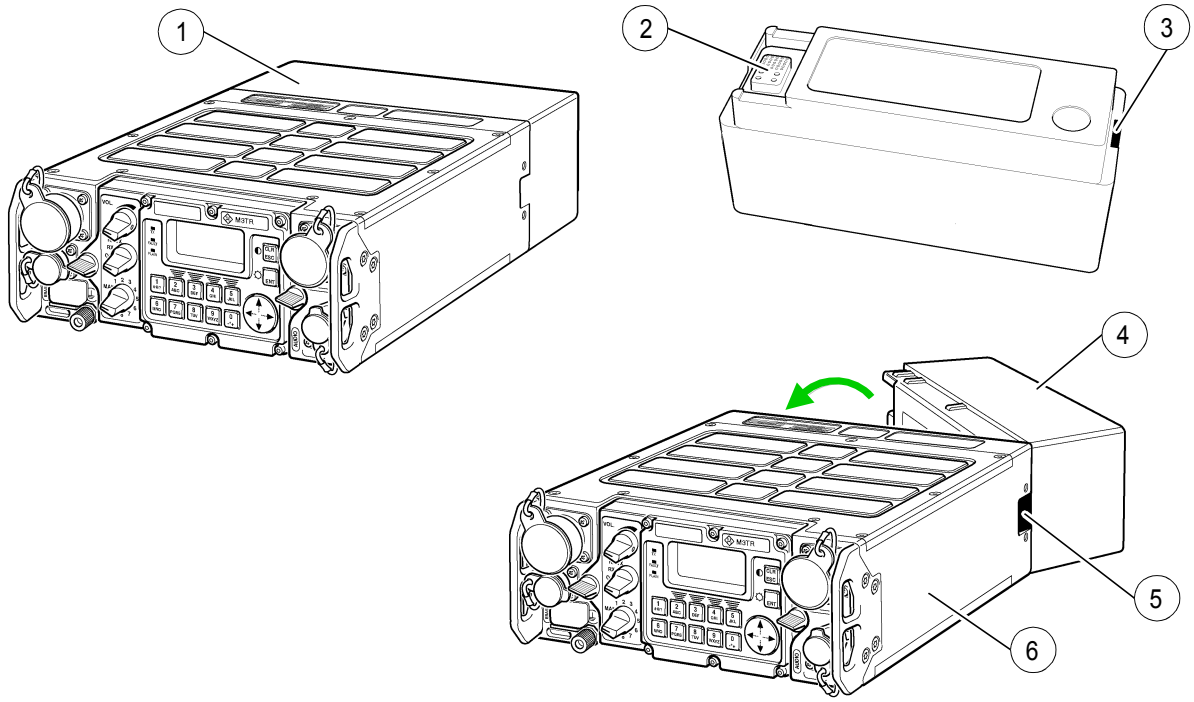
CAUTION

Dispose of used up R&S IB3002 Batteries in accordance with the relevant national regulations for special waste disposal.

R&S IB3001 Lithium Ion Batteries are rechargeable.

1. Unpack the battery.
2. Engage the catch of the battery into the recess of tactical radio: Figure 2.1.
3. Push the other end of the battery towards the battery connector on tactical radio and press in. Make sure the locking device of tactical radio is fully engaged.
4. Make sure that the battery is fully engaged.
5. To remove the battery press the locking device and fold the battery out sideways.

Figure 2.1 Battery Installation



ICN-4G-L-231000-R-D0894-00030-A-01-1

1 Locking device
2 Battery socket
3 Catch
4 Battery
5 Recess for catch
6 Tactical radio

2.3 Connect Procedures

See interface descriptions (sect. 9 Drawings)

2.3.1 Connection of Antennas

⚠ WARNING

Keep off the antenna while transmission is in progress. During transmission dangerous high voltages and electromagnetic fields are produced.

Respect the instructions of DIN VDE 0848-2 and the ICNIRP (international commission on non-ionizing radiation protection) Guidelines for non-ionizing emission (see www.icnirp.org).

⚠ CAUTION

Do not use the antenna as a handle to carry the radio!

In case of misuse the warranty shall be deemed forfeit.

⚠ CAUTION

Make sure the manpack system is properly grounded. Otherwise the operator may experience minor shocks while transmission is in progress.

Inadequate or improper grounding jeopardizes staff safety and may result in injury or even death.

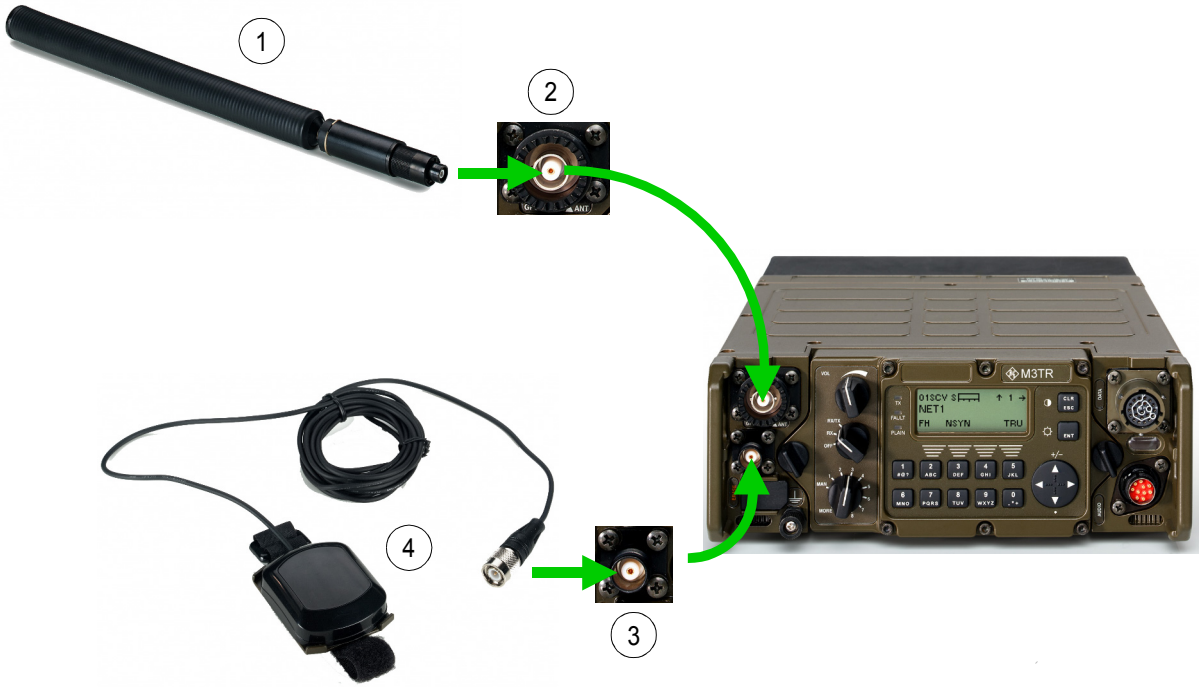
NOTICE

After connecting a GPS antenna the radio must be rebooted. GPS will not work (display NO SAT) before the radio is rebooted.

1. Remove the protective cap of the upper socket (Figure 2.2).
2. Plug the antenna onto the antenna terminal. The connector at the antenna has two longitudinal grooves fitting exactly into the antenna socket ANT of tactical radio.

3. Secure the antenna at tactical radio by means of the captive coupling ring (to be tightened manually, no tool required).
4. To connect the GPS antenna, remove the protective cap of the lower socket (GPS).
5. Plug the GPS antenna onto the antenna terminal. Turn clockwise until the stop is reached.

Figure 2.2 Antenna Connection



ICN-4G-L-231000-R-D0894-00031-A-01-1

1 Antenna
2 Socket ANT
3 Socket GPS
4 GPS antenna

2.3.2 Connection of Handset or Headset

1. Remove the protective cap: Figure 2.3.
2. Plug the cable plug onto the AUDIO socket (align the white markings at both plug and socket).
3. Press the handset cable plug firmly in, turning the cable plug to the right until the plug perceptibly engages (bayonet locking).

Figure 2.3 Handset Connection

ICN-4G-L-231000-R-D0894-00032-A-01-1

1 Handset
2 Socket AUDIO

2.4 Pre-Operation

2.4.1 Requirements

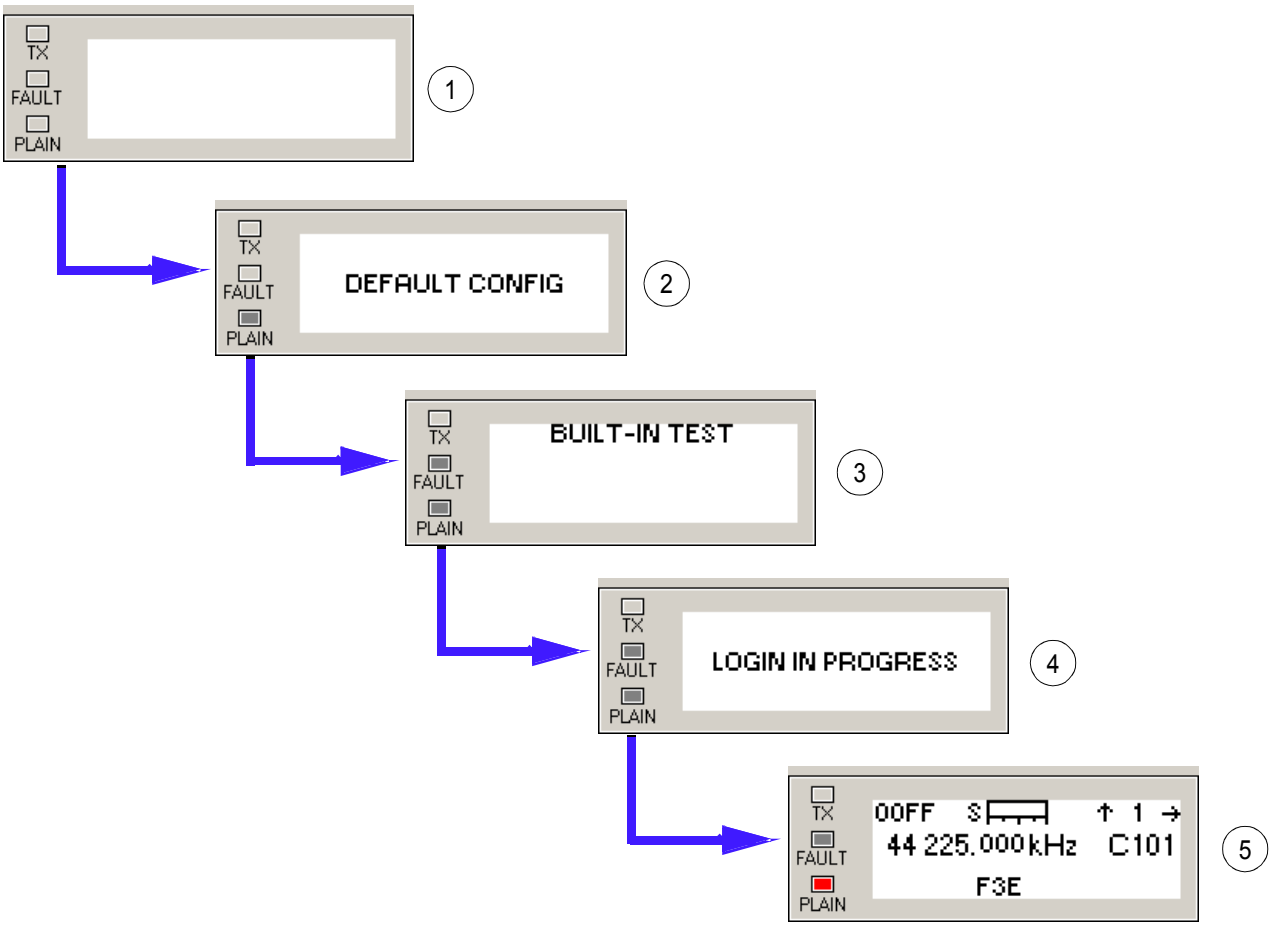
Before putting the tactical radio into operation make sure that

- a fully charged R&S IB3001 Battery or a new R&S IB3002 Battery is available (for manpack application).
- an HF/VHF antenna or VHF/UHF antenna is available, for example:
  - R&S HV3001 (ident. no. 6095.4507.02), 1.5 to 30 MHz, 25 W
  - R&S HV3002 (ident. no. 6128.1300.02), 225 to 400 MHz, 20 W
- a R&S GA3001 Handset (ident. no. 6098.2505.02) or R&S GA3002 Headset (ident. no. 6098.2605.02) is available.
- required option codes are installed.

2.4.2 Switching On

- When the Preset Page selector is in position MAN, the displays in Figure 2.4 appear.
- After error-free LOGIN all parameters of the tactical radio are set as before the last shut-down.
- If the Power-on Built-in Test (PBIT) detects a fault in the tactical radio, a message to this effect will appear directly. To continue the login process despite the fault, press the CLR/ESC key (repetitively, if necessary). For details on PBIT refer to sect. 6.2 Troubleshooting utilizing BIT.

Figure 2.4 Switching from OFF to RX or RX/TX



ICN-4G-L-231000-R-D0894-00035-A-01-1

1 Radio is switched off
2 Activating default setting
3 Built-in test
4 Auto login
5 Setting before last shut-down

2.4.3 Automatic Update

The R&S M3TR Radios test the firmware versions of internal modules and connected devices after switching-on. If any old or wrong versions are found, an automatic update is offered to ensure optimal performance of all components. If no choice is made within 30 seconds, the radio continues its boot process as usual.

If the update process is not performed, one or more warnings may indicate the wrong module / device versions after startup. In addition, the error list will contain a message "UPDATE NEEDED".

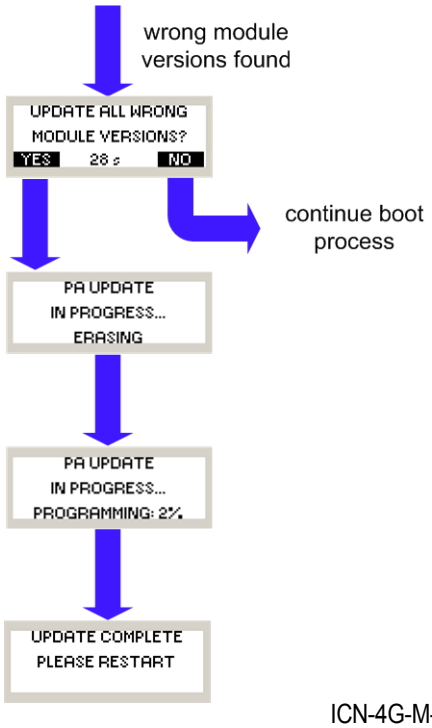
NOTICE

As long as the update is offered, only a reduced set of remote commands is available. Please refer to the remote interface documentation for details.

Automatic update is supported for the following modules / devices:

- internal HF/VHF power amplifier
- internal VHF/UHF power amplifier
- internal frontend
- internal synthesizer
- accessories, e.g. antenna tuning units, antennas and power amplifiers (see catalog 'Secure Communications' (part on the CD delivered with the radio))

Figure 2.5 Example of the Automatic Update Process of a Power Amplifier



ICN-4G-M-231000-R-D0894-00077-A-01-1

When the update process is finished, turn off all components for at least 15 seconds in order to activate the new firmware.

NOTICE

The update process can take several minutes to finish. Unless immediate communication is required, it is recommended to carry out the necessary updates in order to ensure optimal performance.

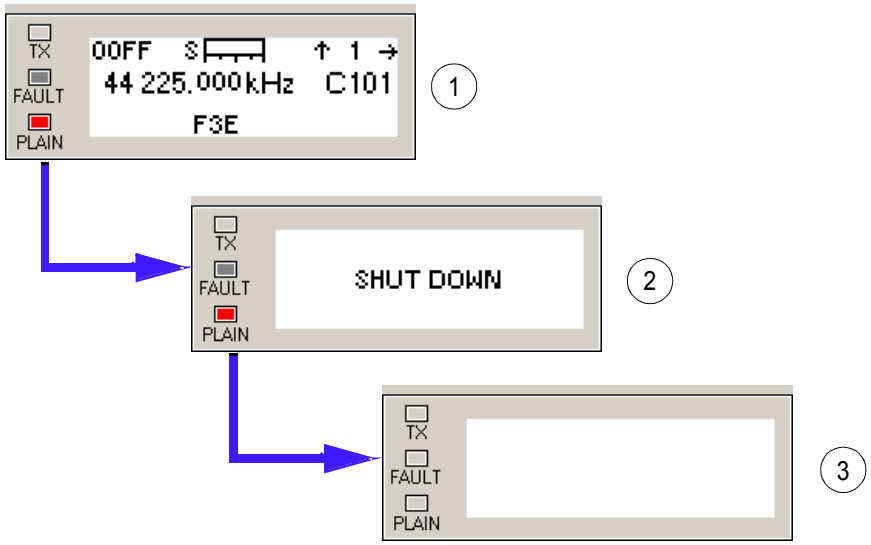
2.5 Post-Operation

CAUTION

Do not actuate either channel or mode switch while the message 'SHUT DOWN' is displayed!

When turning the mode switch to OFF, the displays in Figure 2.6 appear.

Figure 2.6 Switching from RX or RX/TX to OFF



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1 Current setting
2 Shut-down
3 Radio off

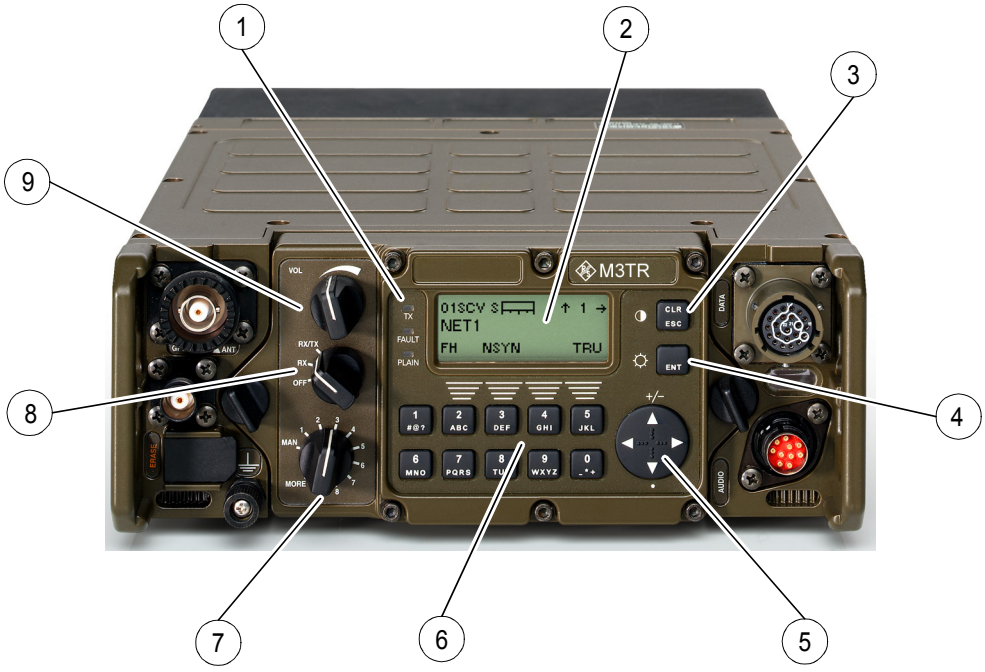
3 Basic Operation

3.1 Controls and Indicators

3.1.1 Control Elements

- **Keys and Switches on Front Panel (Figure 3.1)**

Figure 3.1 Keys and Switches on Front Panel



ICN-4G-L-231000-R-D0894-00033-A-01-1

1 Status LEDs, TX, FAULT, PLAIN
2 Alphanumerical display
3 CLR/ESC key and display contrast control key
4 ENT Key and display brightness control key
5 Menu navigation key
6 Alphanumerical keypad
7 Preset page selector
8 Mode switch
9 Volume control

- **PTT Key on Handset (Figure 3.2)**

Figure 3.2 PTT Key on Handset

ICN-4G-L-231000-R-D0894-00048-A-01-1

1 Key PTT (Push to Talk) for switchover from receive to transmit mode

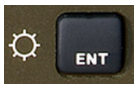
NOTICE

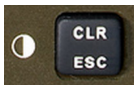
This is PTT for voice operation (PTT1).

Key PTT is only active if the radio is set to Audio modes and in Rx/Tx mode (1, Table 3.1).

3.1.2 Brief Description of Control Elements on the Front Panel

Table 3.1 Control Elements on the Front Panel

Item	Control	Action	Note
1		Set the mode switch as required.	**OFF:** The radio is switched off. **RX:** The receive function is enabled. The transmit function is disabled. **RX / TX:** The transmit and receive functions are enabled.
2		Enter numerical/alphanumerical characters. or Select special functions via softkeys.	An entry may be e.g. a frequency or any other operational data. Keys 2 to 5 are context-sensitive, i.e. they are also used as softkeys depending on the menu. The relevant softkey labels are indicated in the bottom line of the display.
3		Press.	The ENT key is used to confirm entries made via the numerical keypad, adopting the new value and returning to the next higher menu level. In case of an invalid input the edit mode is retained and an approximated admissible value is suggested, which can be accepted or changed. Also, as long as you keep pressing the ENT key, the display brightness continually increases or decreases.
4		Set the Preset Page selector as required.	**MAN:** Fixed frequency operation **1 to 9:** Communication mode settings are called up directly. **MORE:** Communication mode settings are called up via editor (10 to 99) and numerical keys.

Item	Control	Action	Note
5		Turn the volume control as required.	Low volume: Turn counter-clockwise Full volume: Turn clockwise **NOTICE** **The volume control is used to adjust the output level of Rx signal and sidetone.**
6		Press.	This key has several functions: • In edit mode it clears any numerical entry preceding the cursor (CLR). • It calls the next higher menu level of the menu structure (ESC). • It quits a submenu, abandoning any changes made. • As long as you keep pressing the key, the contrast continually increases or decreases.
7		Press.	This key has several functions: • It is used to navigate in the menus. • It is used to edit any entries made via the numerical keypad.

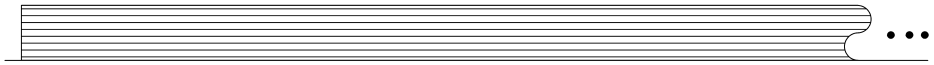
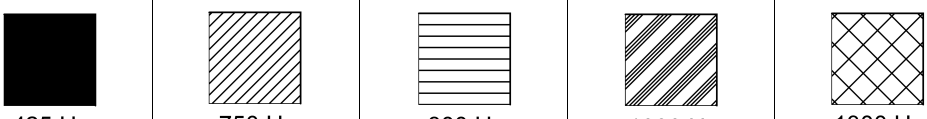
3.1.3 Messages of Status LEDs

Table 3.2 Messages of Status LEDs

LED	Colour	Note
TX	green	Receive operation
TX	red	Transmit operation, power available at antenna
TX	off	Squelch active, no valid signal is received
Fault	off	Tactical radio is operative
Fault	red	**CAUTION** **Device isn't fully operative!**
PLAIN	off	Encrypted transmit/receive operation
PLAIN	red	Plain transmit/receive operation

3.1.4 Tones

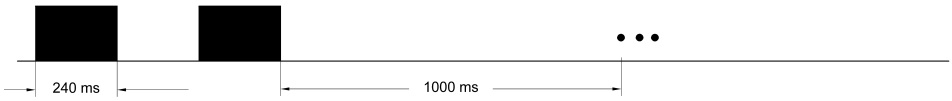
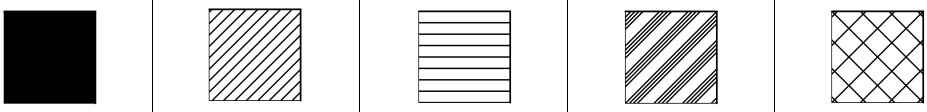
Table 3.3 General Tones

Name	Timing Diagram	Audio [1]
Busy		
Alarm Message Received		
Error		
Notification / Confirmation		
Net Entry Request		
Battery Low		
		

... = Repetion until condition is over.

[1] Only available on CD.

Table 3.4 Phone Tones

Name	Timing Diagram	Audio [1]
Busy		
Ringback		
Call Waiting		
PTT active		
Connected		
		

... = Repetion until condition is over.

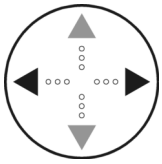
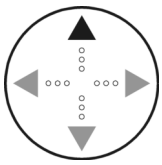
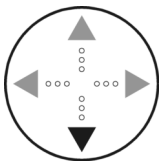
[1] Only available on CD.

3.1.5 Navigation Philosophy

Menu navigation is based on a uniform concept used throughout the software, i.e. wherever you are in the menu tree the same keystrokes will you bring forward, back, up or down. The four cursor control keys are the central navigation elements. The ENT and the CLR/ESC key as well as the softkeys (2 to 5) also have navigation functions.

Navigation is supported by the display: Arrows in the top line indicate whether it is possible to move forward to the next page of the same menu level or back or up to the next higher level. Softkey labels (bottom line of display) shown in black colour indicate that the underlying function is available for selection or editing of values.

Table 3.5 Navigation Philosophy

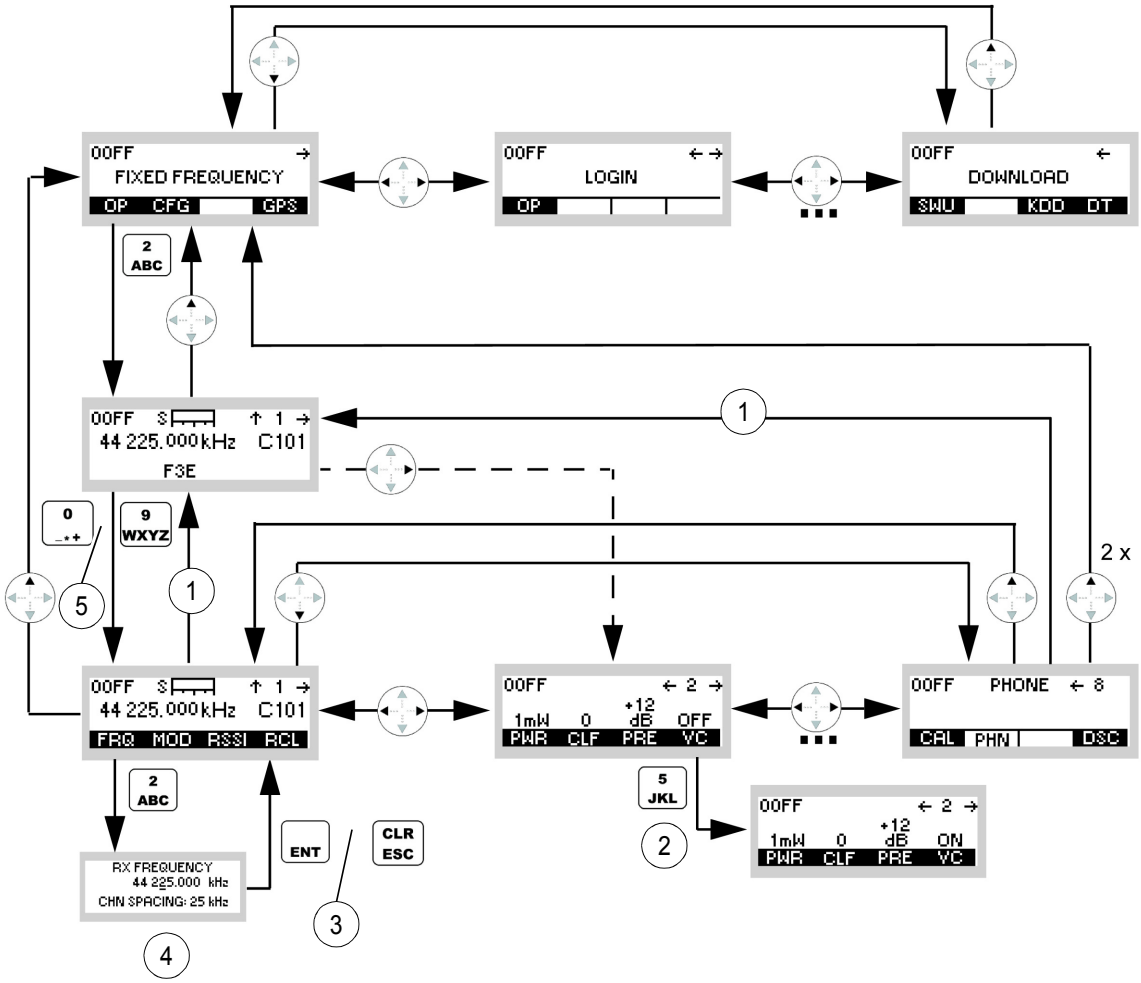
Navigation key	Function
	Move to next/previous page of same menu level
	Move back to first page of same menu level If first page is already selected: move upward to next higher menu level If pressed twice in any menu: move up to main menu
	Move to last page of same menu level
2 ABC to 5 JKL	Move to submenu, open editor/selection window
ENT	In edit mode: confirm entry and return to next higher menu level

Navigation key	Function
CLR ESC	In edit mode: abandon new entry and return to next higher menu level

Figure 3.3 shows these actions for an example in Fixed Frequency Operation.

Figure 3.4 shows these actions for an example in Fixed Frequency Configuration.

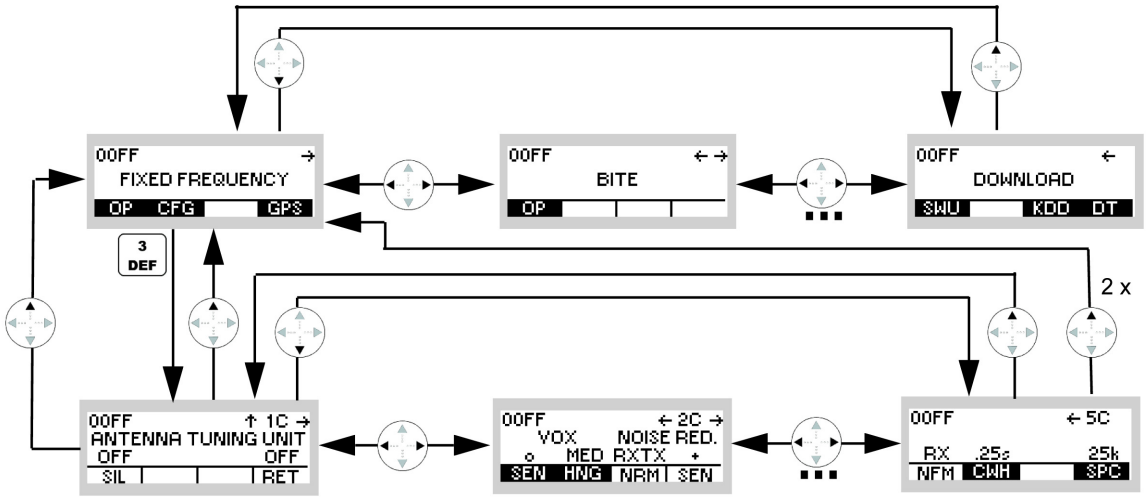
Figure 3.3 Example of Fixed Frequency Operation



ICN-4G-A-231000-R-D0894-00040-A-01-1

1 approx. 10 s
2 Toggle Function
3 or
4 RX Frequency Editor
5 to

Figure 3.4 Example of Fixed Frequency Configuration

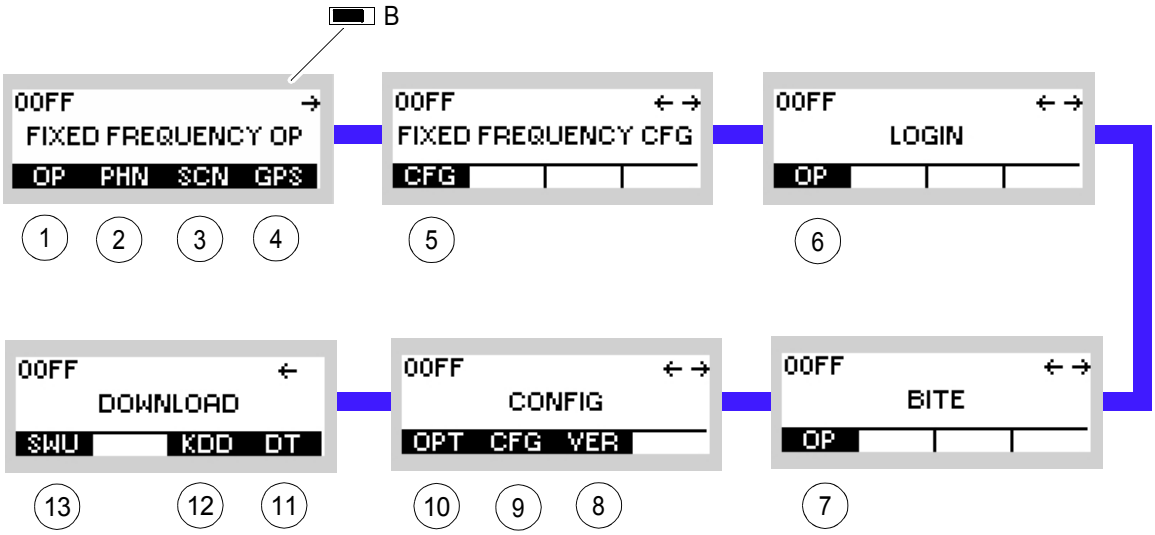


ICN-4G-A-231000-R-D0894-00041-A-01-1

3.2 Fixed Frequency

3.2.1 Preset Page FF (Fixed Frequency)

Figure 3.5 Preset Page Fixed Frequency (FF)



ICN-4G-N-231000-R-D0894-00042-A-01-1

B Battery symbol, if a battery is connected.
Battery Indication
- No indication
  Remaining battery capacity approx. > 15%
- Blinking battery symbol and beep tone every five min.
  Remaining battery capacity approx. 15% to 3%
- Blinking battery symbol and double beep tone every min.
  Remaining battery capacity approx. < 3%

1 sect. 3.2.2 Settings in the Menu OP (FIXED FREQUENCY OP, Operation)
2 sect. 3.3.2 Settings in the Menu PHN (FIXED FREQUENCY OP, Operation)
3 sect. 3.4.2 Settings in the Menu SCN (FIXED FREQUENCY OP, Operation)
4 sect. 5.2.2.1 Display of the Own GPS Position
5 sect. 3.3.3 Settings in the Menu CFG (FIXED FREQUENCY CFG, Configuration)
6 sect. 3.5 Login
7 sect. 6.2.6 Settings in Menu OP (BITE, Operation)
8 sect. 3.7.2 Settings in Menu VER (CONFIG, Inquiring the Software Version)
9 sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters)
10 sect. 3.3.3.11 Changing the Channel Spacing
11 sect. 3.7.3 Settings in Menu DT (DOWNLOAD, Loading Pre-configured Radio Parameters)
12 Not relevant in this application.
13 This function is described in the service documentation.

3.2.2 Settings in the Menu OP (FIXED FREQUENCY OP, Operation)

Starting Point:

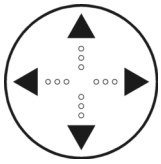
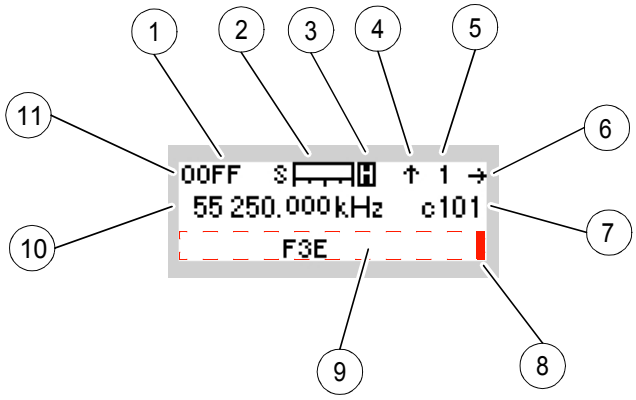
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes, e.g.: **NOTICE** **For further information see Figure 3.6 and Figure 3.7.**
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes, e.g.:
3		Press.	Press several times until the desired subordinate menu is activated (see Figure 3.8). The menu structure is explained separately by Figure 3.9. After a delay of approximately 10 seconds, the FF operational page 1 is automatically reactivated.

Figure 3.6 Fixed Frequency Operational Page 1 (Rx Mode)



ICN-4G-N-231000-R-D0894-00071-A-01-1

1 Stored operation mode
   - A3G = ALE-3G
   - A2G = ALE-2G
   - DM = Data Modem
   - FF = Fixed Frequency
   - HFM = HF Modem
   - HQ = Have Quick
   - SCH = SECOM-H
   - SCP = SECOM-P
   - SCS = SECOS
   - SCV = SECOM-V
   - SDV = Secure Digital Voice
2 Input signal level (RSSI)
3 Power save mode: 'H' means high power consumption
4 Return to main menu of FF is possible
5 Page 1x of submenu
   - blank = Operation
   - C = Configuration
   - GPS = GPS Reporting
   - IP = IP over Air
   - M = Message Service
   - P = Phone
   - SC = Scan

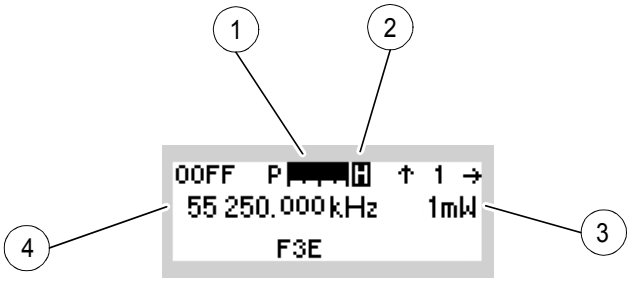
Page y1 of submenu
- BIT = BITE operation
- LOG = Login operation

Page CFG1x of configuration submenu
- K = Option keys
- C = Global radio parameters
- V = Software version

Page DLD1x of download submenu
- S = Software
- K = SECOS or HQ Presets
- D = Presets

6 Further menu of same menu level available
7 Channel number settings for fixed frequency. The 'c' signals that the channel settings are changed.
8 Status information or spontaneous messages available, to display them press CLR/ESC key
9 Status information and spontaneous messages if no button is displayed. Here current modulation mode
10 Effective RX frequency
11 Selected preset page

Figure 3.7 Fixed Frequency Operational Page 1 (Tx Mode)



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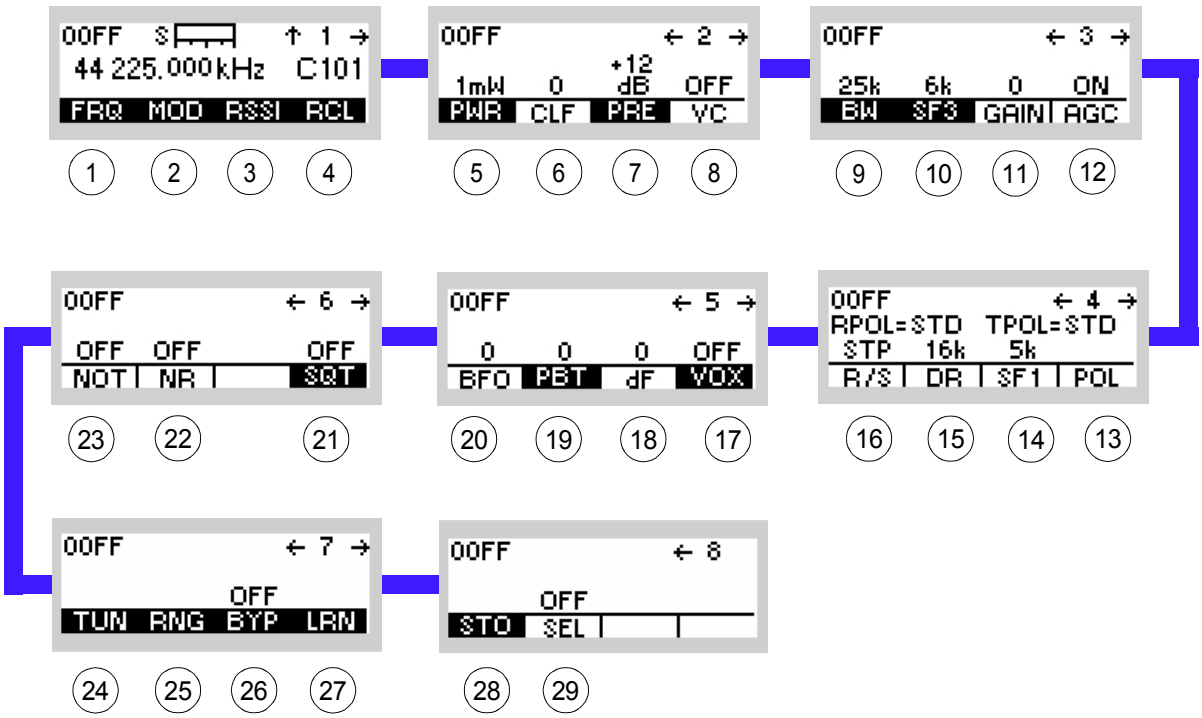
1 TX power level
2 Power save mode: 'H' means high power consumption
3 TX power level
4 Effective TX frequency

Figure 3.8 Menu OP (FF, Submenus)



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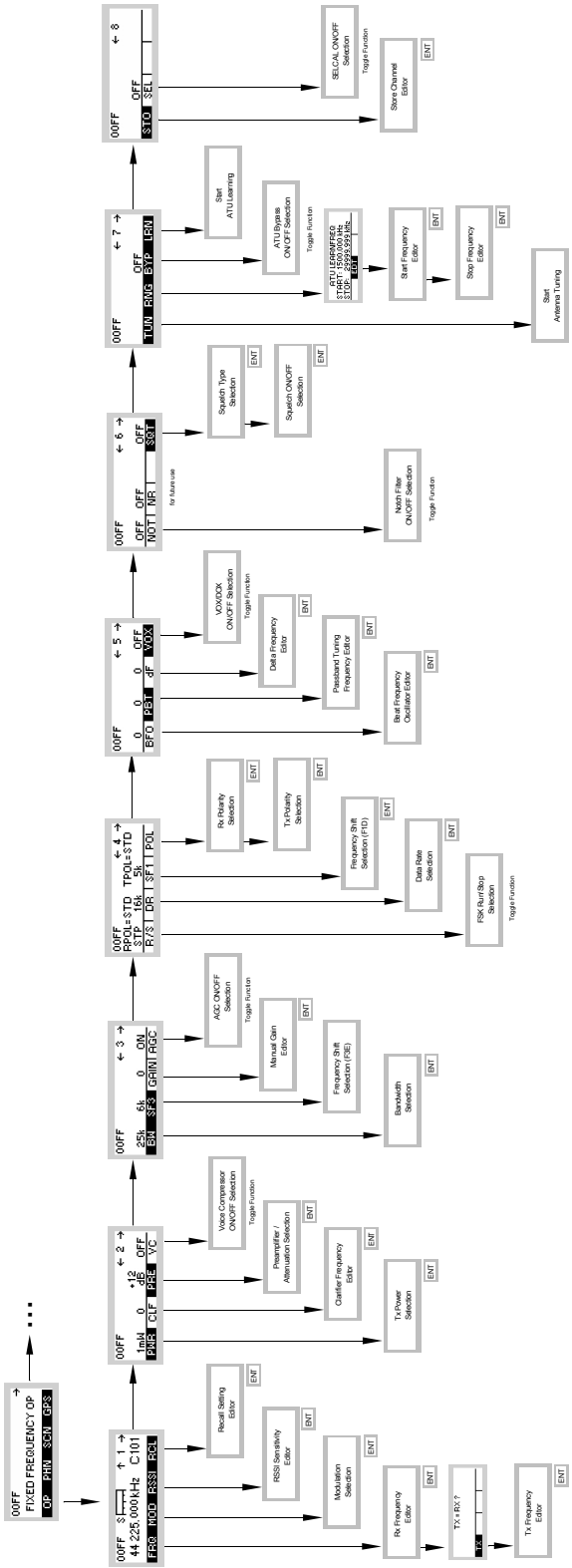
1 See sect. 3.2.2.1 Changing the Frequency
2 See sect. 3.2.2.2 Changing the Modulation Mode
3 See sect. 3.2.2.3 Changing the Squelch Sensitivity
4 See sect. 3.2.2.4 Recalling Settings
5 See sect. 3.2.2.5 Changing the Power Level
6 See sect. 3.2.2.6 Changing the Clarifier Frequency
7 See sect. 3.2.2.7 Changing the Preamplifier / Attenuation Setting
8 See sect. 3.2.2.8 Switching the Voice Compressor On or Off
9 See sect. 3.2.2.9 Changing the Bandwidth
10 See sect. 3.2.2.10 Changing the Frequency Shift (F3E)
11 See sect. 3.2.2.11 Changing the Manual Gain
12 See sect. 3.2.2.12 Switching the Automatic Gain Control On or Off
13 See sect. 3.2.2.16 Changing the Polarity
14 See sect. 3.2.2.15 Changing the Frequency Shift (F1D)
15 See sect. 3.2.2.14 Changing the Data Rate
16 See sect. 3.2.2.13 Switching the FSK Output On or Off
17 See sect. 3.2.2.20 Changing the VOX Function
18 See sect. 3.2.2.19 Changing the Delta Frequency
19 See sect. 3.2.2.18 Changing the Passband Tuning Frequency
20 See sect. 3.2.2.17 Changing the BFO Frequency
21 See sect. 3.2.2.22 Changing the Squelch Type
22 Switching the Noise Filter On or Off (For Future Use)
23 See sect. 3.2.2.21 Switching the Notch Filter On or Off
24 See sect. 3.2.2.23 Starting ATU Tuning Range *)
25 See sect. 3.2.2.24 Changing the ATU Tuning Range
26 See sect. 3.2.2.25 Bypassing the ATU
27 See sect. 3.2.2.26 Starting ATU Learning *)
28 See sect. 3.2.2.27 Storing Current Settings
29 See sect. 3.2.2.28 Switching the SELCAL Function On or Off

*) With MR 300xU (x = 0 to 3) this function is only available if the tactical radio is operated in conjunction with an external power amplifier / antenna tuning unit. With MR 300xH (x = 0 to 3) this function is always available.

Figure 3.9 Menu OP (FF, Structure)



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3.2.2.1 Changing the Frequency

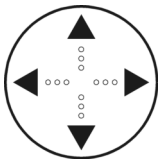
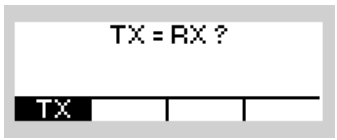
NOTICE

Only a channel configured as modifiable can have its TX and/or RX frequency modified. This can be configured via R&S RNMS3000.

By means of softkey FRQ (Frequency) the operator can change the transmit and/or receive frequency. In RX mode, the effective RX frequency, e.g. 55.250 kHz, is displayed. For PTT, the effective TX frequency, e.g. 55.250 kHz, is displayed (RX frequency = TX frequency).

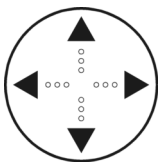
Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (FRQ)	Press.	The display changes:

Step	Control	Action	Note
4	0 _ * + to 9 WXYZ or 	Enter a new RX frequency. Change RX frequency selectively.	Range: depends on installed option codes Step: 25 kHz
5	ENT	Press.	If the entered RX frequency is within the permitted entry range, the display changes: 

NOTICE

For operation with the same Rx and TX frequency, just press ENT to finish frequency setting. Continue with step 6 if a TX frequency different from the RX frequency is requested.

Step	Control	Action	Note
6	2 ABC (TX)	Press.	The display changes:
7	0 _ * + to 9 WXYZ or 	Enter a new TX frequency. Change TX frequency selectively.	Range: depends on installed option codes Step: 25 kHz

Step	Control	Action	Note
8	ENT	Press.	If the entered TX frequency is within the permitted entry range, the editor window will be closed

3.2.2.2 Changing the Modulation Mode

NOTICE

Only a channel configured as modifiable can have its modulation mode modified. This can be configured via R&S RNMS3000.

By means of softkey MOD (Modulation) the operator can change the modulation mode. The effective modulation mode, e.g. A3E, is displayed.

Starting point: Main page of FF OP menu

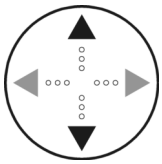
Step	Control	Action	Note
1	(OP) 2 ABC	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	(MOD) 3 DEF	Press.	The display changes:
4		Press several times until the desired modulation mode is displayed.	Possible values: A1A → A3E → H3E → R3E → A3E WB → +J3E → -J3E → J2D → F3E → F3E WB → F1D →F1D_F3E →F3EWB_F3E →A3E WB_A3E (see Table 3.6)
5	ENT	Press.	The selection window is closed. The new modulation mode is now effective.

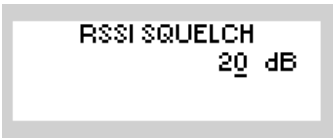
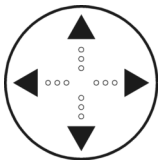
Table 3.6 Explanation of Modulation Modes

Type of emission	Abbreviation (old)	Abbreviation (new, WARC 1979)
Amplitude change signalling, no modulation, Morse telegraphy	CW	A1A
Amplitude modulation, double sideband and carrier	AM	A3E
Amplitude modulation, single sideband and carrier	AME	H3E
Amplitude modulation, single sideband and reduced carrier	A3A	R3E
Amplitude modulation, double sideband and carrier, wideband	AM WB	A3E WB
Single sideband, upper sideband, carrier suppression	USB	+J3E
Single sideband, lower sideband, carrier suppression	LSB	-J3E
Single sideband, upper sideband, modem operation	Modem operation	J2D
Frequency modulated carrier, voice transmission	FM	F3E
Frequency modulated carrier, wideband	FM WB	F3E WB
Frequency modulation, FSK (Frequency Shift Keying), modem operation	FSK	F1D

3.2.2.3 Changing the Squelch Sensitivity

By means of softkey RSSI (Receive Signal Strength Indication for carrier squelch), the operator can change the sensitivity for the selected squelch type. When the desired squelch type is selected (see sect. 3.2.2.22 Changing the Squelch Type), the squelch sensitivity will be automatically activated.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	4 GHI (RSSI)	Press.	The display changes: 
4	0 _*+ to 9 WXYZ or 	Enter a new squelch value. Change squelch value selectively.	Range: 0 to 100 dB Step: 1 dB The new SQL value will be effective immediately.

Step	Control	Action	Note
5	ENT	Press.	The editor window is closed.

- When enabled, the audio signal is muted as long as the received signal strength (RSS) remains below an adjustable threshold. The TX LED (= OFF) serves as an optical indicator.

  The threshold can be adjusted over a range of 110 dB, in steps of 1 dB. The setting in dB is related to an RF level of -115 dBm.

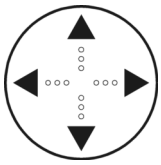
  RSSI squelch is available in modulation modes:

  A3E, H3E, R3E, -J3E, +J3E, J2D, F3E, F1D, A3E WB, F3E WB

3.2.2.4 Recalling Settings

By means of softkey RCL (Recall), the operator can recall the equipment setting stored in a particular channel. In TX/RX mode, the effective channel, e.g. 101, is displayed.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _ * + to 9 WXYZ	Press any of these keys.	The display changes:
3	5 JKL (RCL)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter the relevant channel number. Change channel number selectively.	Range: 1 to 450
5	ENT	Press.	If the entered channel number is within the permitted entry range, the editor window will be closed. All settings stored in the selected channel are activated.

- The user is able to recall any channel from 1 to 400 on the preset page MAN, as long as it has already been stored either from the MMI or with the R&S RNMS3000. Using the MMI, channels can be stored by means of the softkey STO (see sect. 3.2.2.27 Storing Current Settings).
- Channels can be pre-configured via R&S RNMS3000 and can be configured as modifiable or not. If a channel is not modifiable, the user will not be able to edit its parameters from the MMI.
- Channels 401 to 450 can only be recalled but cannot be edited or stored. These channels are to be defined during radio configuration and will appear on the radio presets pages in the range from 1 to 99.

NOTICE

Channel 101 is the default channel. When the operator presses the erase key, all channels, except channel 101, will be erased. Channel 101 will be reset to its default values to give the operator a starting point to manually configure other channels.

3.2.2.5 Changing the Power Level

By means of softkey PWR (Power) the operator can change the power level. When the PTT key is pressed, the effective power level, e.g. 0.5 W, will be displayed.

Starting point: Main page of FF OP menu

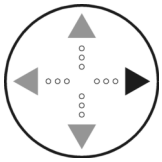
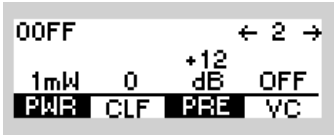
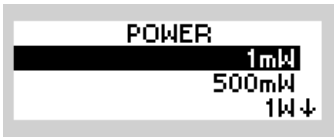
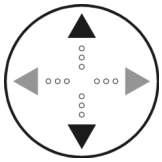
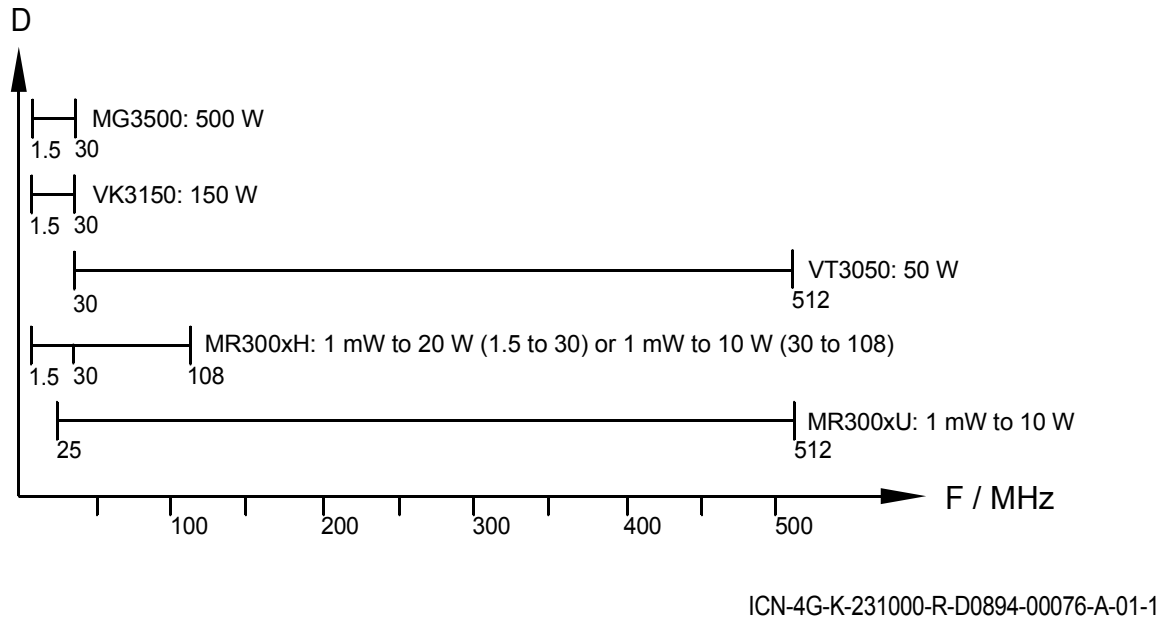
Step	Control	Action	Note
1	(OP) 2 ABC	Press.	The display changes:
2		Press once.	The display changes: 
3	(PWR) 2 ABC	Press.	The display changes: Example: 
4		Press several times until the desired power level is displayed.	Possible values: See data sheets (sect. 9 Drawings) and Figure 3.11.
5	ENT	Press.	The selection window is closed. The new power level is now effective.
6	PTT key on handset (see Figure 3.10)	Press. (This is necessary to see the new setting).	The display changes: The newly set transmit power is displayed.

Figure 3.10 Dependency Device - Frequency Range - Power



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D Device
F Frequency

- The PWR softkey is used to select from a choice of transmit powers. By selecting a higher transmit power the coverage for radiocommunication is extended. The nature of the terrain also needs to be considered when selecting the transmit power.
- The PWR softkey is used to select a value from a list of transmit powers. By selecting a higher transmit power the coverage for radiocommunication is extended. The nature of the terrain also needs to be considered when selecting the transmit power.

  The transmit mode is started by activating any of the following sources:

  - PTT1 (PTT at audio connector), using the PTT key on R&S GA3001 Handset Figure 3.10.
  - PTT2 (PTT at data connector).

  To enable these PTT signals it is necessary that the related coding pins, i.e. COD0 of audio connector for PTT1 and COD1 of data connector for PTT2, be grounded.

  When PTT is initiated the source of the signal to be transmitted is automatically identified. PTT1 selects the voice interface as signal source in all modulation modes except F1D. In F1D mode PTT1 does not have any effect.

  PTT2 selects the line interface (for all modulation modes except F1D) or the data terminal 2 (for direct FSK) interface.

  PTT1 always has priority over PTT2. That is, when both PTT sources are activated, the function of PTT1 is executed.

Figure 3.11 PTT (Push To Talk) Key

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1 PTT (Push to Talk) key

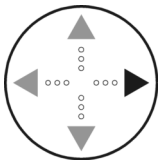
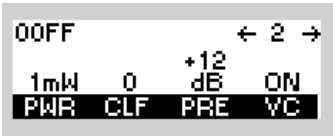
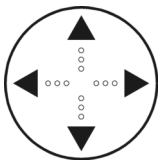
NOTICE

Pressing PTT key will only have effect in Tx/Rx mode (set mode switch in position RX/TX).

3.2.2.6 Changing the Clarifier Frequency

By means of softkey CLF (Clarifier) the operator can change the clarifier tuning frequency.

Starting point: Main page of FF OP menu

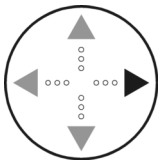
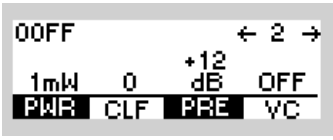
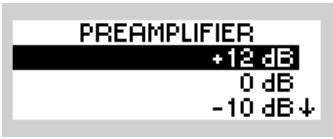
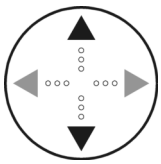
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 
3	3 DEF (CLF)	Press.	The display changes:
4		Change clarifier value selectively.	Range: -200 to 200 Hz Step: 1 Hz The new value will be effective immediately.
5	ENT	Press.	The editor window is closed.

- The CLF (Clarifier) function is used for fine tuning to the receive signal (RIT, Receiver Incremental Tuning). This function is particularly important for single sideband modulation (SSB). CLF can improve the signal quality.
- The clarifier function is available in all frequency ranges and for the modulation modes J3E-, J3E+, A1A, H3E, R3E.
- The clarifier directly effects the synthesizer, thus changing the local oscillator 1. However the value of the displayed nominal frequency on the MMI is not changed.
- In TX mode the RF frequency is not changed, even when the clarifier frequency is not equal to zero.
- Default: 0 Hz

3.2.2.7 Changing the Preamplifier / Attenuation Setting

By means of softkey PRE (Preamplifier) the operator can change the preamplifier settings.

Starting point: Main page of FF OP menu

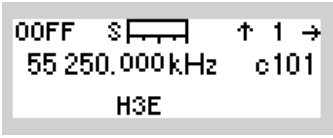
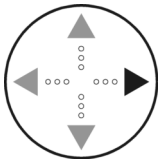
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 
3	4 GHI (PRE)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible values: +12 dB -> 0 dB -> -10 dB -> -20 dB -> -30 dB The new value will be effective immediately.
5	ENT	Press.	The selection window is closed.

- Superimposed over these manual settings is an automatic process (in case AGC function is switched on), which controls the preamplifier gain depending on the received signal strength to prevent saturation of the stages that follow. The manual settings are limits up to which the automatic process controls, i.e. for low-level signals the attenuation/gain values apply; if the signal is above a threshold it is further attenuated. The PRE function is used to select from a choice of receiver input sensitivities.
- With the preamplifier set to +12 dB, maximum input sensitivity is selected.
- Default: 0 dB

3.2.2.8 Switching the Voice Compressor On or Off

By means of softkey VC (Voice Compression) the operator can switch the voice compression function on or off.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes:
3	5 JKL (VC)	Press.	Repetitively pressing this key toggles the VC on and off.

- The VC softkey is used to improve the signal quality. The voice compressor reduces the dynamic range of the wanted signal, thus achieving a higher average output power.
- Default: ON

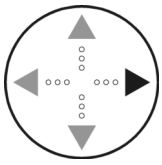
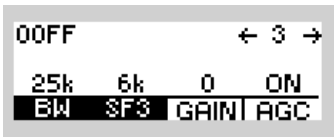
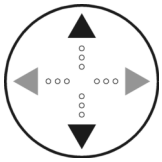
3.2.2.9 Changing the Bandwidth

NOTICE

Only a channel configured as modifiable can have its RX bandwidth modified. This can be configured via R&S RNMS3000.

By means of softkey BW (Bandwidth) the operator can only change the RX bandwidth. The effective bandwidth, e.g. 25 kHz, is displayed.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	(OP) 2 ABC	Press.	The display changes:
2		Press twice.	The display changes: 
3	(BW) 2 ABC	Press.	The display changes:
4		Press several times until the desired setting is displayed.	Possible values: 25 kHz (see Table 3.7) The new value is effective immediately.
5	ENT	Press.	The selection window is closed.

- The BW function is used to select from a choice of bandwidths. The effective choice of bandwidths is dependent on the set modulation mode (sect. 3.2.2.2 Changing the Modulation Mode) and set frequency range.

  In the example above modulation mode A3E is set, resulting in bandwidths of 6 kHz → 8 kHz → 12.5 kHz → 25 kHz

  Signal quality and selected bandwidth are related as follows:

  - large bandwidth, good voice transmission, increased noise component possible
  - narrow bandwidth, poor voice transmission, small noise component

- Default settings for the different modulation modes and frequency ranges: see Table 3.7.

Table 3.7 Possible Bandwidths

Frequency range	Modulation mode	Bandwidth	Default BW
1.5 MHz to 24.999999 MHz	+J3E	1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	2.4 kHz
	-J3E	1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	2.4 kHz
	A3E	6.0, 8.0, 12.5, 25 kHz	6 kHz
	H3E	3.1 kHz	3.1 kHz
	R3E	3.1 kHz	3.1 kHz
	A1A	0.15, 0.3, 0.4, 0.6, 0.8, 1.0, 1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	0.3 kHz
	F3E	8.0, 12.5 kHz	12.5 kHz
	F1D	Automatically set, depending on bit rate 50, 75, 100, 150, 300, 600 b/s (see table dependency SF1 - bit rate - bandwidth: Table 3.8)	Default bit rate 300 b/s
	J2D	0.15, 0.3, 0.4, 0.6, 0.8, 1.0, 1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	3.1 kHz
25 MHz to 29.999999 MHz	+J3E	1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	2.4 kHz
	-J3E	1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	2.4 kHz
	A3E	6.0, 8.0, 12.5, 25 kHz	6 kHz
	H3E	3.1 kHz	3.1 kHz
	R3E	3.1 kHz	3.1 kHz
	A1A	0.15, 0.3, 0.4, 0.6, 0.8, 1.0, 1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	0.3 kHz
	F3E	8.0, 12.5, depending on shift SF3	Depending on shift SF3
	F1D	Automatically set, depending on bit rate 50, 75, 100, 150, 300, 600 b/s (see table dependency SF1 - bit rate - bandwidth: Table 3.8)	Default bit rate 300 b/s
	J2D	0.15, 0.3, 0.4, 0.6, 0.8, 1.0, 1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	3.1 kHz

Frequency range	Modulation mode	Bandwidth	Default BW
30 MHz to 511.999999 MHz	F3E	25 kHz, depending on shift SF3	25 kHz
	F1D	Automatically set, depending on bit rate 1200, 2400, 4800, 9600, 14400, 16000, 24000 b/s (see table dependency SF1 - bit rate - bandwidth: Table 3.8)	Default bit rate 16000 b/s
	A3E	6.0, 8.0, 12.5, 25 kHz	6 kHz
	H3E	3.1 kHz	3.1 kHz
	R3E	3.1 kHz	3.1 kHz
	A1A	0.15, 0.3, 0.4, 0.6, 0.8, 1.0, 1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	0.3 kHz
	+J3E	1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	2.4 kHz
	-J3E	1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	2.4 kHz
	F3E wide	25, 35 kHz	35 kHz
	A3E wide	25, 35 kHz	35 kHz
	J2D	0.15, 0.3, 0.4, 0.6, 0.8, 1.0, 1.5, 1.8, 2.1, 2.4, 2.7, 3.1 kHz	3.1 kHz

Table 3.8 Dependency SF1 - Bit Rate - Bandwidth

		Shift F1					
		42 Hz	**85 Hz**	225 Hz	425 Hz	5 kHz	6.25 kHz
Bit Rate	50	150 Hz	300 Hz	600 Hz	1000 Hz		
b/s	75	150 Hz	300 Hz	600 Hz	1000 Hz		
	100	300 Hz	**300 Hz**	600 Hz	1500 Hz		
	150	300 Hz	300 Hz	800 Hz	1500 Hz		
	300	300 Hz	400 Hz	800 Hz	1500 Hz		
	600	400 Hz	600 Hz	1000 Hz	1500 Hz		
	1200					25 kHz	25 kHz
	2400					25 kHz	25 kHz
	4800					25 kHz	25 kHz
	9600					25 kHz	25 kHz
	14400					25 kHz	25 kHz
	16000					25 kHz	25 kHz
	25600					35 kHz	35 kHz

Example: For a frequency shift of 85 Hz and a bit rate of 100 b/s the bandwidth is automatically set to 300 Hz.

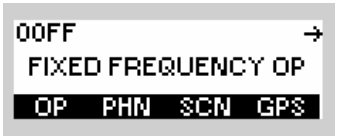
3.2.2.10 Changing the Frequency Shift (F3E)

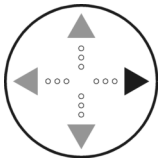
NOTICE

Only a channel configured as modifiable can have its frequency shift modified. This can be configured via R&S RNMS3000.

By means of softkey SF3 (Shift) the operator can change the frequency shift. The effective frequency shift, e.g. 6.00 kHz, is displayed.

Starting point: Main page of FF OP menu



Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press twice.	The display changes:
3	3 DEF (SF3)	Press.	Repetitively pressing this key changes the value for SF3. Possible values: 5.00 kHz → 6.25 kHz → 8 kHz

- The SF3 (Shift) softkey is used to change the frequency shift for modulation modes F3E and F3E WB.

  The choice of available frequency shifts depends on the selected frequency (recommended settings: Table 3.9).

  In the example above a frequency of 55 250.000 kHz is set, so the choice is 5.00 kHz → 6.25 kHz → 8 kHz.

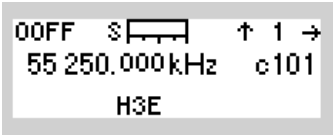
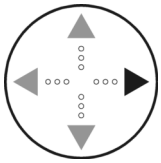
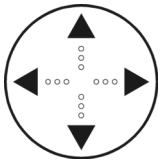
Table 3.9 Recommended Settings for Modulation, SF3, BW

Frequency range	Modulation mode	Shift F3E	Default shift (SF3)	Bandwidth	Default BW
1.5 MHz to 24.999999 MHz	F3E	2.5 kHz	2.5 kHz	8.0, 12.5 kHz	12.5 kHz
25 MHz to 29.999999 MHz	F3E	2.5 kHz	6.25 kHz	8.0, 12.5 kHz	12.5 kHz
		5 kHz		25 kHz	25 kHz
		6.25 kHz		25 kHz	25 kHz
		8 kHz		25 kHz	25 kHz
	F3E wide	5 kHz	5 kHz	25 kHz, 35 kHz	25 kHz
		6.25 kHz		25 kHz, 35 kHz	25 kHz
		8 kHz		25 kHz, 35 kHz	25 kHz
30 MHz to 511.999999 MHz	F3E	5 kHz	6.25 kHz	25 kHz	25 kHz
		6.25 kHz		25 kHz	25 kHz
		8 kHz		25 kHz	25 kHz
	F3E wide	5 kHz	5 kHz	25 kHz, 35 kHz	35 kHz
		6.25 kHz		25 kHz, 35 kHz	35 kHz
		8 kHz		25 kHz, 35 kHz	35 kHz

3.2.2.11 Changing the Manual Gain

By means of softkey GAIN (Manual Gain Control) the operator can change the level of the received signal that results in nominal audio level.

Starting point: Main page of FF OP menu

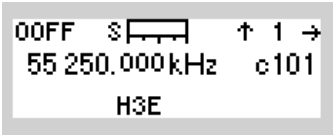
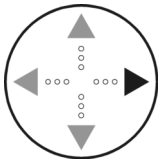
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press twice.	The display changes:
3	4 GHI (GAIN)	Press.	The display changes:
4		Change gain value selectively.	Position the cursor. Increase or decrease the value. Range: 0 to 100 dB Step: 1 dB
5	ENT	Press.	The selection window is closed. The new gain is now effective.

- The MGC (Manual Gain Control) function is used to select the level of the received signal that results in nominal audio level. By increasing the manual gain value, the volume of the decoded signal is reduced. Effects on the antenna input signal (e.g. fading) will no longer be levelled out automatically. In practical applications it is recommended to use AGC together with AGC threshold instead of MGC. AGC and MGC setting is dependent on the selected modulation mode.
- Default: 0 dB

3.2.2.12 Switching the Automatic Gain Control On or Off

By means of softkey AGC (Automatic Gain Control) the operator can switch the Automatic Gain Control function on or off.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press twice.	The display changes:
3	5 JKL (AGC)	Press.	Repetitively pressing this key toggles AGC on and off.

- The AGC (Automatic Gain Control) function is used to switch from AGC to MGC (Manual Control) and vice versa.

  AGC and MGC setting is dependent on the selected modulation mode.

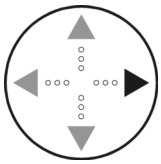
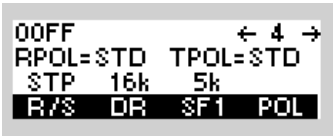
  When changing from AGC to MGC (AGC off) the settings for MGC (see sect. 3.2.2.11 Changing the Manual Gain) are reset to zero. AGC ensures a constant audio level even if the antenna level varies.

- Default: ON

3.2.2.13 Switching the FSK Output On or Off

By means of softkey R/S (Run/Stop) the operator can switch the FSK output on and off.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press three times.	The display changes: 
3	2 ABC (R/S)	Press.	Repetitively pressing this key toggles the FSK output on and off. RUN → ON STP → OFF

- The R/S softkey is used to switch the data output at socket X5 (socket DATA at the front panel) on and off.

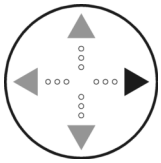
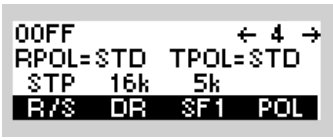
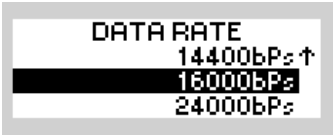
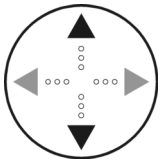
  This permits a teletyper connected to this socket to be activated or deactivated. This function is only available for modulation mode F1D: sect. 3.2.2.2 Changing the Modulation Mode.

- No default setting

3.2.2.14 Changing the Data Rate

By means of softkey DR (Data Rate) the operator can change the bit rate for modulation mode F1D. The effective data rate, e.g. 16k is displayed.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press three times.	The display changes: 
3	3 DEF (DR)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible values: 50 to 24 000 b/s (see Table 3.10)
5	ENT	Press.	The selection window is closed. The new selection is now effective.

- The DR softkey is used to change the data rate for modulation mode F1D.

  The function directly influences the IF filter bandwidth.

  In voice over data mode select data rates > 2400 b/s in conjunction with 150-Hz squelch tone to ensure reliable operation.

  Table 3.10 shows the dependency of the maximum data rate on the transmit/receive frequency used.

  With lower transmit/receive frequencies the data rate decreases as well (e.g. for frequencies < 30 MHz the maximum bit rate is 600 b/s).

  The bandwidth (see sect. 3.2.2.9 Changing the Bandwidth) is automatically adapted by the tactical radio.

Table 3.10 Data Rates in Modulation Mode F1D

Frequency range	Bit rate	Shift F1D (SF1)	Default shift	Internal bandwidth
1.5 MHz to 24.999999 MHz	50 b/s	42 Hz	85 Hz	150 Hz
		85 Hz		300 Hz
		225 Hz		600 Hz
		425 Hz		1000 Hz
	75 b/s	42 Hz	85 Hz	150 Hz
		85 Hz		300 Hz
		225 Hz		600 Hz
		425 Hz		1000 Hz
	100 b/s	42 Hz	85 Hz	300 Hz
		85 Hz		300 Hz
		225 Hz		600 Hz
		425 Hz		1500 Hz
	150 b/s	42 Hz	85 Hz	300 Hz
		85 Hz		300 Hz
		225 Hz		800 Hz
		425 Hz		1500 Hz
	300 b/s	42 Hz	85 Hz	300 Hz
		85 Hz		400 Hz
		225 Hz		800 Hz
		425 Hz		1500 Hz
	600 b/s	42 Hz	85 Hz	400 Hz
		85 Hz		600 Hz
		225 Hz		1000 Hz
		425 Hz		1500 Hz

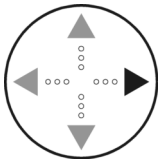
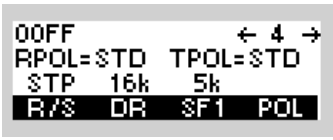
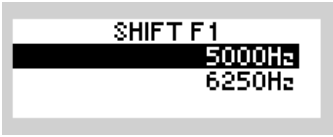
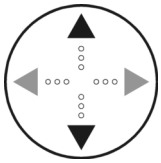
Frequency range	Bit rate	Shift F1D (SF1)	Default shift	Internal bandwidth
25 MHz to 29.999999 MHz	50 b/s	42 Hz	85 Hz	150 Hz
		85 Hz		300 Hz
		225 Hz		600 Hz
		425 Hz		1000 Hz
	75 b/s	42 Hz	85 Hz	150 Hz
		85 Hz		300 Hz
		225 Hz		600 Hz
		425 Hz		1000 Hz
	100 b/s	42 Hz	85 Hz	300 Hz
		85 Hz		300 Hz
		225 Hz		600 Hz
		425 Hz		1000 Hz
	150 b/s	42 Hz	85 Hz	300 Hz
		85 Hz		300 Hz
		225 Hz		800 Hz
		425 Hz		1500 Hz
	300 b/s	42 Hz	85 Hz	300 Hz
		85 Hz		400 Hz
		225 Hz		800 Hz
		425 Hz		1500 Hz
	600 b/s	42 Hz	85 Hz	400 Hz
		85 Hz		600 Hz
		225 Hz		1000 Hz
		425 Hz		1500 Hz
	1200 b/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	2400 b/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	4800 b/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	9600 b/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	14.4 kb/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz

Frequency range	Bit rate	Shift F1D (SF1)	Default shift	Internal bandwidth
	16 kb/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	24 kb/s	5 kHz	5 kHz	35 kHz
		6.25 kHz		35 kHz
30 MHz to 511.999999 MHz	1200 b/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	2400 b/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	4800 b/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	9600 b/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	14.4 kb/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	16 kb/s	5 kHz	5 kHz	25 kHz
		6.25 kHz		25 kHz
	24 kb/s	5 kHz	5 kHz	35 kHz
		6.25 kHz		35 kHz

3.2.2.15 Changing the Frequency Shift (F1D)

By means of softkey SF1 (Shift) the operator can change the frequency shift for modulation mode F1D. The effective frequency shift, e.g. 5 k(Hz), is displayed.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press three times.	The display changes: 
3	4 GHI (SF1)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible values: 42 Hz → 85 Hz → 225 Hz → 425 Hz → 5000 Hz → 6250 Hz (see table data rates in modulation mode F1D: sect. 3.2.2.14 Changing the Data Rate)
5	ENT	Press.	The selection window is closed. The new selection is now effective.

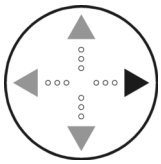
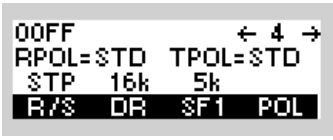
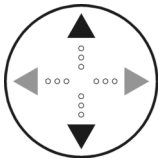
- The SF1 (Shift) softkey is used to change the frequency shift for modulation mode F1D.

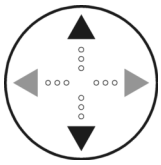
  The bandwidth (sect. 3.2.2.9 Changing the Bandwidth) and the corresponding data rate (sect. 3.2.2.14 Changing the Data Rate) are automatically adapted by the tactical radio.

3.2.2.16 Changing the Polarity

By means of softkey POL (Polarity) the operator can change the polarity.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press three times.	The display changes: 
3	5 JKL (POL)	Press.	The display changes:
4	 and / or ENT	Press to select the desired setting.	Possible values: INV → STD
		Press.	The display changes:

Step	Control	Action	Note
5		Press to select the desired setting.	
	and / or		
	ENT	Press.	The selection window is closed. The new selection is now effective.

- The POL softkey is used to change the polarity of the output voltage at connector X5 (socket DATA on the front panel) from STD = standard to INV = inverted.

  The polarity needs to be adjusted at the teletyper connected to X5. This function is only available for modulation mode F1D (see sect. 3.2.2.2 Changing the Modulation Mode).

  The standard assignment of data polarity to frequency is according to STANAG 4204:

Data level	RS-232 polarity	Frequency polarity
0	positive	Fc - fs
1	negative	Fc + fs

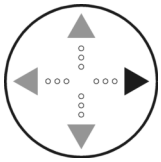
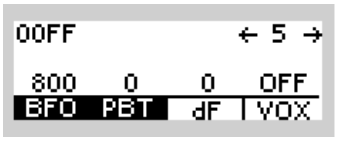
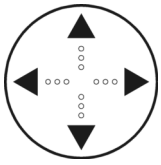
3.2.2.17 Changing the BFO Frequency

NOTICE

Only in modulation mode A1A.

By means of softkey BFO (Beat Frequency Oscillator) the operator can change the BFO frequency.

Starting point: Main page of FF OP menu

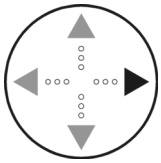
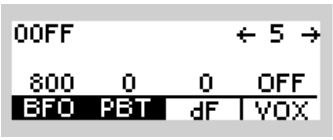
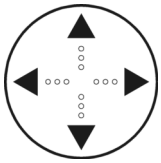
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press four times.	The display changes: 
3	2 ABC (BFO)	Press.	The display changes:
4		Change BFO frequency selectively.	Position the cursor. Increase or decrease the value. The new value is effective immediately. Range: -2 000 to 2 000 Hz Step: 10 Hz

Step	Control	Action	Note
5		Press.	The editor window will be closed.

3.2.2.18 Changing the Passband Tuning Frequency

By means of softkey PBT (Passband Tuning) the operator can change the passband tuning frequency.

Starting point: Main page of FF OP menu

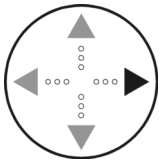
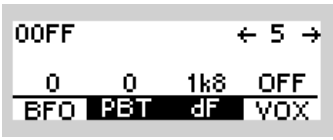
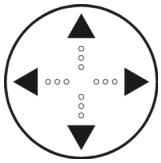
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press four times.	The display changes: 
3	3 DEF (PBT)	Press.	The display changes:
4		Change passband tuning frequency selectively.	Position the cursor. Increase or decrease the value. Range: -2 000 to 2 000 Hz Step: 10 Hz
5	ENT	Press.	If the entered delta frequency is within the permitted entry range, the editor window will be closed.

- The PBT softkey is used for fine tuning to the wanted signal (carrier) frequency. Adjacent signals interfering with the wanted signal are blanked out. The set value will be automatically reset to 0 as soon as the modulation mode is changed.
- Default: 0 Hz

3.2.2.19 Changing the Delta Frequency

By means of softkey dF (Delta Frequency) the operator can tune the centre of the signal spectrum for modulation mode J2D.

Starting point: Main page of FF OP menu

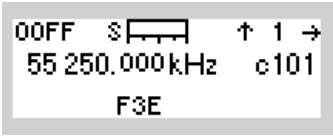
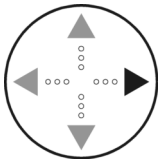
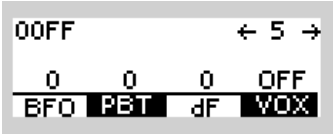
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press four times.	The display changes: 
3	4 GHI (dF)	Press.	The display changes:
4		Change delta frequency selectively.	Position the cursor. Increase or decrease the value. Range: -2 000 to 2 000 Hz Step: 10 Hz
5	ENT	Press.	If the entered delta frequency is within the permitted entry range, the editor window will be closed.

- By setting the delta frequency it is possible to fine tune the centre of the signal spectrum lying in the received bandwidth. This may be useful for adapting to the modem spectrum, which may be shifted due to shifts of receiver and transmitter. The delta frequency function is only available for modulation mode J2D.
- Default: +1800 Hz

3.2.2.20 Changing the VOX Function

By means of softkey VOX (Voice Operated Transmission) the operator can change the VOX function.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press four times.	The display changes: 
3	5 JKL (VOX)	Press.	Repetitively pressing this key changes the VOX function. Possible values: OFF → LIN → VOI

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface.
- If VOX set to VOI (Voice), the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

  VOX = VOI can only be used when a R&S GA3002 Headset is connected.
- If VOX set to LINE, the transmit mode is activated as soon as a voice signal at connector X5 is detected.
- Default: OFF

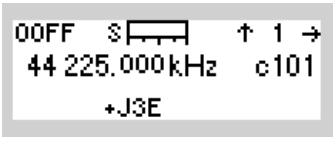
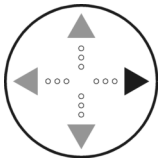
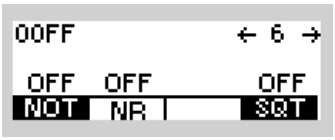
3.2.2.21 Switching the Notch Filter On or Off

NOTICE

Only in modulation mode J3E.

By means of softkey NOT (Notch) the operator can switch the notch filter on or off.

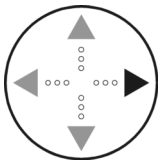
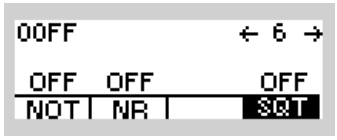
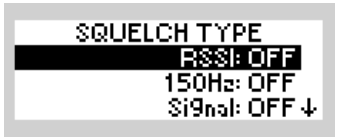
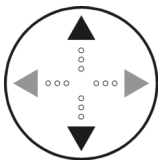
Starting point: Main page of FF OP menu

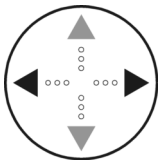
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press five times.	The display changes: 
3	2 ABC (NOT)	Press.	Repetitively pressing this key toggles notch filter on and off.

3.2.2.22 Changing the Squelch Type

By means of softkey SQT (Squelch Type) the operator can change the squelch type.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press five times.	The display changes: 
3	5 JKL (SQT)	Press.	The display changes: 
4		Press several times until the desired squelch type is displayed.	Possible settings ON / OFF: • RSSI (carrier squelch) • 150Hz (150-Hz tone squelch) • Signal (signal squelch) • Syllabic (syllabic squelch)
5	ENT	Press.	The display changes:

Step	Control	Action	Note
6		Press several times until the desired setting is displayed.	Possible values: OFF -> ON
7	ENT	Press.	The selection window is closed. The new setting is now effective. To activate/deactivate other squelch types repeat steps 2 to 7.

- The SQT softkey is used to select from a choice of squelch types.

  RSSI (Received Signal Strength Indication) carrier squelch works as a function of the pre-selected level of the wanted signal strength. Only when this threshold is exceeded will the audio signal be unmuted (see sect. 3.2.2.3 Changing the Squelch Sensitivity).

  150 Hz (150-Hz tone squelch) acts upon a 150-Hz subtone. Only if the wanted signal contains this subtone will the audio signal be unmuted (NATO Standard STANAG 4202). If tone squelch is selected, a 150-Hz tone will be transmitted also with each transmission.

  SIG (signal squelch) acts upon a variable subtone. Only if the wanted signal contains this subtone, which is always transmitted with it, will the audio signal be unmuted. If signal squelch is selected, a subtone is also added to the transmitted signal. The subtone setting on both transmitter and receiver must be identical.

  SYL (syllabic squelch) acts upon the voice part of the wanted signal. I.e. the wanted signal is checked for voice signal parts, and only if such voice signal parts are contained, will the audio signal be unmuted.

- Default: OFF
- The Table 3.11 shows all possible settings in submenu SQT. Four squelch types are available on this menu level. In the table they are used as column headers.

Table 3.11 Squelch Type as a Function of the Modulation Mode

Modulation mode	RSSI	150 Hz	SIG	SYL
A1A	OFF	OFF	OFF	OFF
A3E	ON / OFF	ON / OFF	ON / OFF	ON / OFF
H3E	ON / OFF	ON / OFF	ON / OFF	ON / OFF
R3E	ON / OFF	ON / OFF	ON / OFF	ON / OFF
A3E WB	ON / OFF	OFF	OFF	OFF
+J3E	ON / OFF	OFF	OFF	ON / OFF
-J3E	ON / OFF	OFF	OFF	ON / OFF
J2D	ON / OFF	OFF	OFF	OFF
F3E	ON / OFF	ON / OFF	ON / OFF	ON / OFF
F3E WB	ON / OFF	OFF	OFF	OFF

Modulation mode	RSSI	150 Hz	SIG	SYL
F1D	ON / OFF	OFF	OFF	OFF

- There are squelch types that can be enabled simultaneously (according to Table 3.12) if the dependency on the modulation mode allows the use of the specific squelch type.

Table 3.12 Simultaneous Settings of Squelch

	RSSI	150 Hz	SIG	SYL
RSSI		YES	YES	YES
150 Hz	YES		NO	NO
SIG	YES	NO		NO
SYL	YES	NO	NO	

NOTICE

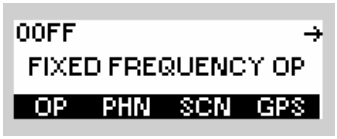
Active power management (PWM = NRM or LOW) combined with RSSI squelch (RSSI = ON) lead to a delay in waking up the radio.

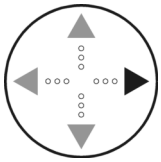
3.2.2.23 Starting ATU Tuning Range

By means of softkey TUN (Tune) the operator can start automatic tuning of the ATU (Antenna Tuning Unit) for a particular frequency.

- This function is only available if R&S MR300xU is operated in conjunction with an external power amplifier / antenna tuning unit.

Starting point: Main page of FF OP menu



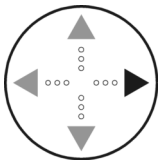
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press six times.	The display changes:
3	2 ABC (TUN)	Press.	The display changes: The ATU starts tuning to the selected frequency.

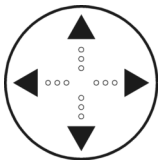
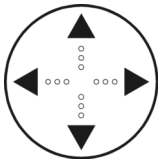
- The TUN softkey is used to start tuning of the ATU to the selected TX frequency. The purpose is to achieve optimum matching of the PA (Power Amplifier) and the connected antenna to the radiation conditions.

3.2.2.24 Changing the ATU Tuning Range

By means of softkey RNG (Range) the operator can define a frequency range for ATU tuning.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press six times.	The display changes:
3	3 DEF (RNG)	Press.	The display changes:
4	3 DEF (EDT)	Press.	The display changes:

Step	Control	Action	Note
5	0 _ * + to 9 WXYZ or 	Enter a new start frequency. Change start frequency selectively.	Range: 1500.000 to 29999.999 kHz Step: 1 Hz **NOTICE** **Start frequency < stop frequency**
6	ENT	Press.	The selection window closes. The display changes:
7	0 _ * + to 9 WXYZ or 	Enter a new stop frequency. Change stop frequency selectively.	Range: 1500.000 to 29999.999 kHz Step: 1 Hz **NOTICE** **Stop frequency > start frequency**
8	ENT	Press.	The selection window closes. The display changes:
9	ENT	Press.	The selection window closes. The start frequency of 9.5 MHz and stop frequency of 29 MHz are now effective.

- The RNG softkey is used to define a frequency range where the ATU (Antenna Tuning Unit) shall learn optimum matching of the connected antenna to the radiation conditions. Learning in this frequency range is started by means of LRN (see sect. 3.2.2.26 Starting ATU Learning).

  The defined frequency range must include the frequencies used for communication.

Example:

The RX/TX frequency is set to 3500.000 kHz as described in sect. 3.2.2.1 Changing the Frequency. Alternative frequencies are 3020.000 kHz and 3980.000 kHz.

The ATU learning frequencies can be defined as follows:

START: 3000.000 kHz

STOP: 4000.000 kHz

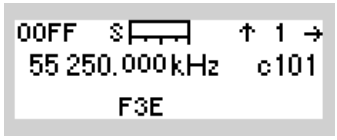
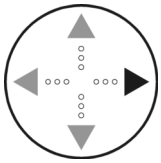
3.2.2.25 Bypassing the ATU

The function is only enabled if an esternal ATUis connected to the radio.

If set to 'ON', the ATU enters the Bypass state. In this state broadband reception using the HF antenna, ATU and other receiver hardware is possible. During transmission (PTT pressed) this feature is set to 'OFF' and disabled.

By means of BYP (Bypass) the operator can bypass the ATU. This results in a longer life cycle of the ATU relays, but will degrade reception performance.

Starting point: Main page of FF OP menu

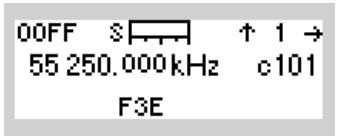
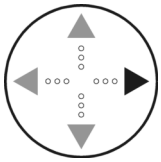
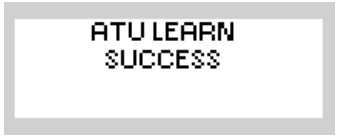
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press six times.	The display changes:
3	4 GHI (BYP)	Press.	Repetitively pressing this key toggles the bypass function on and off.

3.2.2.26 Starting ATU Learning

By means of softkey LRN (Learn) the operator can start automatic tuning (= learning) of the ATU (Antenna Tuning Unit) in a previously defined frequency range (see sect. 3.2.2.24 Changing the ATU Tuning Range).

- This function is only available if R&S MR300xU is operated in conjunction with an external power amplifier / antenna tuning unit.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press six times.	The display changes:
3	5 JKL (LRN)	Press.	The display changes: The ATU starts learning. When it has finished the display changes: 

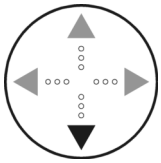
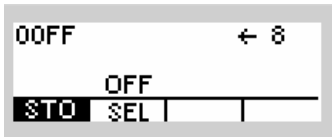
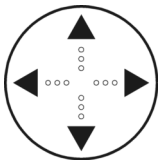
Step	Control	Action	Note

- By using the LRN function ATU settings are stored in a selectable memory bank.

3.2.2.27 Storing Current Settings

By means of softkey STO (Store) the operator can store the current equipment setting in a particular channel. In RX mode, the effective channel, e.g. 101, is displayed.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 
3	2 ABC (STO)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new channel number. Change channel number selectively.	Range: 1 to 450
5	ENT	Press.	If the entered channel number is within the permitted entry range, the editor window will be closed.

- The STO softkey is used to store fixed frequency parameters set on the tactical radio. If a channel has already been stored via R&S RNMS3000 and was configured as modifiable, the storing will overwrite it. If the channel was configured as not modifiable via R&S RNMS3000, it is not possible to store it or overwrite it from the MMI. Settings can be recalled as described in sect. 3.2.2.4 Recalling Settings.
- The following parameters are stored:
  - Modulation mode
  - Frequency
  - Channel spacing
  - Bandwidth
  - AGC
  - BFO frequency
  - Data rate F1D
  - Delta frequency
  - Noise blanker
  - Polarity F1D
  - Power
  - Preamplifier
  - FSK run / stop function
  - Frequency shift F1D
  - Frequency shift F3E
  - Squelch
  - Hold time A1A

3.2.2.28 Switching the SELCAL Function On or Off

Through SELCAL (Selective Calling), it is possible to call a particular airborne radio inside a chosen FF channel network. In order to perform this, an external SELCAL coder connected to the R&S M3TR line interface has to be used and the SELCAL functionality has to be activated.

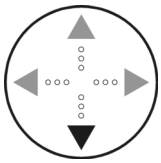
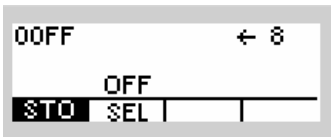
After activation, the operator enters the code of the aircraft, which has to be called, into the SELCAL coder and presses the Call button at the coder to send the code via the actual adjusted frequency. The SELCAL coder activates the PTT, generates the code in form of a tone sequence at the audio line and deactivates the PTT afterwards. Between PTT-ON and PTT-OFF the radio changes the modulation mode to A3E and transmit this tone sequence on a ground-to-air link. After PTT-OFF the modulation is switched back to J3E+ to wait for the answer from the aircraft.

NOTICE

The adjusted frequency for SELCAL should be a learned frequency.

By means of softkey SEL (SELCAL) the operator can switch the SELCAL function on or off.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 

Step	Control	Action	Note
3	3 DEF (SEL)	Press.	Repetitively pressing this key toggles the SELCAL function on and off.

In conjunction with SELCAL the following issues should be taken into account:

- Switching SELCAL ON is only possible if the actual modulation type is set to J3E+ and if the actual channel is modifiable. In case another modulation type is set, the SELCAL softkey is disabled.
- If SELCAL is switched ON, the modulation mode cannot be changed anymore by the operator. SELCAL has to be switched OFF before changing the modulation type. To indicate this to the operator the MOD softkey is not shown and there is a grayed out SEL softkey instead.

3.3 Phone Patch Mode

3.3.1 Basics of Phone Patch Mode

NOTICE

The national regulations for use of the public telephone network will have to be observed.

NOTICE

The VoIP service (see sect. 5.5 Voice over IP (VoIP)) also offers a phone service functionality. In this case, however, the communication is done over an IP network and instead of DTMF tones, the call session is established using proprietary air signalling and SIP signalling.

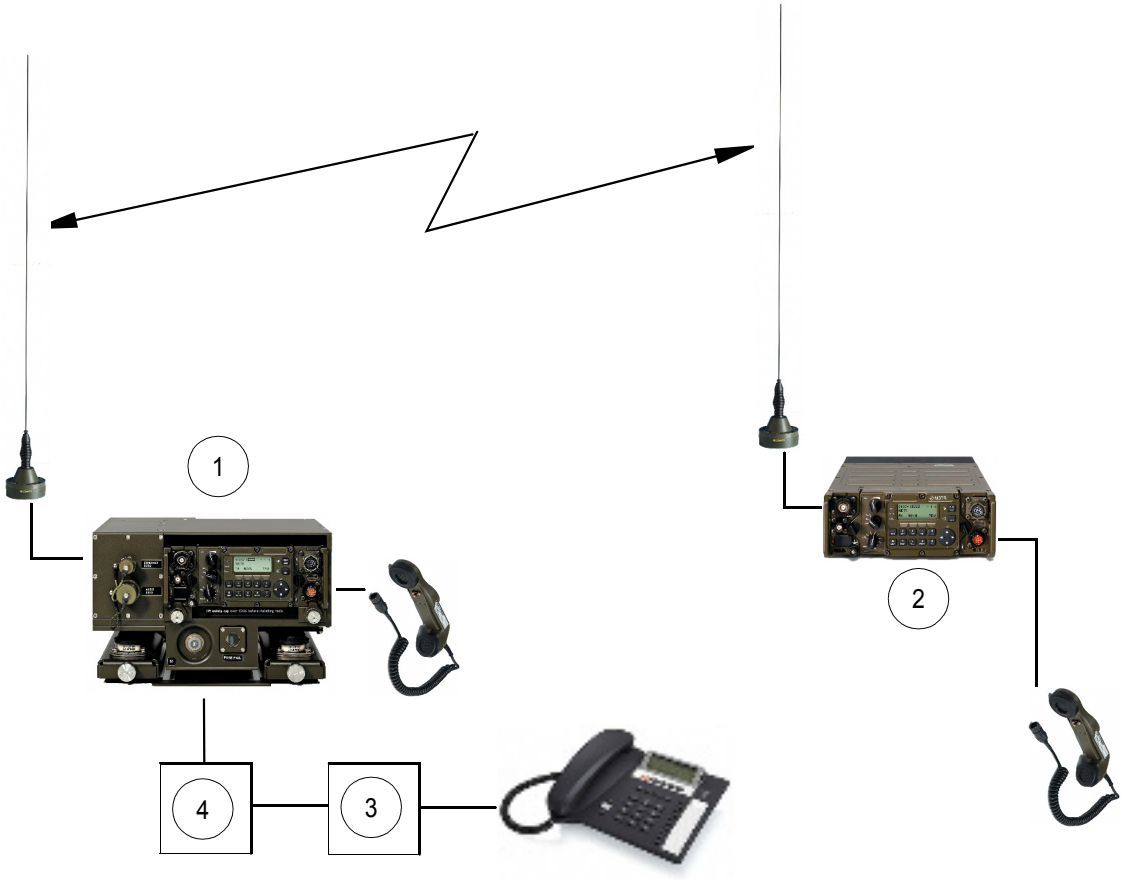
The automatic Phone Patch enables a mobile radio to setup a link with a telephone connected to PABX (Private Automatic Branch Exchange). The signalling is performed with DTMF(Dual Tone Multi Frequency) tones transmitted by the mobile radio. The system is shown in Figure 3.12. A radio (fixed) is directly connected to a PABX. The remote station is mobile and is connected via RF communication with the fixed station.

The fixed radio is connected with audio line interface and PTT, SQL control signals to the PABX box, which interfaces between radio and the PABX. The audio line interface carries the DTMF tones and the voice communication between mobile radio and the phones connected to the PABX. PTT and SQL are used by the fixed radio in the regular way.

The operator at the mobile radio initiates the link by entering a phone number on the MMI (Man-Machine Interface) of the radio. This phone number is transmitted to the fixed station as DTMF tones. With these tones the call is signalled to the addressed phone, which then may establish a voice communication to the mobile radio. The signalling via DTMF is only runs in the direction from mobile station to fix station. The mobile station does not have the ability to detect DTMF tones, it is only able to generate the DTMF tones for signalling to the PABX.

The link must be terminated by the mobile station after voice communication has ended. Calls from the PABX to the mobile radio are performed by activating the PTT line on the fixed radio. The call is transmitted as broadcast to all units of the net.

Figure 3.12 Phone Patch Mode



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1 Fixed
2 Remote (mobile)
3 PABX
4 PABX box

3.3.2 Settings in the Menu PHN (FIXED FREQUENCY OP, Operation)

Starting point:

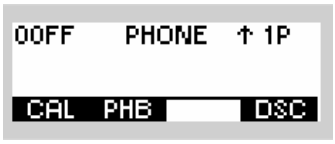
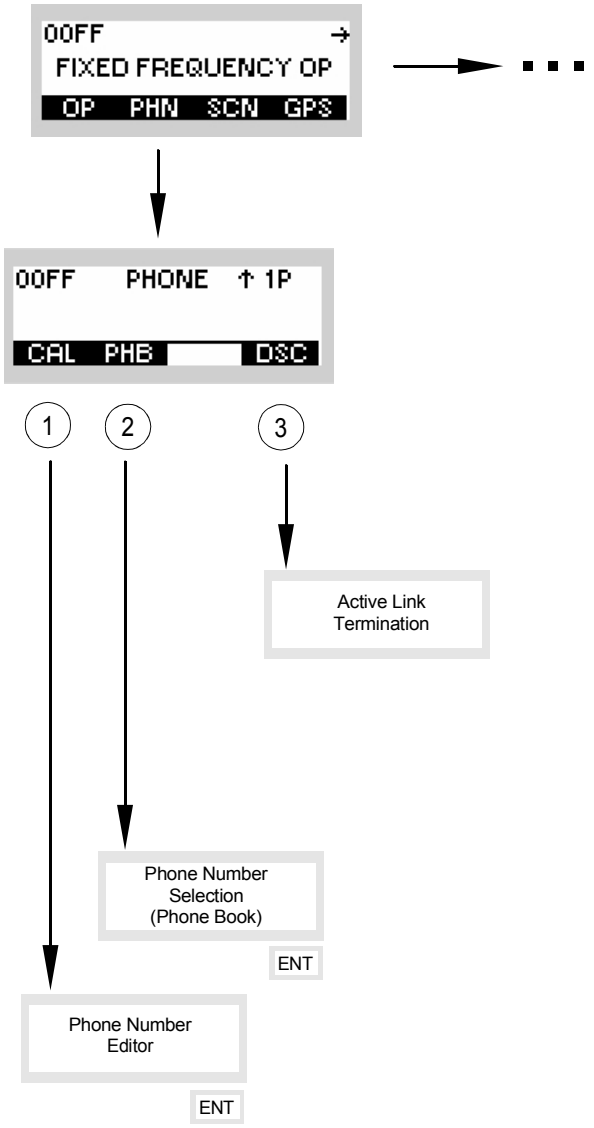
Step	Control	Action	Note
1	3 DEF (PHN)	Press.	The display changes:  The complete menu structure is shown in Figure 3.13.

Figure 3.13 Menu PHN (FF Phone, Submenu)



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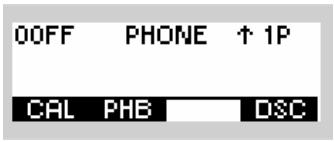
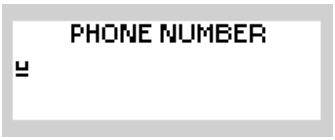
1 see sect. 3.3.2.1 Entering the Phone Number for a Manual Dial
2 see sect. 3.3.2.2 Selecting the Phone Number for a Speed Dial
3 see sect. 3.3.2.3 Terminating an Active Link

3.3.2.1 Entering the Phone Number for a Manual Dial

By means of softkey CAL (CALL) the operator can enter a phone number for manual dial.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	3 DEF (PHN)	Press.	The display changes: 
2	2 ABC (CAL)	Press.	The display changes: 
3	0 _*+ to 9 WXYZ	Enter a phone number.	Phone number may consist of numerals 0 to 9, letters A to D and characters * and #.
4	ENT	Press.	The display changes:

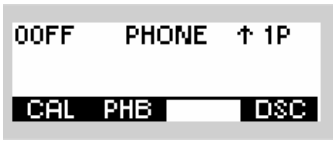
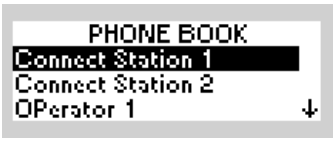
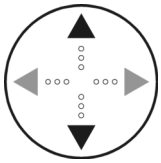
After pressing the CAL softkey any phone number can be entered. The phone number may consist of numerals 0 to 9, letters A to D and characters * and #. The individual characters are selected by pressing the keys several times as on a mobile phone. Maximally 30 characters can be entered per phone number. Phone number entry is completed with ENT, thus starting the emission of the relevant DTMF tone sequence.

In this way multiple phone numbers can be entered consecutively. The DTMF tone sequence is received by the fixed station and transferred via the interface to the PABX which then patches the call to a fixed net.

3.3.2.2 Selecting the Phone Number for a Speed Dial

By means of softkey PHB (Phonebook) the operator can select a phone number for speed dial.

Starting point: Main page of FF menu

Step	Control	Action	Note
1	3 DEF (PHN)	Press.	The display changes: 
2	3 DEF (PHB)	Press.	The display changes: 
3		Select a phone number.	
4	ENT	Press.	The display changes:

Using the PHN softkey, the operator of the mobile device can open a list of phone numbers pre-configured by the RNMS. When a number is selected and then ENT is pressed, the corresponding DTMF tone sequence is emitted, thus initiating the call.

Apart from mere phone numbers, the PHN list may also contain control characters for controlling the phone patch or the associated PABX.

3.3.2.3 Terminating an Active Link

By means of softkey DSC (Disconnect) the operator can disconnect an active link (manual sect. 3.3.2.1 Entering the Phone Number for a Manual Dial or speed dial
sect. 3.3.2.2 Selecting the Phone Number for a Speed Dial).

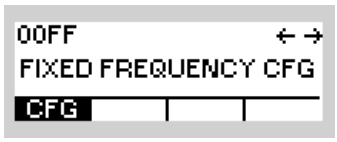
Starting point: Main page of FF menu

Step	Control	Action	Note
1	3 DEF (PHN)	Press.	The display changes:
2	5 JKL (DSC)	Press.	The display changes:

Pressing the DSC (Disconnect) softkey terminates an existing link by transmitting the DTMF sequence "*#".

3.3.3 Settings in the Menu CFG (FIXED FREQUENCY CFG, Configuration)

Starting point:



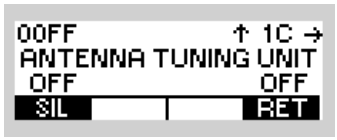
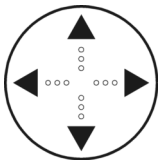
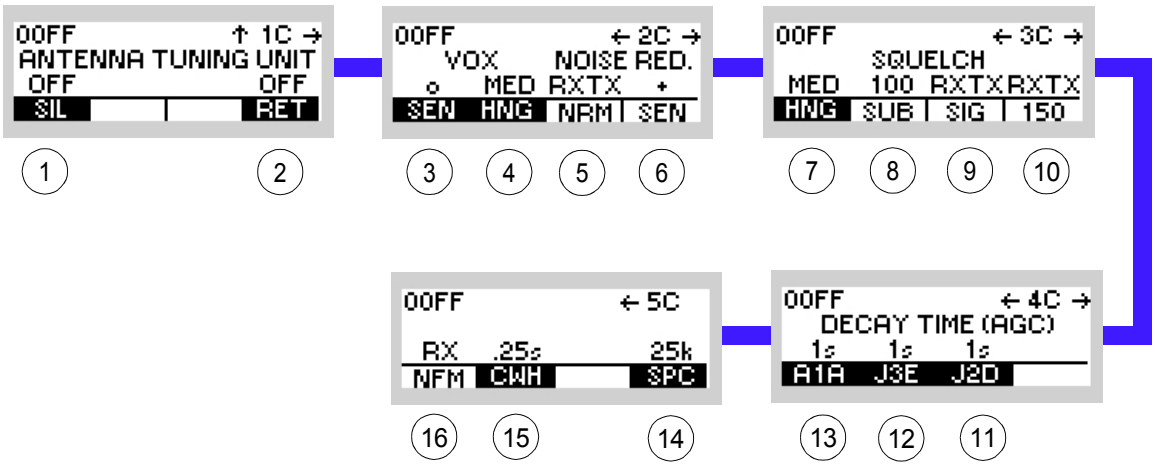
Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes, e.g.: 
2		Press.	Press several times until the desired subordinate menu is activated (see Figure 3.14). The menu structure is explained separately by Figure 3.15.

Figure 3.14 Menu CFG (FF, Submenus)



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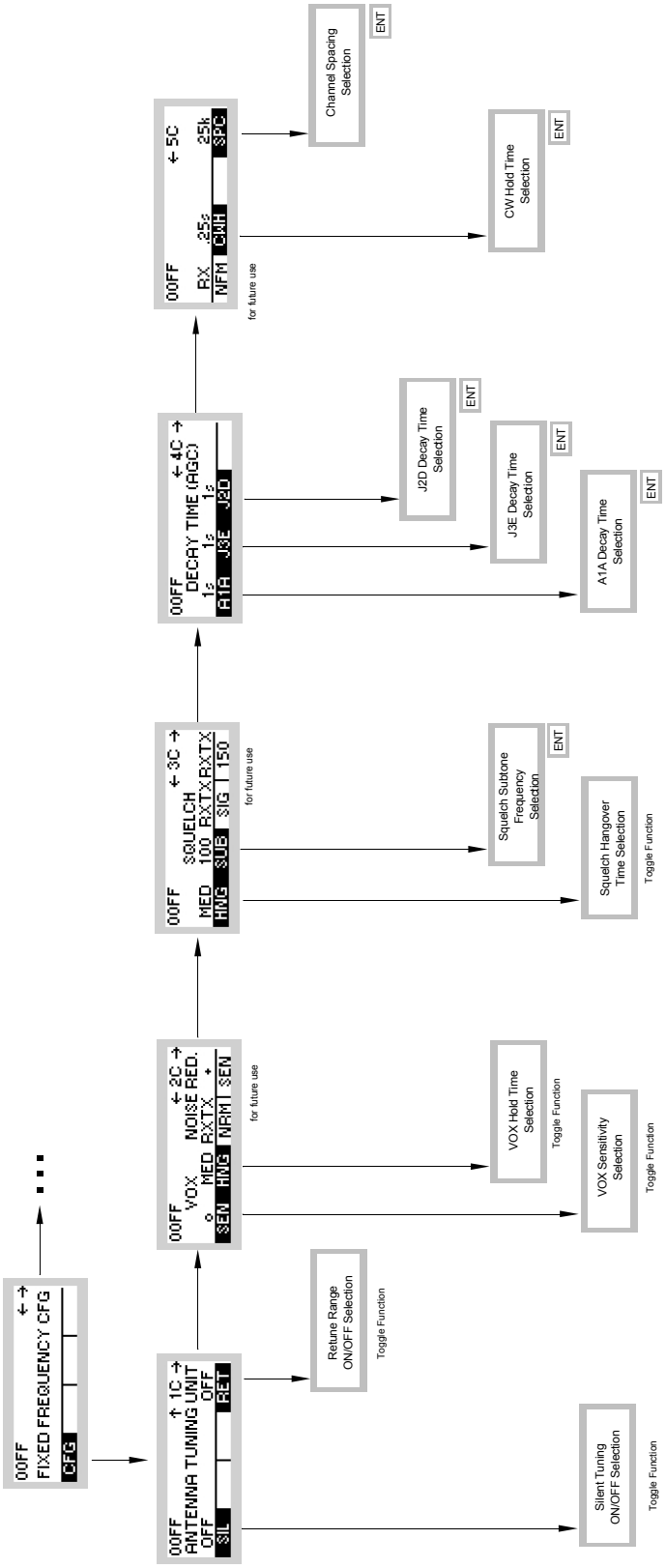
1 See sect. 3.3.3.1 Switching Silent Tuning On or Off
2 See sect. 3.3.3.2 Switching Retune Range On or Off
3 See sect. 3.3.3.3 Changing the VOX Sensitivity
4 See sect. 3.3.3.4 Changing the VOX Holdtime
5 Changing the Noise Reduction Mode (for future use)
6 Changing the Noise Reduction Sensitivity (for future use)
7 See sect. 3.3.3.5 Changing the Squelch Hangover Time
8 See sect. 3.3.3.6 Changing the Signal Squelch Subtone Frequency
9 Changing the Signal Squelch Mode (for future use)
10 Changing the 150-Hz Tone Squelch Mode (for future use)
11 See sect. 3.3.3.9 Changing the Default Decay Time for Modulation Mode J2D
12 See sect. 3.3.3.8 Changing the Default Decay Time for Modulation Mode J3E
13 See sect. 3.3.3.7 Changing the Default Decay Time for Modulation Mode A1A
14 See sect. 3.3.3.11 Changing the Channel Spacing
15 See sect. 3.3.3.10 Changing the CW Holdtime
16 Changing the Notch Filter Mode (for future use)

Figure 3.15 Menu CFG (FF, Structure)



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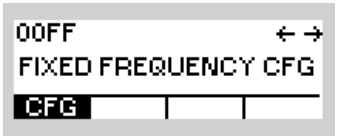
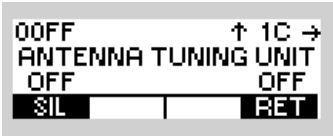
3.3.3.1 Switching Silent Tuning On or Off

By means of softkey SIL (Silent) the operator can switch ATU (Antenna Tuning Unit) tuning on or off.

- This function is only available if R&S MR310xU is operated in conjunction with an external power amplifier / antenna tuning unit.

Starting point: Main page of FF CFG menu



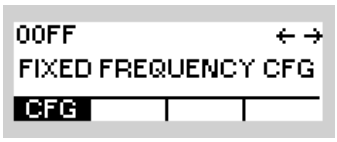
Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2	2 ABC (SIL)	Press.	Repetitively pressing this key switches silent tuning on and off.

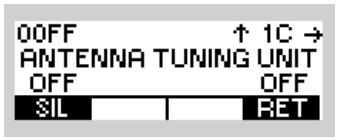
- When the conditions for radiation via the antenna change and then the VSWR threshold is exceeded, the ATU is automatically retuned. This may be undesirable in some tactical missions. In order to prevent the ATU from retuning, SIL can be set to ON. However, this may cause an antenna mismatch.
- Default: OFF

3.3.3.2 Switching Retune Range On or Off

By means of softkey RET (Retune) the operator can switch the retune range on or off.

Starting point: Main page of FF CFG menu



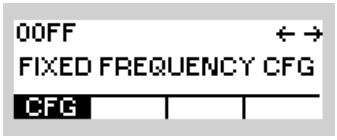
Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2	5 JKL (RET)	Press.	Repetitively pressing this key switches retune function on and off.

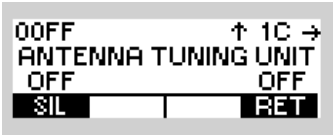
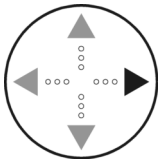
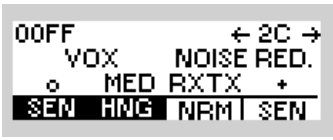
- If the retune function switched on, a new tune process is started with the next PTT activation.

3.3.3.3 Changing the VOX Sensitivity

By means of softkey SEN (Sensitivity) the operator can change the sensitivity for the function VOX. When VOX is selected, the sensitivity will become automatically activated.

Starting point: Main page of FF CFG menu



Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2		Press once	The display changes: 
3	2 ABC (SEN)	Press.	Repetitively pressing this key toggles between five sensitivity levels. Possible settings: -- very low - low o medium + high ++ very high

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface. If VOX is on, the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

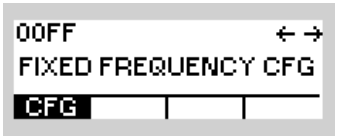
  Softkey SEN is used to change the VOX sensitivity in five steps, provided that VOX is on.

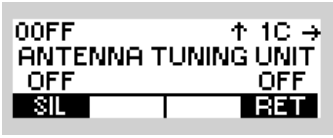
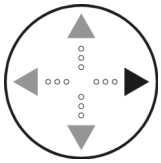
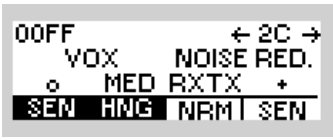
- Default: medium

3.3.3.4 Changing the VOX Holdtime

By means of softkey HNG (Hang) the operator can change the holdtime for the function VOX. When VOX is selected, the holdtime will become automatically activated.

Starting point: Main page of FF CFG menu



Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2		Press once	The display changes: 
3	3 DEF (HNG)	Press.	Repetitively pressing this key toggles between three hold times. Possible settings: SHT short MED medium LNG long

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface. If VOX is on, the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

  The transmitter is keyed as long as a voice signal is present. When the voice stops tactical radio will return to receive mode (RX) only after the holdtime has elapsed.

  The settings SHT, MED, LNG represent the following values:

  Short: 300 ms

  Medium: 600 ms

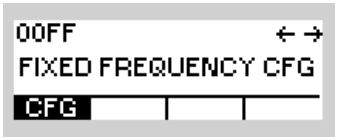
  Long: 900 ms

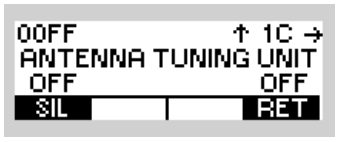
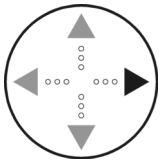
- Default: medium

3.3.3.5 Changing the Squelch Hangover Time

By means of softkey HNG (Hang) the operator can change the hangover time for the selected squelch type. When the desired squelch type is selected, the squelch hangover time will become automatically activated.

Starting point: Main page of FF CFG menu



Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2		Press twice.	The display changes:
3	2 ABC (HNG)	Press.	Repetitively pressing this key toggles between three hangover times. Possible settings: SHT short MED medium LNG long

- The hangover time is the time where the voice signal remains unmuted after the RF signal disappears.
- The settings SHT, MED, LNG represent the following values:

  Short: 300 ms

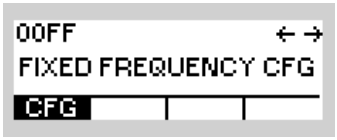
  Medium: 600 ms

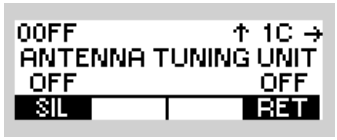
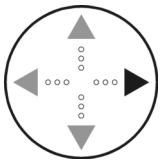
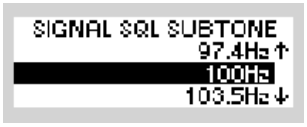
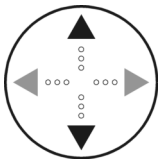
  Long: 900 ms
- Default: medium

3.3.3.6 Changing the Signal Squelch Subtone Frequency

By means of softkey SUB (Subtone) the operator can change the signal squelch subtone frequency. When the desired squelch type is selected, the relevant subtone setting will be automatically activated.

Starting point: Main page of FF CFG menu



Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2		Press twice.	The display changes: Current setting: Subtone 100 Hz
3	3 DEF (SUB)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible values (Hz): 67 - 69.3 - 71.9 - 74.4 - 77 - 79.7 - 82.5 - 85.4 - 88.5 - 91.5 - 94.8 - 97.4 - 100 - 103.5 - 107.2 - 110.9 - 114.8 - 118.8 - 123 - 127.3 - 131.8 - 136.5 - 141.3 - 146.2 - 151.4 - 156.7 - 162.2 - 167.9 - 173.8 - 179.9 - 186.2 - 192.8 - 203.5 - 210.7 - 218.1 - 225.7 - 233.6 - 241.8 - 250.3
5	ENT	Press.	The selection window is closed. The new subtone is now effective

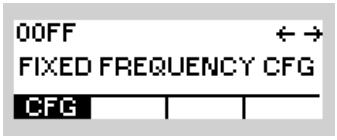
- When enabled, the audio signal is unmuted only if a predefined signal tone is detected in the received signal. The signal tone is attenuated in the audio signal by more than 30 dB. The transmitter superimposes a signal tone on the voice modulation signal. In F3E mode the peak frequency shift is 1650 Hz (±350 Hz).

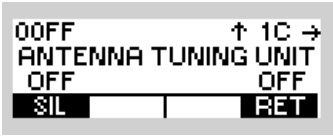
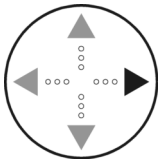
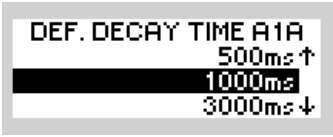
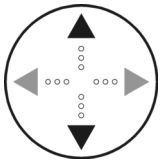
  The signal squelch is supported in modulation modes F3E and A3E.

3.3.3.7 Changing the Default Decay Time for Modulation Mode A1A

By means of softkey A1A the operator can change the default decay time for modulation mode A1A. If modulation mode A1A is selected, the new decay time will be used.

Starting point: Main page of FF CFG menu



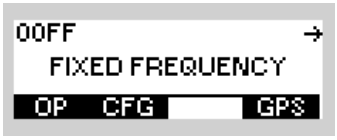
Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2		Press three times.	The display changes:
3	2 ABC (A1A)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible values: 25 ms - 150 ms - 500 ms - 1000 ms - 3000 ms - 5000 ms - 9000 ms
5	ENT	Press.	The selection window is closed. The new decay time is now effective.

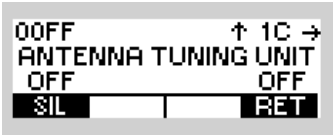
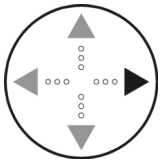
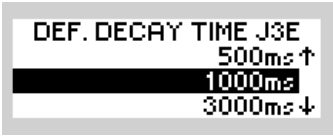
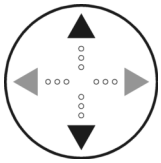
- The decay time is used to select a delay after which the gain is reduced by AGC (Automatic Gain Control).
- Default: 1 sec

3.3.3.8 Changing the Default Decay Time for Modulation Mode J3E

By means of softkey J3E the operator can change the default decay time for modulation mode J3E. If then modulation mode J3E is selected, the new decay time will be used.

Starting point: Main page of FF CFG menu



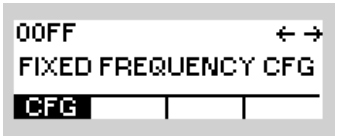
Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2		Press three times.	The display changes:
3	3 DEF (J3E)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible values: 25 ms - 150 ms - 500 ms - 1000 ms - 3000 ms - 5000 ms - 9000 ms
5	ENT	Press.	The selection window is closed. The new decay time is now effective.

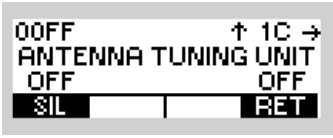
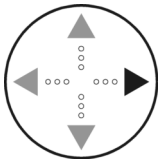
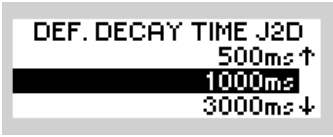
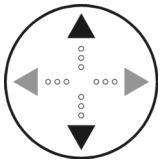
- The decay time is used to select a delay after which the gain is reduced by AGC (Automatic Gain Control).
- Default: 1 sec

3.3.3.9 Changing the Default Decay Time for Modulation Mode J2D

By means of softkey J2D the operator can change the default decay time for modulation mode J2D. If then modulation mode J2D is selected, the new decay time will be used.

Starting point: Main page of FF CFG menu



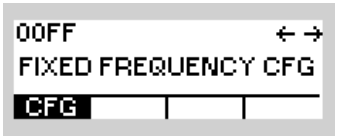
Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2		Press three times.	The display changes:
3	4 GHI (J2D)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible values: 25 ms - 150 ms - 500 ms - 1000 ms - 3000 ms - 5000 ms - 9000 ms
5	ENT	Press.	The selection window is closed. The new decay time is now effective.

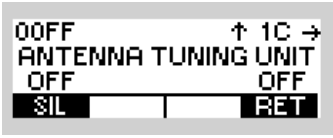
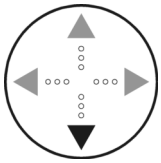
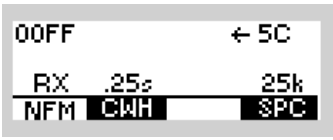
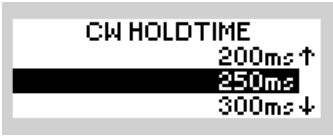
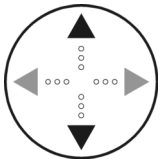
- The decay time is used to select a delay after which the gain is reduced by AGC (Automatic Gain Control).
- Default: 1 sec

3.3.3.10 Changing the CW Holdtime

By means of softkey CWH (CW Holdtime) the operator can change the CW holdtime. By setting the modulation mode to A1A the set CW holdtime is automatically activated.

Starting point: Main page of FF CFG menu



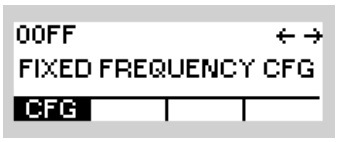
Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2		Press.	The display changes: 
3	3 DEF (CWH)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible values (ms): 50 - 100 - 150 - 200 - 250 - 300 - 350 - 400 - 450 - 500
5	ENT	Press.	The selection window is closed. The new holdtime is now effective.

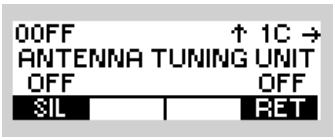
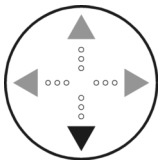
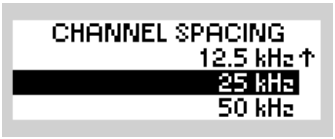
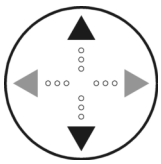
- The CW holdtime is the delay between the moment the operator releases the PTT key (TX operation) and the actual carrier deactivation.

3.3.3.11 Changing the Channel Spacing

By means of softkey SPC (Spacing) the operator can change the channel spacing.

Starting point: Main page of FF CFG menu



Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes: 
2		Press.	The display changes:
3	5 JKL (SPC)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible values: 1 Hz - 5 kHz - 6.25 kHz - 8 1/3 kHz - 12.5 kHz - 25 kHz - 50 kHz
5	ENT	Press.	The selection window is closed. The new channel spacing is now effective.

3.4 Fixed Frequency Scanning

3.4.1 Basics of Fixed Frequency Scanning

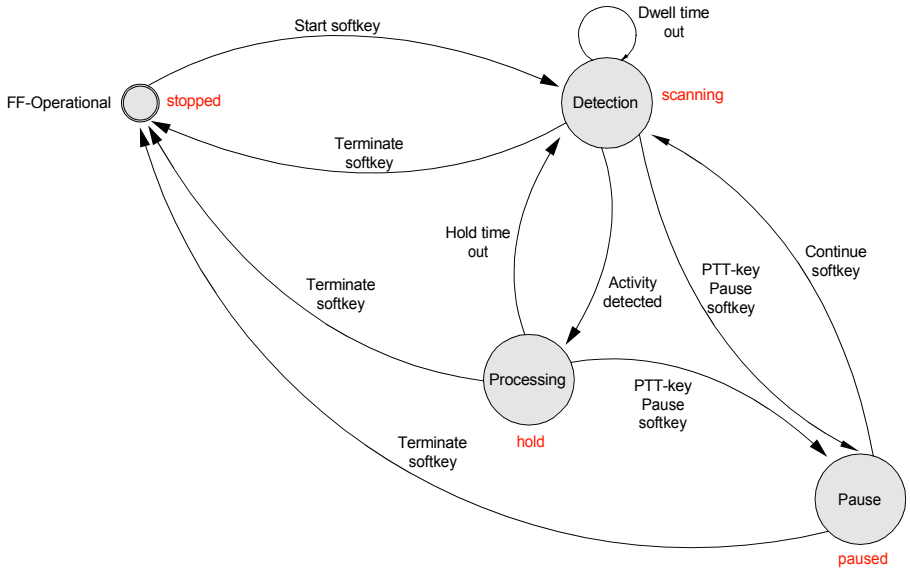
The radio is capable of monitoring activity at different Fixed Frequency settings via two scan modes. They are named "Frequency Scan" and "Channel Scan". Activity is detected by evaluating the configured squelch status. Each frequency or channel is scanned sequentially. After scanning the whole defined range, scanning is resumed at the beginning of the defined range again. Only user interaction will interrupt this loop.

During “Frequency Scan” a defined range (start/stop/step) and in “Channel Scan” a predefined list of channels will be scanned. Each setting will be checked for activity as long as defined by the parameter Dwell Time, which can be configured for each squelch type separately. When activity has been detected, the received signal will be processed as long as defined by the parameter Hold Time.

If an activity is detected, the operator is able to pause the scanning and store the actual frequency into a user defined channel.

Pausing or stopping the scanning procedure is possible any time. When scanning is paused, the last frequency or the last channel settings found will be taken over into the radio FF operational mode. When the operator restarts frequency scanning without changing the start frequency, scanning resumes at the last scanned frequency.

Figure 3.16 State Diagram of the Scanning Feature



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3.4.2 Settings in the Menu SCN (FIXED FREQUENCY OP, Operation)

Starting point:

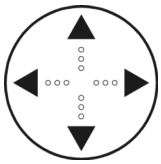
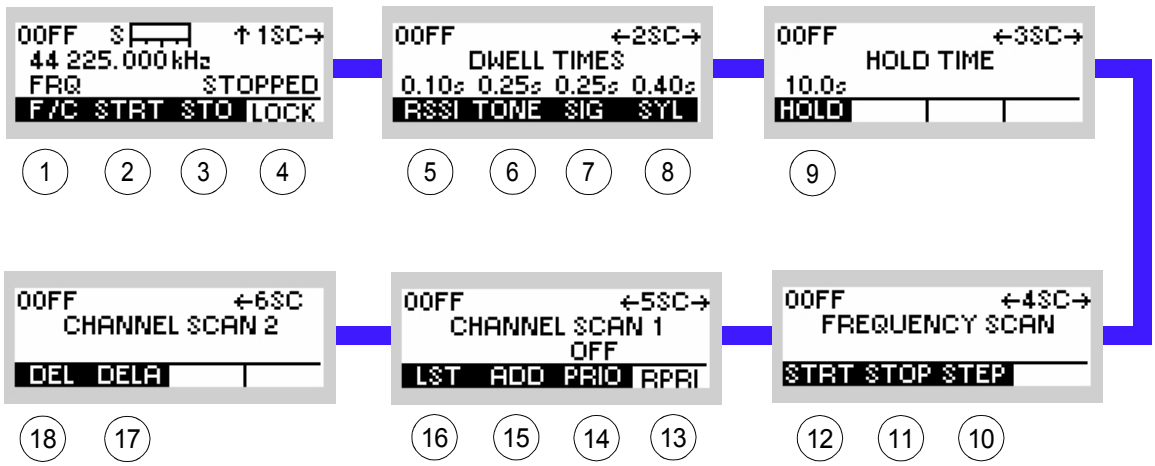
Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired submenu is activated (see Figure 3.17). The complete menu structure is shown in Figure 3.18.

Figure 3.17 Menu SCN (FF Scanning, Submenus)



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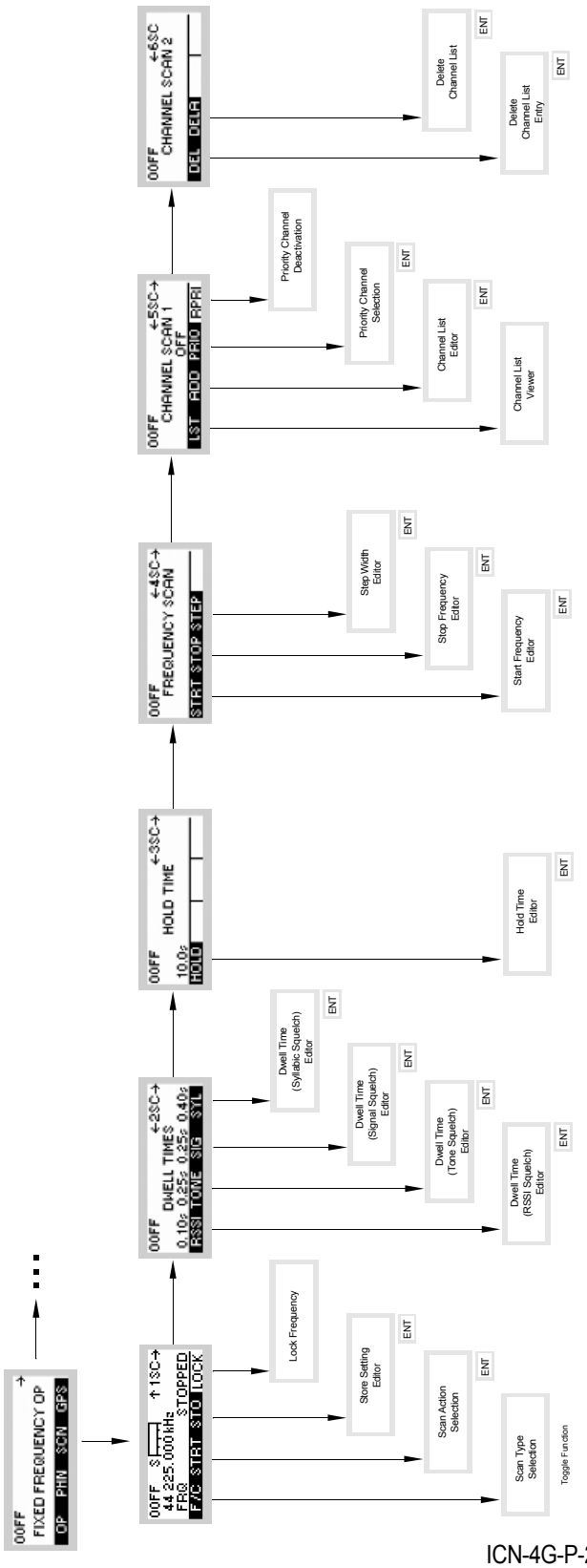
1 see sect. 3.4.2.1 Selecting the Scan Type
2 see sect. 3.4.2.2 Selecting the Scan Action
3 see sect. 3.4.2.3 Storing Found Frequency or Channel
4 see sect. 3.4.2.4 Locking a Frequency
5 see sect. 3.4.2.5 Changing the Dwell Time (RSSI Squelch)
6 see sect. 3.4.2.6 Changing the Dwell Time (Tone Squelch)
7 see sect. 3.4.2.7 Changing the Dwell Time (Signal Squelch)
8 see sect. 3.4.2.8 Changing the Dwell Time (Syllabic Squelch)
9 see sect. 3.4.2.9 Changing the Hold Time
10 see sect. 3.4.2.12 Changing the Step Width (FRQ Scanning)
11 see sect. 3.4.2.11 Changing the Stop Frequency (FRQ Scanning)
12 see sect. 3.4.2.10 Changing the Start Frequency (FRQ Scanning)
13 see sect. 3.4.2.16 Switching the Priority Channel OFF (CHN Scanning)
14 see sect. 3.4.2.15 Switching the Priority Channel ON (CHN Scanning)
15 see sect. 3.4.2.14 Adding Channels to the Channel List (CHN Scanning)
16 see sect. 3.4.2.13 Viewing a Channel List (CHN Scanning)
17 see sect. 3.4.2.18 Deleting a Channel List (CHN Scanning)
18 see sect. 3.4.2.17 Deleting a Channel List Entry (CHN Scanning)

Figure 3.18 Menu SCN (FF Scanning, Structure)



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3.4.2.1 Selecting the Scan Type

By means of softkey F/C (Frequency / Channel) the operator can select the scanning type.

There are two different types of scanning available:

- FRQ = Frequency Scanning
- CHN = Channel Scanning

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2	2 ABC (F/C)	Press.	Repetitively pressing this key toggles between FRQ (Frequency) and CHN (Channel).

3.4.2.2 Selecting the Scan Action

By means of softkey STRT (Start) the operator can start the FF scanning.

The STRT softkey is only enabled if the preconditions for the chosen scanning type are fulfilled.

Preconditions

- Frequency Scanning:
  - One squelch type has to be switched on (see sect. 3.2.2.22 Changing the Squelch Type)
  - PTT key must no be pressed
- Channel Scanning
  - There has to be more than one channel in the channel list
  - PTT key must no be pressed

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes, e.g.:
2	3 DEF (STRT)	Press.	The display changes, e.g.:

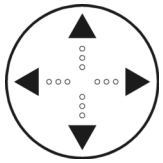
Table 3.13 Possible States of FF Scanning

State	Display	Actions
stopped		STRT (start scanning) STO (see sect. 3.4.2.3 Storing Found Frequency or Channel)
scanning		PAUS (pause scanning) STOP (terminate scanning)
paused		CON (continue the scanning) STOP (terminate scanning)
hold		PAUS (pause scanning) STOP (terminate scanning) LOCK (see sect. 3.4.2.4 Locking a Frequency)

3.4.2.3 Storing Found Frequency or Channel

To store a frequency or channel found during the scanning the scan procedure must be paused (see sect. 3.4.2.2 Selecting the Scan Action) after the activity was detected. The operator is then able to store the found frequency or channel by means of the softkey STO (Store).

Starting point: Activity is detected (e.g. 16.5 MHz)

Step	Control	Action	Note
1	2 ABC (PAUS)	Press.	The display changes:
2	4 GHI (STO)	Press.	The display changes:
3	0 _*+ to 9 WXYZ or 	Enter the channel number. Change channel number selectively.	Range: 2 to 400
4	ENT	Press.	The editor window is closed.

3.4.2.4 Locking a Frequency

If an activity on a channel is detected, the scanning changes to the hold state. If the operator decides that the detected activity is not relevant, he can press the LOCK softkey. From then on, this frequency will no longer be detected.

If the operator locks a frequency during channel scan, the concerned channel will be deleted from the scanning channel list.

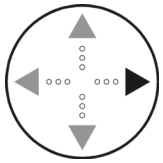
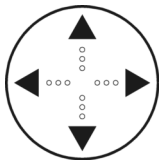
Starting point: Activity is detected (e.g. 16.5 MHz)

Step	Control	Action	Note
1	(LOCK) 5 JKL	Press.	The frequency is locked and will not be recognized again until restart of the scan.

3.4.2.5 Changing the Dwell Time (RSSI Squelch)

By means of softkey RSSI (Receive Signal Strength Indication for carrier squelch) the operator can set the dwell time of the RSSI squelch.

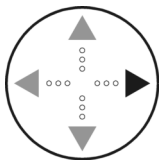
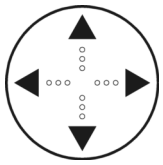
Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (RSSI)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter the time. Change time selectively.	Range: 50 ms to 60000 ms
5	ENT	Press.	The editor window is closed.

3.4.2.6 Changing the Dwell Time (Tone Squelch)

By means of softkey TONE the operator can set the dwell time of the tone squelch.

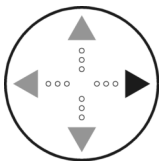
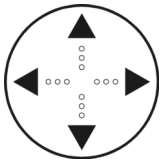
Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press once.	The display changes:
3	3 DEF (TONE)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter the time. Change time selectively.	Range: 100 ms to 60000 ms
5	ENT	Press.	The editor window is closed.

3.4.2.7 Changing the Dwell Time (Signal Squelch)

By means of softkey SIG (Signal) the operator can set the dwell time of the signal squelch.

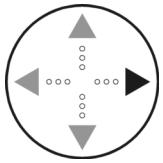
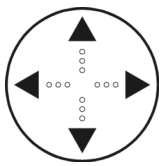
Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	(SCN) 4 GHI	Press.	The display changes:
2		Press once.	The display changes:
3	(SIG) 4 GHI	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter the time. Change time selectively.	Range: 100 ms to 60000 ms
5	ENT	Press.	The editor window is closed.

3.4.2.8 Changing the Dwell Time (Syllabic Squelch)

By means of softkey SYL (Syllabic) the operator can set the dwell time of the syllabic squelch.

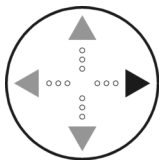
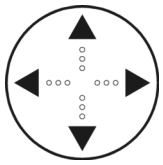
Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press once.	The display changes:
3	5 JKL (SYL)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter the time. Change time selectively.	Range: 200 ms to 60000 ms
5	ENT	Press.	The editor window is closed.

3.4.2.9 Changing the Hold Time

By means of softkey HOLD the operator can set the hold time of the processing state.

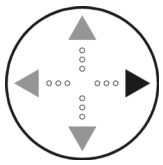
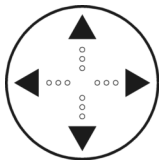
Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press twice.	The display changes:
3	2 ABC (HOLD)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter the time. Change time selectively.	Range: 0 to 60000 ms (0 = OFF)
5	ENT	Press.	The editor window is closed.

3.4.2.10 Changing the Start Frequency (FRQ Scanning)

By means of softkey STRT (Start) the operator can set the start frequency for FRQ scanning.

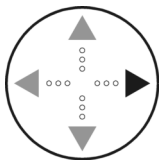
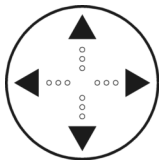
Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press three times.	The display changes:
3	2 ABC (STRT)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter the frequency. Change frequency selectively.	Range: 1500.000 kHz to 511975.000 kHz
5	ENT	Press.	The editor window is closed.

3.4.2.11 Changing the Stop Frequency (FRQ Scanning)

By means of softkey STOP the operator can set the stop frequency for FRQ scanning.

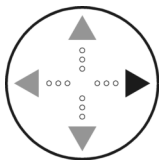
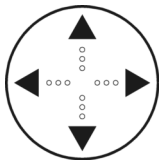
Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press three times.	The display changes:
3	3 DEF (STOP)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter the frequency. Change frequency selectively.	Range: 1500.000 kHz to 511975.000 kHz
5	ENT	Press.	The editor window is closed.

3.4.2.12 Changing the Step Width (FRQ Scanning)

By means of softkey STEP the operator can set the step width of the FRQ scanning.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press three times.	The display changes:
3	4 GHI (STEP)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter the step width. Change step width selectively.	Range: 0.001 kHz to 510500.000 kHz
5	ENT	Press.	The editor window is closed.

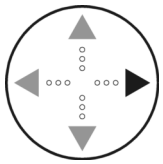
3.4.2.13 Viewing a Channel List (CHN Scanning)

NOTICE

The softkey LST is enabled only if there is at least one channel added to the channel list.

By means of softkey LST (List) the operator can view the channel list for CHN scanning.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press four times.	The display changes:
3	2 ABC (LST)	Press.	The display changes:
4	ENT	Press.	The display changes back to the starting point.

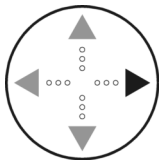
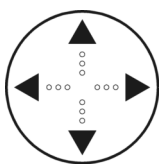
3.4.2.14 Adding Channels to the Channel List (CHN Scanning)

NOTICE

Only predefined channels, with at least one squelch type is switched on, can be stored into the scanning channel list.

By means of softkey ADD the operator can add predefined channels to the channel list.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press four times.	The display changes:
3	3 DEF (ADD)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter the channel number. Change channel number selectively.	Only predefined channels will be added to the channel list, depending on the squelch setting (if no squelch is on, the channel won't be added to the list).

Step	Control	Action	Note
5		Press.	The editor window is closed. The channel will be added to the channel list if all preconditions are fulfilled.

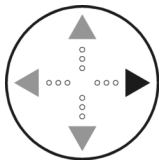
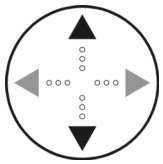
3.4.2.15 Switching the Priority Channel ON (CHN Scanning)

NOTICE

The softkey PRIO is enabled only if there is at least one channel added to the channel list.

By means of softkey PRIO (Priority) the operator can select a priority channel.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press four times.	The display changes:
3	4 GHI (PRIO)	Press.	The display changes:
4		Press to select.	
5	ENT	Press.	The editor window is closed. The display changes:

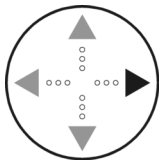
3.4.2.16 Switching the Priority Channel OFF (CHN Scanning)

NOTICE

The softkey RPRI is enabled only if a priority channel is set.

By means of softkey RPRI the operator can deactivate the channel priority.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press four times.	The display changes:
3	5 JKL (RPRI)	Press.	The display changes:

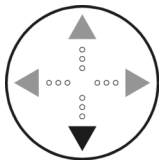
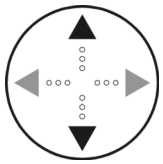
3.4.2.17 Deleting a Channel List Entry (CHN Scanning)

NOTICE

The softkey DEL is enabled only if there is at least one channel added to the channel list.

By means of softkey DEL (Delete) the operator can delete an entry.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (DEL)	Press.	The display changes:
4		Press to select.	
5	ENT	Press.	The editor window is closed. The channel is deleted from the channel list.

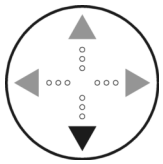
3.4.2.18 Deleting a Channel List (CHN Scanning)

NOTICE

The softkey DELA is enabled only if there is at least one channel added to the channel list.

By means of softkey DELA (Delete All) the operator can delete the channel list.

Starting point: Main page of FF OP menu

Step	Control	Action	Note
1	4 GHI (SCN)	Press.	The display changes:
2		Press once.	The display changes:
3	3 DEF (DELA)	Press.	The display changes:
4	ENT	Press.	The editor window is closed. The display changes:

3.5 Login

3.5.1 Settings in Menu OP (Operation)

- In the LOGIN menu the level of user access (user levels 0 to 2 are available) can be selected, allowing the user to perform the functions he is authorized to use. Selection is made by entering a 4-digit password and confirming with ENT.

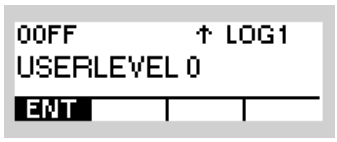
- The following default passwords are defined:

  Level 0: no password required

  Level 1: 1234

  Level 2: 2345

  These passwords can be changed via the R&S RNMS3000 (Radio Network Management System).
- The issuance of user rights (i.e. user levels) is managed by the system administrator.
- The assignment of user levels to radio functions is fix and cannot be changed. So for instance starting the downloading procedure always requires user level 2 to be selected.

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes, e.g.: 
2	2 ABC (ENT)	Press.	The display changes, e.g.:
3	0 _*+ to 9 WXYZ	Press.	Enter password.

Step	Control	Action	Note
4		Press.	

3.5.1.1 User Levels in Fixed Frequency Mode

In Table 3.14 the user level required for each function is stated.

Table 3.14 User Level in Fixed Frequency Mode

Function	Meaning	User level
	OPERATION	
FRQ	Changing the Frequency	1
MOD	Changing the Modulation Mode	1
RSSI	Changing the Squelch Sensitivity	0
RCL	Recalling Settings	0
PWR	Changing the Power Level	0
CLF	Changing the Clarifier Frequency	0
PRE	Changing the Preamplifier/ Attenuation Setting	2
VC	Switching the Voice Compressor On or Off	2
BW	Changing the Bandwidth	1
SF3	Changing the Frequency Shift (F3E)	2
GAIN	Changing the Manual Gain	2
AGC	Switching the Automatic Gain Control On or Off	2
R/S	Switching the FSK Output On or Off	0
DR	Changing the Data Rate	2
SF1	Changing the Frequency Shift (F1D)	2
POL	Changing the Polarity	2
BFO	Changing the BFO Frequency	0
PBT	Changing the Passband Tuning Frequency	0
dF	Changing the Delta Frequency	0
VOX	Changing the VOX Function	0
NOT	Switching the Notch Filter On or Off	2
NR	Switching the Noise Filter On or Off (For Future Use)	2
SQT	Changing the Squelch Type	0
TUN	Starting ATU Tuning	0
RNG	Changing the ATU Tuning Range	0
BYP	Bypassing the ATU	0
LRN	Starting ATU Learning	0
STO	Storing Current Settings	1
SEL	Switching the SELCAL Function On or Off	0

Function	Meaning	User level
	CONFIGURATION	
SIL	Switching Silent Tuning On or Off	0
RET	Switching Retune Range On or Off	2
SEN	Changing the VOX Sensitivity	0
HNG	Changing the VOX Holdtime	2
NRM	Changing the Noise Reduction Mode (for future use)	2
SEN	Changing the Noise Reduction Sensitivity (for future use)	0
HNG	Changing the Squelch Hangover Time	2
SUB	Changing the Signal Squelch Subtone Frequency	2
SIG	Changing the Signal Squelch Mode (for future use)	2
150	Changing the 150-Hz Tone Squelch Mode (for future use)	2
A1A	Changing the Default Decay Time for Modulation Mode A1A	2
J3E	Changing the Default Decay Time for Modulation Mode J3E	2
J2D	Changing the Default Decay Time for Modulation Mode J2D	2
NFM	Changing the Notch Filter Mode (for future use)	2
CWH	Changing the CW Holdtime	2
SPC	Changing the Channel Spacing	1

3.5.1.2 User Levels in FF Phone Mode

In Table 3.15 the user level required for each function is stated.

Table 3.15 User Level in FF Phone Mode

Function	Meaning	User level
CAL	Entering the Phone Number for a Manual Dial	0
PHB	Selecting the Phone Number for a Speed Dial	0
DSC	Terminating an Active Link	0

3.5.1.3 User Levels in FF Scanning Mode

In Table 3.16 the user level required for each function is stated.

Table 3.16 User Level in FF Scanning Mode

Function	Meaning	User level
F/C	Selecting the Scan Type	0
STRT	Start the scanning	0
STO	Storing Found Frequency or Channel	1
LOCK	Lock Frequency	0
PAUS	Pause scanning	0
STOP	Terminate scanning	0
CON	Continue the scanning	0
RSSI	Changing the Dwell Time (RSSI Squelch)	2
TONE	Changing the Dwell Time (Tone Squelch)	2
SIG	Changing the Dwell Time (Signal Squelch)	2
SYL	Changing the Dwell Time (Syllabic Squelch)	2
HOLD	Changing the Hold Time	2
STRT	Changing the Start Frequency (FRQ Scanning)	0
STOP	Changing the Stop Frequency (FRQ Scanning)	0
STEP	Changing the Step Width (FRQ Scanning)	0
LST	Viewing a Channel List (CHN Scanning)	0
ADD	Adding Channels to Channel List (CHN Scanning)	0
PRIO	Switching the Priority Channel ON (CHN Scanning)	0
RPRI	Switching the Priority Channel OFF (CHN Scanning)	0
DEL	Deleting a Channel List Entry (CHN Scanning)	0
DELA	Deleting a Channel List (CHN Scanning)	1

3.5.1.4 User Levels in ALE-2G Mode

In Table 3.17 the user level required for each function is stated.

Table 3.17 User Levels in ALE-2G Mode

Function	Meaning	User level
	OPERATION	
SCG	Scan Groups	0
SCN	Changing the Scan Rate	1
CALL	Initiating a Call	0
CHN	Selecting the Channel for Fixed Call	0
INDV	Selecting the Address for Individual Call	0
NET	Selecting the Address for Net Call	0
ALL	Selecting the Address for All Call	0
ANY	Selecting the Address for Any Call	0
GRP	Create a Station Address List for Group Call	0
ADD	Adding an Individual Address	0
PWR	Changing the Power Level	0
BYP	Bypassing the ATU	0
LRN	Starting ATU Learning for ALE Channels	0
LM	Changing the Link Mode	0
RX	Selecting the RX Message	0
TX	Selecting the TX Message	0
LKD	Listing All Currently Linked Stations	0
TRM	Terminate a Link	0
	CONFIGURATION	
SND	Switching the Sounding On or Off	0
INT	Changing the Sounding Interval	0
LQA	Switching the LQA Request On or Off	0
RPT	Switching the LQA Report On or Off	0
WGT	Changing the Weight of a New LQA Event	1
DLV	Switching the Default Link Mode Voice On or Off	1
UUF	Switching the User Unique Function On or Off	1
ANY	Switching the Acceptance of an Any Call On or Off	1
ALL	Switching the Acceptance of an All Call On or Off	1
WLD	Switching the Acceptance of a Wild Call On or Off	1
TS	Switching the Time Server Function On or Off	0

Function	Meaning	User level
PTA	Switching the Passive Time Acquisition On or Off	0
TIM	Changing the Network Time and Date	0
LBT	Changing the LBT Timeout	1
RTO	Changing the Response Timeout	1
ACT	Changing the Activity Timeout	1
UTR	Switching Unprotected Time Synchronization On or Off	0
TRI	Changing the Time Request Interval	1
KEY	Changing the Linking Protection Key	2
LPL	Changing the Linking Protection Level	2
FTR	Switching Fine Time Synchronization On or Off	1
CTR	Switching Coarse Time Synchronization On or Off	1
LLL	Switching the Acceptance of Links on Lower Linking Protection Level On or Off	1
BER	Changing the Bit Error Ratio Threshold	0
SIN	Changing the SINAD Threshold	0

3.5.1.5 User Levels in ALE-3G Mode

In Table 3.18 the user level required for each function is stated.

Table 3.18 User Levels in ALE-3G Mode

Function	Meaning	User level
	OPERATION	
SCG	Scan Groups	0
CCT	Changing the Call Channel Type	1
CALL	Initiating a Call	0
CHN	Selecting the Channel for Fixed Call	0
INDV	Selecting the Address for Individual Call	0
MCA	Selecting the Address for Multicast Call	0
BCA	Selecting the Address for Broadcast Call	0
LSU	Changing the Type of Link Setup	0
ALME	Initiating an ALM Procedure	0
PWR	Changing the Power Level	0
BYP	Bypassing the ATU	0
LRN	Starting ATU Learning for ALE Channels	0
LM	Changing the Link Mode	0
LDV	Playback a Received Last Ditch Voice Message	0
RX	Selecting the RX Message	0
LKD	Listing All Currently Linked Stations	0
TRM	Terminate a Link	0
	CONFIGURATION	
LQM	Selecting the LQA Mode	0
INT	Changing the LQA Interval	0
EXL	Selecting the Partner Address for LQA Exchange	1
ALQ	Switching Acceptance of LQA Exchange On or Off	1
DEL	Deleting LQA Data	1
LQA	Switching the LQA Request On or Off	0
RPT	Switching the LQA Report On or Off	0
WGT	Changing the Weight of a New LQA Event	1
RTY	Changing the Number of Retries for Initiated Link Setup	1
A2G	Switching the Acceptance of ALE-2G Calls On or Off	1
DLV	Switching the Default Link Mode Voice On or Off	1
UUF	Switching the User Unique Function On or Off	1

Function	Meaning	User level
ANY	Switching the Acceptance of an Any Call On or Off	1
BC	Switching the Acceptance of a Broadcast Call On or Off	1
WLD	Switching the Acceptance of a Wild Call On or Off	1
OD	Switching the Occupancy Detection On or Off	1
MST	Selecting the Priority Based Session Management	1
XDM	Selecting the Adaptive xDL Selection	1
HDP	Selecting the HDL number of packets per Tx frame	1
LDB	Selecting the LDL number of bytes per Tx frame	1
AGR	Display of the Packet Aggregation Setting	0
XDP	Display of the xDL Port Setting	0
VP	Selecting the Voice Priority over IP Data	1
TS	Switching the Time Server Function On or Off	0
SRC	Selecting the Time Source	1
PTA	Switching the Passive Time Acquisition On or Off	0
TIM	Changing the Network Time and Date	0
LBT	Changing the LBT Timeout	1
RTO	Changing the Response Timeout	1
DLT	Changing the Data Link Timeout	1
ACT	Changing the Activity Timeout	1
TR	Switching Time Synchronization over the Air On or Off	1
TRI	Changing the Time Request Interval	1
KEY	Changing the Linking Protection Key	2
LPM	Switching Linking Protection On or Off	2
BER	Changing the Bit Error Ratio Threshold	0
SIN	Changing the SINAD Threshold	0
UTR	Switching unprotected time synchronization on or off	1
EN	Switching the ALM Function On or Off	0
THV	Changing ALM Threshold for Voice/FF Links	0
THD	Changing ALM Threshold for Data Links	0
CHU	Changing ALM Channel Usage	0

3.5.1.6 User Levels in HF Modem Mode

In Table 3.19 the user level required for each function is stated.

Table 3.19 User Levels in HF Modem Mode

Function	Meaning	User level
	OPERATION	
FRQ	Changing the Frequency for Data Transmission	1
PWR	Changing the Power Level for Data Transmission	0
TRM	Terminating the Data Transmission	0
TUN	Tuning the Antenna	0
DR	Changing the Data Rate and Forward Error Correction for Data Transmission	1
IL	Changing the Interleaver Length for Data Transmission	1
SC	Changing the Sub Carrier for Data Transmission (STANAG-4529 only)	1
	CONFIGURATION	
HFM	Selecting the HF Modem Waveform	1
OPM	Selecting the Asynchronous Modem Operation Mode	0
EOM	Selecting the Modem Message Protocol	1
SOD	Changing the Modem Synchronization on Data Mode	1
DAQ	Changing the Modem De-acquire Limit	1
DTT	Changing the Modem Doppler Tracking Time	1
MBL	Changing the Maximum Message Block Length	1
TLC	Changing the Modem TX Level Control Blocks	1

3.5.1.7 User Levels in OFDM Modem Mode

In Table 3.20 the user level required for each function is stated.

Table 3.20 User Levels in OFDM Modem Mode

Function	Meaning	User level
	OPERATION	
FRQ	Changing the Frequency for Data Transmission	1
PWR	Changing the Power Level for Data Transmission	0
TRM	Terminating a Link	0
DR	Changing the Data Rate and Bandwidth for Data Transmission	0
MDE	Changing the Mode for Data Transmission	1
ABD	Switching Autobaud On and Off	1
SVC	Changing the Service Mode	0
	CONFIGURATION	
SPC	Changing the Channel Spacing	1

3.5.1.8 User Levels in Secure Digital Voice Mode

In Table 3.21 the user level required for each function is stated.

Table 3.21 User Levels in Secure Digital Voice Mode

Function	Meaning	User level
	OPERATION	
FRQ	Changing the Frequency for SDV Communication	1
PWR	Changing the Power Level for SDV Communication	0
VOC	Changing the SDV Vocoder Mode	0
TUN	Tuning the Antenna	0
KEY	Selecting the Active COMSEC Key for SDV Communication	0
	CONFIGURATION	
SEL	Editing a User-defined COMSEC Key for SDV Communication	0

3.5.1.9 User Levels in SECOM-H Mode

In Table 3.22 the user level required for each function is stated.

Table 3.22 User Levels in SECOM-H Mode

Function	Meaning	User level
	OPERATION	
TRM	Terminating a Link	0
TAQ	Initiating Time Acquisition	0
FHS	Initiating a Free Hopset Search	0
PWR	Changing the Power Level	0
SP	Changing the Search Pattern Time	1
AHS	Switching the Advanced Hopset On or Off	0
STN	Addressing a Station	0
GRP	Addressing a Group	0
SVC	Selecting the Service Mode	0
VOX	Selecting the VOX Function	0
KEY	Selecting a Keyset	0
HOP	Selecting a Hopset	0
BYP	Bypassing the ATU	0
LRN	Learning of the ATU	0
TM	Changing the SECOM-H Time	0
DT	Changing the SECOM-H Date	0
	CONFIGURATION	
SEL	Editing a User Keyset	0
SEL	Editing a User Hopset	0
DR	Changing the Data Rate for SECOM-H Transmission	0
ILV	Changing the Interleaving Length	0
WF	Changing the Waveform	0
TSC	Defining a Radio as a Time Reference Unit	1
TB	Switching the Time Beacon Mode On or Off	1
TRU	Selecting the Time Source	0
SEN	Changing the VOX Sensitivity	0
HNG	Changing the VOX Hangtime	2
FHS	Switching the Free Hopset Search Mode On or Off	1
MIN	Changing the Number of Channels in an Advanced Hopset (MIN)	1
MAX	Changing the Number of Channels in an Advanced Hopset (MAX)	1

3.5.1.10 User Levels in SECOM-P Mode

In Table 3.23 the user level required for each function is stated.

Table 3.23 User Levels in SECOM-P Mode

Function	Meaning	User level
	OPERATION	
MDE	Changing the Hopping Mode	0
SYN	Initiating a Net Entry	0
BC/SEL	Link Types	0
LTH	Changing the Link Threshold	0
HTH	Changing the Hailing Threshold	0
PWR	Changing the Power Level	0
SVC	Changing the Service Mode	0
FCS	Changing the Free Channel Search Threshold	1
BI	Initiating a Break-In Request	0
AUT	Authentication	0
	CONFIGURATION	
SEC	Switching the COMSEC Mode On or Off	0
HLG	Changing the General Hailing Frequency	1
HLC	Changing the Channel Hailing Frequency	1
DFF	Changing the Digital Fixed Frequency	1
VIL	Switching the Voice Interleaver Mode On or Off	0
DR	Changing the Data Rate for SECOM-P Transmission	0
VOX	Selecting the VOX Function	0
SEN	Changing the VOX Sensitivity	0
HNG	Changing the VOX Hangtime	2
BIE	Switching the Break-In Signalling On or Off	2
MS	Changing the Master / Slave Role	0

3.5.1.11 User Levels in SECOM-V Mode

In Table 3.24 the user level required for each function is stated.

Table 3.24 User Levels in SECOM-V Mode

Function	Meaning	User level
	OPERATION	
TRM	Terminating a Link	0
NE	Initiating Net Entry	0
PWR	Changing the Power Level	0
MDE	Changing the Hopping Mode	0
SP	Changing the Search Pattern Time	1
STN	Addressing a Station	0
GRP	Addressing a Group	0
BC	Addressing for Broadcast	0
SVC	Selecting the Service Mode	0
VOX	Selecting the VOX Function	0
KEY	Selecting a Keyset	0
HOP	Selecting a Hopset	0
TM	Changing the SECOM-V Time	0
DT	Changing the SECOM-V Date	0
OBH	Switching the Out of Band Hailing Function On or Off	0
CH1	Selecting the Out of Band Hailing Channels	2
CH2	Selecting the Out of Band Hailing Channels	2
	CONFIGURATION	
SEL	Editing a User Keyset	0
SEL	Editing a User Hopset	0
GHL	Changing the General Hailing Frequency	1
NHL	Changing the Net Hailing Frequency	1
LNE	Changing the Net Entry Frequency	2
DFF	Changing the Digital Fixed Frequency	1
DR	Changing the Data Rate for SECOM-V Transmission	0
ANE	Switching the Automatic Net Entry Mode On or Off	1
TB	Switching the Time Beacon Mode On or Off	1
TRU	Defining a Radio as a Time Reference Unit	0
SEN	Changing the VOX Sensitivity	0
HNG	Changing the VOX Hangtime	2

Function	Meaning	User level
CH	Changing the Out of Band Hailing Channel	1
FRQ	Changing the Out of Band Hailing Channel Frequency	2
MOD	Changing the Out of Band Hailing Channel Modulation Mode	2
DT	Changing the Out of Band Hailing Channel Detection Method	2
S/N	Changing the Out of Band Hailing Channel Signal to Noise Squelch Level	2
RSSI	Changing the Out of Band Hailing Channel RSSI Squelch Level	0
CTT	Selecting the Out of Band Hailing Channel Tone Squelch Frequency	1

3.5.1.12 User Levels in GPS Reporting Mode

In Table 3.25 the user level required for each function is stated.

Table 3.25 User Levels in GPS Reporting Mode

Function	Meaning	User level
IMP	Initiating a GPS Position Information Transmission (Push, Immediately)	0
PSH	Initiating a GPS Position Information Transmission (Push, Scheduled)	0
IPL	Initiating a GPS Information Request (Pull, Immediately, as Controller Feature)	0
PUL	Initiating a GPS Information Request (Pull, Scheduled, as Controller Feature)	1
APR	Initiating an Auto Push Configuration Request Transmission (as Controller Feature)	1
LST	List of Received GPS Position Information	0
CRP	Switching the Controller Reports Position as Controller Feature On or Off	1
FMT	Selecting the Format of GPS Position Display	1
ROL	Selecting the Role of a Participant	1

3.5.1.13 User Levels in IPoA Mode

In Table 3.26 the user level required for each function is stated.

Table 3.26 User Levels in IPoA Mode

Function	Meaning	User level
CON	Changing the Connection Mode	0
MDE	Changing the Operation Mode	0
RT	Editing the Routing Table	0
MRT	Editing the Multicast Routing Table	0
IPA	Changing the Radio Air Interface IP Address	1
NMA	Changing the Radio Air Interface Netmask	1
IPP	Changing the PPP IP Interface Address	1
VOL	Switching Local Voice Selection On or Off	1
VOF	Switching Voice Forwarding Selection On or Off	1
BCF	Switching Relay IP Broadcast Selection On or Off	1
PRV	Inquiring the Statistic Items of the Air Interface	0
NXT	Inquiring the Statistic Items of the Air Interface	0

3.5.1.14 User Levels in Message Service Mode

In Table 3.27 the user level required for each function is stated.

Table 3.27 User Levels in Message Service Mode

Function	Meaning	User level
ALR	Initiating an Alert Message	0
IN	Received Alert Messages	0
TON	Changing the Acoustic Alert Message Signalization State	0
SDM	Initiating an SDM Message	0
IN	Received SDM Messages	0
DRF	Initiating an SDM Message from the Draft Folder	0

3.5.1.15 User Levels in Voice over IP Mode

In Table 3.28 the user level required for each function is stated.

Table 3.28 User Levels in Voice over IP Mode

Function	Meaning	User level
CAL	Entering the Phone Number for a Manual Dial	0
PHB	Selecting the Phone Number for a Speed Dial (Using the Phone Book)	0
ACC	Accept an Incoming Call	0
DSC	Terminating an Active Call Session	0

3.5.1.16 User Levels in LOGIN Mode

In Table 3.29 the user level required for each function is stated.

Table 3.29 User Levels in LOGIN Mode

Function	Meaning	User level
ENT	Enter Password to Change User Level	0

3.5.1.17 User Levels in BITE Mode

In Table 3.30 the user level required for each function is stated.

Table 3.30 User Levels in BITE Mode

Function	Meaning	User level
BIT	Starting IBIT (Initiated Built-In Test)	0
STS	Inquiring the Device Status	1
PRV	Inquiring Error Messages	1
NXT	Inquiring Error Messages	1
CAL	Calibration	2

3.5.1.18 User Levels in CONFIG Mode

In Table 3.31 the user level required for each function is stated.

Table 3.31 User Levels in CONFIG Mode

Function	Meaning	User level
	OPTION KEY	
VAL	Show selection list of valid option keys	2
INV	Show selection list of invalid option keys	2
RES	Show selection list of deactivation responses	2
NEW	Open editor for new option keys	2
	GLOBAL RADIO PARAMETERS	
PRT	Selecting the Port for Configuration	1
MDE	Configuring the Data Term 1: Mode	1
BAU	Configuring the Data Term 1: Baud Rate	1
FLW	Configuring the Data Term 1: Flow Control	1
DPS	Configuring the Data Term 1: Data / Parity / Stop	1
VOC	Configuring the Vocoder	1
SRC	Configuring the IP Port	1
VOI	Changing the Voice Sidetone Volume	0
LIN	Changing the Line Sidetone Volume	0
IN	Changing the Line Input Level	1
OUT	Changing the Line Output Level	1
PWM	Changing the Power Management	0
MEM	Selecting the ATU Memory Bank	0
P/S	Selecting PTT or Squelch Output	0
BAT	Checking the Battery Charging State	0
TM	Changing the Time	0
DT	Changing the Date	0
IP	Changing the Network Settings	2
G/N	Changing the Network Settings	2
CLR	Changing the Network Settings	1
ETH	Switching the Ethernet Function On or Off	2
DCK	Selecting the Switching Threshold for Antenna Relay of Docking Station	1
PA	Selecting the Switching Threshold for Antenna Relay of External Amplifier	1
AIND	Switching Audio Indications On or Off	0

Function	Meaning	User level
24V	Switching the 24-VDC Outputs on the Audio Connector On or Off	1
SQL	Switching the Squelch Line On or Off	0
ETHF	Selecting the Ethernet Interface	1
TX	Selecting the Transmission Inhibit Mode	0
DM	Deleting Currently Active Mission	2
R/F	Selecting the RF Input/Output Port	1
R/FT	Changing the Switching Threshold for RF Input / Output Port	1
PRE	Switching the R&S VT3050 Preamplifier On or Off	1
ATU	Switching the Internal ATU On or Off	1
	INQUIRING THE SOFTWARE VERSION	
CSCI	Inquiring the Computer Software Configuration Items	0
KID	Inquiring the Key Seed ID	0

3.5.1.19 User Levels in DOWNLOAD Mode

In Table 3.32 the user level required for each function is stated.

Table 3.32 User Levels in DOWNLOAD Mode

Function	Meaning	User level
RGA	Select radio global address to be loaded	2
DT	Start download	2
CNC	Cancel download	2

3.6 Emergency Operation Procedures

CAUTION

The safest way to erase all sensitive data is to press the erase key at least 2 s in power-on status of the radio. After erase the radio reboots with default settings.

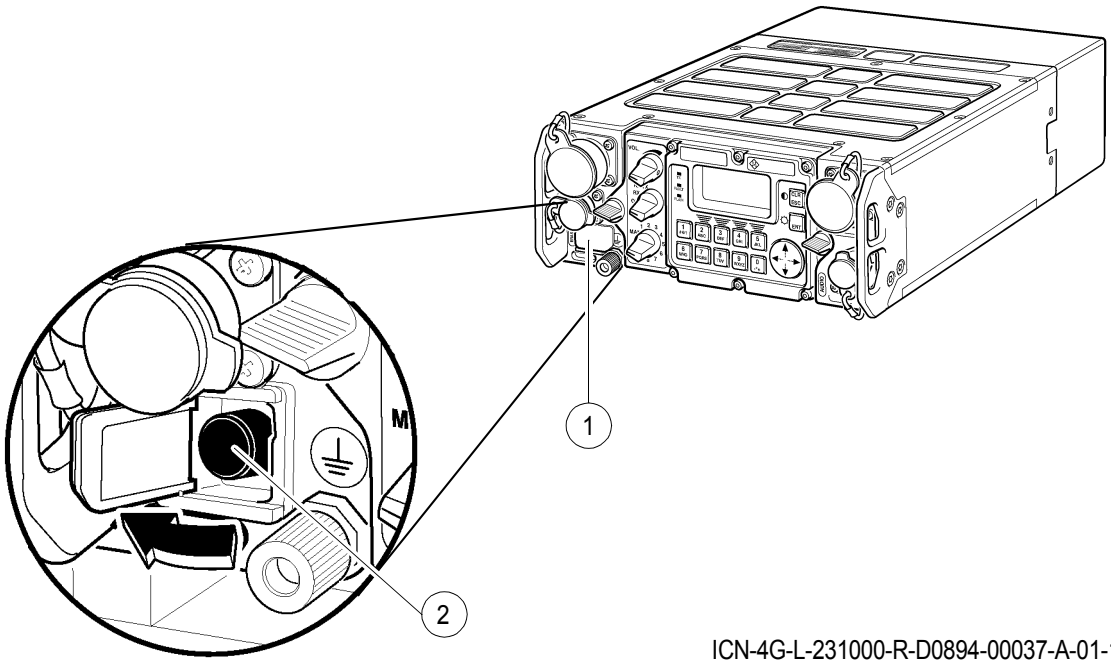
When the erase key has been actuated (> 2 s), all data need to be re-loaded to the tactical radio by using the Fillgun R&S GP3000 (ident. no. 6099.3805.02, preset page data) and the Key Distribution Device R&S KDD3750 (ident. no. 6131.2010.02, security data and TDMA tables).

When pressing the erase key only shortly (< 1 s), just the preset page data are erased.

Use the erase key only in case of emergency!

The radio should preferably be powered up when pressing the erase key. This will save backup battery power.

Figure 3.19 Erase Key



1 Protective flap
2 Erase key

Item	Control	Action	Note
1	Protective flap	Open.	
2	Erase key	Press < 1 s.	All preset pages are cleared. Preset Page 00 contains default values for fixed frequency operation. The radio restarts.
		Press > 2 s.	All preset pages, security data and TDMA tables are cleared. Preset Page 00 contains default values for fixed frequency operation The radio restarts.

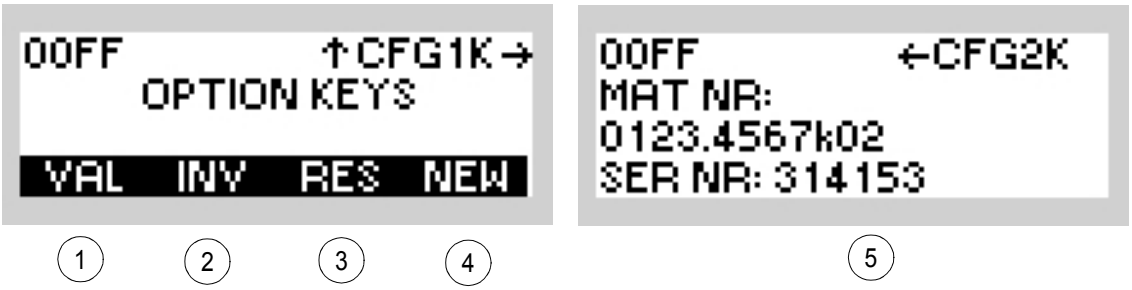
3.7 Configuration

3.7.1 Settings in Menu OPT (CONFIG, Managing Option Keys)

Starting point:

Step	Control	Action	Note
1	(OPT) 2 ABC	Press.	The display changes, e.g.: Press several times until the desired subordinate menu is activated (see).

Figure 3.20 Menu OPT (CONFIG, Submenus)



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1 See sect. 3.7.1.1 Viewing a Valid Option Key
2 See sect. 3.7.1.2 Viewing an Invalid Option Key
3 See sect. 3.7.1.3 Viewing Deactivation Responses
4 See sect. 3.7.1.4 Entering a New Option Key
5 See sect. 3.7.1.5 Viewing Additional Information for Options

- Option keys are used to activate/deactivate installed software options (e.g. SECOM-H, ALE). There are activation and deactivation keys, all provided by the manufacturer.
- Entry of activation/deactivation keys is performed using the NEW function on the MMI, valid (activated) and invalid (deactivated) keys can be viewed by pressing the respective softkey. However, these softkeys are only available if there is at least one valid/invalid option key.
- As a means to check if an option has been really deactivated, a response to this effect can be viewed and acknowledged to the manufacturer, if necessary.

NOTICE

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/).

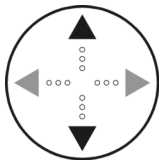
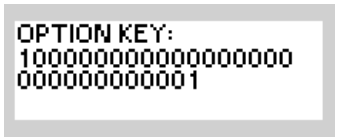
If you want to erase an installed option code later on (by loading an deactivation key), first of all perform a Quick Erase. Then load the preset pages with the Fillgun R&S GP3000.

3.7.1.1 Viewing a Valid Option Key

By means of softkey VAL (Valid) the operator can select a valid option key to view the key and its validity.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	2 ABC (OPT)	Press.	The display changes:
2	2 ABC (VAL)	Press.	The display changes:

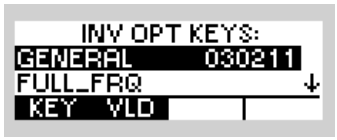
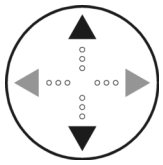
Step	Control	Action	Note
3		Press to select the desired setting.	Possible settings: • GENERAL • FULL_FRQ • ALE • OFDM (modem) • SECOMH • SECOMV • 4285 (modem) • FRQ_0.1-24.9 • FRQ_25-29.9 • FRQ_30-59.9 • FRQ_60-87.9 • FRQ_88-99.9 • FRQ_100-107.9 • FRQ_108-145.9 • FRQ_146-173.9 • FRQ_174-224.9 • FRQ_225-399.9 • FRQ_400-511.9 • IP_OVER_AIR • GPS_REP • LINK_SW • ALE_LP • LINK_Y • RS_PA_NOT_NEEDED • ALE-3G • ALE-3G_DLP • ALE-3G_RLSU The available choice depends on which keys are actually installed. Now the respective key can be viewed.
4	**2 ABC** (KEY)	Press.	The display changes: (example) 
5	**CLR ESC**	Press.	The display changes: Now the validity of the respective key can be viewed.

Step	Control	Action	Note
6	3 DEF (VLD)	Press.	The display changes, e.g.: VALID: PERMANENT or VALID FROM: 2003-07-05 04:00 VALID TO: ↓ or VALID FROM: VALID FOR: ↑ 3333H
7	ENT	Press.	The window is closed.

3.7.1.2 Viewing an Invalid Option Key

By means of softkey INV (Invalid) the operator can select an invalid option key to view the key and its validity.

Starting point: Main page of CONFIG menu

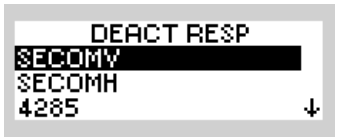
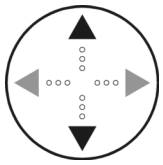
Step	Control	Action	Note
1	2 ABC (OPT)	Press.	The display changes:
2	3 DEF (INV)	Press.	The display changes: 
3		Press to select the desired setting.	Possible settings: • GENERAL • FULL_FRQ • ALE • OFDM (modem) • SECOMH • SECOMV • 4285 (modem) • FRQ_0.1-24.9 • FRQ_25-29.9 • FRQ_30-59.9 • FRQ_60-87.9 • FRQ_88-99.9 • FRQ_100-107.9 • FRQ_108-145.9 • FRQ_146-173.9 • FRQ_174-224.9 • FRQ_225-399.9 • FRQ_400-511.9 • IP_OVER_AIR • GPS_REP • LINK_SW • ALE_LP • LINK_Y • RS_PA_NOT_NEEDED • ALE-3G • ALE-3G_DLP • ALE-3G_RLSU The available choice depends on which keys have already been deactivated. Now the respective key can be viewed.

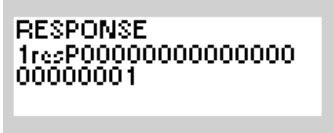
Step	Control	Action	Note
4	**2 ABC** (KEY)	Press.	The display changes: (example) OPTION KEY: Sinv111111111111111 11111111115
5	**CLR ESC**	Press.	The display changes: INV OPT KEYS: GENERAL 030211 FULL_FRQ ↓ KEY VLD Now the validity of the respective key can be viewed.
6	**3 DEF** (VLD)	Press.	The display changes, e.g.: VALID: PERMANENT or VALID FROM: 2003-07-05 04:00 VALID TO: ↓ or VALID FROM: VALID FOR: ↑ 3333H
7	**ENT**	Press.	The window is closed.

3.7.1.3 Viewing Deactivation Responses

By means of softkey RES (Response) the operator can view the software-produced response after deactivation of an option.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	2 ABC (OPT)	Press.	The display changes:
2	4 GHI (RES)	Press.	The display changes: 
3		Press to select the desired setting.	Possible settings: • GENERAL • FULL_FRQ • ALE • OFDM (modem) • SECOMH • SECOMV • 4285 (modem) • FRQ_0.1-24.9 • FRQ_25-29.9 • FRQ_30-59.9 • FRQ_60-87.9 • FRQ_88-99.9 • FRQ_100-107.9 • FRQ_108-145.9 • FRQ_146-173.9 • FRQ_174-224.9 • FRQ_225-399.9 • FRQ_400-511.9 • IP_OVER_AIR • GPS_REP • LINK_SW • ALE_LP • LINK_Y • RS_PA_NOT_NEEDED • ALE-3G • ALE-3G_DLP • ALE-3G_RLSU The available choice depends on which keys have already been deactivated. Now the respective response can be viewed.

Step	Control	Action	Note
4	ENT	Press.	The display changes: (example)  Now the option key belonging to the deactivation response can be viewed.
5	ENT	Press.	The display changes:
6	ENT	Press.	The window is closed.

3.7.1.4 Entering a New Option Key

By means of softkey NEW the operator can enter a new option key, either for activation or deactivation.

Starting point: Main page of CONFIG menu

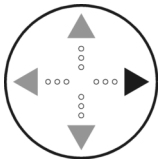
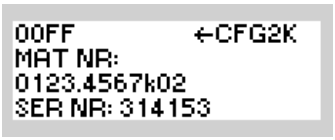
Step	Control	Action	Note
1	2 ABC (OPT)	Press.	The display changes:
2	5 JKL (NEW)	Press.	The display changes:
3	0 _*+ to 9 WXYZ	Enter the required option key.	
4	ENT	Press.	The display changes: (example) If the entered key is incorrect the display will read KEY INVALID.
5	ENT	Press.	The window is closed.

- Entry of an option deactivation key is only possible if this option has not been activated yet. This option menu is updated only after changing the preset page.
- After actions on the MMI menu CFGK1 must be left for the new settings to become effective. Simply go to the next side menu and then back to CFGK1.
- An already deactivated option key cannot be re-activated by re-entering the initially used activation key, even though the message "KEY ACCEPTED" is displayed when you try to do this.

3.7.1.5 Viewing Additional Information for Options

There is a possibility to view the material (part) number and serial number of the tactical radio.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	2 ABC (OPT)	Press.	The display changes:
2		Press.	The display changes: 

3.7.1.6 Selecting the Port for Configuration

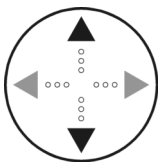
NOTICE

Depending on the currently selected preset page, not all functions / settings may be available. As an example, the “SECOM-V” main menu page is shown.

Operation in special communication modes (see sect. 4 Operation in Special Communication Modes) may support various communication services that allow configuration of their data source (referred to as "port").

By means of softkey PRT (Port) the operator can select the port he wants to configure.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2	2 ABC (PRT)	Press.	The display changes:
3		Press to select the desired setting.	Possible settings: • DATA TERM 1 • INT VOCODER • IP PORT
4	ENT	Press.	The selection window is closed. The selected port can be configured.

3.7.1.7 Configuring the Data Term 1 Port: Mode

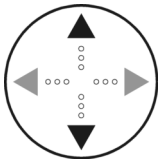
NOTICE

Depending on the currently selected preset page, not all functions / settings may be available. As an example, the "SECOM-V" main menu page is shown.

Select DATA TERM 1 (sect. 3.7.1.6 Selecting the Port for Configuration) as port in order to configure the Data Terminal 1 settings (data connector X5, front).

By means of softkey MDE (Mode) the operator can configure the mode for data transmission.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2	3 DEF (MDE)	Press.	The display changes:
3		Press to select the desired setting.	Possible settings: • ASYN STREAM (STR) • SYN TRANS (TRS)
4	ENT	Press.	The selection window is closed. The new setting is now effective.

3.7.1.8 Configuring the Data Term 1 Port: Baud Rate

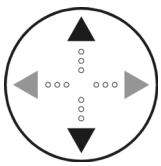
NOTICE

Depending on the currently selected preset page, not all functions / settings may be available. As an example, the "SECOM-V" main menu page is shown.

Select DATA TERM 1 (sect. 3.7.1.6 Selecting the Port for Configuration) as port in order to configure the Data Terminal 1 settings (data connector X5, front).

By means of softkey BAU (Baud Rate) the operator can configure the baud rate for data transmission.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2	4 GHI (BAU)	Press.	The display changes:
3		Press to select the desired setting.	Possible settings: 115200 - 57600 - 38400 - 19200 - 9600 - 4800 - 2400 - 1200
4	ENT	Press.	The selection window is closed. The new setting is now effective.

NOTICE

The data rate at the Data Terminal 1 always has to be higher than the air-data rate. The recommended setting is 115200 Baud in combination with hardware flow control (RTS/CTS).

3.7.1.9 Configuring the Data Term 1 Port: Flow Control

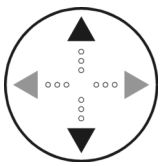
NOTICE

Depending on the currently selected preset page, not all functions / settings may be available. As an example, the "SECOM-V" main menu page is shown.

Select DATA TERM 1 (sect. 3.7.1.6 Selecting the Port for Configuration) as port in order to configure the Data Terminal 1 settings (data connector X5, front).

By means of softkey FLW (Flow) the operator can configure the flow control (handshake) for data transmission.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2	5 JKL (FLW)	Press.	The display changes:
3		Press to select the desired setting.	Possible settings: • NONE (no handshake) • RTS/CTS (hardware handshake)
4	ENT	Press.	The selection window is closed. The new setting is now effective.

NOTICE

In synchronous mode, RTS has to be held at a constant level at least for two data clock cycles to be recognized correctly. In case of a violation, the data stream will be corrupted.

3.7.1.10 Configuring the Data Term 1 Port: Data / Parity / Stop

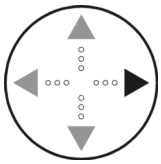
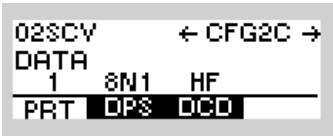
NOTICE

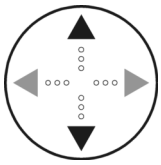
Depending on the currently selected preset page, not all functions / settings may be available. As an example, the "SECOM-V" main menu page is shown.

Select DATA TERM 1 (sect. 3.7.1.6 Selecting the Port for Configuration) as port in order to configure the Data Terminal 1 settings (data connector X5, front).

By means of softkey DPS (Data / Parity / Stop) the operator can configure the data, parity and stop bit for data transmission.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
		Press once.	The display changes: 
2	3 DEF (DPS)	Press.	The display changes:

Step	Control	Action	Note
3		Press to select the desired setting.	Possible settings: 8N1 - 8N2 - 8E1 - 8E2 - 8O1 - 8O2 - 7N1 - 7N2 - 7E1 - 7E2 - 7O1 - 7O2
4		Press.	The selection window is closed. The new setting is now effective.

The parameters have the following meaning, e.g. 8N1:

Data bits	8, possible: 7 or 8
Parity	N, possible: N (no parity), E (even parity), O (odd parity)
Stop bits	1, possible: 1 or 2

3.7.1.11 Changing the DCD Mode

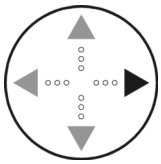
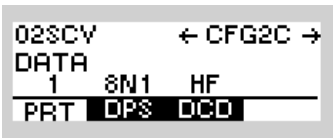
NOTICE

Depending on the currently selected preset page, not all functions / settings may be available. As an example, the "SECOM-V" main menu page is shown.

By means of softkey DCD (Data Carrier Detected) the operator can select the DCD mode.

The DCD mode controls the behaviour of the RS232 dcd pin. If DCD mode DATA is selected, the dcd envelops the outgoing RS232 data. Otherwise if HF is selected, the dcd pin is active while HF is detected.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
		Press once.	The display changes: 
2	4 GHI (DCD)	Press.	Repetitively pressing this key toggles between two modes. Possible settings: HF _ DATA

3.7.1.12 Configuring the Vocoder

NOTICE

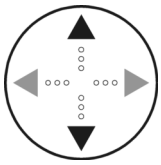
Depending on the currently selected preset page, not all functions / settings may be available. As an example, the “SECOM-V” main menu page is shown.

Select INT VOCODER (sect. 3.7.1.6 Selecting the Port for Configuration) as port in order to configure the vocoder. Reducing the data rate can improve intelligibility of voice under difficult channel conditions.

By means of softkey VOC (Vocoder) the operator can configure the port INT VOCODER.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2	3 DEF (VOC)	Press.	The display changes:

Step	Control	Action	Note
3		Press to select the desired setting.	Possible settings: SECOM-H • MELP 600 • MMBE 1k2 • MELP 2k4 • MMBE 2k4 • AMBE 2k4 SECOM-P • CVSD SECOM-V • MELP 2k4 • AMBE 2k4 • AMBE 4k8 • AMBE 9k6 • CVSD 16k • AMBE 16k
4		Press.	The selection window is closed. The new setting is now effective.

3.7.1.13 Configuring the IP Port

NOTICE

Depending on the currently selected preset page, not all functions / settings may be available. As an example, the “SECOM-V” main menu page is shown.

By means of softkey SRC (Source) the operator can configure the source for IP data.

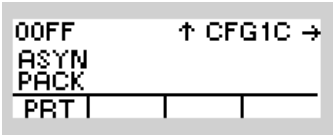
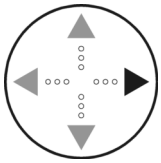
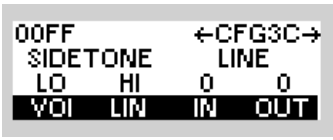
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: **NOTICE** **IP Port must be selected for configuration (sect. 3.7.1.6 Selecting the Port for Configuration).**
3	3 DEF (SRC)	Press.	Pressing this key toggles between the sources ETH and PPP. ETH: Only the Ethernet interface is available as source for IP traffic. PPP: The Ethernet interface and Data Terminal 1 via PPP are available as sources for IP traffic. See sect. 5.3.3.7 Changing the PPP IP Interface Address for further details.

3.7.1.14 Changing the Voice Sidetone Volume

By means of softkey VOI (Voice) the operator can select the voice sidetone volume to be used.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	2 ABC (VOI)	Press.	Repetitively pressing this key toggles between three levels. Possible settings: HI - OFF - LO

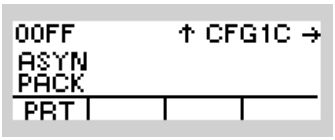
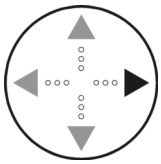
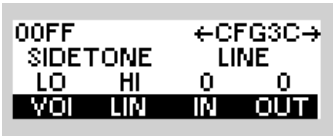
NOTICE

When using an external loudspeaker the sidetone should be set to OFF to prevent any feedback effects (whistling) in TX mode.

3.7.1.15 Changing the Line Sidetone Volume

By means of softkey LIN (Line) the operator can select the line sidetone volume to be used.

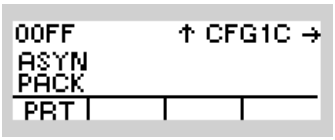
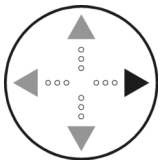
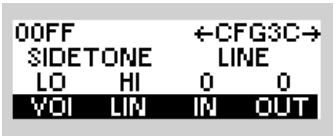
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	3 DEF (LIN)	Press.	Repetitively pressing this key toggles between three volume settings. Possible settings: HI - OFF - LO

3.7.1.16 Changing the Line Input Level

By means of softkey IN (Input) the operator can select the line input level to be used.

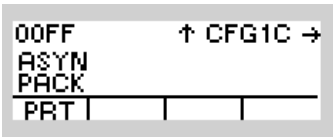
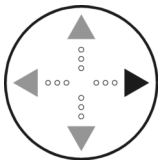
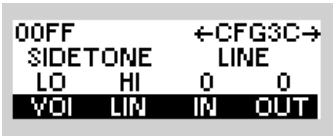
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	4 GHI (IN)	Press.	Repetitively pressing this key toggles between four level settings. Possible settings: • +3 (dB) • 0 (dB) • - 6 (dB) • - 12 (dB)

3.7.1.17 Changing the Line Output Level

By means of softkey OUT (Output) the operator can select the line output level to be used.

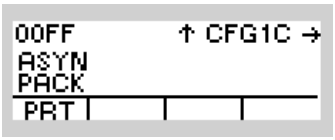
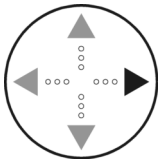
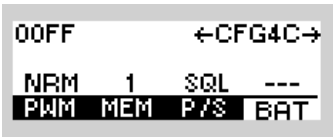
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	5 JKL (OUT)	Press.	Repetitively pressing this key toggles between four level settings. Possible settings: • +3 (dB) • 0 (dB) • - 6 (dB) • - 12 (dB)

3.7.1.18 Changing the Power Management

By means of softkey PWM (power management) the operator can adjust the power consumption of the tactical radio.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	2 ABC (PWM)	Press.	Repetitively pressing this key toggles between three levels. Possible settings: NRM (normal) - LOW - HGH (high)

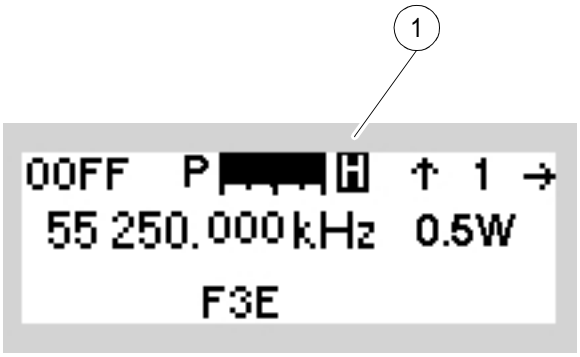
For power management the following levels are available:

Level	Backlight	Sleep Mode	150-V Supply	Audio Interface
High	on	off	on	on
Normal	automatic switch off	off	on	on
Low	automatic switch off	on	off	off

Sleep mode: The radio switches periodically to Rx mode to check whether there is a receive signal. When no Rx signal is available the radio returns to sleep mode (= minimum power consumption).

The display shows the set power consumption (see Figure 3.21):

Figure 3.21 Display Power Consumption



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1 inverse H = high power consumption
blank = normal power consumption
inverse E = low power consumption

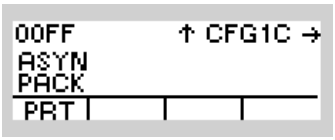
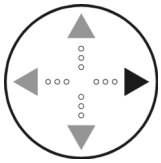
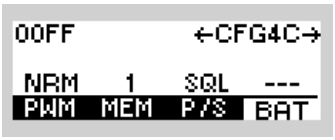
NOTICE

For operation of the tactical radio in a docking station power management is deactivated. The display then automatically indicates "H".

3.7.1.19 Selecting the ATU Memory Bank

By means of softkey MEM (Memory) the operator can switch between two memory banks where ATU settings are stored.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	3 DEF (MEM)	Press.	Pressing this key toggles between two memory banks. Possible settings: 1 - 2

- By using the LRN function ATU settings are stored in a memory bank.

  Two memory banks are available for storing. This allows the operator to store ATU settings for two different locations or antennas. When changing the location only the relevant memory bank (MEM1 or MEM2) needs to be selected.

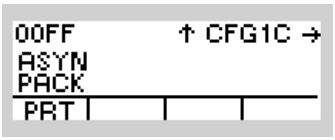
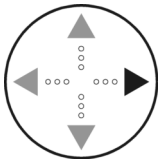
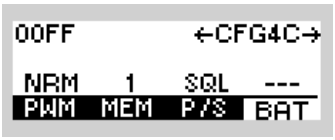
NOTICE

When the erase key is actuated, the two memory banks are cleared.

3.7.1.20 Selecting PTT or Squelch Output

By means of softkey P/S (PTT/Squelch) the operator can toggle between PTT and squelch output.

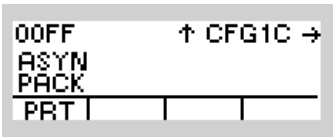
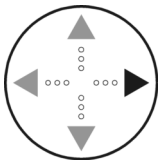
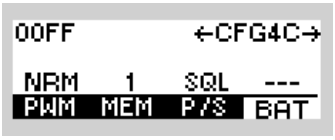
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	4 GHI (P/S)	Press.	Pressing this key toggles between PTT and squelch output.

3.7.1.21 Checking the Battery Charging State

By means of softkey BAT (battery) the operator can check the battery charging state.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press three times.	The display changes: 

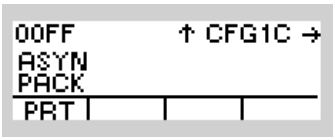
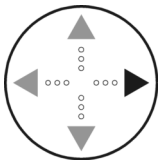
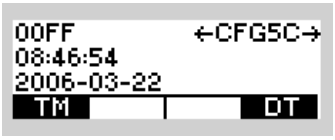
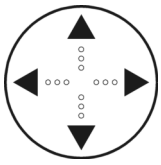
The battery charging state is given in percent:

Display 100%	battery fully charged
Display 0%	battery empty
Display ---	external power supply

3.7.1.22 Changing the Time

By means of softkey TM (Time) the operator can change the local time.

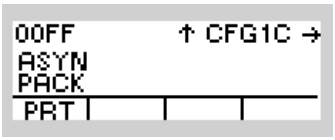
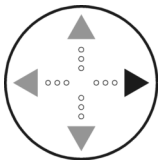
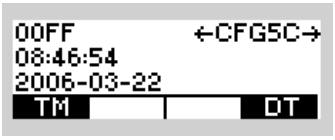
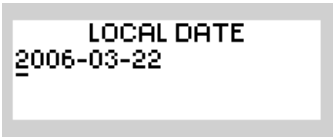
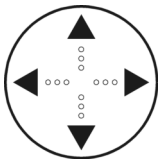
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press four times.	The display changes: 
3	2 ABC (TM)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter a new time. Change time selectively.	Format: hh:mm:ss Range: hh: 00 to 23 mm: 00 to 59 ss: 00 to 59
5	ENT	Press.	The selection window is closed. The new time is now effective.

3.7.1.23 Changing the Date

By means of softkey DT (Date) the operator can change the local date.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press four times.	The display changes: 
3	5 JKL (DT)	Press.	The display changes: 
4	0 _ * + to 9 WXYZ or 	Enter a new date. Change date selectively.	Format: yyyy-mm-dd Range: yyyy: 1970 to 2099 mm: 01 to 12 dd: 01 to 31
5	ENT	Press.	The selection window is closed. The new date is now effective.

3.7.1.24 Changing the Network Settings

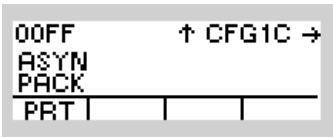
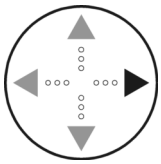
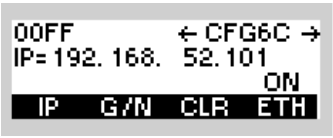
NOTICE

Make sure that the Ethernet function is enabled (see sect. 3.7.1.25 Switching the Ethernet Function On or Off) before proceeding with these settings.

Changing the IP Address

By means of softkey IP (Internet Protocol) the operator can assign an IP address to his tactical radio. This address is permitted to be used only once within the local network. The IP address is entered block by block.

Starting point: Main page of CONFIG menu

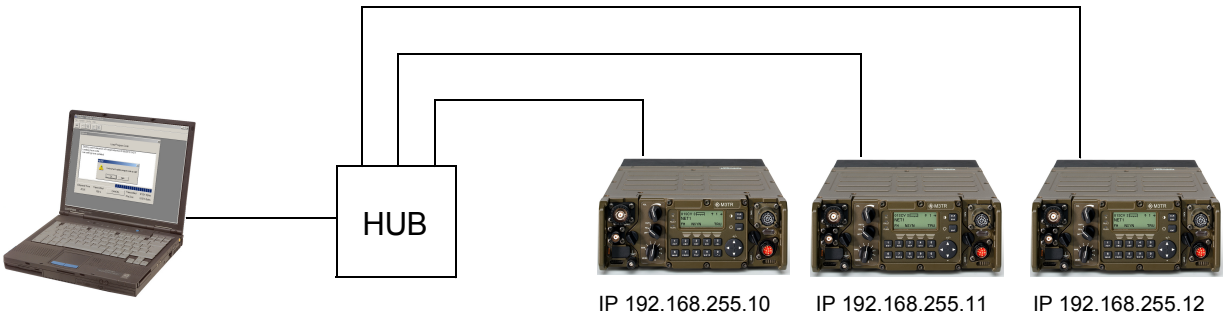
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press five times.	The display changes: 
3	2 ABC (IP)	Press.	The display changes:
4	0 _ * + to 9 WXYZ	Enter the new IP address block 1.	Possible range IP1: see remarks below

Step	Control	Action	Note
5	ENT	Press.	The display changes:
6	0 _ * + to 9 WXYZ	Enter the new IP address block 2.	Possible range IP2: see remarks below Proceed in the same way for blocks 3 and 4.
7	ENT	Press.	The selection window is closed. The new IP address is now effective. **NOTICE** **Shut down the radio and restart it for the new IP address to become effective.**

This setting is important for (see Figure 3.22):

- Software update of tactical radio
- Remote control via Ethernet
- IPoA protocol

Figure 3.22 Application: Software Update



ICN-4G-A-231000-R-D0894-00100-A-01-1

For addressing the tactical radio the Internet Protocol (IP) is used. Therefore a unique IP address needs to be assigned to each device, permitting the device to be identified and addressed without ambiguity.

When specifying the subnet mask and the IP addresses (own and gateway), please observe the IETF (= Internet Engineering Task Force) standards (RFC pages (= Request for Commands)), in particular:

796:	Address Mappings
940:	Toward an Internet Standard Scheme for Subnetting
950:	Internet Standard Subnetting Procedure
1219:	On the Assignment of Subnet Numbers
1517:	Applicability Statement for the Implementation of Classless Inter-Domain Routing
1519:	Classless Inter-Domain Routing: an Address Assignment and Aggregation Strategy
1918:	Address Allocation for Private Internets

In compliance with RFC1918 the following address ranges are reserved for private networks:

- 10.0.0.0 to 10.255.255.255, associated subnet mask 255.0.0.0
- 172.16.0.0 to 172.31.255.255, associated subnet mask 255.255.0.0
- 192.168.0.0 to 192.168.0.255, associated subnet mask 255.255.255.0

The subnet mask defines the respective address parts for network address and local address.

	Network address			Local address
Subnet mask	255	255	255	0
IP addresses	192	168	0	0
	:	:	:	:
	192	168	0	255

max. 256 units

0 reserved for network

255 reserved for broadcast

NOTICE

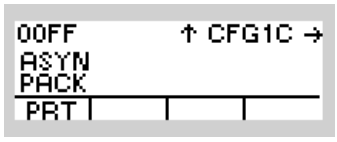
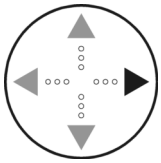
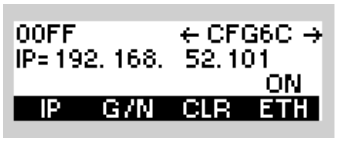
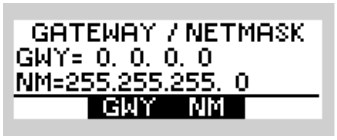
IP addresses 0.0.0.0 and 255.255.255.255 are not permitted to be used.

For the net infrastructure, e.g. router, we recommend to use the lower local addresses.

Changing the Gateway Address

By means of softkeys G/N (Gateway/Netmask) and GWY (Gateway) the operator can assign a gateway address to his tactical radio. This address is permitted to be used only once within the local network. The gateway address is entered block by block.

Starting point: Main page of CONFIG menu

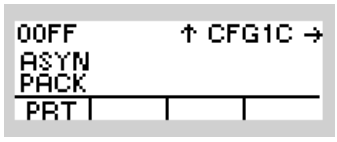
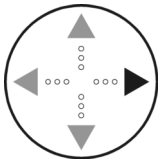
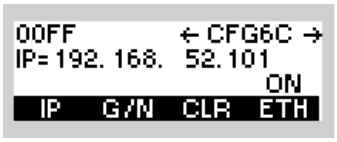
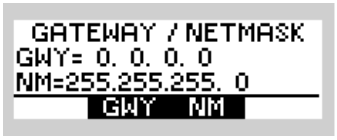
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press five times.	The display changes: 
3	3 DEF (G/N)	Press.	The display changes: 
4	3 DEF (GWY)	Press.	The display changes:
5	0 _*+ to 9 WXYZ	Enter the new GWY address block 1.	Possible range GWY1: see remarks above
6	ENT	Press.	The display changes:

Step	Control	Action	Note
7	0 _ * + to 9 WXYZ	Enter the new GWY address block 2.	Possible range GWY2: see remarks below Proceed in the same way for blocks 3 and 4.
8	ENT	Press.	The selection window is closed. The new gateway address is now effective. **NOTICE** **Shut down the radio and restart it for the new gateway address to become effective.**

Changing the Netmask Address

By means of softkeys G/N (Gateway/Netmask) and NM (Netmask) the operator can assign a netmask address to his tactical radio. This address is permitted to be used only once within the local network. The netmask address is entered block by block.

Starting point: Main page of CONFIG menu

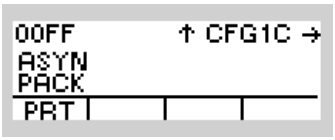
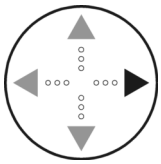
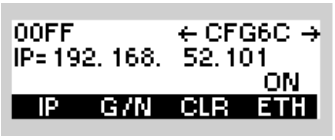
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press five times.	The display changes: 
3	3 DEF (G/N)	Press.	The display changes: 
4	4 GHI (NM)	Press.	The display changes:
5	0 _*+ to 9 WXYZ	Enter the new NM address block 1.	Possible range NM1: see remarks above
6	ENT	Press.	The display changes:

Step	Control	Action	Note
7	0 _ * + to 9 WXYZ	Enter the new NM address block 2.	Possible range NM2: see remarks below Proceed in the same way for blocks 3 and 4.
8	ENT	Press.	The selection window is closed. The new netmask address is now effective. **NOTICE** **Shut down the radio and restart it for the new netmask address to become effective.**

Resetting the Network Setting

By means of softkey CLR (Clear) the operator can reset the network setting of the radio.

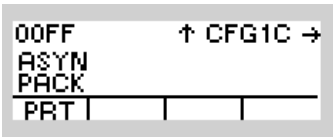
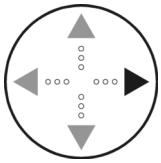
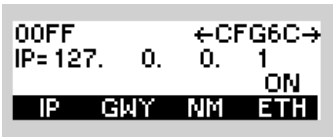
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press five times.	The display changes: 
3	4 GHI (CLR)	Press.	The display changes:
8	ENT	Press.	The network setting is reset to: • IP address: 192.168.52.1 • Netmask: 255.255.255.0 • Gateway address: 0.0.0.0 **NOTICE** **The radio shuts down and restarts automatically.**

3.7.1.25 Switching the Ethernet Function On or Off

By means of softkey ETH (Ethernet) the operator can switch the network functionality on or off.

Starting point: Main page of CONFIG menu

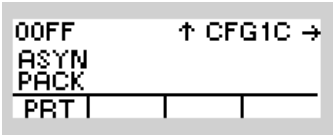
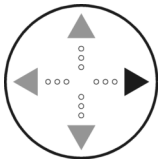
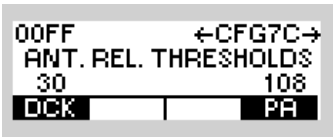
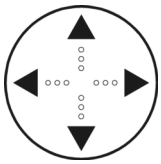
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press five times.	The display changes: 
3	5 JKL (ETH)	Press.	Repetitively pressing this key toggles the Ethernet function on and off.

- The Ethernet function can be switched off in order to save battery power while using the radio as a manpack.

3.7.1.26 Selecting the Switching Threshold for Antenna Relay of Docking Station

By means of softkey DCK (Docking) the operator can select the switching threshold for the antenna relay of the docking station (vehicular mount).

Starting point: Main page of CONFIG menu

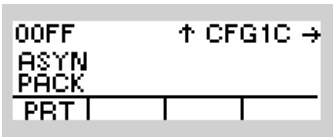
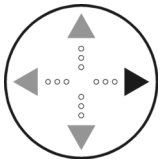
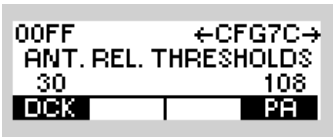
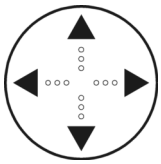
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press six times.	The display changes: 
3	2 ABC (DCK)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter the relevant frequency. Change frequency selectively.	Range: 1 MHz to 512 MHz
5	ENT	Press.	If the entered frequency is within the permitted entry range, the editor window will be closed.

This controls the switchover frequency of the antenna relay in R&S IV3001, R&S KG3131A or similar docking stations. Please avoid to set that switching threshold to frequencies between the current RX and TX frequencies.

3.7.1.27 Selecting the Switching Threshold for Antenna Relay of External Amplifier

By means of softkey PA (Power Amplifier) the operator can select the switching threshold for the antenna relay of an external V/UHF Power Amplifier R&S VT3050(C).

Starting point: Main page of CONFIG menu

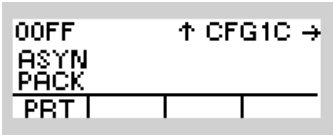
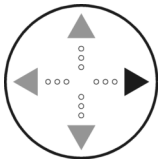
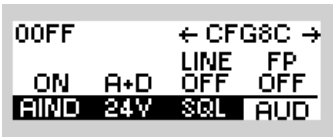
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press six times.	The display changes: 
3	5 JKL (PA)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter the relevant frequency. Change frequency selectively.	Range: 1 MHz to 512 MHz
5	ENT	Press.	If the entered frequency is within the permitted entry range, the editor window will be closed.

This controls the switchover frequency of the antenna relay in external Power Amplifiers R&S VT3050 and R&S VT3050C. If a single antenna shall be used for the whole frequency range, select 30 MHz and use the UHF connector. Please avoid to set that switching threshold to frequencies between the current RX and TX frequencies.

3.7.1.28 Switching Audio Indications On or Off

By means of softkey AIND (Audio Indication) the operator can switch the function audio indication on and off.

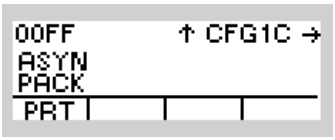
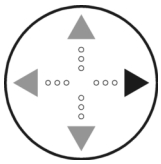
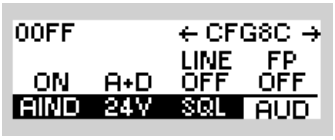
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press seven times.	The display changes: 
3	2 ABC (AIND)	Press.	Repetitively pressing this key toggles between audio indications on and off.

3.7.1.29 Switching the 24-VDC Outputs on the Audio Connector On or Off

By means of softkey 24V the operator can switch the 24-VDC outputs on and off.

Starting point: Main page of CONFIG menu

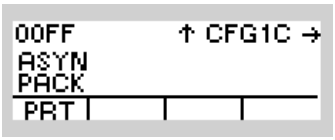
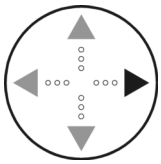
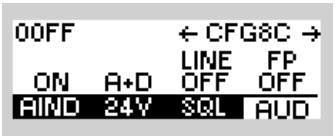
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press seven times.	The display changes: 
3	3 DEF (24V)	Press.	Repetitively pressing this key toggles between two output settings. Possible settings: • DAT • A+D

- Please note that "24 V" refers to the nominal supply voltage of the radio. If the radio is supplied by 32 V via the rear connector of the radio, approx. 32 V are present on audio and data connectors. For more information, please check the interface description for X5, pin VBATT.
- It is not possible to switch off the supply voltage on the data connector X5, but the supply voltage on the audio connector X4 can be switched on if "A+D" is selected. It is off in position "DAT".

3.7.1.30 Switching the Squelch Line On or Off

By means of softkey SQL the operator can switch the squelch line on and off.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press seven times.	The display changes: 
3	4 GHI (SQL)	Press.	Repetitively pressing this key toggles the squelch line on and off.

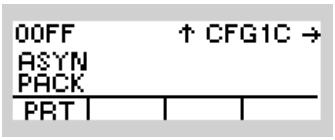
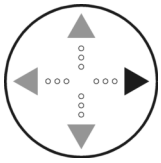
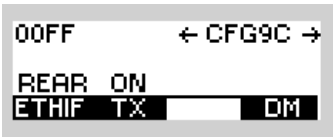
If it is necessary to mute the Line interface output while nothing (depending on the squelch type selected) is received, switch on the squelch of the line interface. This setting ON is needed for interoperation with some Intercoms and remote consoles.

3.7.1.31 Selecting the Ethernet Interface

The R&S M3TR Tactical Radio in model 06 can provide Ethernet signals either on connector X5 (data connector, front) or on connector X6 (rear). This function is not available for other models.

By means of softkey ETHIF (Ethernet Interface) the operator can select the Ethernet interface.

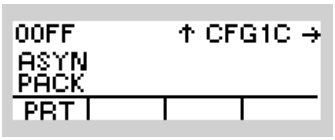
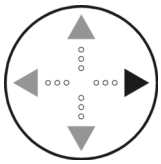
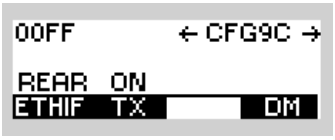
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press eight times.	The display changes: 
3	2 ABC (ETHIF)	Press.	Repetitively pressing this key toggles between rear and front Ethernet.

3.7.1.32 Selecting the Transmission Inhibit Mode

By means of softkey TX the operator can enable or inhibit transmission.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press eight times.	The display changes: 
3	3 DEF (TX)	Press.	Repetitively pressing this key toggles between enabled and inhibited transmission.

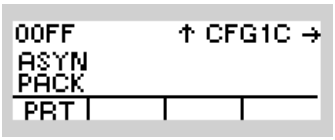
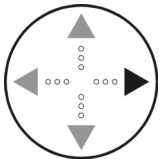
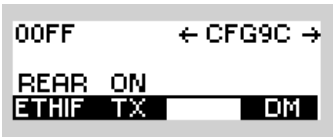
NOTICE

Transmission can be inhibited by this option or by the mode switch in position "RX". This case is indicated by "KNOB" on the display.

3.7.1.33 Deleting Currently Active Mission

By means of softkey MD (Mission Delete), the operator can delete the currently activated mission.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press eight times.	The display changes: 
3	5 JKL (MD)	Press.	The display changes:

Step	Control	Action	Note
4	ENT	Press.	The currently loaded mission is now being deleted. After deletion, the following messages will be displayed. The standard mission with only MAN preset page will be loaded.

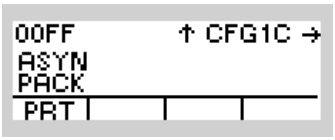
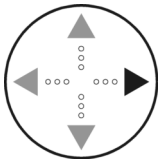
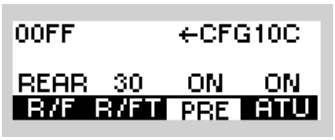
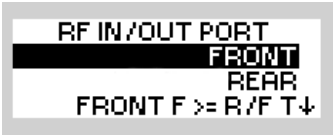
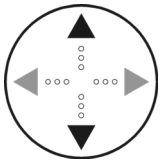
NOTICE

The erase key (see sect. 3.6 Emergency Operation Procedures) deletes the whole persistent data memory with the radio on or off, including the cryptographic parts, while the DM softkey only deletes the transferred mission.

3.7.1.34 Selecting the RF Input/Output Port

By means of softkey R/F (Rear/Front) the operator can select the RF input/output port to be used.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press nine times.	The display changes: 
3	2 ABC (R/F))	Press.	The display changes: 
4		Press to select the desired setting.	Possible settings: • FRONT • REAR • FRONT F >= R/F T • FRONT F < R/F T
5	ENT	Press.	The selection window is closed. The new setting is effective.

NOTICE

The frequency dependent values "FRONT F >= RF/ T" and "FRONT F < RF/ T" will not be provided if two external power amplifiers are connected to the radio.

FRONT

Means that FRONT connector is used permanently - independent of which Rx/Tx frequency is actually set.

REAR

Means that REAR connector is used permanently - independent of which Rx/Tx frequency is actually set.

Choose position REAR to allow operation with external power amplifiers. If the radio is removed from the docking station, it switches automatically to FRONT independent of the current frequency.

FRONT F >= R/F T

Means that FRONT connector is used if actual Rx/Tx frequency ≥ RF threshold. Otherwise REAR connector is used.

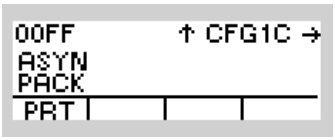
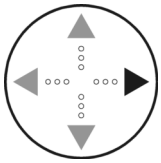
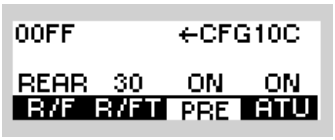
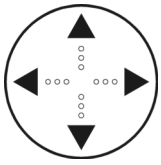
FRONT F < R/F T

Means that FRONT connector is used if actual Rx/Tx frequency < RF threshold. Otherwise REAR connector is used.

3.7.1.35 Changing the Switching Threshold for RF Input / Output Port

By means of softkey R/FT (Rear/Front Threshold) the operator can change the switching threshold for RF input/output port.

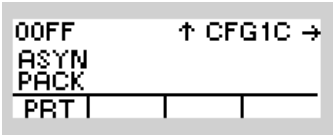
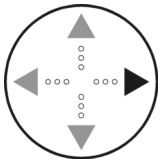
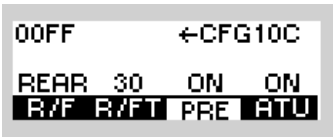
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press nine times.	The display changes: 
3	3 DEF (R/FT)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter the relevant frequency. Change frequency selectively.	Range: 1 MHz to 512 MHz Step: 1 MHz
5	ENT	Press.	If the entered frequency is within the permitted entry range, the editor window will be closed.

3.7.1.36 Switching the Preamplifier of R&S VT3050 On or Off

By means of softkey PRE (Preamplifier) the operator can switch the preamplifier of the R&S VT3050 Power Amplifier on or off.

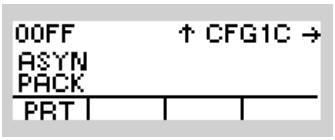
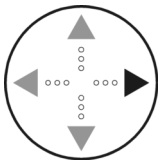
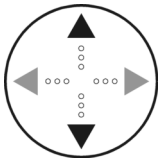
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press nine times.	The display changes:  **NOTICE** **This function is only available if an R&S VT3050 is connected to the radio.**
3	4 GHI (PRE)	Press.	Repetitively pressing this key toggles the preamplifier of the R&S VT3050 Power Amplifier on and off.

3.7.1.37 Switching the Internal ATU On or Off

By means of softkey ATU the operator can switch the internal ATU on or off.

Starting point: Main page of CONFIG menu

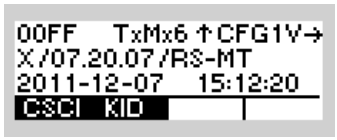
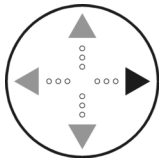
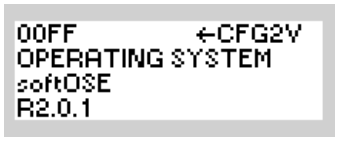
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press nine times.	The display changes:
3	5 JKL (ATU)	Press.	The display changes:
4		Press.	Possible settings: • ON • OFF
5	ENT	Press.	The selection window is closed. The new setting is now effective.

NOTICE

This softkey influences internal ATUs only. External ATUs are always in state "ON".

3.7.2 Settings in Menu VER (CONFIG, Inquiring the Software Version)

Starting point:

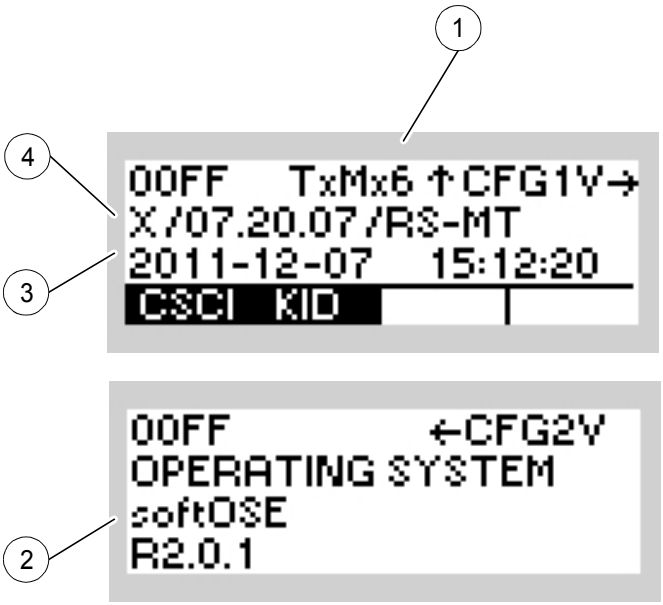
Step	Control	Action	Note
1	4 GHI (VER)	Press.	The display changes:  The following function is possible: • sect. 3.7.2.1 Inquiring the Computer Software Configuration Items • sect. 3.7.2.2 Inquiring the Key Seed ID
2		Press once.	The display changes: 

NOTICE

The following screens () show examples of version data.

Of course, the data may vary from case to case.

Figure 3.23 Version Data



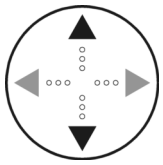
ICN-4G-P-231000-R-D0894-00081-A-01-1

1 Type of Radio Controller
  3 = Radio Controller (6098.9200.02)
  6 = Radio Controller (6126.4877.02)
  8 = Radio Controller (6140.7240.02)
2 Name of operating system / Version, e.g. softOSE / R2.0.1
3 Software Build, e.g. 2006 - 10 - 30, 13:15:08
4 CNR Model / Software Version, e.g. X / 07.20.07

3.7.2.1 Inquiring the Computer Software Configuration Items

By means of softkey CSCI (Computer Software Configuration Items) the operator can inquire the versions of software and hardware items installed in the tactical radio.

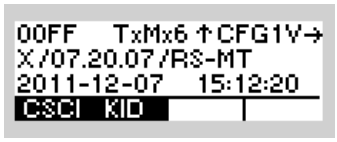
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	4 GHI (VER)	Press.	The display changes:
2	2 ABC (CSCI)	Press.	The display changes:
3		Press several times until the desired item is displayed.	Possible CSCIs: (Computer Software Configuration Items) **NOTICE** **For service purposes only!** The actual CSCI version is shown only after the relevant software is restarted.

3.7.2.2 Inquiring the Key Seed ID

By means of softkey KID (Key Seed ID) the operator can inquire the ID of currently used key seed.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	(VER) 4 GHI	Press.	The display changes: 
2	(KID) 3 DEF	Press.	The display changes:

3.7.3 Settings in Menu DT (DOWNLOAD, Loading Pre-configured Radio Parameters)

Requirements:

- User Level 2
- Fillgun is connected

Figure 3.24 Connected Fillgun

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Starting point:

NOTICE

Softkeys SWU and KDD

Softkey SWU (Software Update) controls the software update of the Hardware Protection Prozessor (HPP) inside the tactical radio. A special PC tool is used for this and it is done only in the factory.

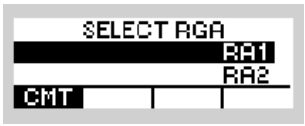
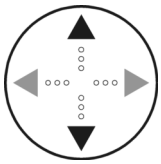
Softkey KDD (Key Distribution Device) is a special SECOS function. For further information see the relevant operating manual.

Step	Control	Action	Note
1	3 DEF (DT)	Press.	SER describes the interface type over which the fillgun download is running. (SER = serial interface; the fillgun is connected over the connector DATA with the tactical radio) The display changes: The following functions are possible: • sect. 3.7.3.1 Selecting the Radio Global Address • sect. 3.7.3.3 Downloading

3.7.3.1 Selecting the Radio Global Address

By means of softkey RGA (Radio Global Address) the operator can select the radio global address to be loaded.

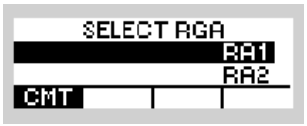
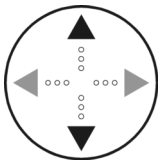
Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	5 JKL (DT)	Press.	The display changes:
2	3 DEF (RGA)	Press.	The display changes: The tactical radio searches for all possible RGAs which can be loaded from the fillgun. The display changes: 
3		Press to select the desired setting.	Possible settings: RA1 RA2
4	ENT	Press.	The display changes: The tactical radio will load the configuration with RGA = RA2.

3.7.3.2 Inquiring the Radio Global Address Comment

By means of softkey CMT (Comment) the operator can inquire the radio global address comment.

Starting point: Main page of CONFIG menu

Step	Control	Action	Note
1	5 JKL (DT)	Press.	The display changes:
2	3 DEF (RGA)	Press.	The display changes: The tactical radio searches for all possible RGAs (profiles) which can be loaded from the fillgun. The display changes: 
3		Press to select the desired setting.	Possible settings: • RA1 • RA2
4	2 ABC (CMT)	Press.	The display changes:

3.7.3.3 Downloading

Starting the Download

By means of softkey DT the operator can start the download.

Starting point: see sect. 3.7.3.1 Selecting the Radio Global Address, step 4

Step	Control	Action	Note
1	4 GHI (DT)	Press.	The display changes: If the download was successful, the update starts automatically. The display changes:

Cancelling the Download

By means of softkey CNC the operator can cancel the download.

Starting point: see sect. 3.7.3.1 Selecting the Radio Global Address, step 4

Step	Control	Action	Note
1	5 JKL (CNC)	Press.	The display changes:

Continuing the Download

By means of softkey ACC the operator can continue a download which has been interrupted.

Starting point: see sect. 3.7.3.1 Selecting the Radio Global Address, step 4

Step	Control	Action	Note
1	4 GHI (CNC)	Press.	The display changes:

Step	Control	Action	Note
2	2 ABC (ACC)	Press.	The display changes: If the download was successful, the update starts automatically. The display changes:

3.7.3.4 Typical Procedure for Loading the Preset Pages into the Radio

NOTICE

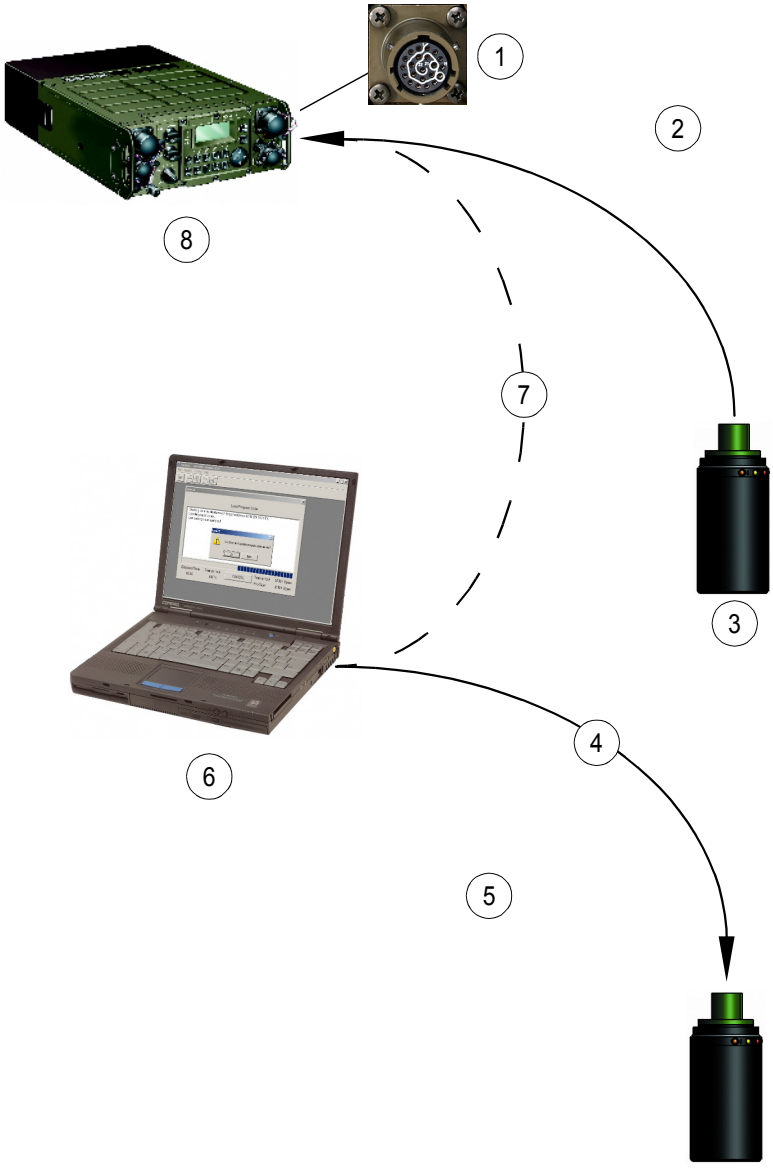
Connect the fillgun before selecting the download menu!

If the IP address is changed during mission download, the radio will reboot afterwards.

Preset Page loading is performed by using one of the following devices (see also Figure 3.25):

- PC via Serial Cable R&S GK3003 (see ”From PC into the Radio” on p. 3.220)
- Fillgun R&S GP3000 (see ”From Fillgun into the Radio” on p. 3.221).

Figure 3.25 Loading the Preset Pages



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1 Socket X5 (DATA)
2 Loading the Preset Pages into the radio
3 Fillgun
Status LEDs
P = Power On
D = Link to radio/PC established
E = Error
↑ = Read from memory
↓ = Write to memory
4 USB Cable R&S GK3021
5 Loading the Preset Pages into the fillgun
6 PC with:
Radio Network Management System (RNMS3000)
Remote Distributor and Loader (RDL)
7 Serial Cable
8 Tactical Radio

From PC into the Radio

The following steps are required to download the configuration:

1. Connect fillgun connector on radio front panel via serial cable to the PC (RS-232-C interface, see Figure 3.25).
2. Switch PC and radio on (make sure that the radio is on Preset Page 0).
3. Start the RNMS3000 (Mission Planner, MPlan) software on the PC. For further information refer to RNMS3000 documentation.
4. Create a new mission in MPlan.
5. Generate the radio configurations of the mission in MPlan.
6. Start the RNMS3000 (Remote Device Loader, RDL) software. For further information refer to RNMS3000 documentation.
7. In RDL switch to the tab "RS232 M3TR/S4100". All available RS-232-C ports of the PC are displayed.
8. Select the desired radio configurations in the left window of RDL.
9. Copy the configurations to the desired RS-232-C port using drag and drop.
10. Select and download desired configuration as described in sect. 3.7.3.1 Selecting the Radio Global Address and sect. 3.7.3.3 Downloading.
11. Exit RDL software and switch off radio.
12. Disconnect R&S GK3003 from PC and radio.

From Fillgun into the Radio

The following steps are required to load the configuration to the Fillgun:

1. Connect the R&S GP 3000 Fillgun via the R&S GK3021 USB Cable to the PC (USB interface, see Figure 3.25).
2. Switch PC on.
3. Start the RNMS3000 (Mission Planner, MPlan) software on the PC. For further information refer to RNMS3000 documentation.
4. Create a new mission in MPlan.
5. Generate the radio configurations of the mission in MPlan.
6. Start the RNMS3000 (Remote Device Loader, RDL) software. For further information refer to RNMS3000 documentation.
7. In RDL switch to the tab "Fillgun GP3x00". The fillgun is displayed in the list with its existing radio configurations (if any).
8. Delete all existing configurations using the popup menu item "Delete fillgun".
9. Select the desired radio configurations in the left window of RDL.
10. Copy the configurations to the fillgun using drag and drop.
11. Exit RDL software.
12. Disconnect USB cable at the PC and fillgun.
13. Connect fillgun to connector X5.
14. Select and download desired configuration as described in sect. 3.7.3.1 Selecting the Radio Global Address and sect. 3.7.3.3 Downloading.
15. Disconnect fillgun.

3.7.3.5 Download via LAN

The following steps are required to download the configuration:

1. Connect radio and PC to LAN and make sure that both are in the same IP subnet..
2. Switch PC and radio on (make sure that the radio is on Preset Page 0).
3. Start the RNMS Mission Planner (MPlan) software on the PC. For further information refer to RNMS documentation.
4. Create a new mission in MPlan (see RNMS documentation).
5. Generate the radio configurations of the mission in MPlan (see RNMS documentation).
6. Start the RNMS Remote Device Loader (RDL) software. For further information refer to RNMS documentation.
7. In RDL switch to the tab "LAN M3TR".
8. Search for available radios in the LAN using the popup menu item "Search in LAN". All available radios are displayed after a short time. If no radios are found, check the IP settings of the PC and the radio.
9. Select the desired radio configuration in the left window of RDL.
10. Copy the configuration to the desired radio using drag and drop.
11. Exit RDL software.
12. Disconnect radio and PC from LAN.

4 Operation in Special Communication Modes

4.1 Introduction

This documentation gives information about the optional communication modes provided by the optional software:

- See sect. 4.2.3 Preset Page A2G (ALE-2G)
- See sect. 4.3.2 Preset Page A3G (ALE-3G)
- See sect. 4.4.1.1 Preset Page HFM (HF-MODEM)
- See sect. 4.8.2 Preset Page DM (Data Modem)
- See sect. 4.4.4 Preset Page SDV (Secure Digital Voice)
- See sect. 4.5.2 Preset Page SCH (SECOM-H)
- See sect. 4.6.2 Preset Page SCP (SECOM-P)
- See sect. 4.7.1.6 Preset Page SCH (SECOM-H)

4.2 Automatic Link Establishment 2nd Generation (ALE-2G)

4.2.1 Basics of ALE-2G

The ALE-2G mode (Automatic Link Establishment 2nd Generation) affords the radio operator the following features which automate and simplify the task of establishing communications with a distant station:

- Selective call and link with another station using only that station's address
- Automatic determination of the best calling channel using LQA (Link Quality Analysis)
- Link with a network of stations
- Automatic transmission of a message to a distant station or group of stations (AMD = Automatic Message Display)
- Assignment and grouping of channels into so called scan groups and assignment of scan groups to networks or stations
- Scanning of channels of the assigned (scanning) scan group at a rate of 2 chnPs (Channels Per Second) or 5 chnPs

4.2.1.1 Selective Call and Handshake

Each station in an ALE network has its own unique address (call sign). When calling another ALE station, the calling station transmits the target address on the selected channel. When the called station hears its own address, it stops scanning and responds to the calling station. The calling station then transmits an acknowledgement (two way handshake) and the two stations are linked. The operators of the calling and the called stations are notified that the link has been established and can begin passing traffic.

4.2.1.2 Link Quality Analysis and Automatic Link Establishment

During link establishment LQA data may be exchanged between stations in addition to the addresses. These LQA data are in the form of a number which represents the quality of the transmission path between stations.

When the station operator wishes to make a call, the link is established automatically using the accumulated LQA data to determine the best available channel out of the scan group assigned to the destination address (next call scan group).

4.2.1.3 Message Transmission

ALE provides for operation in an AMD mode, which enables operators to send messages up to 90 characters long to other stations when linking. Such a message is subject to configuration and is shown on the display.

4.2.1.4 ALE-2G Calls

The operator can initiate calls in the preselected call type (scan rate or fixed) and traffic type (link mode) to the preselected destination address in one of the following ways:

- Pressing the call button
- Asserting PTT
- Presence of data on the data interface.

The operator may make a call at a scan rate of 2 chnPs or 5 chnPs where ALE uses the channels of the currently selected next call scan group to place the call.

Or the operator may wish to make a call in fixed mode where ALE makes the call on a pre-selected channel.

Individual Calls (Point-to-Point Connection)

Individual Calls are used to establish a link with another station (point-to-point connection).

The operator may make a call to the selected individual station at a scan rate of 2 chnPs or 5 chnPs, where the radio uses the stored LQA information to select the best channel on which to attempt to make the call. With this type of call, the radio will attempt to call a station on each channel in the currently selected next call scan group until link establishment is successful. The call will be attempted first on the best channel, proceeding to the second best and so forth, until a link is established or all channels in the scan group have been tried.

The operator may also make a call by first selecting a channel on which to call (scan rate fixed).

Net Calls

A Net Call is a call made to all participants in a particular net.

Following the call, each net participant station responds only in its particular time slot. The time slot is determined by where that station's address appears in the list of net participants. For this reason, all participants in the net must be listed in identical order in each station of the net.

Group Calls

For a Group Call first all stations to be called have to be selected. The called stations pick out the time slot for their response following the sequence in the call list.

All Calls (Broadcast Calls)

An All Call is a broadcast call which is not directed to a specific station.

If the scan rate is set to FIX, the All Call is made on a particular channel. At scan rate 2 chnPs or 5 chnPs the All Call is made on the first channel in the selected scanning scan group. Whether a station actually sets up a link when receiving a broadcast call, is up to configuration.

Any Calls

An Any Call is a linked call which can be answered by up to 16 stations. The called stations pick out a random time slot for their response.

Whether a station actually sets up a link when receiving an Any Call is up to configuration.

LQA Calls

An LQA Call is a call directed to a particular station. As soon as the link has been established, the LQA data of the two stations are exchanged.

Sound Calls

A Sound Call is a call which is not directed to any particular station. All stations listening in on the calling channel automatically carry out a channel analysis.

4.2.1.5 ALE-2G Missions and Database

The operator plans ALE-2G networks using the R&S Mission Planner. The R&S Mission Planner generates the ALE-2G database for each radio in the network and the operator has to load the data into each participating radio in the network. The ALE-2G network shall consist of at least 2 radios and up to 15 radios.

4.2.1.6 User Unique Functions

The User Unique Function (UUF) is used to control the link mode (i.e. traffic type). Two types of link mode are defined. These types are manufacturer specific.

- Analog voice / FF
- Internal modem

The default link mode is analog voice / FF, i.e. when no UUF is used, the link mode is analog voice. The radio has the capability to send and process the UUF words defined also for other Rohde & Schwarz radios supporting UUF.

In the call phase, a UUF command word is transmitted which depends on the link mode currently set on the radio.

Table 4.1 User Unique Functions

Link Mode	UUF
Analog voice / FF	No UUF is transmitted.
Internal Modem	UUF for modem operation is transmitted if UUF is switched ON.

When the called radio receives a UUF, it automatically activates the link mode indicated by the UUF.

4.2.2 Basics of ALE-2G LP

The ALE-2G LP (Automatic Link Establishment 2nd Generation with Linking Protection) provides additional FED-STD-1049 capability. Compliance with this standard ensures that all information in the link protocol, such as e.g. addresses and network relations, is protected against tapping. The protective function only covers the linking procedure. To safeguard the subsequent data or voice transmission, additional cryptographic measures must be taken at the transmitting and receiving stations.

The link protection function is performed in compliance with FED-STD-1049, the Rohde & Schwarz implementation supporting three of the five protection levels defined by FED-STD-1049, namely AL-0, AL-1 and AL-2. Protection level AL-2 guarantees maximum security (protection interval 2 s) at high demands on network synchronization, whereas protection level AL-1 provides slightly less security (protection interval 60 s) at lower demands on network synchronization. The protection interval defines the time during which the input quantities of the encryption algorithm are constant.

The 24 bit ALE words for linking are encrypted by means of the lattice algorithm. Input quantities for this algorithm are the user-defined key, the frequency, date and time of day. For maintaining synchronism, a time acquisition protocol is started as soon as a certain time uncertainty threshold has been exceeded. The key can be 56 bits long, allowing as many as 2^{56} different keys in the network.

This procedure assumes a time synchronous network. For initial synchronization and for maintaining synchronism various procedures are used. One station within the network is the time master station (= time server) providing the other stations (net stations) with the exact time.

Each station determines its own time uncertainty, also taking into account the precision of the internal clock. When time information from the time server is being received, delay and internal processing times will also be allowed for. The radio uses a clock with a precision of ±0.5 ppm (parts per million), so that even with a 2 s protection interval (AL-2) re-synchronization will only be necessary after 23 days or more (see Table 4.2). With the transceiver being switched off, however, the clock precision is not better than ±7.5 ppm.
The FED-STD-1049 defines eight time quality levels.

Table 4.2 Time Uncertainty Definition

Time quality code	Time uncertainty
0	none
1	20 ms
2	100 ms
3	500 ms
4	2 s
5	10 s
6	60 s
7	unbound

Protection level 2 requires a time quality of at least 4 and protection level 1 a time quality of at least 6. The time server always has a time quality of 1 (= 20 ms). Time quality 0 is reserved for stations with absolute time.

For maintaining synchronism, a time acquisition protocol is started as soon as a certain time uncertainty threshold has been exceeded. In the course of this the exact time is acquired from the time server or any other station within the network. The acquired time quality is always poorer by one level than the actual time quality of the inquired station. Therefore stations which are no time server cannot obtain time qualities better than 2. This protocol also is protected for as long as the time uncertainties are tolerated by the link protection procedure.

For stations which do not have at all any information on the date or time or whose time uncertainty is too great, another time acquisition protocol is implemented. Due to the lack of time information, however, this protocol cannot be protected. It has been provided mainly for stations entering the network at a later stage.

4.2.2.1 Achieving Network Synchronism

In order to achieve network synchronism when installing the system, proceed as follows:

Installing the time server:

1. Enter the linking protection key.
2. Enter the ALE net time with a precision of ±10 s or better.
3. Set the configuration parameters for example as follows:
   - Link protection level: 1 or 2
   - Fine time request: ON
   - Coarse time request: ON
   - Unprotected time request: ON
   - Passive time acquisition: ON
   - Time request interval: 5 min
   - Time server: ON

After setting the time server parameter to ON, the radio starts broadcasting the net time.

NOTICE

As per definition the time server has the exact time, the time server radio should not be switched off. In the off-state the internal clock of the radio has a precision of only ±7.5 ppm.

Installing a net station:

1. Enter the linking protection key.
2. Set the configuration parameters for example as follows:
   - Link protection level: 1 or 2
   - Fine time request: ON
   - Coarse time request: ON
   - Unprotected time request: ON
   - Passive time acquisition: ON
   - Time request interval: 5 min
   - Time server: OFF
3. Enter the ALE net time with a precision of ±10 s or better.

After the time request interval has elapsed the net station sends a time request to the server.

NOTICE

The station can be switched off, although in this case the time quality quickly deteriorates.

4.2.2.2 Maintaining Network Synchronism

Due to the inaccuracy of the internal clock, synchronism of the net stations will be lost in the course of time. The table below shows how long a net station on protection level 1 or 2 is able to keep itself synchronized.

Table 4.3 Time to Keep Radio (Net Station) Synchronized

Protection level	Radio switched on or off all the time	
	Radio switched on	Radio switched off
AL-1	approx. 2 years	approx. 3 months
AL-2	23 days	2.5 days

NOTICE

The table assumes that the time server is not switched off.

When the time quality of a station falls below a certain threshold, the time acquisition protocol is started automatically. Using this protocol the station tries to improve its time quality. The intervals between these attempts can be programmed with the parameter time request interval. The protocol runs until the time quality reaches a sufficient value.

The following procedures are available:

- Protected Fine Time Request

  With the protected fine time request, a net station inquires the time from the time server or from another net station. The time lag between the two stations must not be greater than two seconds. The received time quality then is poorer by at least one level than the actual reference time. Time transmission is protected.

- Protected Coarse Time Request

  With the protected coarse time request, the time lag between the two stations is allowed to be as great as one minute. Here time transmission also is protected.

- Unprotected Time Request

  With the unprotected time request, time transmission takes place without protection. The inquiring station transmits a random value. The time is then transmitted with this random value encrypted using the lattice algorithm.

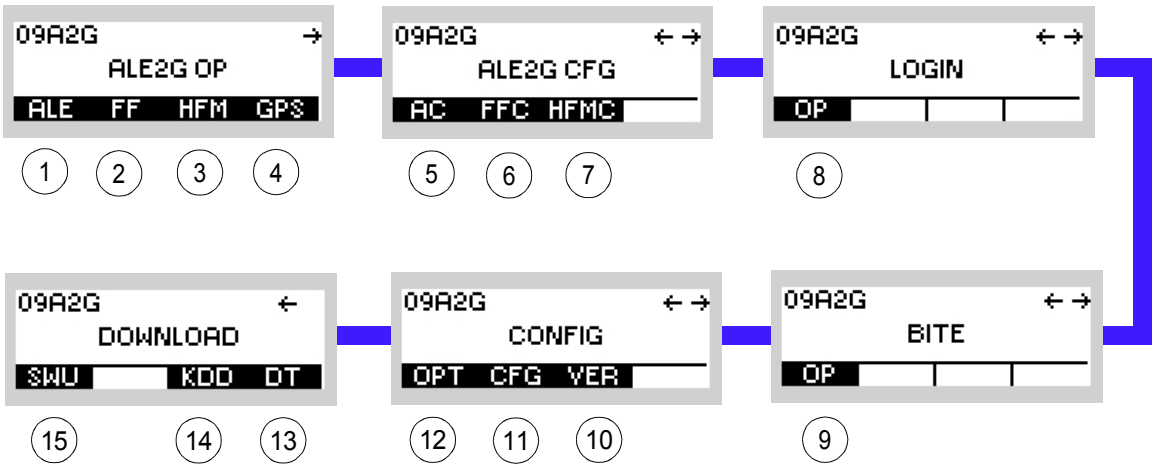
4.2.2.3 Changing the Time Server

In most cases, a failure of the time server is tolerable for several days even with protection level AL-2.This level does not require resynchronization before the 23rd day.

If, however, the time server fails to operate for a longer time, a different net station (and only one) has to be designated time server. The new time server then instantaneously broadcasts its time with the selected AL for the time server, its time quality now being 1 (= 20 ms).

4.2.3 Preset Page A2G (ALE-2G)

Figure 4.1 Preset Page A2G (ALE-2G)



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1 See sect. 4.2.3.1 Settings in the Menu ALE (ALE2G OP, Operation)
2 See sect. 4.2.4 Settings in the Menu FF (ALE2G OP, Operation)
3 See sect. 4.2.5 Settings in the Menu HFM (ALE2G OP, Operation)
4 See sect. 5.2.2.1 Display of the Own GPS Position
5 See sect. 4.2.6 Settings in the Menu AC (ALE2G CFG, Configuration)
6 See sect. 4.2.7 Settings in the Menu FFC (ALE2G CFG, Configuration)
7 See sect. 4.2.8 Settings in the Menu HFMC (ALE2G CFG, Configuration)
8 See sect. 3.5 Login
9 See sect. 6.2.6 Settings in Menu OP (BITE, Operation)
10 See sect. 3.7.2 Settings in Menu VER (CONFIG, Inquiring the Software Version)
11 See sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters)
12 See sect. 3.7 Configuration
13 See sect. 3.7.3 Settings in Menu DT (DOWNLOAD, Loading Pre-configured Radio Parameters)
14 Not relevant in this application.
15 This function is described in the service documentation.

4.2.3.1 Settings in the Menu ALE (ALE2G OP, Operation)

Starting point:

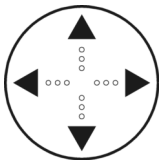
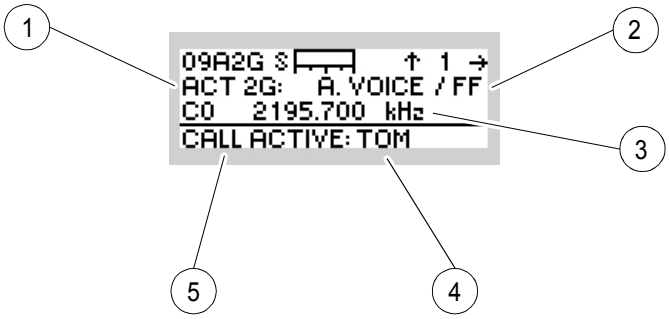
Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes, e.g.:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes, e.g.:
3		Press.	Press several times until the desired submenu is activated (see Figure 4.3). The complete menu structure is shown in Figure 4.4. After a delay of approximately 10 seconds, the ALE operational page 1 is automatically reactivated. If ESC is pressed, the display in the lower status line changes, it now shows the active scan group and the precision of the clock.

Figure 4.2 ALE-2G Operational Page 1



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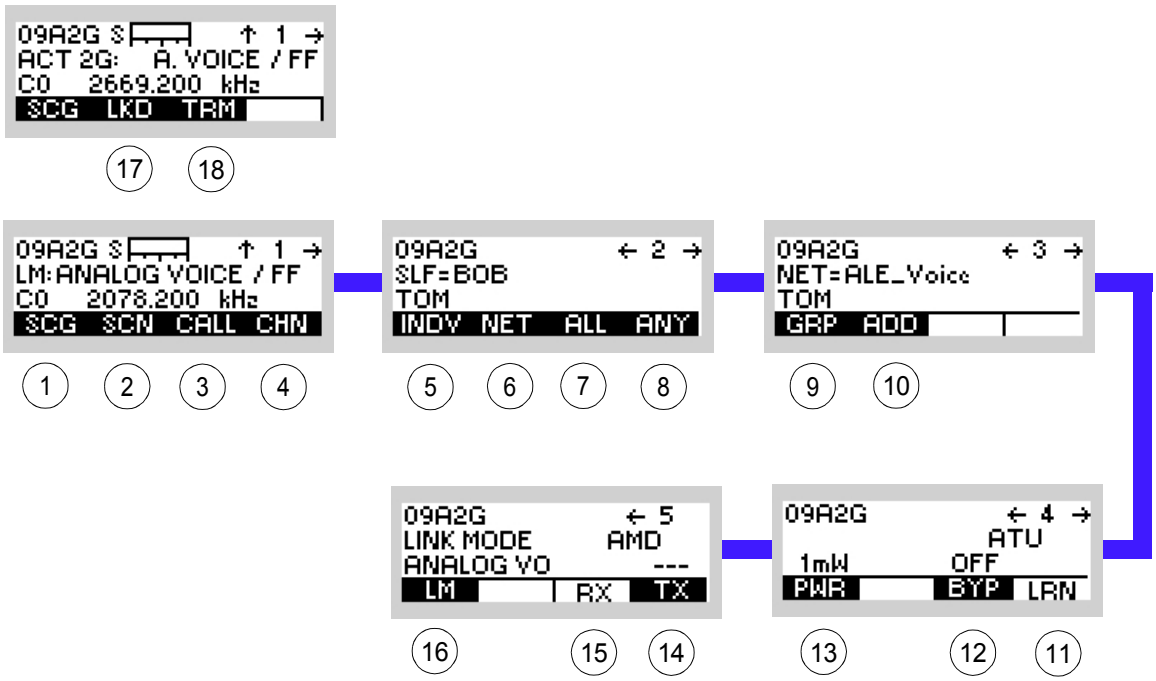
1 Type of ALE network
2 Link mode
3 Frequency
4 Linked station
5 Call state

Figure 4.3 Menu ALE (ALE-2G, Submenus)



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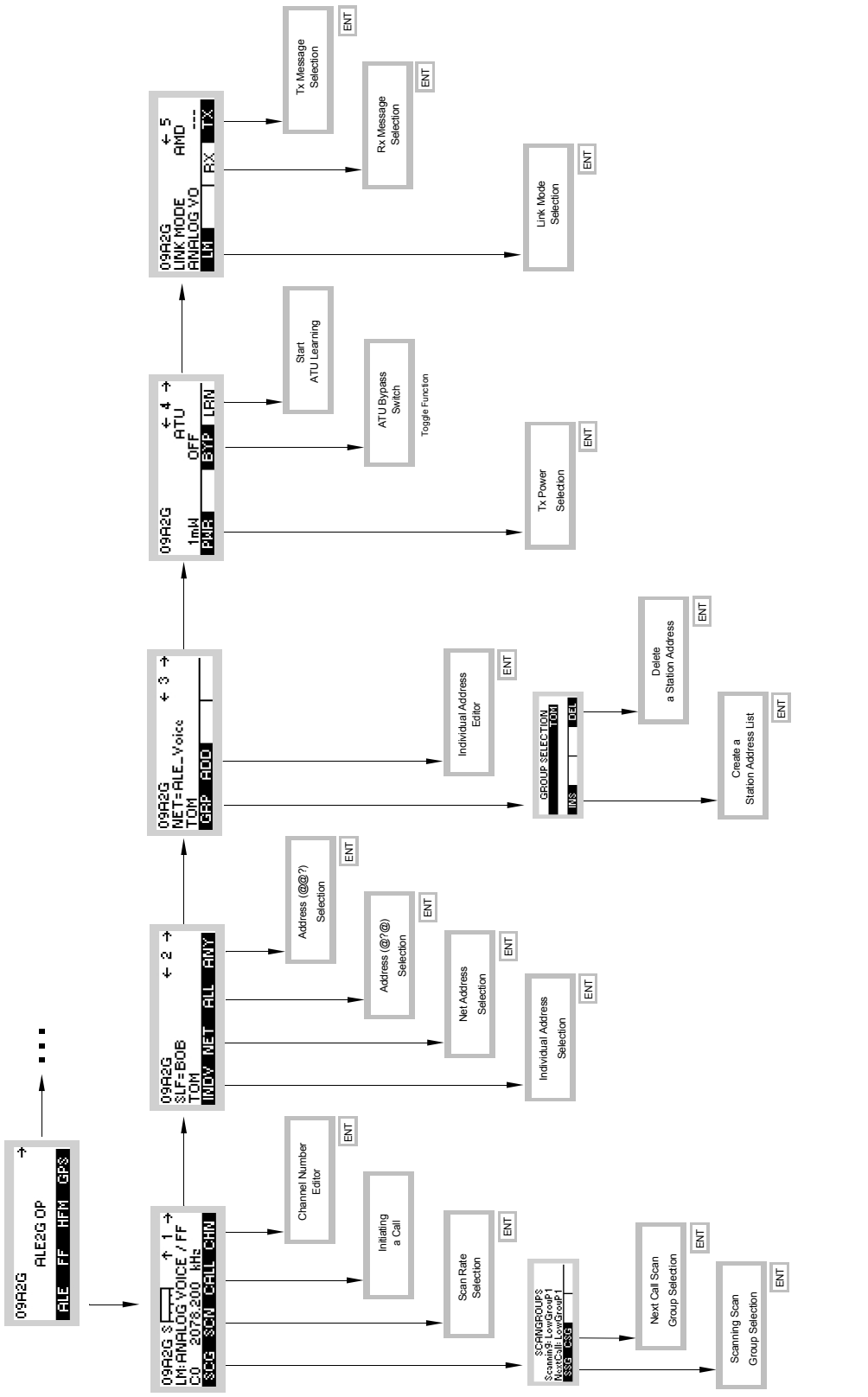
1 See sect. 4.2.3.2 Scan Groups
2 See sect. 4.2.3.3 Changing the Scan Rate
3 See sect. 4.2.3.4 Initiating a Call
4 See sect. 4.2.3.5 Selecting the Channel for Fixed Call
5 See sect. 4.2.3.6 Selecting the Address for Individual Call
6 See sect. 4.2.3.7 Selecting the Address for Net Call
7 See sect. 4.2.3.8 Selecting the Address for All Call
8 See sect. 4.2.3.9 Selecting the Address for Any Call
9 See sect. Station Addresses in a Group for Group Call
10 See sect. Adding an Individual Address
11 See sect. 4.2.3.12 Starting ATU Learning for ALE Channels
12 See sect. 4.2.3.11 Bypassing the ATU
13 See sect. 4.2.3.10 Changing the Power Level
14 See sect. 4.2.3.15 Selecting the TX Message
15 See sect. 4.2.3.14 Selecting the RX Message
16 See sect. 4.2.3.13 Changing the Link Mode
17 See sect. 4.2.3.16 Listing All Currently Linked Stations
18 See sect. 4.2.3.17 Terminating a Link

Figure 4.4 Menu ALE (ALE-2G, Structure)



ICN-4G-Q-231072-R-D0894-00004-A-01-1

4.2.3.2 Scan Groups

- The scanning and next call scan groups are used in combination with scan rate 2 chnPs or 5 chnPs (see sect. 4.2.3.3 Changing the Scan Rate).
- The scan group is a number of channels grouped to be scanned and used for calling.
- The currently selected scanning scan group is the one in which the radio is presently scanning and listening for incoming ALE-2G calls.
- The next call scan group is associated to the currently selected destination address and is used for calling the currently selected destination. If as next call scan group “rx = tx” is selected, the next call scan group is the same as the currently selected scanning scan group.

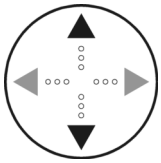
NOTICE

As each address has its own associated scan group, changing the destination address may also change the next call scan group.

Changing the Scanning Scan Group

By means of softkeys SCG (Scan Group) and SSG (Scanning Scan Group) the operator can change the scanning scan group.

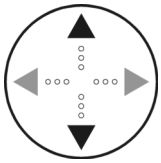
Starting point: Main page of e.g. ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (SCG)	Press.	The display changes:
4	2 ABC (SSG)	Press.	The display changes:
5		Press several times until the desired scan group is displayed.	Possible values (example): LowGroup1 -> LowGroup2 -> MediumGroup1 -> HighGroup1
6	ENT	Press.	The selection window is closed. The new scan group is now effective.

Changing the Next Call Scan Group

By means of softkeys SCG (Scan Group) and CSG (Call Scan Group) the operator can change the next call scan group.

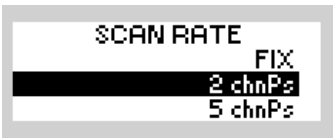
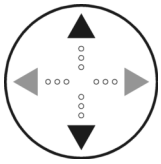
Starting point: Main page of e.g. ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (SCG)	Press.	The display changes:
4	3 DEF (CSG)	Press.	The display changes:
5		Press several times until the desired next call scan group is displayed.	Possible values (example): LowGroup1 -> LowGroup2 -> MediumGroup1 -> HighGroup1 -> tx=rx
6	ENT	Press.	The selection window is closed. The new next call scan group is now effective.

4.2.3.3 Changing the Scan Rate

By means of softkey SCN (Scan) the operator can change the scan rate.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	3 DEF (SCN)	Press.	The display changes: 
4		Press several times until the desired scan rate is displayed.	Possible values: FIX -> 2 chnPs -> 5 chnPs
5	ENT	Press.	The selection window is closed. The new scan rate is now effective.

- With scan rate FIX the radio listens in only on the set channel. A link is set up also exclusively on this frequency.
- With scan rates 2 chnPs (2 channels per second) and 5 chnPs (5 channels per second) the radio listens into all channels of the currently set scanning scan group (for details see sect. 4.2.3.2 Scan Groups). Channel change takes place two or five times per second, respectively.
- With scan rates 2chnPs or 5chnPs a link is set up on one of the channels of the next call scan group (for details see sect. 4.2.3.2 Scan Groups). The next call scan group is associated to the currently selected destination address and may change upon selection of another destination address. If as next call scan group “rx = tx” is selected, the next call scan group is the same as the currently selected scanning scan group.

4.2.3.4 Initiating a Call

By means of softkey CALL the operator can initiate an ALE call.

Before you initiate a new ALE call, check the following:

- If a link is already existing, terminate the existing link (see sect. 4.2.3.17 Terminating a Link).
- Select the address to call to (one of Individual, Net, Group, All or Any).
- Select other call parameters as required (e.g. link mode, scan rate, Tx-AMD, power level).

NOTICE

The CALL softkey replaces the TRM softkey if ALE is scanning.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:

Step	Control	Action	Note
3	4 GHI (CALL)	Press.	The display changes:

4.2.3.5 Selecting the Channel for Fixed Call

By means of softkey CHN (Channel) the operator can select the channel for a fixed call.

NOTICE

In ALE-3G this parameter is only effective if CCT (Changing the Call Channel Type) is set to "fixed".

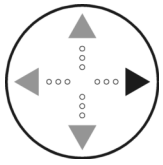
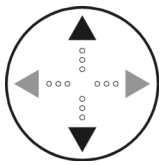
Starting point: Main page of e.g. ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	5 JKL (CHN)	Press.	The display changes:
4	0 _*+ to 9 WXYZ	Enter a new channel number.	Range (example): 0 to 11
5	ENT	Press.	The editor window is closed. The new channel number is now effective.

4.2.3.6 Selecting the Address for Individual Call

By means of softkey INDV (Individual) the operator can select the address for an Individual Call.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (INDV)	Press.	The display changes:
4		Press several times until the desired address is displayed.	Possible values (example): BOB → TOM → SAM → EDGAR → MIKE → HELEN → EVA → BO? → SA? → B?? → S?? → ANDREAS → ALPHA → BRAVO → CHARLY
5	ENT	Press.	The selection window is closed. For example EDGAR is selected for addressing.

To initiate an Individual Call proceed as follows:

- If required, terminate an existing link (sect. 4.2.3.17 Terminating a Link).
- Select the scan rate (sect. 4.2.3.3 Changing the Scan Rate).
- Select the message to be sent after link-up (sect. 4.2.3.12 Starting ATU Learning for ALE Channels).
- Select the power level (sect. 4.2.3.10 Changing the Power Level).
- Press PTT (link mode Analog Voice / FF),

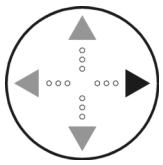
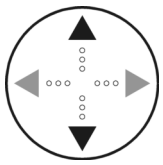
  apply data (link mode Internal Modem) or

  press the softkey CALL (sect. 4.2.3.4 Initiating a Call).

4.2.3.7 Selecting the Address for Net Call

By means of softkey NET the operator can select the address for a Net Call.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press once.	The display changes:
3	3 DEF (NET)	Press.	The display changes:
4		Press several times until the desired address is displayed.	Possible values (example): 2GNET1 → 3GNET1 → 3GNET2
5	ENT	Press.	The selection window is closed. For example 2GNET1 is selected for addressing.

To initiate a Net Call proceed as follows:

- If required, terminate an existing link (sect. 4.2.3.17 Terminating a Link).
- Select the scan rate (sect. 4.2.3.3 Changing the Scan Rate).
- Select the message to be sent after link-up (sect. 4.2.3.12 Starting ATU Learning for ALE Channels).
- Select the power level (sect. 4.2.3.10 Changing the Power Level).
- Press PTT (link mode Analog Voice / FF),

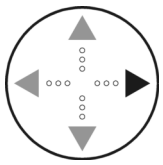
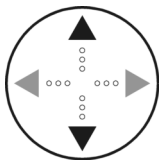
  apply data (link mode Internal Modem) or

  press the softkey CALL (sect. 4.2.3.4 Initiating a Call).

4.2.3.8 Selecting the Address for All Call

By means of softkey ALL the operator can select the address for an All Call.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press once.	The display changes:
3	4 GHI (ALL)	Press.	The display changes:
4		Press several times until the desired address is displayed.	Possible values (example): @?@ → @M@ → @B@
5	ENT	Press.	The selection window is closed. For example @B@ is selected for addressing.

To initiate an All Call proceed as follows:

- If required, terminate an existing link (sect. 4.2.3.17 Terminating a Link).
- Select the scan rate (sect. 4.2.3.3 Changing the Scan Rate).
- Select the message to be sent after link-up (sect. 4.2.3.12 Starting ATU Learning for ALE Channels).
- Select the power level (sect. 4.2.3.10 Changing the Power Level).
- Press PTT (link mode Analog Voice / FF),

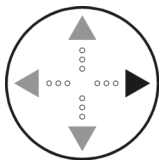
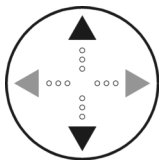
  apply data (link mode Internal Modem) or

  press the softkey CALL (sect. 4.2.3.4 Initiating a Call).

4.2.3.9 Selecting the Address for Any Call

By means of softkey ANY the operator can select the address for an Any Call.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press once.	The display changes:
3	5 JKL (ANY)	Press.	The display changes:
4		Press several times until the desired address is displayed.	Possible values (example): @@? → @@M → @@B → @AM → @OB
5	ENT	Press.	The selection window is closed. For example @@B is selected for addressing.

To initiate an Any Call proceed as follows:

- If required, terminate an existing link (sect. 4.2.3.17 Terminating a Link).
- Select the scan rate (sect. 4.2.3.3 Changing the Scan Rate).
- Select the message to be sent after link-up (sect. 4.2.3.12 Starting ATU Learning for ALE Channels).
- Select the power level (sect. 4.2.3.10 Changing the Power Level).
- Press PTT (link mode Analog Voice / FF),

  apply data (link mode Internal Modem) or

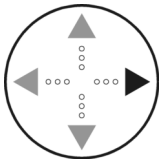
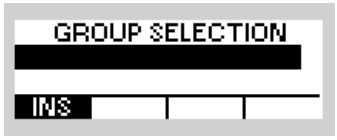
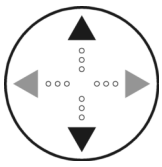
  press the softkey CALL (sect. 4.2.3.4 Initiating a Call).

Station Addresses in a Group for Group Call

Create a Station Address List for Group Call

By means of softkeys GRP (Group) and INS (Insert) the operator can create a station address list for a Group Call.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press twice.	The display changes:
3	2 ABC (GRP)	Press.	The display changes: 
4	2 ABC (INS)	Press.	The display changes:
5		Press several times until the desired address is displayed.	Possible values (example): BOB → TOM → SAM → EDGAR → MIKE → HELEN → EVA → BO? → SA? → B?? → S?? → ANDREAS → ALPHA → BRAVO → CHARLY

Step	Control	Action	Note
6	ENT	Press.	The selection window is closed. For example BOB is part of the group selection for addressing.
7	2 ABC (INS)	Press.	Repeat steps 5 and 6 for each further participant to be added to the group (max. 15 participants in a group).
8	ENT	Press twice.	The selection window is closed.

To initiate a Group Call proceed as follows:

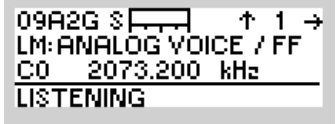
- If required, terminate an existing link (sect. 4.2.3.17 Terminating a Link).
- Select the scan rate (sect. 4.2.3.3 Changing the Scan Rate).
- Select the message to be sent after link-up (sect. 4.2.3.12 Starting ATU Learning for ALE Channels).
- Select the power level (sect. 4.2.3.10 Changing the Power Level).
- Press PTT (link mode Analog Voice / FF),

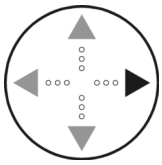
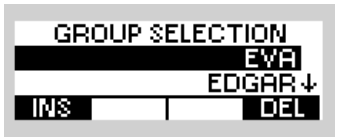
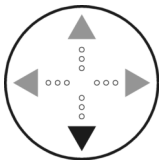
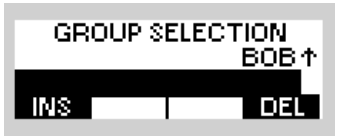
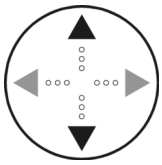
  apply data (link mode Internal Modem) or

  press the softkey CALL (sect. 4.2.3.4 Initiating a Call).

Inserting a Station Address in a Group for Group Call
By means of softkeys GRP (Group) and INS (Insert) the operator can insert a station address in the group for a Group Call.

Starting point: Main page of ALE2G OP menu

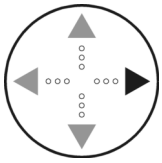
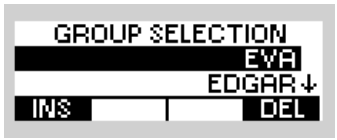
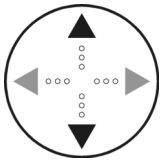
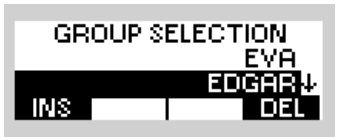
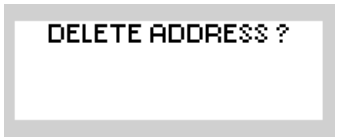
Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes: 

Step	Control	Action	Note
2		Press twice.	The display changes:
3	2 ABC (GRP)	Press.	The display changes: 
4		Press several times until blank line appears in the display.	The display changes: 
5	2 ABC (INS)	Press.	The display changes:
6		Press several times until the desired address is displayed.	Possible values (example): TOM → SAM → MIKE → HELEN → BO? → SA? → B?? → S?? → ANDREAS → ALPHA → BRAVO → CHARLY
7	ENT	Press three times.	The selection window is closed. For example BO? is part of the group selection for addressing.

Deleting a Station Address in a Group for Group Call

By means of softkeys GRP (Group) and DEL (Delete) the operator can delete a station address in the group for a Group Call.

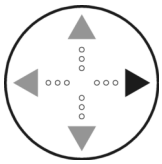
Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press twice.	The display changes:
3	2 ABC (GRP)	Press.	The display changes: 
4		Press several times until the desired address is displayed.	The display changes: 
5	5 JKL (DEL)	Press.	The display changes: 
7	ENT	Press three times.	The selection window is closed. The selected address is deleted.

Adding an Individual Address

By means of softkey ADD (Address) the operator can add an individual address to the individual address list.

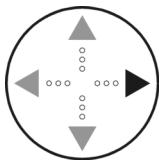
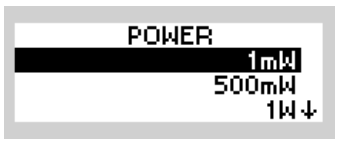
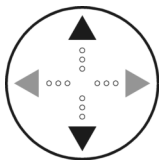
Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press twice.	The display changes:
3	3 DEF (ADD)	Press.	The display changes:
4	0 _*+ to 9 WXYZ	Enter the address.	
5	ENT	Press.	The entered individual address is stored in the address list and can be selected.

4.2.3.10 Changing the Power Level

By means of softkey PWR (Power) the operator can change the power level.

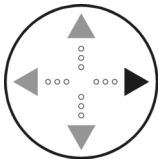
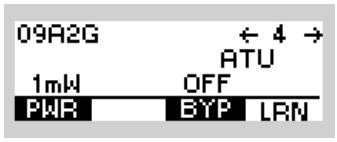
Starting point: Main page of e.g. ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press three times.	The display changes:
3	2 ABC (PWR)	Press.	The display changes: 
4		Press several times until the desired value is displayed.	Possible values: see sect. 3.2.2.5 Changing the Power Level
5	ENT	Press.	The selection window is closed. The new setting is now effective.

4.2.3.11 Bypassing the ATU

By means of softkey BYP (Bypass) the operator can select between ATU bypassed (ON) and ATU not bypassed (OFF), which is the preferred setting to achieve high RX sensitivity. This function does not affect the ATU behaviour during active transmission.

Starting point: Main page of e.g. ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press three times.	The display changes: 
3	4 GHI (BYP)	Press.	Repetitively pressing this key toggles between ATU bypassed on and off.

4.2.3.12 Starting ATU Learning for ALE Channels

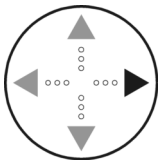
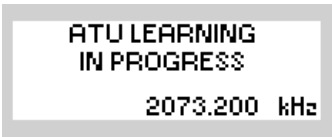
NOTICE

If an R&S HX3000 Antenna is connected, scan groups must not contain frequencies lower than 1.6 MHz, otherwise ATU-LEARN will fail.

With MR300xU (x = 0 to 3) this function is only available if the tactical radio is operated in conjunction with an external power amplifier / antenna tuning unit. With MR300xH (x = 0 to 3) this function is always available.

By means of softkey LRN (Learn) the operator can start ATU learning for ALE channels.

Starting point: Main page of e.g. ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press three times.	The display changes:
3	5 JKL (LRN)	Press.	The display changes: 

- In the learning procedure all ALE channels are set one after another. In each case the antenna tuning unit will start tuning anew. When the carrier is activated after learning and an ALE channel is set, the ATU will stop tuning anew.
- This works similarly to the softkey TUN in other modes, but allows to consecutively tune all ALE channels. After a time that depends on the number of ALE channels defined, the current antenna impedance is matched to the radio. Repeat Learn for instance after changing the antenna, antenna position or frequency. The tuning results for all ALE channels are stored in the radio, even after switching the radio off and on again.

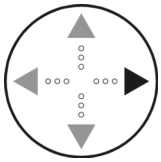
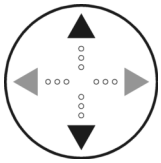
4.2.3.13 Changing the Link Mode

By means of softkey LM (Link Mode), the operator can change the type of traffic to transfer after an ALE link has been established.

NOTICE

The link mode may be changed only if ALE is scanning.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press four times.	The display changes:
3	2 ABC (LM)	Press.	The display changes:
4		Press several times until the desired value is displayed.	Possible values: • ANALOG VOICE / FF • INTERNAL MODEM

Step	Control	Action	Note
5	ENT	Press.	The selection window is closed. The new setting is now effective.

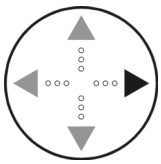
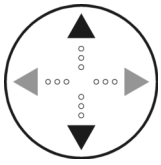
4.2.3.14 Selecting the RX Message

By means of softkey RX the operator can select the RX message to be displayed.

NOTICE

This softkey is enabled only if ALE-2G Rx messages (AMD) have been received previously.

Starting point: Main page of e.g. ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press four times.	The display changes:
3	4 GHI (RX)	Press.	The display changes:
4		Press several times until the desired RX message is displayed.	Possible values (example): THE FIRST TRANSMIT → THE SECOND TRANSMIT

Step	Control	Action	Note
5	ENT	Press.	The display changes: MESSAGE THE FIRST TRANSMIT AMD MESSAGE.

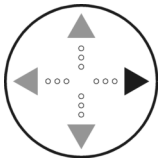
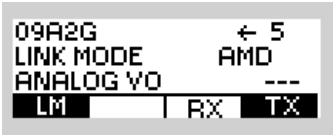
4.2.3.15 Selecting the TX Message

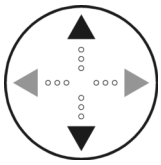
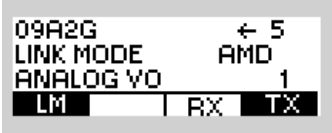
By means of softkey TX the operator can select the TX message to be sent in the next ALE-2G link-up.

NOTICE

TX messages are only processed if a ALE-2G station is selected as next call destination.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press four times.	The display changes: 
3	5 JKL (TX)	Press.	The display changes:

Step	Control	Action	Note
4		Press several times until the desired TX message is displayed.	Possible values (example): --- → THE FIRST TRANSMIT → THE SECOND TRANSMIT → THE THIRD TRANSMIT → THE 4. TRANSMIT AMD → THE 5. TRANSMIT AMD → THE 6. TRANSMIT AMD → THE 7. TRANSMIT AMD → THE 8. TRANSMIT AMD → THE 9. TRANSMIT AMD → THIS IS THE TENTH TRANSMIT AMD **NOTICE** **--- = no Tx message is sent with the next ALE call.**
5	ENT	Press.	The display changes, e.g.:
6	ENT	Press.	The display changes, e.g.: 

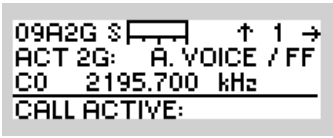
4.2.3.16 Listing All Currently Linked Stations

If a link is established (CALL ACTIVE), by means of softkey LKD (Linked) the operator can get a list of the call signs of all currently linked stations.

NOTICE

The list of the currently linked stations available in the initiating station can contain only call signs if a handshake has been performed between stations.

Starting point: Main page of e.g. ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes: 
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	3 DEF (LKD)	Press.	The display changes:

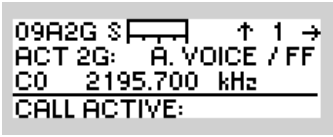
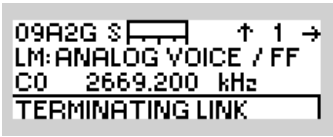
4.2.3.17 Terminating a Link

By means of softkey TRM (Terminate) the operator can terminate the running link.

NOTICE

The TRM softkey replaces the CALL softkey if an ALE call is in progress (ALE is not scanning).

Starting point: Main page of e.g. ALE2G OP menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes: 
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	4 GHI (TRM)	Press.	The link is terminated manually. 

- When the linked stations have finished communicating, it is necessary to terminate the link so that the stations can return to availability.
- The link can be terminated in two ways:

  - Manually by pressing softkey TRM
  - Automatically through a non-activity timeout

  The timer is reset by a change in the operating state from reception to transmission, times out after a programmable period of time and then terminates the link automatically.

  In both cases a link termination command is transmitted to the distant station, returning the local station to availability.
- An active call in progress can be stopped by pressing softkey TRM.

4.2.4 Settings in the Menu FF (ALE2G OP, Operation)

Starting point:

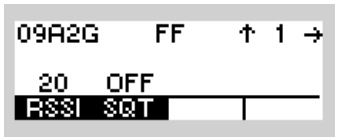
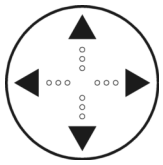
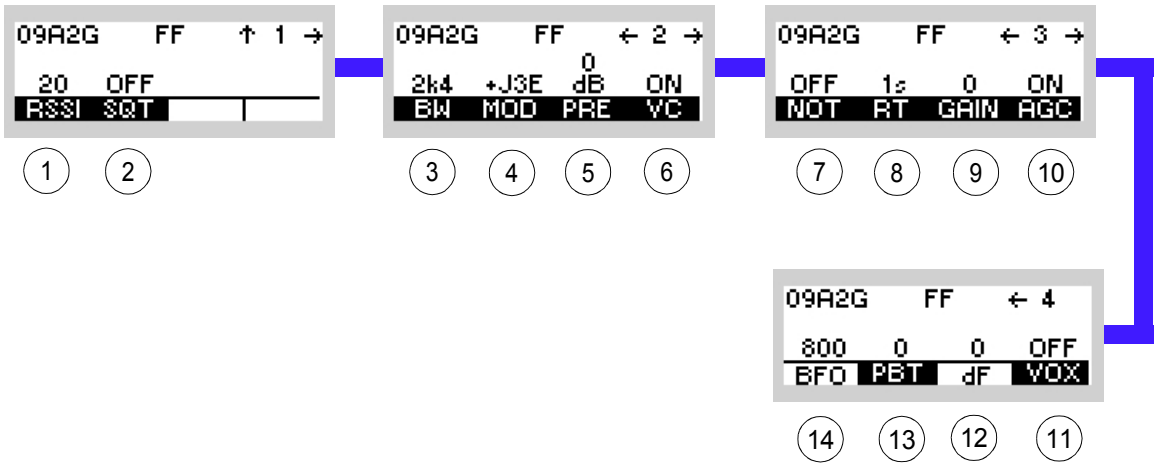
Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes, e.g.: 
2		Press.	Press several times until the desired submenu is activated (see).

Figure 4.5 Menu FF (ALE-2G, Submenus)



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1 See sect. 4.2.4.1 Changing the Squelch Sensitivity
2 See sect. 4.2.4.2 Changing the Squelch Type
3 See sect. 4.2.4.3 Changing the Bandwidth
4 See sect. 4.2.4.4 Changing the Modulation Mode
5 See sect. 4.2.4.5 Changing the Preamplifier Setting
6 See sect. 4.2.4.6 Switching the Voice Compressor On or Off
7 See sect. 4.2.4.7 Switching the Notch Filter On or Off
8 See sect. 4.2.4.8 Changing the Decay Time
9 See sect. 4.2.4.9 Changing the Manual Gain
10 See sect. 4.2.4.10 Switching the Automatic Gain Control On or Off
11 See sect. 4.2.4.14 Changing the VOX Function
12 See sect. 4.2.4.13 Changing the Delta Frequency
13 See sect. 4.2.4.12 Changing the Passband Tuning Frequency
14 See sect. 4.2.4.11 Changing the BFO Frequency

4.2.4.1 Changing the Squelch Sensitivity

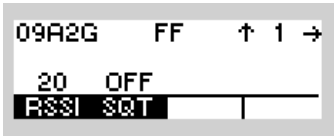
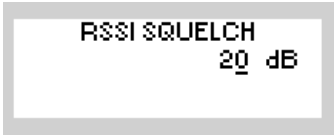
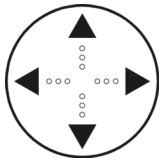
NOTICE

The squelch sensitivity takes also effect on non-voice links.

See sect. 3.2.2.3 Changing the Squelch Sensitivity

By means of softkey RSSI (Receive Signal Strength Indicator for carrier squelch) the operator can change the squelch sensitivity.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2	2 ABC (RSSI)	Press.	The display changes: 
3	0 _*+ to 9 WXYZ or 	Enter a new squelch value. Change squelch value selectively.	Possible values: see sect. 3.2.2.3 Changing the Squelch Sensitivity
4	ENT	Press.	The editor window is closed.

4.2.4.2 Changing the Squelch Type

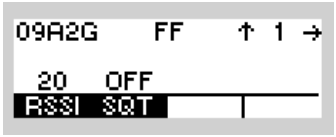
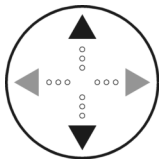
NOTICE

The squelch type takes also effect on non-voice links.

See sect. 3.2.2.22 Changing the Squelch Type

By means of softkey SQT (Squelch Type) the operator can change the squelch type.

Starting point: Main page of ALE2G OP menu

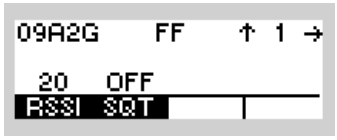
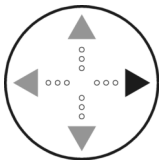
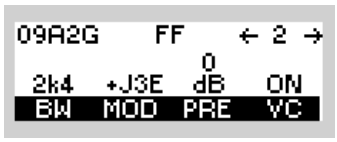
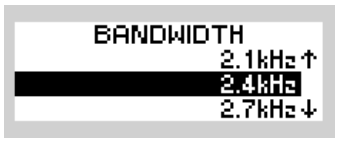
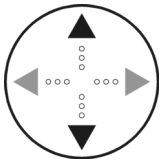
Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2	3 DEF (SQT)	Press.	The display changes:
3		Press several times until the desired squelch type is displayed.	Possible values: see sect. 3.2.2.22 Changing the Squelch Type
4	ENT	Press.	The selection window is closed. The new value is now effective.

4.2.4.3 Changing the Bandwidth

See sect. 3.2.2.9 Changing the Bandwidth

By means of softkey BW (Bandwidth) the operator can only change the Rx bandwidth. The effective bandwidth, e.g. 2.4 kHz, is displayed.

Starting point: Main page of ALE2G OP menu

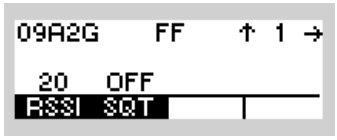
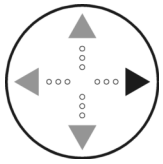
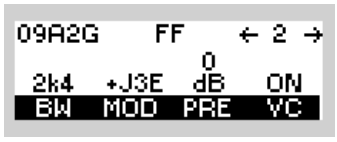
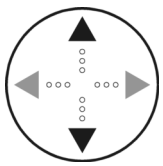
Step	Control	Action	Note
1	(FF) 3 DEF	Press.	The display changes: 
2		Press once.	The display changes: 
3	(BW) 2 ABC	Press.	The display changes: 
4		Press several times until the desired value is displayed.	Possible values: see sect. 3.2.2.9 Changing the Bandwidth
5	ENT	Press.	The selection window is closed. The new value is now effective.

4.2.4.4 Changing the Modulation Mode

See sect. 3.2.2.2 Changing the Modulation Mode

By means of softkey MOD (Modulation) the operator can change the modulation mode. The effective modulation mode, e.g. +J3E, is displayed.

Starting point: Main page of ALE2G OP menu

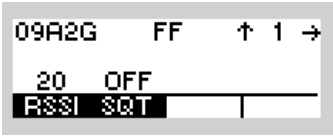
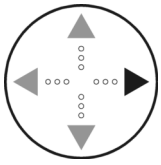
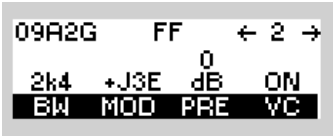
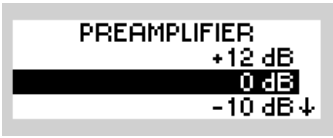
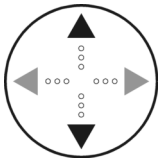
Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press once.	The display changes: 
3	3 DEF (MOD)	Press.	The display changes:
4		Press several times until the desired modulation mode is displayed.	Possible values: see sect. 3.2.2.2 Changing the Modulation Mode
5	ENT	Press.	The selection window is closed. The new modulation mode is now effective.

4.2.4.5 Changing the Preamplifier Setting

See sect. 3.2.2.7 Changing the Preamplifier / Attenuation Setting.

By means of softkey PRE (Preamplifier) the operator can change the preamplifier setting.

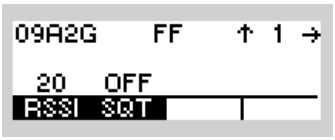
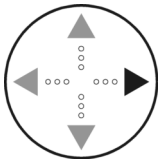
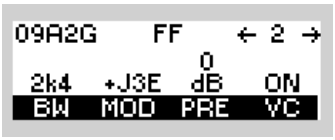
Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press once.	The display changes: 
3	4 GHI (PRE)	Press.	The display changes: 
4		Press several times until the desired value is displayed.	Possible values: see sect. 3.2.2.7 Changing the Preamplifier / Attenuation Setting
5	ENT	Press.	The selection window is closed. The new value is now effective.

4.2.4.6 Switching the Voice Compressor On or Off

By means of softkey VC (Voice Compression) the operator can switch the voice compression function on or off.

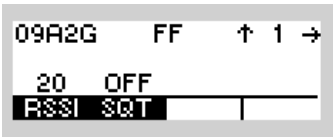
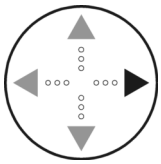
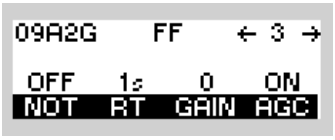
Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press once.	The display changes: 
3	5 JKL (VC)	Press.	Repetitively pressing this key toggles the VC on and off.

4.2.4.7 Switching the Notch Filter On or Off

By means of softkey NOT (Notch) the operator can switch the notch filter on or off.

Starting point: Main page of ALE2G OP menu

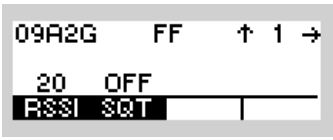
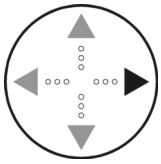
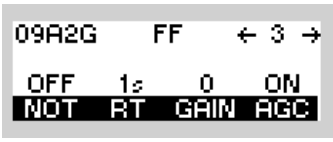
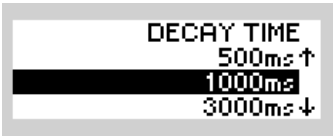
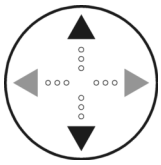
Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	2 ABC (NOT)	Press.	Repetitively pressing this key toggles notch filter on and off.

4.2.4.8 Changing the Decay Time

See sect. 3.3.3.8 Changing the Default Decay Time for Modulation Mode J3E.

By means of softkey RT the operator can change the decay time for modulation mode J3E. If then modulation mode J3E is selected, the new decay time will be used.

Starting point: Main page of ALE2G OP menu

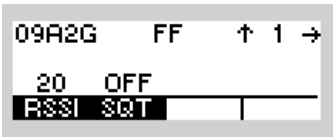
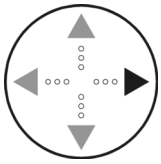
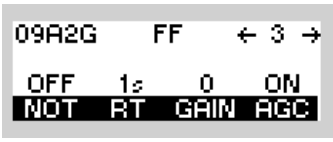
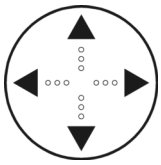
Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	3 DEF (RT)	Press.	The display changes: 
4		Press several times until the desired value is displayed.	Possible values: see sect. 3.3.3.8 Changing the Default Decay Time for Modulation Mode J3E
5	ENT	Press.	The selection window is closed. The new value is now effective.

4.2.4.9 Changing the Manual Gain

See sect. 3.2.2.11 Changing the Manual Gain.

By means of softkey GAIN (Manual Gain Control) the operator can change the manual gain. The effective manual gain, e.g. 0 dB, is displayed.

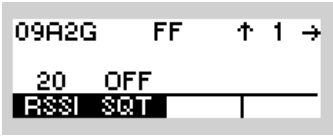
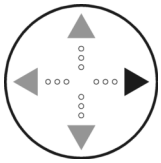
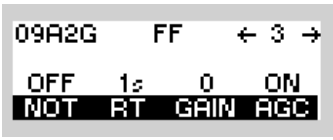
Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	4 GHI (GAIN)	Press.	The display changes:
4		Change gain value selectively.	Possible values: see sect. 3.2.2.11 Changing the Manual Gain
5	ENT	Press.	The editor window is closed. The new value is now effective.

4.2.4.10 Switching the Automatic Gain Control On or Off

By means of softkey AGC (Automatic Gain Control) the operator can switch the Automatic Gain Control function on or off.

Starting point: Main page of ALE2G OP menu

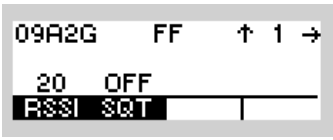
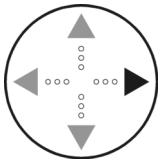
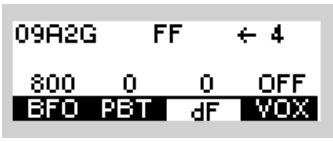
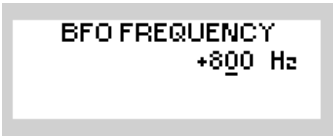
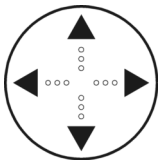
Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	5 JKL (AGC)	Press.	Repetitively pressing this key toggles AGC on and off.

4.2.4.11 Changing the BFO Frequency

See sect. 3.2.2.17 Changing the BFO Frequency.

By means of softkey BFO (Beat Frequency Oscillator) the operator can change the frequency of the output signal to an audible tone.

Starting point: Main page of ALE2G OP menu

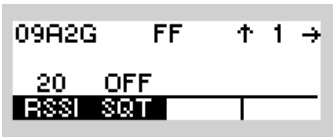
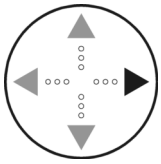
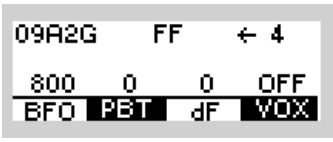
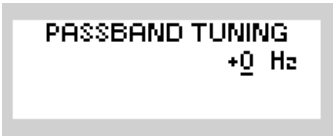
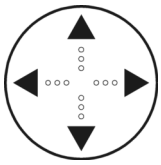
Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	2 ABC (BFO)	Press.	The display changes: 
4		Change value selectively.	Possible values: see sect. 3.2.2.17 Changing the BFO Frequency
5	ENT	Press.	The editor window is closed. The new value is now effective.

4.2.4.12 Changing the Passband Tuning Frequency

See sect. 3.2.2.18 Changing the Passband Tuning Frequency.

By means of softkey PBT (Passband Tuning) the operator can change the passband tuning frequency.

Starting point: Main page of ALE2G OP menu

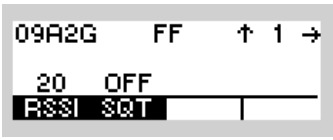
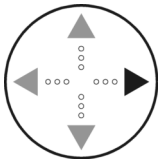
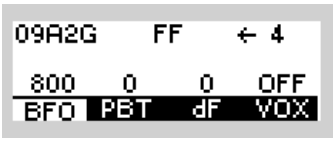
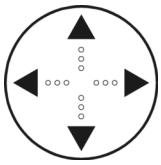
Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	3 DEF (PBT)	Press.	The display changes: 
4		Change value selectively.	Possible values: see sect. 3.2.2.18 Changing the Passband Tuning Frequency
5	ENT	Press.	The editor window is closed. The new value is now effective.

4.2.4.13 Changing the Delta Frequency

See sect. 3.2.2.19 Changing the Delta Frequency.

By means of softkey dF (Delta Frequency) the operator can tune the centre of the signal spectrum for modulation mode J2D.

Starting point: Main page of ALE2G OP menu

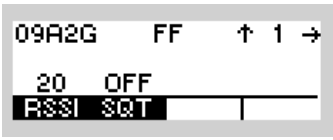
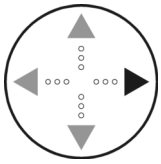
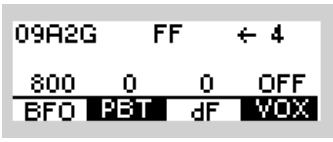
Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	4 GHI (dF)	Press.	The display changes:
4		Change value selectively.	Possible values: see sect. 3.2.2.19 Changing the Delta Frequency
5	ENT	Press.	The editor window is closed. The new value is now effective.

4.2.4.14 Changing the VOX Function

See sect. 3.2.2.20 Changing the VOX Function.

By means of softkey VOX (Voice Operated Transmission) the operator can change the VOX function.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	3 DEF (FF)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	5 JKL (VOX)	Press.	Repetitively pressing this key changes the VOX function. Possible values: see sect. 3.2.2.20 Changing the VOX Function

4.2.5 Settings in the Menu HFM (ALE2G OP, Operation)

Starting point:

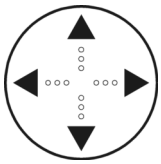
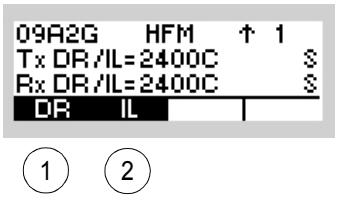
Step	Control	Action	Note
1	4 GHI (HFM)	Press.	The display changes, e.g.:
2		Press.	Press to activate the submenu (see Figure 4.6).

Figure 4.6 Menu HFM (ALE-2G, Submenus)



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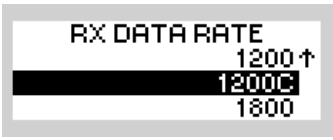
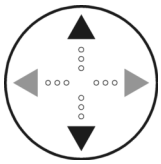
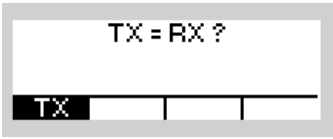
1 See sect. 4.2.5.1 Changing the Data Rate for Data Transmission / Reception
2 See sect. 4.2.5.2 Changing the Interleaver Length for Data Transmission / Reception

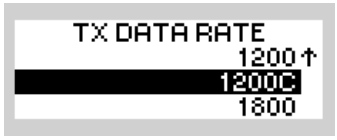
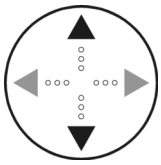
4.2.5.1 Changing the Data Rate for Data Transmission / Reception

See sect. 4.4.2.5 Changing the Data Rate and Forward Error Correction for Data Transmission.

By means of softkey DR (Data Rate) the operator can change the data rate used for the over-the-air data transmission and reception. The RX and TX data rate can be chosen separately.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	4 GHI (HFM)	Press.	The display changes:
2	2 ABC (DR)	Press.	The display changes: 
3		Press several times until the desired value is displayed.	Possible values: see sect. 4.4.2.5 Changing the Data Rate and Forward Error Correction for Data Transmission
4	ENT	Press.	The display changes: 
		For RX = TX	
5	ENT	Press.	The selection window is closed. The new setting is now effective.

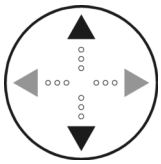
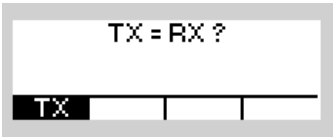
Step	Control	Action	Note
		For RX <> TX	
5	2 ABC (TX)	Press.	The display changes: 
6		Press several times until the desired value is displayed.	Possible values: see sect. 4.4.2.5 Changing the Data Rate and Forward Error Correction for Data Transmission
7	ENT	Press.	The selection window is closed. The new setting is now effective.

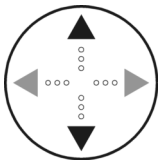
4.2.5.2 Changing the Interleaver Length for Data Transmission / Reception

See sect. 4.4.2.6 Changing the Interleaver Length for Data Transmission.

By means of softkey IL (Interleaver) the operator can change the interleaver length used for the over-the-air data transmission and reception. The RX and TX interleavers can be chosen separately.

Starting point: Main page of ALE2G OP menu

Step	Control	Action	Note
1	4 GHI (HFM)	Press.	The display changes:
2	3 DEF (IL)	Press.	The display changes:
3		Press several times until the desired value is displayed.	Possible values: see sect. 4.4.2.6 Changing the Interleaver Length for Data Transmission
4	ENT	Press.	The display changes: 
		For RX = TX	
5	ENT	Press.	The selection window is closed. The new setting is now effective.

Step	Control	Action	Note
			For RX <> TX
5	2 ABC (TX)	Press.	The display changes:
6		Press several times until the desired value is displayed.	Possible values: see sect. 4.4.2.6 Changing the Interleaver Length for Data Transmission
7	ENT	Press.	The selection window is closed. The new setting is now effective.

4.2.6 Settings in the Menu AC (ALE2G CFG, Configuration)

Starting point:

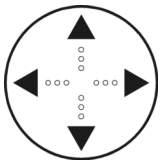
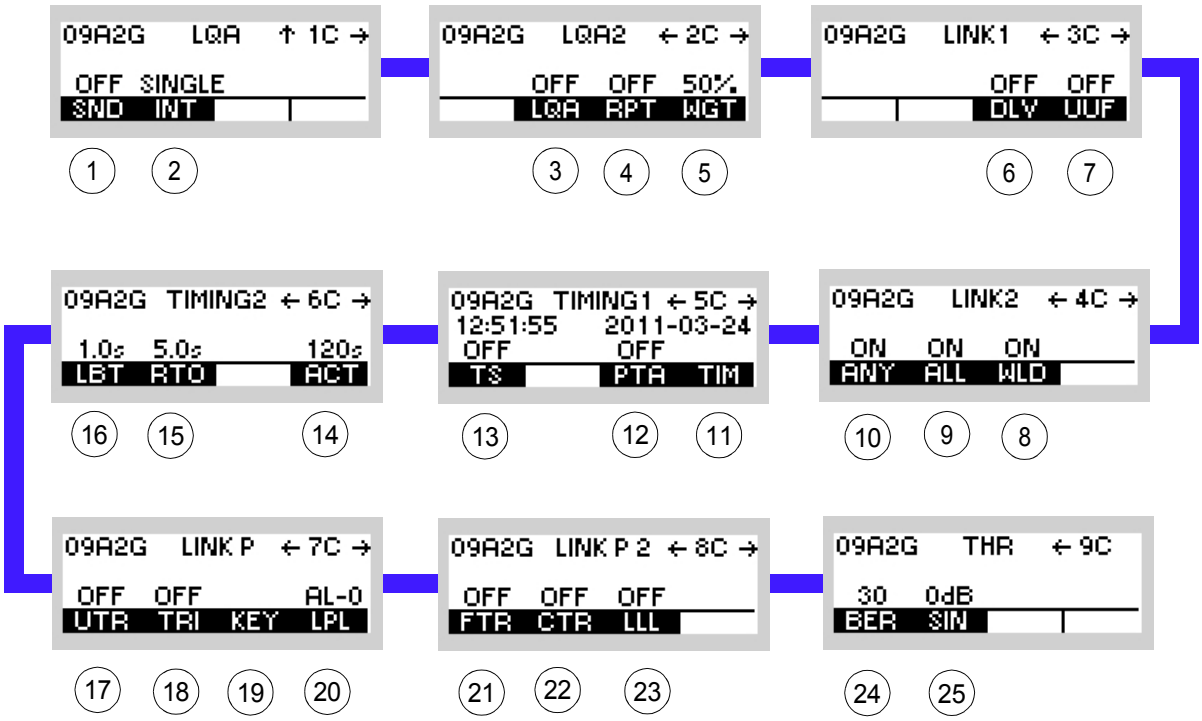
Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired submenu is activated (see Figure 4.7). The complete menu structure is shown in Figure 4.8.

Figure 4.7 Menu AC (ALE-2G, Submenus)



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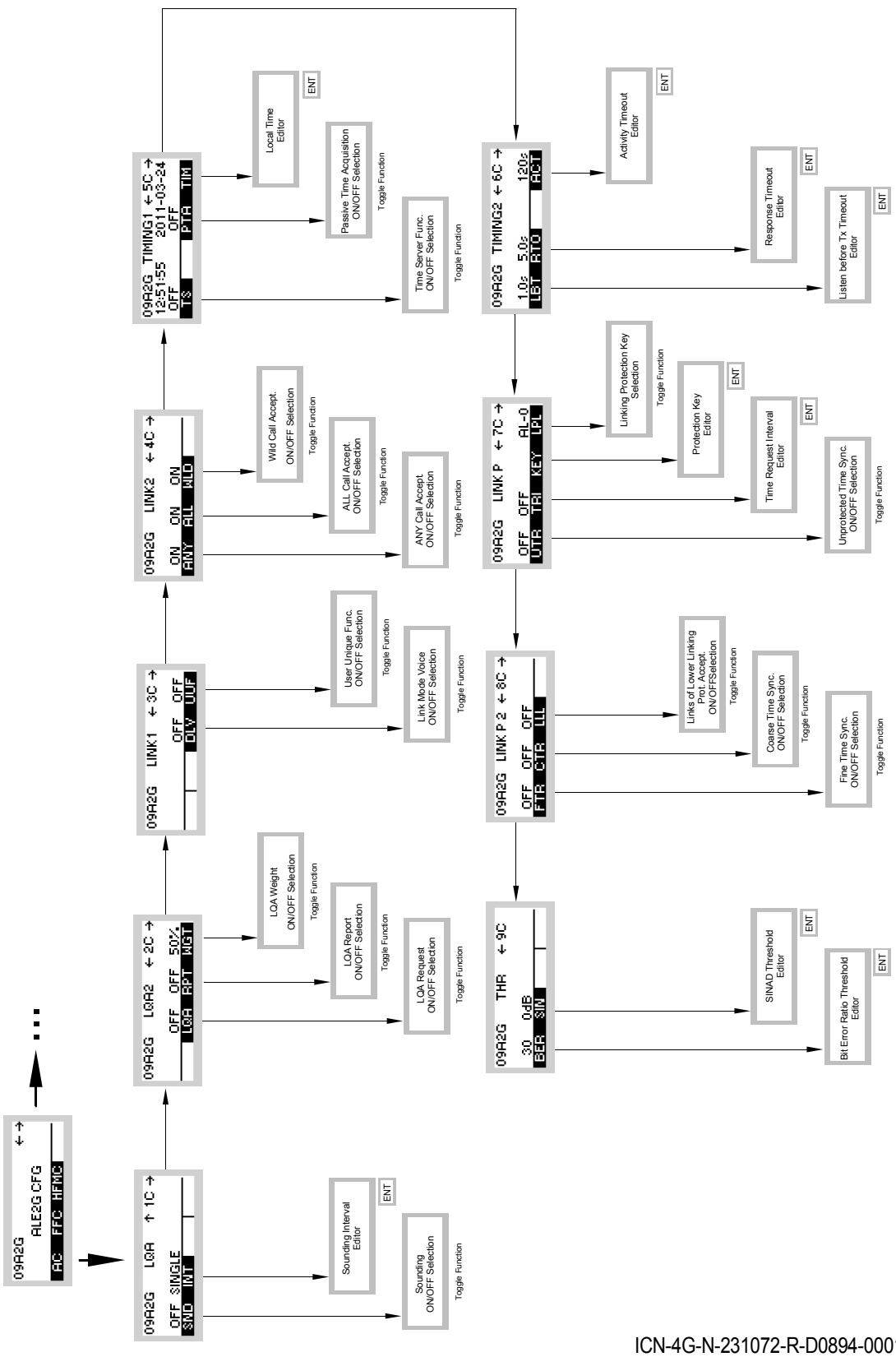
1 See sect. 4.2.6.1 Switching the Sounding On or Off
2 See sect. 4.2.6.2 Changing the Sounding Interval
3 See sect. 4.2.6.3 Switching the LQA Request On or Off
4 See sect. 4.2.6.4 Switching the LQA Report On or Off
5 See sect. 4.2.6.5 Changing the Weight of a New LQA Event
6 See sect. 4.2.6.6 Switching the Default Link Mode Voice On or Off
7 See sect. 4.2.6.7 Switching the User Unique Function On or Off
8 See sect. 4.2.6.10 Switching the Acceptance of a Wild Call On or Off
9 See sect. 4.2.6.9 Switching the Acceptance of an All Call On or Off
10 See sect. 4.2.6.8 Switching the Acceptance of an Any Call On or Off
11 See sect. 4.2.6.13 Changing the Network Time and Date
12 See sect. 4.2.6.12 Switching the Passive Time Acquisition On or Off
13 See sect. 4.2.6.11 Switching the Time Server Function On or Off
14 See sect. 4.2.6.16 Changing the Activity Timeout
15 See sect. 4.2.6.15 Changing the Response Timeout
16 See sect. 4.2.6.14 Changing the LBT Timeout
17 See sect. 4.2.6.17 Switching Unprotected Time Synchronization On or Off
18 See sect. 4.2.6.18 Changing the Time Request Interval
19 See sect. 4.2.6.19 Changing the Linking Protection Key
20 See sect. 4.2.6.20 Changing the Linking Protection Level
21 See sect. 4.2.6.21 Switching Fine Time Synchronization On or Off
22 See sect. 4.2.6.22 Switching Coarse Time Synchronization On or Off
23 See sect. 4.2.6.23 Switching the Acceptance of Links on Lower Linking Protection Level On or Off
24 See sect. 4.2.6.24 Changing the Bit Error Ratio Threshold
25 See sect. 4.2.6.25 Changing the SINAD Threshold

Figure 4.8 Menu AC (ALE-2G, Structure)



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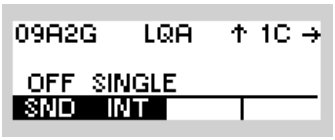
4.2.6.1 Switching the Sounding On or Off

By means of softkey SND (Sounding) the operator can switch sounding on or off.

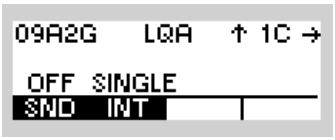
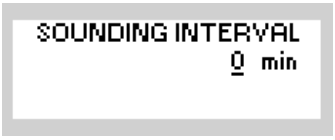
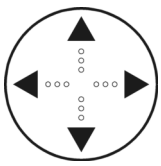
Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2	2 ABC (SND)	Press.	If INT is set to SINGLE (see sect. 4.2.6.2 Changing the Sounding Interval): • Only a single sound call with the self address e.g. BOB is placed. If INT is set to > 0 s: • E.g. every 5 minutes a sound call with the self address BOB is placed if the radio is in listening mode.

4.2.6.2 Changing the Sounding Interval

By means of softkey INT (Interval) the operator can change the sounding interval.

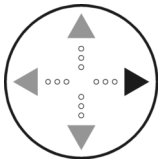
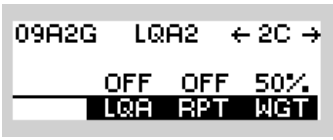
Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2	3 DEF (INT)	Press.	The display changes: 
3	0 _*+ to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 (single) to 1 440 minutes Step: 1 minute **NOTICE** **If the interval is set to '0', the time request is switched to 'single', so that the operator is able to make a single sound call. If the function 'SND' (see sect. 4.2.6.1 Switching the Sounding On or Off) was previously ON, the user has to turn it OFF and then switch it ON again, in order to perform the single sound call.**
4	ENT	Press.	The editor window is closed. The new setting is now effective.

4.2.6.3 Switching the LQA Request On or Off

By means of softkey LQA (Link Quality Analysis) the operator can switch the request on or off.

Starting point: Main page of e.g. ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press once.	The display changes: 
3	3 DEF (LQA)	Press.	Repetitively pressing this key switches the LQA request on and off.

- If LQA is set to ON, as soon as the link has been established (Individual Call) the LQA data of two stations are exchanged.

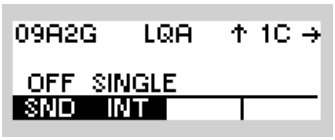
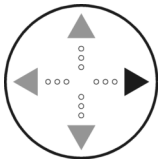
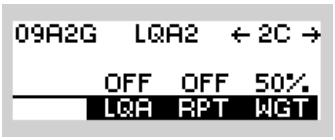
NOTICE

This function shows only effect if ALE-2G calls are established (ALE2G interoperability).

4.2.6.4 Switching the LQA Report On or Off

By means of softkey RPT (Report) the operator can switch the LQA (Link Quality Analysis) report on or off.

Starting point: Main page of e.g. ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press once.	The display changes: 
3	4 GHI (RPT)	Press.	Repetitively pressing this key switches the LQA report on and off.

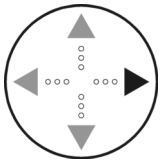
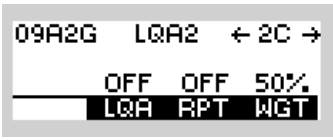
NOTICE

This function shows only effect if ALE-2G calls are established (ALE2G interoperability).

4.2.6.5 Changing the Weight of a New LQA Event

By means of softkey WGT (Weight) the operator can change the weight of a new LQA (Link Quality Analysis) event.

Starting point: Main page of e.g. ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press once.	The display changes: 
3	5 JKL (WGT)	Press.	Repetitively pressing this key changes the weight of a new LQA event. Possible values: • 25 % • 50 % • 75 %

NOTICE

This function shows only effect if ALE-2G calls are established (ALE2G interoperability).

4.2.6.6 Switching the Default Link Mode Voice On or Off

By means of softkey DLV (Default Link Voice) the operator can decide how the radio shall respond in the event that an incoming ALE-2G call does not contain a UUF (User Unique Function, see also sect. 4.2.6.7 Switching the User Unique Function On or Off).

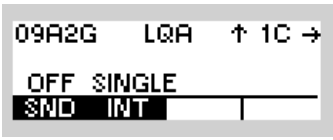
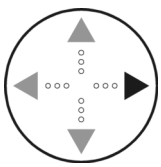
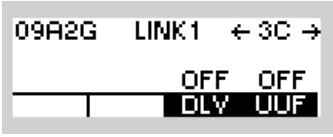
If default link mode voice is set to ’ON’, the radio receiving the call automatically establishes a link of type 'ANALOG VOICE / FF'.

If default link mode voice is set to ’OFF’, the radio receiving the call automatically establishes a link of the type which is specified in 'Link Mode' (see sect. 4.2.3.13 Changing the Link Mode).

NOTICE

If default link mode voice is set to ’ON’, UUF has to be switched ’ON’ in all stations communicating with each other (see also sect. 4.2.6.7 Switching the User Unique Function On or Off).

Starting point: Main page of e.g. ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	4 GHI (DLV)	Press.	Repetitively pressing this key switches the default link mode voice on and off.

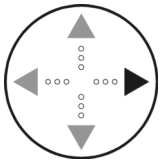
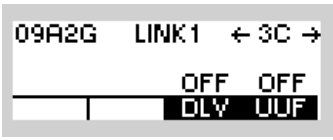
NOTICE

This function shows only effect if ALE-2G calls are incoming (ALE2G interoperability).

4.2.6.7 Switching the User Unique Function On or Off

By means of softkey UUF (User Unique Function) the operator can switch the transmission of UUFs on or off.

Starting point: Main page of e.g. ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press twice.	The display changes: 
3	5 JKL (UUF)	Press.	Repetitively pressing this key switches the UUF on and off.

The user unique function is used to control the link mode. Two types of UUFs are defined. These types are manufacturer specific.

- Analog voice
- Modem

The default link mode is analog voice / FF, i.e. when no UUF is used, the link mode is analog voice.

The radio has the capability to send and process the UUF words defined also for other Rohde & Schwarz radios supporting UUF.

In the call phase a UUF command word is transmitted which depends on the link mode currently set in the radio.

Table 4.4 User Unique Functions

Link mode	UUF
Analog Voice / FF	No UUF is transmitted.
Internal Modem	UUF for modem operation is transmitted if UUF is switched ON.

When the receiving radio receives a UUF, it automatically switches to the link mode indicated with the UUF (see also sect. 4.2.6.6 Switching the Default Link Mode Voice On or Off).

If UUF is switched off, UUFs are not transmitted and all stations communicating with each other have to be set to the same link mode and the default link mode voice has to be switched off (see also sect. 4.2.6.6 Switching the Default Link Mode Voice On or Off).

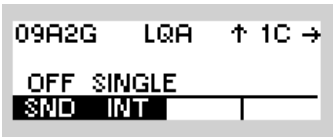
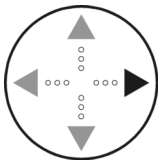
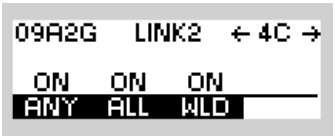
NOTICE

This function shows only effect if ALE-2G calls are initiated (ALE2G interoperability).

4.2.6.8 Switching the Acceptance of an Any Call On or Off

By means of softkey ANY the operator can switch the acceptance of an Any Call on or off.

Starting point: Main page of e.g. ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	2 ABC (ANY)	Press.	Repetitively pressing this key switches the acceptance of an Any Call on and off.

- If ANY is set to ON, after reception of an Any Call the radio links up.

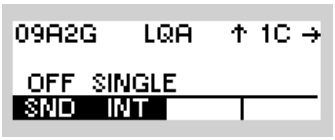
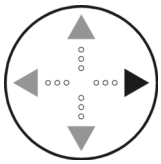
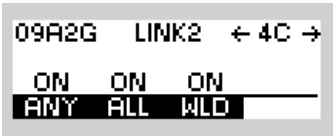
NOTICE

This function shows only effect if ALE-2G calls are coming in (ALE2G interoperability).

4.2.6.9 Switching the Acceptance of an All Call On or Off

By means of softkey ALL the operator can switch the acceptance of an All Call on or off.

Starting point: Main page of ALE 2G CFG menu

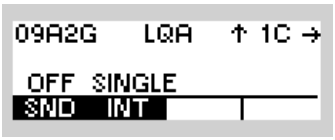
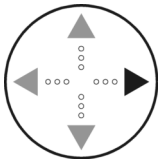
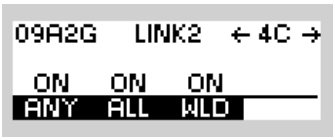
Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	3 DEF (ALL)	Press.	Repetitively pressing this key switches the acceptance of an All Call on and off.

- If ALL is set to ON, after reception of an All Call the radio links up.

4.2.6.10 Switching the Acceptance of a Wild Call On or Off

By means of softkey WLD (Wild) the operator can switch the acceptance of a Wild Call on or off.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	4 GHI (WLD)	Press.	Repetitively pressing this key switches the acceptance of a Wild Call on and off.

- If WLD is set to ON, after reception of a Wild Call the radio links up.

NOTICE

This function shows only effect if ALE-2G calls are coming in (ALE2G interoperability).

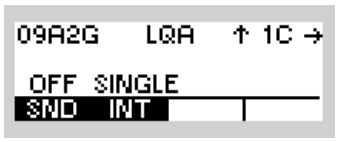
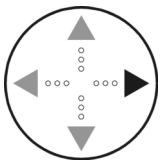
4.2.6.11 Switching the Time Server Function On or Off

By means of softkey TS (Time Server) the operator can define the radio as time master of the ALE-2G network.

NOTICE

Make sure that only one time server exists in an ALE-2G network.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press four times.	The display changes:
3	2 ABC (TS)	Press.	Repetitively pressing this key switches the time server function on and off.

By using the time server function, the local station can be designated as time server (time master station). When the local station is the time server within the network, it transmits the time in a protected broadcast call. Per definition the time quality now is 20 ms.

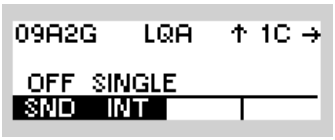
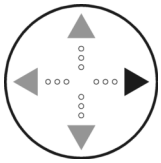
NOTICE

This setting takes effect only if the linking protection level is set to AL1 or AL2.

4.2.6.12 Switching the Passive Time Acquisition On or Off

By means of softkey PTA (Passive Time Acquisition) the operator can switch passive time acquisition on or off.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press four times.	The display changes:
3	4 GHI (PTA)	Press.	Repetitively pressing this key switches the passive time acquisition on and off.

With the passive time acquisition protected transmissions are monitored. If at least two stations receive a time with a better time quality than their own, the clock of the receiver will be adjusted.

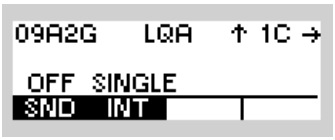
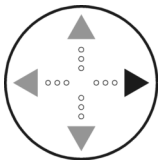
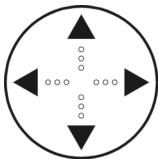
NOTICE

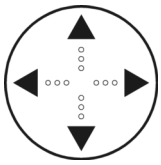
This setting takes effect only if the linking protection level is set to AL1 or AL2.

4.2.6.13 Changing the Network Time and Date

By means of softkey TIM (Time) the operator can change the network time and / or date.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press four times.	The display changes:
3	5 JKL (TIM)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter a new time. Change time selectively.	Format: hh:mm:ss Range: hh: 00 to 23 mm: 00 to 59 ss: 00 to 59

Step	Control	Action	Note
5	ENT	Press.	The display changes: NETWORK DATE 2008-10-29
6	0 _ * + to 9 WXYZ or 	Enter a new date. Change date selectively.	Format: yyyy:mm:dd Range: yyyy: 1970 to 2099 mm: 01 to 12 ss: 01 to 31
7	ENT	Press.	

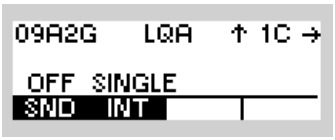
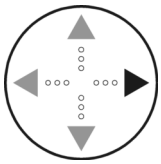
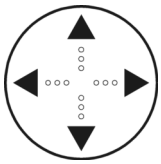
NOTICE

This setting takes effect only if the linking protection level is set to AL1 or AL2.

4.2.6.14 Changing the LBT Timeout

By means of softkey LBT (Listen Before Transmit) the operator can change the LBT timeout.

Starting point: Main page of ALE2G CFG menu

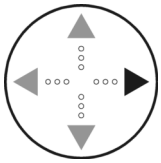
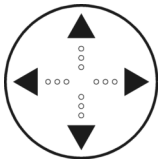
Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press five times.	The display changes:
3	2 ABC (LBT)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 to 10 s Step: 0.1 s **NOTICE** **0 s = OFF**
5	ENT	Press.	The editor window is closed. The new setting is now effective.

The LBT timeout is the time the tactical radio waits and checks if a channel is occupied by an ALE net before a call is made. If an occupied channel is detected, this channel will be skipped and the next channel of the configured scan group is used.

4.2.6.15 Changing the Response Timeout

By means of softkey RTO (Response Timeout) the operator can change the response timeout.

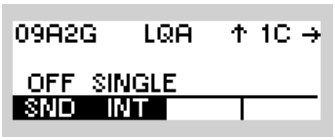
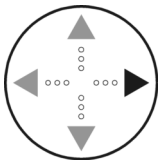
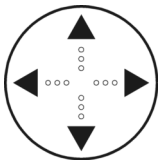
Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press five times.	The display changes:
3	3 DEF (RTO)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 2 to 60 s Step: 0.1 s
5	ENT	Press.	The editor window is closed. The new setting is now effective.

4.2.6.16 Changing the Activity Timeout

By means of softkey ACT (Activity) the operator can change the activity timeout.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press five times.	The display changes:
3	5 JKL (ACT)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 to 5000 s Step: 0.001 s **NOTICE** **0 s = OFF**
5	ENT	Press.	The editor window is closed. The new setting is now effective.

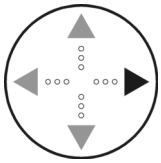
NOTICE

If the activity timeout is set to a value other than zero, it is recommended to set the RSSI squelch to ON (detection of activity!).

4.2.6.17 Switching Unprotected Time Synchronization On or Off

By means of softkey UTR (Unprotected Time Synchronization) the operator can switch the unprotected time synchronization on or off.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press six times.	The display changes:
3	2 ABC (UTR)	Press.	Repetitively pressing this key switches the unprotected time synchronization on or off.

With the unprotected time request, time transmission takes place without protection. The inquiring station transmits a random value. The time is then transmitted with this random value, using the lattice algorithm.

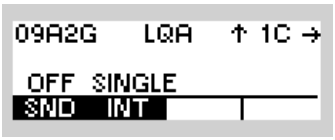
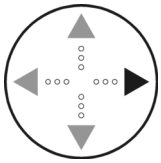
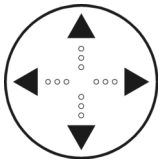
NOTICE

This setting takes effect only if the linking protection level is set to AL1 or AL2.

4.2.6.18 Changing the Time Request Interval

By means of softkey TRI (Time Request Interval) the operator can change the time request interval.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press six times.	The display changes:
3	3 DEF (TRI)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 (OFF) to 1 440 minutes Step: 1 minute
5	ENT	Press.	The editor window is closed. The new setting is now effective.

When the time quality of a station falls below a certain threshold, the time acquisition protocol is started automatically. Using this protocol the station tries to improve its time quality. The intervals between these attempts can be programmed via the function 'Time REQ INTV'. The protocol runs until the time quality reaches a sufficient value.

If the interval is set to '0', the time request is switched off.

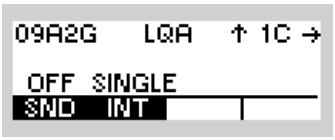
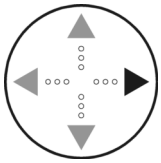
NOTICE

This parameter takes effect only if the linking protection level is set to AL1 or AL2.

4.2.6.19 Changing the Linking Protection Key

By means of softkey KEY (Linking Protection Key) the operator can change the linking protection key.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes: 
2		Press six times.	The display changes:
3	4 GHI (KEY)	Press.	The display changes:
4	0 _*+ to 9 WXYZ	Enter the key.	
5	ENT	Press.	The editor window is closed. The new key is now effective.

The 24 bit ALE words for linking are encrypted by means of the lattice algorithm. One of the input quantities for this algorithm is the user-defined key. The key can be 56 bits long.

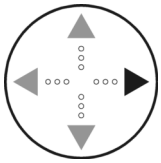
NOTICE

This parameter takes effect only if the linking protection level is set to AL1 or AL2.

4.2.6.20 Changing the Linking Protection Level

By means of softkey LPL (Linking Protection Level) the operator can change the linking protection level.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press six times.	The display changes:
3	5 JKL (LPL)	Press.	Repetitively pressing this key toggles the value between AL0, AL1 and AL2.

Protection level 2 guarantees maximum security (protection interval 2 s) at high demands on network synchronization, whereas protection level 1 provides slightly less security (protection interval 60 s) at lower demands on network synchronization. The protection interval defines the time during which the input quantities of the encryption algorithm are constant.

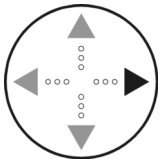
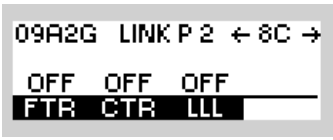
Protection Level 0 means that linking protection is switched off.

The 24-bit ALE (= Automatic Link Establishment) words for linking are encrypted by means of the lattice algorithm. Input quantities for this algorithm are the user-defined key (see sect. 4.2.6.19 Changing the Linking Protection Key), the frequency, date and time of day.

4.2.6.21 Switching Fine Time Synchronization On or Off

By means of softkey FTR (Fine Time Synchronization) the operator can switch the fine time synchronization on or off.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press seven times.	The display changes: 
3	2 ABC (FTR)	Press.	Repetitively pressing this key switches the fine time synchronization on or off.

With the protected fine time request, a net station inquires the time from the time server. The time lag between the two stations must not be greater than two seconds. The received time quality then is poorer by one level than the actual reference time. Time transmission is protected.

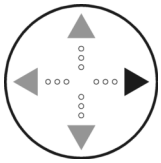
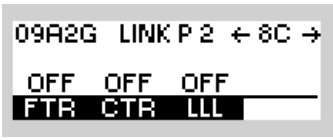
NOTICE

This setting takes effect only if the linking protection level is set to AL1 or AL2.

4.2.6.22 Switching Coarse Time Synchronization On or Off

By means of softkey CTR (Coarse Time Synchronization) the operator can switch the coarse time synchronization on or off.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press seven times.	The display changes: 
3	3 DEF (CTR)	Press.	Repetitively pressing this key switches the coarse time synchronization on or off.

With the protected coarse time request, the time lag between the two stations is allowed to be as great as one minute. Here time transmission also is protected.

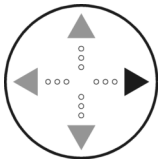
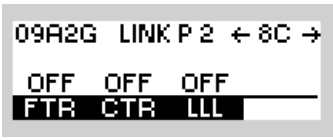
NOTICE

This setting takes effect only if the linking protection level is set to AL1 or AL2.

4.2.6.23 Switching the Acceptance of Links on Lower Linking Protection Level On or Off

By means of softkey LLL (Link on Lower Level) the operator can switch the acceptance of incoming calls with a lower linking protection level on or off.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press seven times.	The display changes: 
3	4 GHI (LLL)	Press.	Repetitively pressing this key switches the acceptance of incoming calls with a lower linking protection level on or off.

If 'Link on lower' is switched on, the radio (if on level 2) links also to other stations, which are calling on linking protection level 0 or 1.

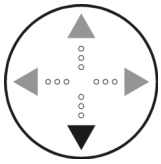
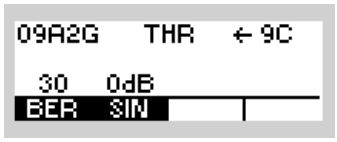
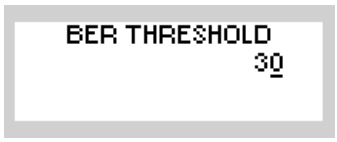
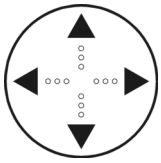
NOTICE

This setting takes effect only if the linking protection level is set to AL1 or AL2.

4.2.6.24 Changing the Bit Error Ratio Threshold

By means of softkey BER (Bit Error Ratio threshold) the operator can change the threshold at which a link setup response is accepted. If the calculated Bit Error Ratio is below the threshold, the link will be accepted, otherwise, it will be discarded. With a value of 30, all link setup responses are accepted.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press once.	The display changes: 
3	2 ABC (BER)	Press.	The display changes: 
4	0 _ * + to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 to 30 Step: 1

Step	Control	Action	Note
5	ENT	Press.	The editor window is closed. The new setting is now effective.

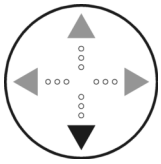
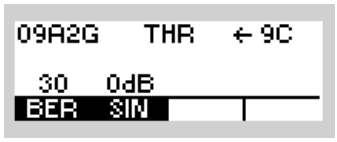
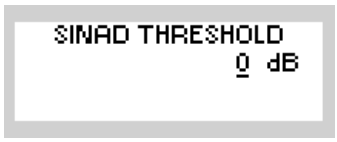
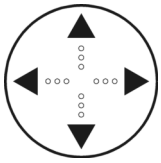
NOTICE

This function shows only effect if ALE2G calls are initiated (ALE2G interoperability).

4.2.6.25 Changing the SINAD Threshold

By means of softkey SIN (SINAD - Signal to Noise and Distortion Ratio) the operator can change the threshold at which a link setup response is accepted. If the calculated SINAD is above the threshold, the link is accepted, otherwise, it is discarded. With a value of 0, all link setup responses are accepted.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press once.	The display changes: 
3	3 DEF (SIN)	Press.	The display changes: 
4	0 _*+ to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 to 30 Step: 1

Step	Control	Action	Note
5	ENT	Press.	The editor window is closed. The new setting is now effective.

NOTICE

This function shows only effect if ALE2G calls are initiated (ALE2G interoperability).

4.2.7 Settings in the Menu FFC (ALE2G CFG, Configuration)

Starting point:

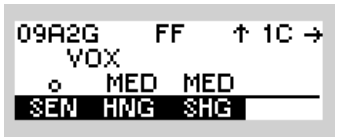
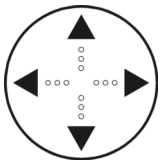
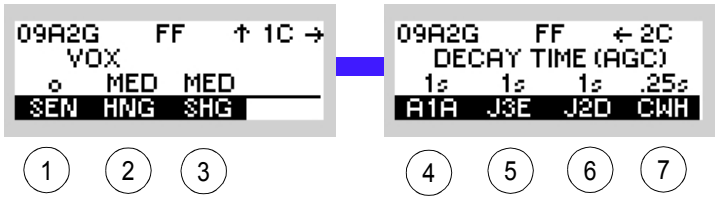
Step	Control	Action	Note
1	3 DEF (FFC)	Press.	The display changes, e.g.: 
2		Press.	Press several times until the desired submenu is activated (see Figure 4.9).

Figure 4.9 Menu FFC (ALE-2G, Submenus)



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1 See sect. 4.2.7.1 Changing the VOX Sensitivity
2 See sect. 4.2.7.2 Changing the VOX Holdtime
3 See sect. 4.2.7.3 Changing the Squelch Hangover Time
4 See sect. 4.2.7.4 Changing the Default Decay Time for Modulation Mode A1A
5 See sect. 4.2.7.5 Changing the Default Decay Time for Modulation Mode J3E
6 See sect. 4.2.7.6 Changing the Default Decay Time for Modulation Mode J2D
7 See sect. 4.2.7.7 Changing the CW Holdtime

4.2.7.1 Changing the VOX Sensitivity

By means of softkey SEN (Sensitivity) the operator can change the sensitivity for the function VOX. When VOX is selected, the sensitivity will become automatically activated.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	3 DEF (FFC)	Press.	The display changes:
2	2 ABC (SEN)	Press.	Repetitively pressing this key toggles between five sensitivity levels.

4.2.7.2 Changing the VOX Holdtime

By means of softkey HNG (Hang) the operator can change the holdtime for the function VOX. When VOX is selected, the holdtime will be automatically activated.

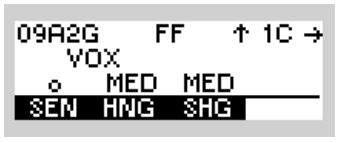
Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	3 DEF (FFC)	Press.	The display changes:
2	3 DEF (HNG)	Press.	

4.2.7.3 Changing the Squelch Hangover Time

By means of softkey SHG (Squelch Hangover) the operator can change the hangover time for the selected squelch type. When the desired squelch type is selected, the squelch hangover time will become automatically activated.

Starting point: Main page of ALE2G CFG menu

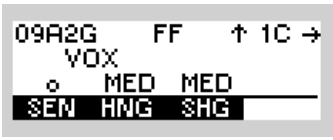
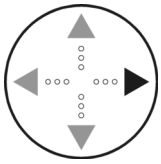
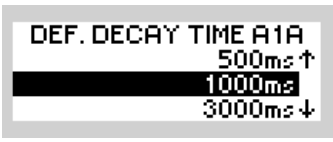
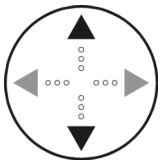
Step	Control	Action	Note
1	2 ABC (FFC)	Press.	The display changes: 
2	4 GHI (SHG)	Press.	

4.2.7.4 Changing the Default Decay Time for Modulation Mode A1A

See sect. 3.3.3.7 Changing the Default Decay Time for Modulation Mode A1A.

By means of softkey A1A the operator can change the default decay time for modulation mode A1A. If modulation mode A1A is selected, the new decay time will be used.

Starting point: Main page of ALE2G CFG menu

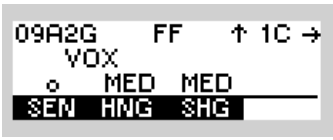
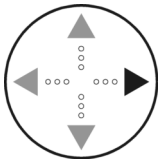
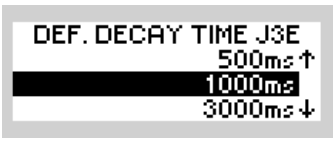
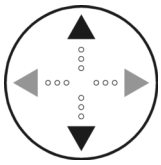
Step	Control	Action	Note
1	3 DEF (FFC)	Press.	The display changes: 
2		Press once.	The display changes:
3	2 ABC (A1A)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible settings: see sect. 3.3.3.7 Changing the Default Decay Time for Modulation Mode A1A
5	ENT	Press.	The selection window is closed. The new value is now effective.

4.2.7.5 Changing the Default Decay Time for Modulation Mode J3E

See sect. 3.3.3.8 Changing the Default Decay Time for Modulation Mode J3E.

By means of softkey J3E the operator can change the default decay time for modulation mode J3E. If then modulation mode J3E is selected, the new decay time will be used.

Starting point: Main page of ALE2G CFG menu

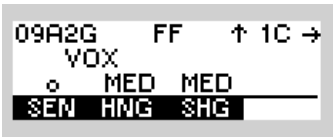
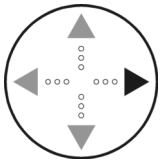
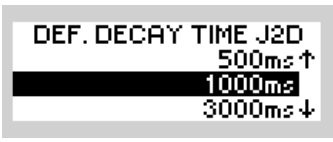
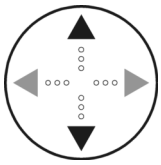
Step	Control	Action	Note
1	3 DEF (FFC)	Press.	The display changes: 
2		Press once.	The display changes:
3	3 DEF (J3E)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible settings: see sect. 3.3.3.8 Changing the Default Decay Time for Modulation Mode J3E
5	ENT	Press.	The selection window is closed. The new value is now effective.

4.2.7.6 Changing the Default Decay Time for Modulation Mode J2D

See sect. 3.3.3.9 Changing the Default Decay Time for Modulation Mode J2D.

By means of softkey J2D the operator can change the default decay time for modulation mode J2D. If then modulation mode J2D is selected, the new decay time will be used.

Starting point: Main page of ALE2G CFG menu

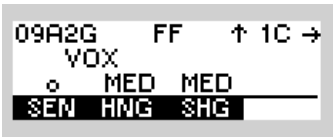
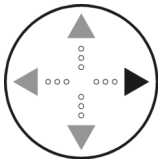
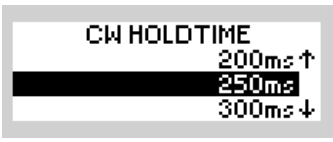
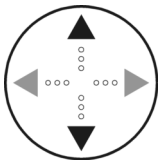
Step	Control	Action	Note
1	3 DEF (FFC)	Press.	The display changes: 
2		Press once.	The display changes:
3	4 GHI (J2D)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible settings: see sect. 3.3.3.9 Changing the Default Decay Time for Modulation Mode J2D
5	ENT	Press.	The selection window is closed. The new value is now effective.

4.2.7.7 Changing the CW Holdtime

See sect. 3.3.3.10 Changing the CW Holdtime.

By means of softkey CWH (CW Holdtime) the operator can change the CW holdtime. By setting the modulation mode to A1A the set CW holdtime is automatically activated.

Starting point: Main page of ALE2G CFG menu

Step	Control	Action	Note
1	3 DEF (FFC)	Press.	The display changes: 
2		Press once.	The display changes:
3	5 JKL (CWH)	Press.	The display changes: 
4		Press several times until the desired setting is displayed.	Possible settings: see sect. 3.3.3.10 Changing the CW Holdtime
5	ENT	Press.	The selection window is closed. The new value is now effective.

4.2.8 Settings in the Menu HFMC (ALE2G CFG, Configuration)

Starting point:

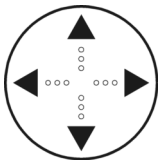
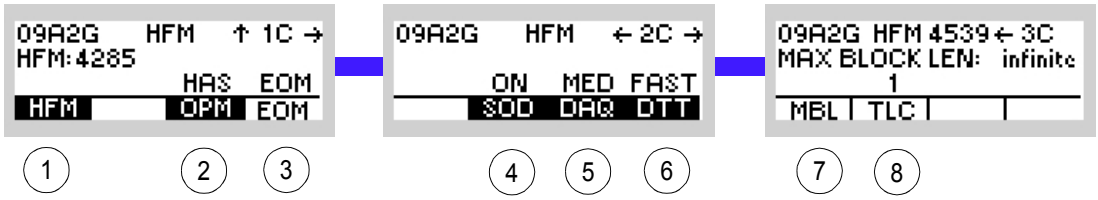
Step	Control	Action	Note
1	4 GHI (HFMC)	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired submenu is activated (see Figure 4.10).

Figure 4.10 Menu HFMC (ALE-2G, Submenus)



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1 See sect. 4.4.3.1 Selecting the HF Modem Waveform
2 See sect. 4.4.3.2 Selecting the Asynchronous Modem Operation Mode
3 See sect. 4.4.3.3 Selecting the Modem Message Protocol
4 See sect. 4.4.3.4 Changing the Modem Synchronization on Data Mode
5 See sect. 4.4.3.5 Changing the Modem De-acquire Limit
6 See sect. 4.4.3.6 Changing the Modem Doppler Tracking Time
7 See sect. 4.4.3.7 Changing the Maximum Message Block Length
8 See sect. 4.4.3.8 Changing the Modem TX Level Control Blocks

4.3 Automatic Link Establishment 3rd Generation (ALE-3G)

4.3.1 Basics of ALE-3G

The third generation Automatic Link Establishment ALE-3G is a standard defined in STANAG-4538. It offers advantages over ALE-2G (second generation) like faster link setup, higher sensitivity and higher throughput for data traffic.

The enhancements were achieved by

- using the same family of waveforms for link setup and data transmissions (PSK = Phase Shift Keying)
- including embedded data transmission protocols with ARQ (Automatic Repeat Request)
- synchronous scanning of channels by all radios in an ALE-3G network (time synchronization of all radios in a network is required).

4.3.1.1 Achieving Network Synchronization

For highest performance network synchronization may be obtained using the GPS (Global Positioning System) or NTP (Network Time Protocol) time in all radios of a network.

If GPS or NTP time is not available, one time server station in a network is defined. For the other stations in the network at first manual time entry (e.g. time from wristwatch) and subsequent time synchronization over the air is needed.

4.3.1.2 Improved LQA Mechanism and Automatic Channel Selection

During synchronous LQA (link quality analysis) sounding, LQA exchange, link setup and data exchange, the ALE-3G system monitors the channel quality and stores BER (Bit Rrror Rate) and S/N (Signal-to-Noise ratio) values in a database. To have the best channel conditions for the next link setup, the radio refers to the database and chooses the best quality channel. This function is called ACS (Automatic Channel Selection).

4.3.1.3 ALE-3G Calls

Individual calls (point-to-point), broadcast calls and multicast calls are supported.

NOTICE

R&S EK4100 Systems can only link to broadcast calls, because the acknowledgement cannot be transmitted.

The operator can initiate synchronous or asynchronous calls in the preselected traffic type (link mode) to the preselected destination address in one of the following ways:

- Pressing the call button.
- Asserting PTT.
- Presence of data on the data interface.

4.3.1.4 ALE-3G Missions and Database

The operator plans ALE-3G networks using the R&S Mission Planner. The R&S Mission Planner generates the ALE-3G database for each radio in the network and the operator has to load the data into each participating radio in the network. The ALE-3G network shall comprise 2 radios, but not more than 127 radios.

The ALE-3G database consists of a set of ALE-3G data (initial network parameters) as well as an entire ALE-2G database. The ALE-3G data is needed to operate the ALE-3G network and the ALE-2G data is needed for ALE-2G concurrent operation. Each ALE-3G network is configured to transmit data encrypted (with COMSEC) or plain, which results in different operating modes for ALE-3G.

4.3.1.5 ALE-2G Concurrent Operation in ALE-3G

A radio operating in ALE-3G mode is able to process ALE-2G incoming calls as well. This is possible due to the fact that ALE-3G addresses and ALE-2G call signs are correlated. The correlation is handled in the ALE database.

A radio operating in ALE-3G mode is also able to call radios operating in ALE-2G mode.

Due to these features it is possible to have ALE-3G networks with ALE-2G operating radios integrated.

4.3.1.6 Optimized Transfer of IP Packets

IP-based data transmission with the embedded xDL (x = L = Low or H = High, Data Rate Link) data link protocol offers the following features:

Adaptive Selection of ARQ Protocols
The ALE-3G protocol can automatically select the best setting of the xDL ARQ protocol based on measurements of the actual channel condition and the used packets size. This adaptive selection will achieve a better throughput than the manual selection.

Priority-Based Session Management
To optimize throughput of peer-to-peer traffic in an ALE-3G network, an innovative algorithm for managing xDL sessions can be used. This priority-based session management takes into account the priority of the traffic and improves throughput and latency.

Packet Aggregation
Another way to improve the throughput of the xDL packet transfer is the aggregation of smaller packets to a datagram of maximum 10 Kbytes.

4.3.1.7 Voice Priority over IP Data

'Voice Priority over IP data' (VPoIPD) enables the user to initiate a voice link while configured for IP-data connections. As possible voice modes 'Analog Voice', 'Secure Digital Voice' or 'Last Ditch Voice' could be selected. If VPoIPD is disabled, there will be no reaction to any voice PTT requested, but incoming voice calls are still processed. If VPoIPD is enabled, the radio behaves as follows:

The request for the voice call may be made in two different states of the radio:

- The radio is currently 'listening/scanning”, the voice call can be initiated immediately.
- The radio has established (or is establishing) an IP-data link. In this case this link will be terminated automatically. Afterwards the radio will initiate the voice call.

After the voice link is disconnected (by user termination, or if the activity timeout is reached), the radio will return to normal data operation: In case of available data a new call will be established, or the radio will return to 'listening/scanning”.

The radio will preserve the IP-data to transmit while a voice priority call is active. Even if there is no data loss caused by the voice call, the data could still become obsolete by the time-to-live information. Also the normal congestion handling is active.

4.3.1.8 Automatic Link Maintenance (ALM)

The ALE-3G Automatic Link Maintenance (ALM) function is responsible for monitoring the quality of an established link, and for initiating corrective action when necessary.

In the R&S M3TR, Late Link Entry LLE is mutually integrated into the ALM functionality. The LLE allows unlinked stations to enter existing links at a later phase.

After a Link Setup the ALM function will calculate the channel quality of the link and compare it against a configured ALM threshold. If the channel quality is below the configured threshold, a relink operation will be issued on a different channel to find a channel with a quality above the threshold. If the channel quality of all channels are below the threshold, the ALM function will relink on the best available channel in the scan group. During an active 3G link the ALM function can monitor the channel quality based on SNR information of HF-Modem receptions and trigger an automatic ALM relink if necessary.

For successful operation it is important that the slave doesn't send any data for 1.5 seconds after the masters starts with relink operation.

4.3.1.9 Communication Security (COMSEC)

If COMSEC is activated for an ALE-3G network, all communication is secured and unsecured communication will be avoided. All data transmitted with xDL will be encrypted. Moreover, two additional secure voice transmission modes are available: Last Ditch Voice and Secure Digital Voice.

4.3.1.10 Last Ditch Voice (LDV)

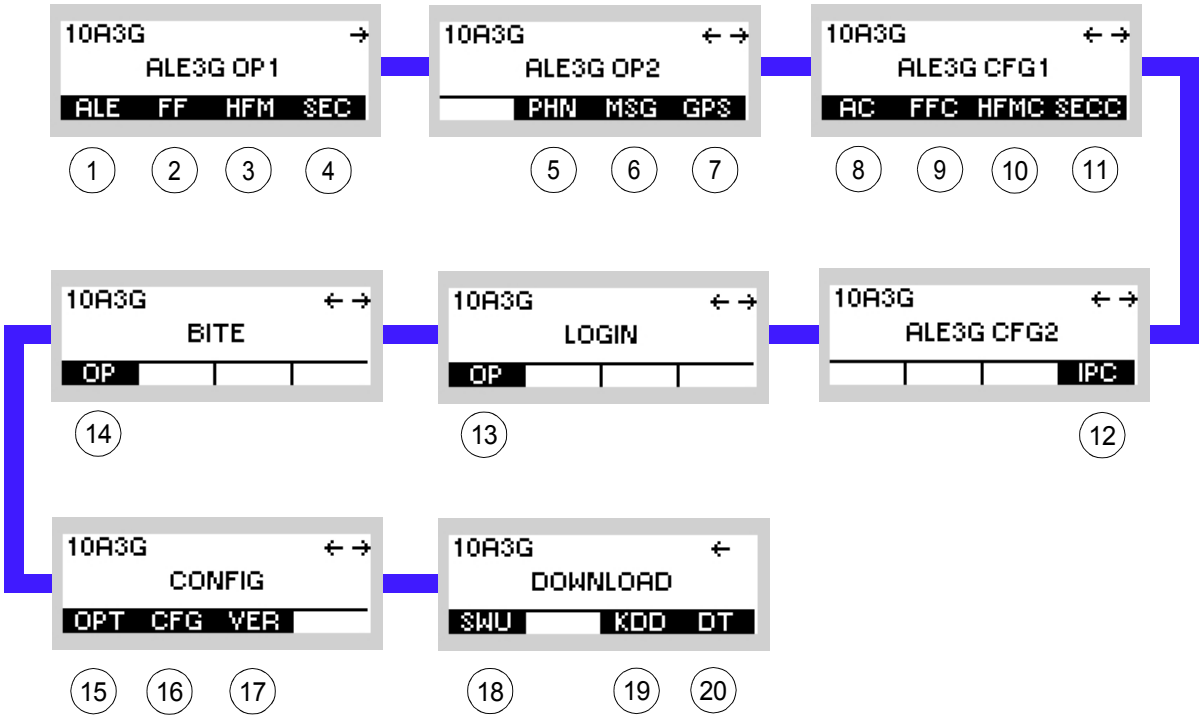
With the Last Ditch Voice mode the operator is able to transmit a 60 s voice message via the ARQ Protocols. This guarantees that the voice message reaches the recipient under almost all circumstances, but not in real-time like a conventional voice call. Each station can store one LDV message. A new received LDV message is indicated to the user at the MMI and via an audio indication. The user has also the ability to play back the received LDV message until a new LDV message is received.

4.3.1.11 Secure Digital Voice (SDV)

In mode ALE-3G the feature Secure Digital Voice can be used for encrypted voice communication under highly degraded shortwave channel conditions. For details see sect. 4.5 Secure Digital Voice. Additionally to the security features described at Secure Digital Voice operation mode, Secure Digital Voice with ALE-3G provides a replay protection. The replay protection avoids the decryption of old waveform signals.

4.3.2 Preset Page A3G (ALE-3G)

Figure 4.11 Preset Page A3G (ALE-3G)



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1 See sect. 4.3.2.1 Settings in the Menu ALE (ALE3G OP1, Operation)
2 See sect. 4.2.4 Settings in the Menu FF (ALE2G OP, Operation)*
3 See sect. 4.2.5 Settings in the Menu HFM (ALE2G OP, Operation)*
4 See sect. 4.3.3 Settings in the Menu SEC (ALE3G OP1, Operation)
5 See sect. 5.5.2 Settings in Menu PHN (SECOM-V OP, Operation)
6 See sect. 4.3.3 Settings in the Menu MSG (ALE3G OP2, Operation)
7 See sect. 5.2.2 Settings in Menu GPS (e.g. SECOM-P OP, Operation)
8 See sect. 4.3.4 Settings in the Menu AC (ALE3G CFG1, Configuration)
9 See sect. 4.2.7 Settings in the Menu FFC (ALE2G CFG, Configuration)*
10 See sect. 4.2.8 Settings in the Menu HFMC (ALE2G CFG, Configuration)*
11 See sect. 4.4.5 Settings in the Menu CFG (SECURE VOICE, Configuration)
12 See sect. 4.3.5 Settings in the Menu IPC (ALE3G CFG2, Configuration)
13 See sect. 3.5 Login
14 See sect. 6.2 Troubleshooting utilizing BIT
15 See sect. 3.7 Configuration
16 See sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters)
17 See sect. 3.7.2 Settings in Menu VER (CONFIG, Inquiring the Software Version)
18 This function is described in the service documentation.
19 Not relevant in this application.
20 sect. 3.7.3 Settings in Menu DT (DOWNLOAD, Loading Pre-configured Radio Parameters)

* These functions are identical for ALE-2G and ALE-3G.

4.3.2.1 Settings in the Menu ALE (ALE3G OP1, Operation)

Starting point:

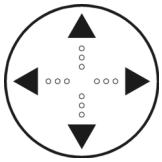
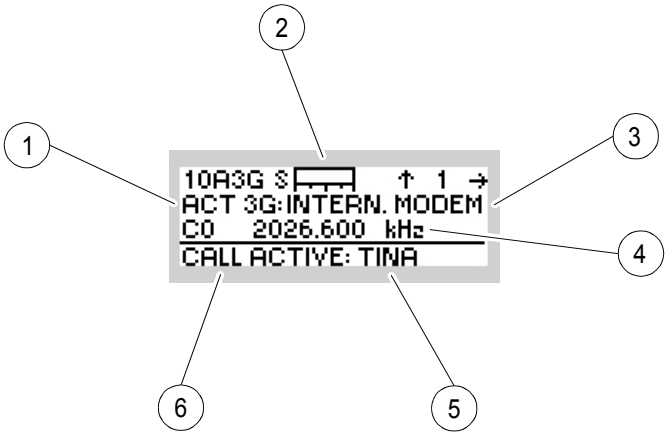
Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes, e.g.: **NOTICE** **For further information see .**
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes, e.g.:
3		Press.	Press several times until the desired submenu is activated (see Figure 4.13). The complete menu structure is shown in Figure 4.14. After a delay of approximately 10 seconds, the ALE operational page 1 is automatically reactivated.

Figure 4.12 ALE-3G Operational Page 1



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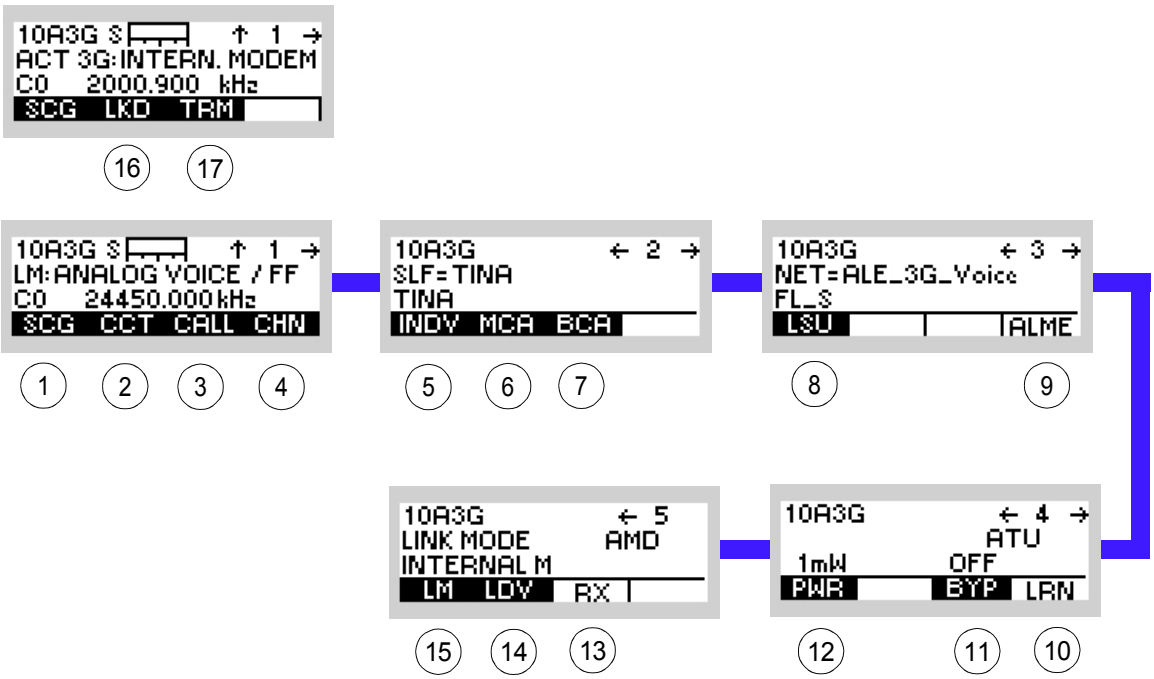
1 If linked, type of link (ALE-2G or ALE-3G)
2 S-Meter (Rx)
3 Link mode
4 Frequency
5 Linked station
6 Call state

Figure 4.13 Menu ALE (ALE-3G, Submenus)



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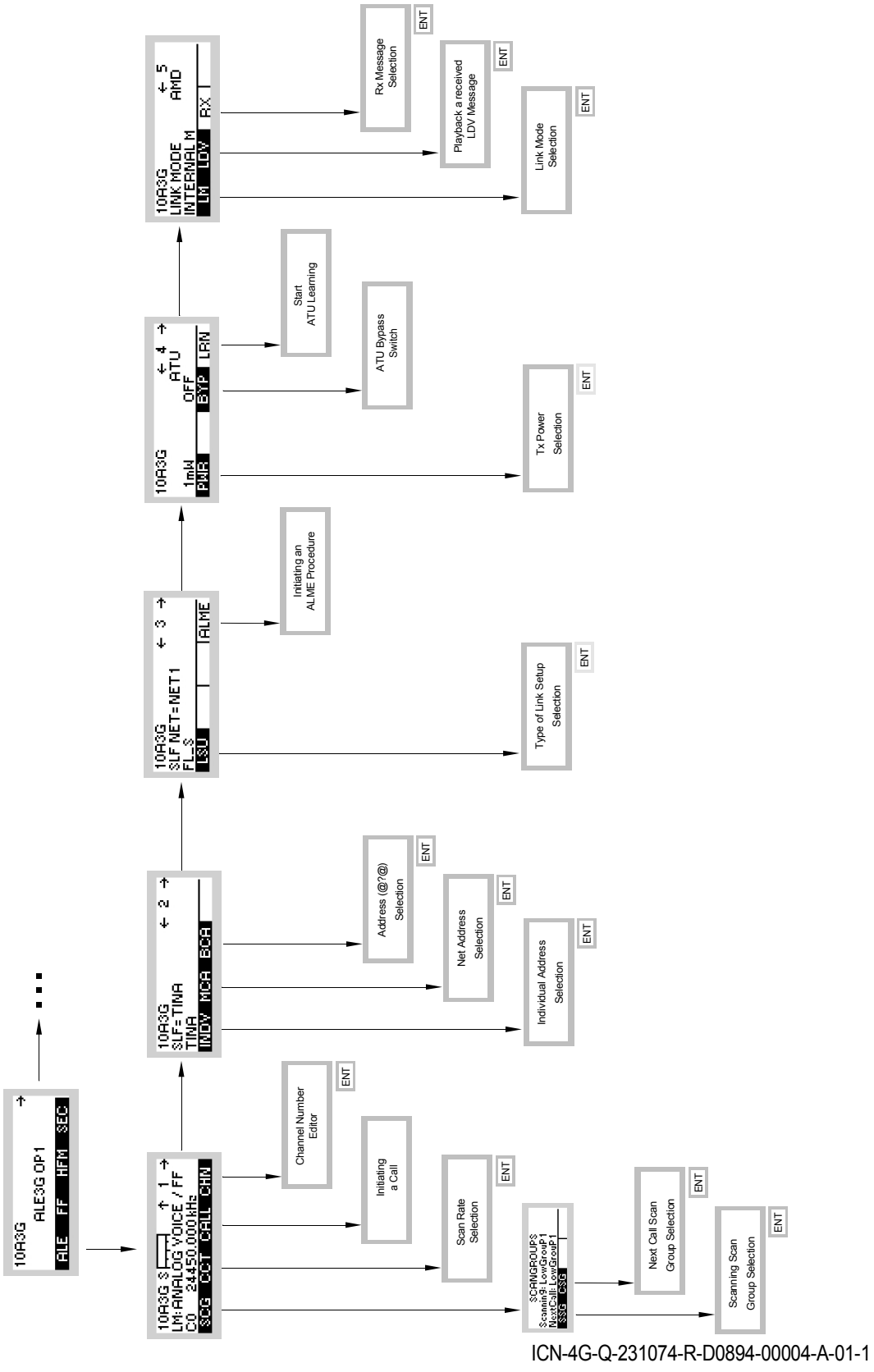
1 See sect. 4.3.2.2 Scan Groups
2 See sect. 4.3.2.3 Changing the Call Channel Type
3 See sect. 4.3.2.4 Initiating a Call
4 See sect. 4.3.2.5 Selecting the Channel for Fixed Call
5 See sect. 4.3.2.6 Selecting the Address for Individual Call
6 See sect. 4.3.2.7 Selecting the Address for Multicast Call
7 See sect. 4.3.2.8 Selecting the Address for Broadcast Call
8 See sect. Changing the Type of Link Setup
9 See sect. Initiating an ALM Procedure
10 See sect. 4.2.3.12 Starting ATU Learning for ALE Channels*
11 See sect. 4.2.3.11 Bypassing the ATU*
12 See sect. 4.2.3.10 Changing the Power Level*
13 See sect. 4.2.3.14 Selecting the RX Message*
14 See sect. 4.3.2.10 Playing Back a Received Last Ditch Voice Message
15 See sect. 4.3.2.9 Changing the Link Mode
16 See sect. 4.2.3.16 Listing All Currently Linked Stations*
17 See sect. 4.2.3.17 Terminating a Link*

* These functions are identical for ALE-2G and ALE-3G.

Figure 4.14 Menu ALE (ALE-3G, Structure)



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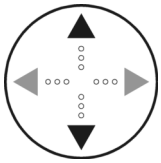
4.3.2.2 Scan Groups

A scan group is a number of channels grouped to be scanned and used for calling.

Changing the Scan Group

By means of softkeys SCG (Scan Group) and SSG (Scanning Scan Group) the operator can change the currently used scan group.

Starting point: Main page of e.g. ALE3G OP1 menu

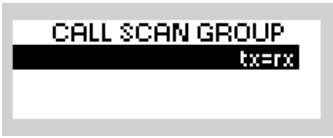
Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (SCG)	Press.	The display changes:
4	2 ABC (SSG)	Press.	The display changes:
5		Press several times until the desired scan group is displayed.	Possible values (example): LowGroup1 -> LowGroup2 -> MediumGroup1 -> HighGroup1

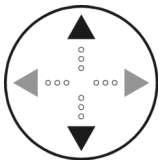
Step	Control	Action	Note
6	ENT	Press.	The selection window is closed. The new scan group is now effective.

Changing the Next Call Scan Group

By means of softkeys SCG (Scan Group) and CSG (Call Scan Group) the operator can change the Next Call scan group.

Starting point: Main page of e.g. ALE3G OP1 menu

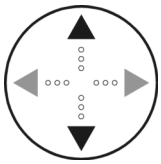
Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (SCG)	Press.	The display changes:
4	3 DEF (CSG)	Press.	The display changes: 

Step	Control	Action	Note
5		Press several times until the desired next call scan group is displayed.	Possible values (example): LowGroup1 -> LowGroup2 -> MediumGroup1 -> HighGroup1 -> tx=rx
6	ENT	Press.	The selection window is closed. The new next call scan group is now effective. **NOTICE** **The next call scan group is only used for ALE-2G calls.**

4.3.2.3 Changing the Call Channel Type

By means of softkey CCT (Call Channel Type) the operator can change the algorithm the radio uses to select the channel for the next call.

Starting point: Main page of ALE3G OP1 menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	3 DEF (CCT)	Press.	The display changes:
4		Press several times until the desired call channel type is displayed.	Possible values: next channel -> best channel -> fixed channel
5	ENT	Press.	The selection window is closed. The new call channel type is now effective.

Next Channel:

The next link will be set up on the next possible channel in the scanning cycle. If a link setup fails, the radio uses a backoff strategy to select the channel for the next link setup attempt.

Best Channel:

The next link will be set up on the channel with the best signal-to-noise ratio (SNR). Therefore the radio consults its link quality table. If a link setup fails, the radio uses a backoff strategy to select the channel for the next link setup attempt.

Fixed Channel:

The next link will be set up on an operator-chosen channel. If a link setup fails, the radio waits a randomly chosen number of dwell times until the fixed channel is met again. For all further attempts the fixed channel will be used.

4.3.2.4 Initiating a Call

By means of softkey CALL the operator can initiate an ALE call.

NOTICE

The CALL softkey replaces the TRM softkey when ALE is scanning.

Before you initiate a new ALE call, check the following:

- If a link is already existing, terminate the existing link (see sect. 4.2.3.17 Terminating a Link).
- Select the address to call (one of individual, multicast or broadcast).
- Select other call parameters as required (e.g. link mode, call channel type, power level).

Starting point: Main page of ALE3G OP1 menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:

Step	Control	Action	Note
3	4 GHI (CALL)	Press.	The display changes:

4.3.2.5 Selecting the Channel for Fixed Call

By means of softkey CHN (Channel) the operator can select the channel for a fixed call.

NOTICE

In ALE-3G this parameter is only effective if CCT (Changing the Call Channel Type) is set to "fixed".

Starting point: Main page of e.g. ALE3G OP1 menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	5 JKL (CHN)	Press.	The display changes:
4	0 _*+ to 9 WXYZ	Enter a new channel number.	Range (example): 0 to 11
5	ENT	Press.	The editor window is closed. The new channel number is now effective.

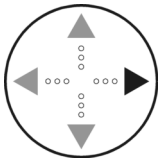
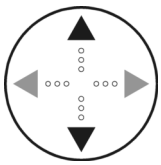
4.3.2.6 Selecting the Address for Individual Call

By means of softkey INDV (Individual) the operator can select the address for an individual call.

NOTICE

The selected individual address can be associated to an ALE-3G station or to an ALE-2G station.

Starting point: Main page of ALE3G OP1 menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (INDV)	Press.	The display changes:
4		Press several times until the desired address is displayed.	Possible values (example): BOB → TOM → SAM → EDGAR → MIKE → HELEN → EVA → BO? → SA? → B?? → S?? → ANDREAS → ALPHA → BRAVO → CHARLY

Step	Control	Action	Note
5	ENT	Press.	The selection window is closed. For example EDGAR is selected for addressing.

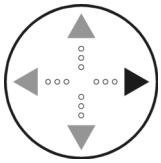
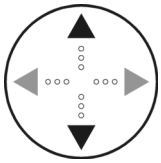
NOTICE

This will not just change the address, but will also change the type of the next call(s), since there is no option to initiate individual, multicast or broadcast calls separately.

4.3.2.7 Selecting the Address for Multicast Call

By means of softkey MCA (Multicast Call) the operator can select the address for a multicast call.

Starting point: Main page of ALE3G OP1 menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press once.	The display changes:
3	3 DEF (MCA)	Press.	The display changes:
4		Press several times until the desired address is displayed.	Possible values (example): GROUP1
5	ENT	Press.	The selection window is closed. For example GROUP1 is selected for addressing.

NOTICE

This will not just change the address, but will also change the type of the next call(s), since there is no option to initiate individual, multicast or broadcast calls separately.

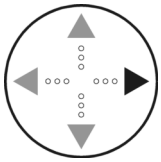
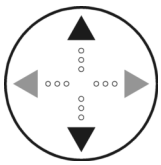
4.3.2.8 Selecting the Address for Broadcast Call

By means of softkey BCA (Broadcast) the operator can select the address for a broadcast call.

NOTICE

The selected broadcast address can be associated to an ALE-3G or to an ALE-2G (All Call).

Starting point: Main page of ALE3G OP1 menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press once.	The display changes:
3	4 GHI (BCA)	Press.	The display changes:
4		Press several times until the desired address is displayed.	Possible values (example): BROADCAST → @?@ → @M@ → @B@

Step	Control	Action	Note
5	ENT	Press.	The selection window is closed. For example @B@ is selected for addressing.

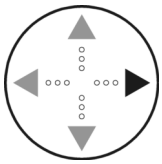
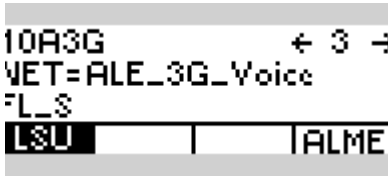
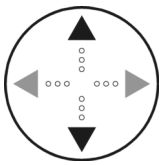
NOTICE

This will not just change the address, but will also change the type of the next call(s), since there is no option to initiate individual, multicast or broadcast calls separately.

Changing the Type of Link Setup

By means of softkey LSU (Link Setup) the operator can change the type of link setup.

Starting point: Main page of ALE3G OP1 menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press twice.	The display changes: 
3	2 ABC (LSU)	Press.	The display changes:
4		Press several times until the desired type is displayed.	Possible values: • FLSU_ASYNC (Fast Link Setup Asynchronous) • FLSU_SYNC (Fast Link Setup Synchronous)
5	ENT	Press.	The selection window is closed. The new link setup type is now effective.

FLSU_ASYNC:

The next call will be an asynchronous call, i.e. the duration of the call is extended to the time it takes to cycle through all scanning frequencies. This assures an asynchronously but periodically scanning radio to scan the frequency which is used for the call.

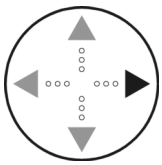
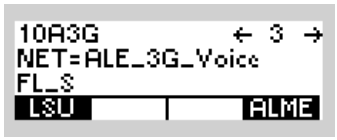
FLSU_SYNC:

If the radios time is not synchronized to the network time, the latter asynchronous call procedure is used for calling. If the radios time is synchronized to the network time, this selection enables a shorter form of call - the synchronous call. The call duration is less than one dwell period, therefore all participating radios have to keep synchronism by means of GPS synchronization or a time request to a time server or NTP.

Initiating an ALM Procedure

During an active ALE-3G link with link mode Voice/FF, Secure Digital Voice or HF-Modem, an ALM relink operation can be manually triggered by pressing the ALME softkey. The ALM function will relink to find a channel with a channel quality above the configured threshold.

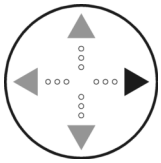
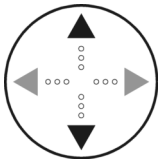
Starting point: Main page of ALE3G OP1 menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press twice.	The display changes: 
3	5 JKL (ALME)	Press.	The manual execution of the ALM function will be triggered based on the preconfigured ALM execution mode (Next Chance/Immediately). The call status will change to 'Relinking'.

4.3.2.9 Changing the Link Mode

By means of softkey LM (Link Mode), the operator can change the type of traffic to transfer after an ALE link has been established.

Starting point: Main page of ALE3G OP1 menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press four times.	The display changes:
3	2 ABC (LM)	Press.	The display changes:
5		Press several times until the desired value is displayed.	Possible values: • ANALOG VOICE FF • INTERNAL MODEM • xDL • SEC DIG VOICE • LAST DITCH VOICE **NOTICE** **For a short explanation of the Link Modes 'xDL' see below.**
6	ENT	Press.	The selection window is closed. The new setting is now effective.

Availability of selectable link modes depends on the configuration of the current preset page, if COMSEC is activated on the current preset page only the secure link modes ’xDL’, ’SEC DIG VOICE’ and ’LAST DITCH VOICE’ are available. With COMSEC deactivated, the unsecure Link Modes ’ANALOG VOICE / FF’,’INTERNAL MODEM’ and ’xDL’ are available for selection.

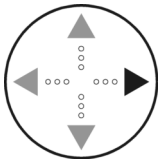
Data Driven Links (link mode xDL)

To set up a link with xDL data must be present on data terminal 1 interface or IP interface. Also an incoming xDL link request sets up a data driven link.

4.3.2.10 Playing Back a Received Last Ditch Voice Message

By means of softkey LDV (Last Ditch Voice), the operator can start the play back of a received Last Ditch Voice message.

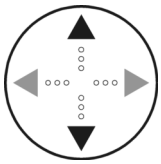
Starting point: Main page of ALE3G OP1 menu

Step	Control	Action	Note
1	2 ABC (ALE)	Press.	The display changes:
2		Press four times.	The display changes:
3	3 DEF (LDV)	Press.	The display changes: The display shows the name of station which sent the message and the time the message was received.
4	ENT	Press.	The display changes: Play back will be started.
	If the CLR/ESC key is pressed instead, the play back won't be started.		

4.3.2.11 Selecting the Active COMSEC Key for SDV Communication

By means of softkey KEY the operator can select the active COMSEC key which shall be used for SDV (Secure Digital Voice) communication.

Starting point: Main page of ALE3G OP1 menu

Step	Control	Action	Note
1	5 JKL (SEC)	Press.	The display changes:
2	2 ABC (KEY)	Press.	The display changes:
3		Press to select the desired keyset.	
4	ENT	Press.	The new key is selected and the selection window is closed.

4.3.2.12 Changing the SDV Vocoder Mode

By means of softkey VOC (Vocoder) the operator can change the SDV communication mode for transmission. There are two modes available:

- MELP2400 (default)

  Good Speech quality for good channel conditions.

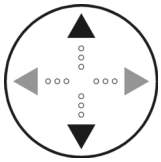
- MELP600

  Fair Speech quality for highly degraded channel conditions.

NOTICE

The receiver must not necessarily be adjusted to the same communication mode due to automode capability of SDV.

Starting point: Main page of ALE3G OP1 menu

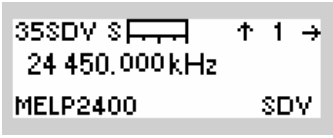
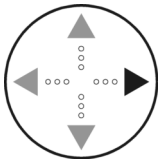
Step	Control	Action	Note
1	5 JKL (SEC)	Press.	The display changes:
2	4 GHI (VOC)	Press.	The display changes:
3		Press to switch between values.	Possible values: MELP0K6 (MELP600) MELP2K4 (MELP2400)

Step	Control	Action	Note
4	ENT	Press.	The selection window is closed. The new setting is now effective.

4.3.2.13 Changing the VOX Function

By means of softkey VOX (Voice Operated Transmission) the operator can change the VOX function.

Starting point: Main page of SDV menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes:
3	5 JKL (VOX)	Press.	Repetitively pressing this key changes the VOX function. Possible values: OFF → LIN → VOI

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface.
- If VOX set to VOI (Voice), the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

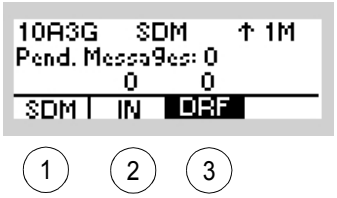
  VOX = VOI can only be used when a R&S GA3002 Headset is connected.
- If VOX set to LINE, the transmit mode is activated as soon as a voice signal at connector X5 is detected.
- Default: OFF

4.3.3 Settings in the Menu MSG (ALE3G OP2, Operation)

Starting point:

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes, e.g.:

Figure 4.15 Menu MSG (ALE-3G, Submenus)



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1 See sect. 4.3.3.1 Initiating an SDM Message
2 See sect. 4.3.3.2 Received SDM Messages
2 See sect. 4.3.3.3 Initiating an SDM Message from the Draft Folder

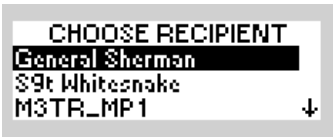
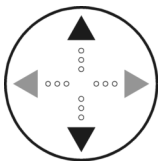
4.3.3.1 Initiating an SDM Message

By means of softkeys SDM (Short Data Message) and EDT (Edit) the operator can create an SDM message or edit an already created SDM message.

By means of softkeys SDM and SND (Send), the operator can send an SDM message.

Starting point: Main page of ALE3G OP2 menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes: 'Pend. Messages' indicates the number of SDM messages waiting to be sent.
2	2 ABC (SDM)	Press.	The display changes: SDM length information indicates whether an SDM has already been prepared and how many characters were input.
3	2 ABC (EDT)	Press.	The display changes:
4	0 _*+ to 9 WXYZ	Enter the message.	

Step	Control	Action	Note
5	ENT	Press.	The entered SDM message is buffered and is now ready to be sent. The display changes:
6	5 JKL (SND)	Press.	The display changes:  Recipient can be • a nickname assigned to an IP address, • a radio name, or • an IP address.
7		Press several times until the desired recipient is selected.	
8	ENT	Press.	The SDM message is now being sent.

NOTICE

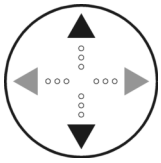
The CLR (Clear) softkey clears all entries. After pressing CLR , the operator is presented with a confirmation dialog to actually delete the previously entered SDM message. Pressing ENT confirms the deletion, ESC cancels the deletion. On deletion, the character counter will be set to 0.

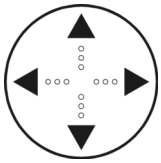
4.3.3.2 Received SDM Messages

Selecting One of the Received SDM Messages

By means of softkeys IN (Inbox) and SHW (Show) the operator can select the message to be displayed.

Starting point: Main page of ALE-3G OP2 menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes: 'NEW' indicates that a new message has come in. Otherwise, the number of messages in the SDM inbox appears in the same position.
2	3 DEF (IN)	Press.	The display changes: **Order of message: sender** Sender can be • a nickname assigned to an IP address, • a radio name, or • an IP address. The asterisk (*) indicates that the message is unread.
3		Press several times until the desired received SDM is selected.	

Step	Control	Action	Note
4	2 ABC (SHW)	Press.	The display changes:
5		Press to scroll within the message content.	

NOTICE

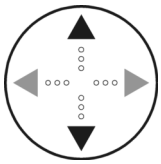
Message Service can buffer up to 10 incoming alert messages in a list if an inbox has been assigned to the related preset page. The newest message is shown at the first position. The sorting depends on the time of arrival. The selected SMS entry is displayed in inverse characters.

As long as any incoming message is still to be read, 'NEW' is indicated on the MMI. When all incoming messages have been read, the number of pending messages in the list is indicated on the MMI.

Deleting One of the Received SDM Messages

By means of softkeys IN and DEL (Delete), the operator can select the message to be deleted.

Starting point: Main page of ALE-3G OP2 menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes:
2	3 DEF (IN)	Press.	The display changes:
3		Press several times until the desired received SDM is selected.	
4	3 DEF (DEL)	Press.	The display changes:
5	ENT	Press.	The selected message is now deleted.

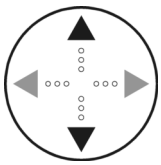
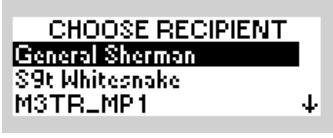
NOTICE

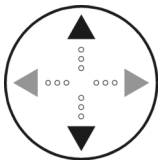
SDM messages are stored in a list. After scrolling through the list view and selecting the message to be deleted, the operator is presented with a confirmation dialog to actually delete the selected SDM. Pressing ENT confirms the deletion, ESC cancels the deletion. Either choice returns the user to the SDM list view. Incoming messages are stored and displayed on a last- in-first-out (newest message is displayed first) basis. If a message is deleted, the message count is decremented and the next message moves up in the list. If the deletion is cancelled, the message order remains.

4.3.3.3 Initiating an SDM Message from the Draft Folder

By means of softkeys DRF (Draft) and SND (Send), the operator can send an predefined SDM message.

Starting point: Main page of ALE3G OP2 menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes:
			The field “Pend. Messages” indicates the number of SDM messages waiting to be sent.
2	4 GHI (DRF)	Press.	The display changes: Record structure: **## : truncated message** ##: the index of draft "Msg content" is shown as truncated ASCII message.
3		Press several times until the desired SDM draft is selected.	
4	5 JKL (SND)	Press.	The display changes:  Recipient can be • a nickname, which is assigned to an IP address, • a radio name, or • an IP address.

Step	Control	Action	Note
5		Press several times until the desired recipient is selected.	
6	ENT	Press.	The selected SDM draft message is now being sent.

NOTICE

The EDT (Edit) softkey opens the SDM message editor window to work on a predefined SDM.

The NEW softkey opens the SDM message editor window to create a new SDM draft.

The DEL (Delete) softkey deletes the selected SDM draft. After pressing DEL, the operator is presented with a confirmation dialog to actually delete the SDM draft. Pressing ENT confirms the deletion, ESC cancels the deletion. The SDM drafts are stored and displayed on a last- in-first-out (newest message is displayed first) principle. If a draft is deleted, the draft count is decremented and the next draft moves up in the list. If the deletion is cancelled, the message order remains.

Message service can buffer up to 20 SDM drafts in a list. This list can be accessed on a preset page for which an inbox has been assigned.

4.3.4 Settings in the Menu AC (ALE3G CFG1, Configuration)

Starting point:

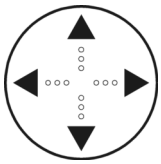
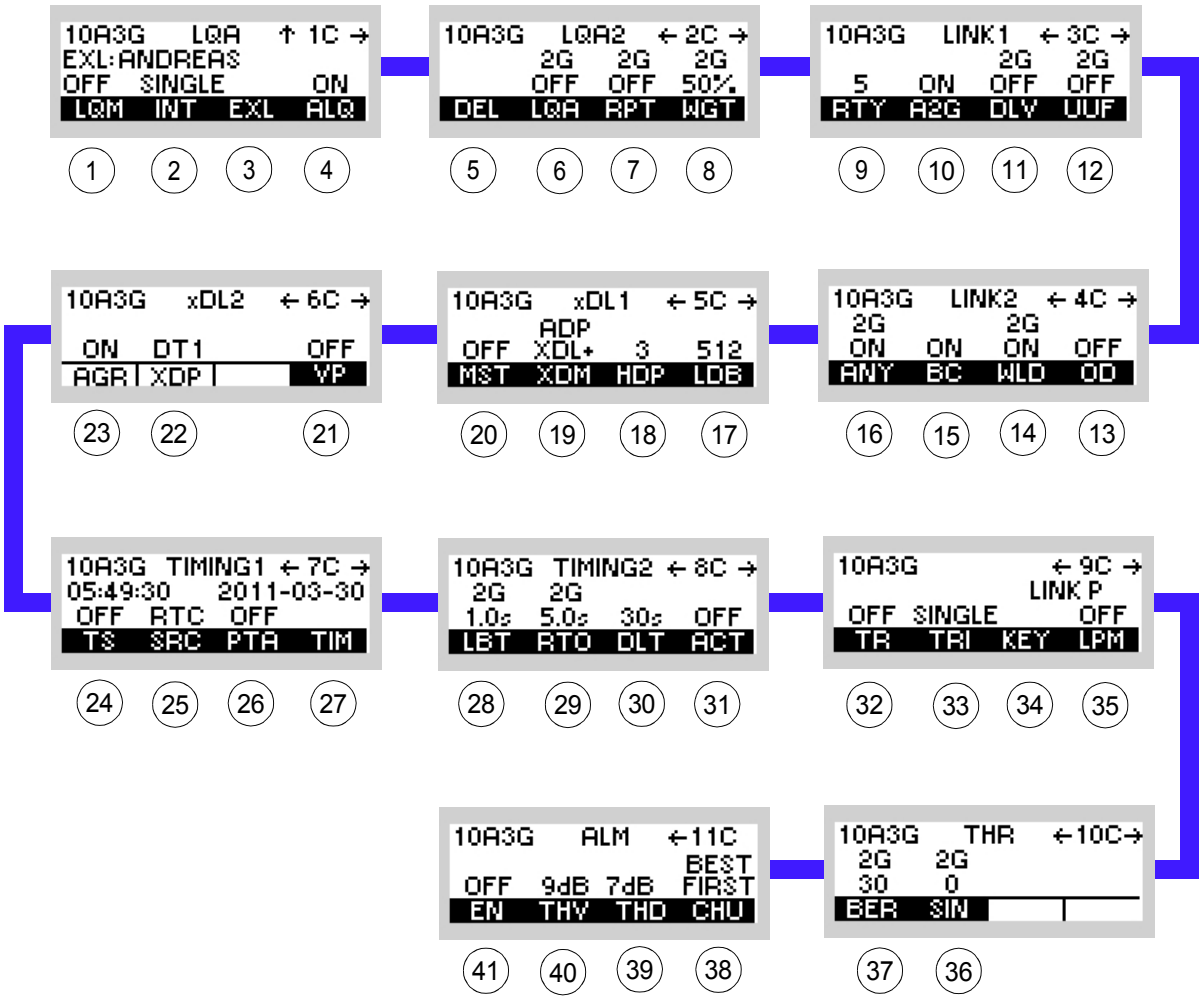
Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired submenu is activated (see Figure 4.16). The complete menu structure is shown in Figure 4.17.

Figure 4.16 Menu AC (ALE-3G, Submenus)



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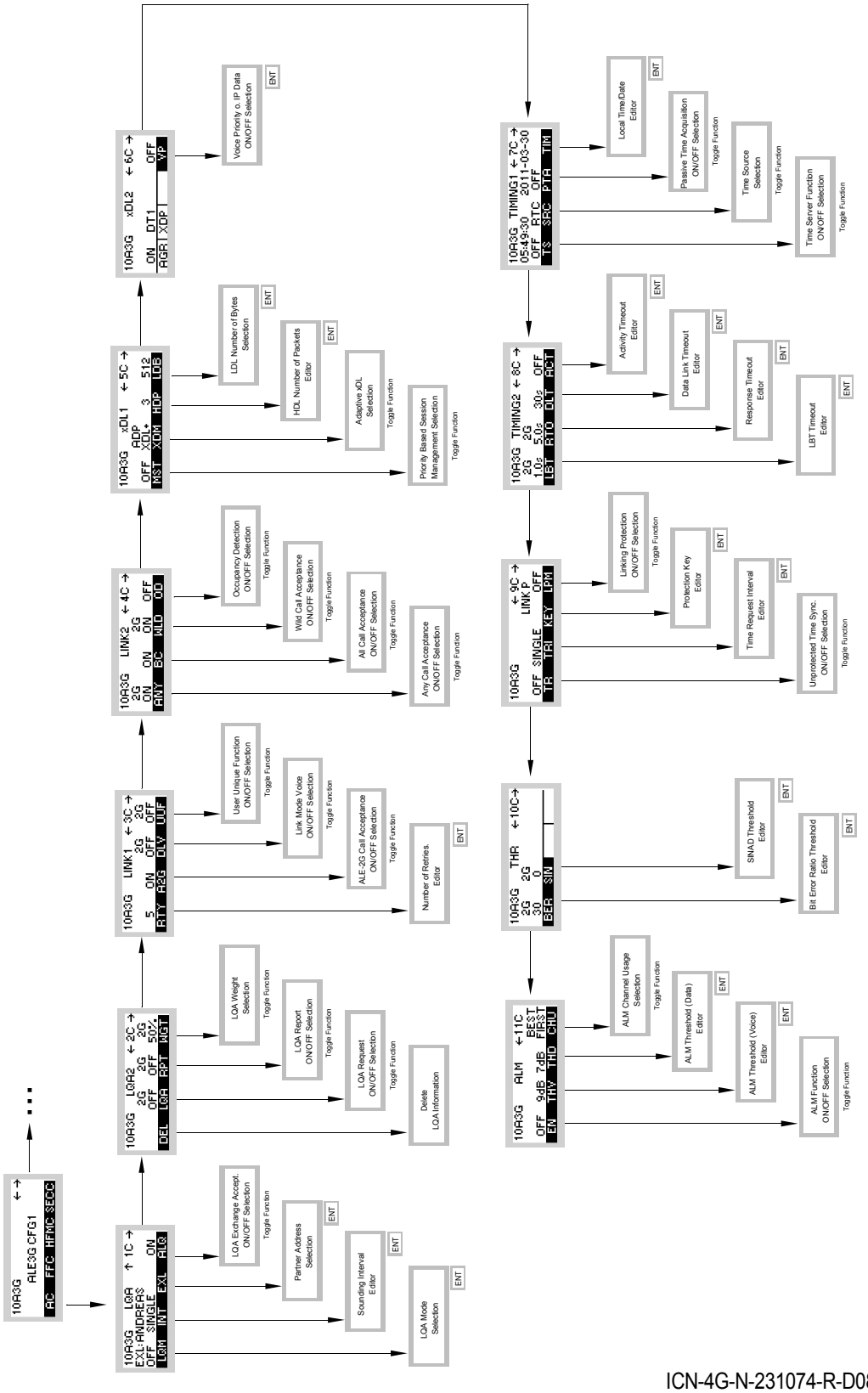
1 See sect. 4.3.4.1 Selecting the LQA Mode
2 See sect. 4.3.4.2 Changing the LQA Interval
3 See sect. 4.3.4.3 Selecting the Partner Address for LQA Exchange
4 See sect. 4.3.4.4 Switching Acceptance of LQA Exchange On or Off
5 See sect. 4.3.4.5 Deleting LQA Data
6 See sect. 4.2.6.3 Switching the LQA Request On or Off [1]
7 See sect. 4.2.6.4 Switching the LQA Report On or Off [1]
8 See sect. 4.2.6.5 Changing the Weight of a New LQA Event
9 See sect. 4.3.4.6 Changing the Number of Retries for Initiated Link Setup[1]
10 See sect. 4.3.4.7 Switching the Acceptance of ALE-2G Calls On or Off
11 See sect. 4.2.6.6 Switching the Default Link Mode Voice On or Off [1]
12 See sect. 4.2.6.7 Switching the User Unique Function On or Off [1]
13 See sect. 4.3.4.9 Switching the Occupancy Detection On or Off
14 See sect. 4.2.6.10 Switching the Acceptance of a Wild Call On or Off [1]
15 See sect. 4.3.4.8 Switching the Acceptance of a Broadcast Call On or Off
16 See sect. 4.2.6.8 Switching the Acceptance of an Any Call On or Off [1]
17 See sect. 4.3.4.13 Selecting the LDL Number of Bytes per TX Frame
18 See sect. 4.3.4.12 Selecting the HDL Number of Packets per TX Frame
19 See sect. 4.3.4.11 Selecting the Adaptive xDL Selection
20 See sect. 4.3.4.10 Selecting the Priority Based Session Management
21 See sect. 4.3.4.16 Selecting the Voice Priority over IP Data
22 See sect. 4.3.4.15 Displaying the xDL Port Setting
23 See sect. 4.3.4.14 Displaying the Packet Aggregation Setting
24 See sect. 4.3.4.17 Switching the Time Server Function On or Off
25 See sect. 4.3.4.18 Selecting the Time Source
26 See sect. 4.3.4.19 Switching the Passive Time Acquisition On or Off
27 See sect. 4.3.4.20 Changing the Network Time and Date
28 See sect. 4.2.6.14 Changing the LBT Timeout [1]
29 See sect. 4.2.6.15 Changing the Response Timeout [1]
30 See sect. 4.3.4.21 Changing the Data Link Timeout
31 See sect. 4.3.4.22 Changing the Activity Timeout
32 See sect. 4.3.4.23 Switching Time Synchronization over the Air On or Off
33 See sect. 4.3.4.24 Changing the Time Request Interval
34 See sect. 4.3.4.25 Changing the Linking Protection Key
35 See sect. 4.3.4.26 Switching Linking Protection On or Off
36 See sect. 4.2.6.25 Changing the SINAD Threshold [1]
37 See sect. 4.2.6.24 Changing the Bit Error Ratio Threshold [1]
38 See sect. 4.3.4.30 Changing ALM Channel Usage
39 See sect. 4.3.4.29 Changing ALM Threshold for Data Links
40 See sect. 4.3.4.28 Changing ALM Threshold for Voice/FF Links
41 See sect. 4.3.4.27 Switching the ALM Function On or Off

[1] This function shows only effect if ALE2G calls are initiated (ALE2G interoperability).

Figure 4.17 Menu AC (ALE-3G, Structure)



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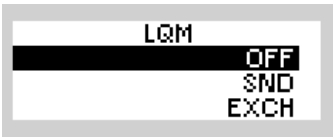
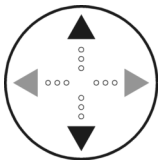
4.3.4.1 Selecting the LQA Mode

By means of softkey LQM (LQA Mode) the operator can switch the LQA (Link Quality Analysis) mode to Sounding (SND), Exchange (EXCH) or OFF.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2	2 ABC (LQM)	Press.	The display changes: 
3		Press several times until the desired value is displayed.	Possible values: Sounding (SND) → Exchange (EXCH) → OFF
4	ENT	Press.	The selection window is closed. The new value is now effective.

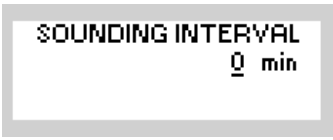
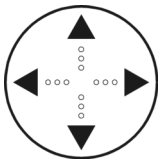
NOTICE

SND or EXCH is only displayed if the INT (sounding interval) is not 0 (single). If the INT is 0 (single), a manual sounding or exchange will be triggered by selecting SND or EXCH.

4.3.4.2 Changing the LQA Interval

By means of softkey INT (Interval) the operator can change the interval for LQA (Link Quality Analysis) sounding or LQA exchange (see sect. 4.3.4.1 Selecting the LQA Mode).

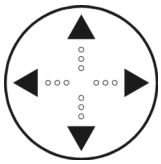
Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2	3 DEF (INT)	Press.	The display changes: 
3	0 _*+ to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 (single) to 1 440 minutes Step: 1 minute **NOTICE** **If the interval is set to '0', the LQA interval is switched to 'single', so that the operator is able to make a single LQA sounding or LQA exchange. If the LQA mode (see sect. 4.3.4.1 Selecting the LQA Mode) was previously selected, the user has to turn it OFF and then choose again the desired LQA mode in order to perform the single operation.**
4	ENT	Press.	The editor window is closed. The new setting is now effective.

4.3.4.3 Selecting the Partner Address for LQA Exchange

By means of softkey EXL (Exchange LQA) the operator can select the station to perform an LQA (Link Quality Analysis) exchange with.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2	4 GHI (EXL)	Press.	The display changes:
3		Press several times until the desired address is displayed.	Possible values (example): ANDREAS
4	ENT	Press.	The selection window is closed. The new setting is now effective.

4.3.4.4 Switching Acceptance of LQA Exchange On or Off

By means of softkey ALQ (Acceptance LQA) the operator can switch the acceptance of LQA (Link Quality Analysis) Exchange on or off. If switched on, the station responds to incoming LQA Exchange requests. If switched off, the station does not respond to incoming LQA Exchange requests.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2	5 JKL (ALQ)	Press.	Repetitively pressing this key switches the LQA exchange on and off.

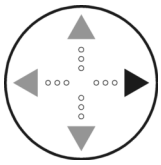
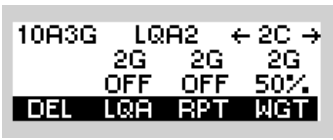
4.3.4.5 Deleting LQA Data

By means of softkey DEL (Delete) the operator can delete all collected LQA (Link Quality Analysis) data.

NOTICE

Be careful when using this softkey, as the entire history concerning the channel quality to other stations gets lost. This means that the best channel selection has no data base to work with.

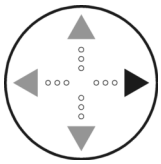
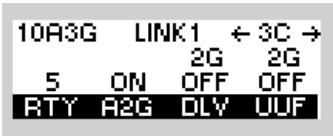
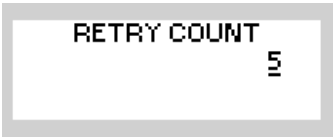
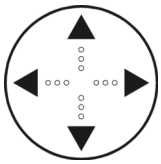
Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press once.	The display changes: 
3	3 DEF (DEL)	Press.	All LQA data is deleted.

4.3.4.6 Changing the Number of Retries for Initiated Link Setup

By means of softkey RTY (Retry) the operator can change the number of retries.

Starting point: Main page of ALE3G CFG1 menu

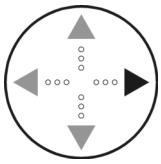
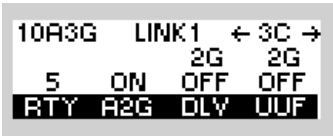
Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press twice.	The display changes: 
3	2 ABC (RTY)	Press.	The display changes: 
4	0 _*+ to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 to 255 **NOTICE** **0 = no retries** 255 = infinite retries
5	ENT	Press.	The editor window is closed. The new setting is now effective.

4.3.4.7 Switching the Acceptance of ALE-2G Calls On or Off

By means of softkey A2G (ALE-2G) the operator can switch the acceptance of incoming ALE2G calls on or off.

If switched on, incoming ALE-2G calls are processed. If switched off, incoming ALE-2G calls are not processed.

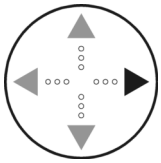
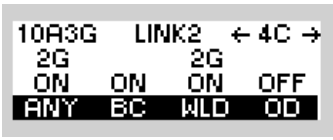
Starting point: Main page of e.g. ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press twice.	The display changes: 
3	3 DEF (A2G)	Press.	Repetitively pressing this key switches the acceptance of ALE-2G calls on and off.

4.3.4.8 Switching the Acceptance of a Broadcast Call On or Off

By means of softkey BC (Broadcast) the operator can switch the acceptance of a broadcast call on or off.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press three times.	The display changes: 
3	3 DEF (BC)	Press.	Repetitively pressing this key switches the acceptance of a broadcast call on and off.

- If BC is set to ON, after reception a broadcast call, the radio links up.

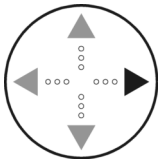
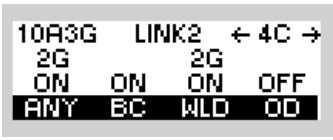
NOTICE

This function shows effect for incoming ALE-2G All calls as well as incoming ALE-3G broadcast calls.

4.3.4.9 Switching the Occupancy Detection On or Off

By means of softkey OD (Occupancy Detection) the operator can switch the occupancy detection feature on or off.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press three times.	The display changes: 
3	5 JKL (OD)	Press.	Repetitively pressing this key switches the occupancy detection on and off.

If switched on, known waveforms will be detected, prohibiting the link setup. If switched off, no listen before transmit will be performed.

The ALE-3G is provided with a highly sophisticated waveform detection system which is called Occupancy Detection (OD) or Listen Before Transmit (LBT). The feature can be used in synchronous and asynchronous mode and detects all waveforms which are shown in the table below. If the feature was activated the ALE-3G performs before every outgoing call a listen before transmit phase with a duration of 900 ms. If a known waveform on the channel was detected, a message will be displayed in a way like "channel occupied hf-modem".

NOTICE

In cases where a radio could not link due to a local disturbance, it may be helpful to deactivate the occupancy detection feature to establish a link. Otherwise the operator shall keep in mind that the transmitted or received PDU (Protocol Data Unit) is corrupted if the occupancy detection is deactivated.

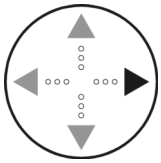
Table 4.5 Waveform Message

Detected waveform	Waveform message
SSB	Voice
Voice	Voice
S4539	HF-Modem
S4285	HF-Modem
S4529	HF-Modem
S4415	HF-Modem
MIL110-A	HF-Modem
MIL110-F	HF-Modem
ALE2G	ALE
S4538-BW0	S4538
S4538-BW1	S4538
S4538-BW2	S4538
S4538-BW3	S4538
S4538-BW4	S4538
S4538-BW5	S4538

4.3.4.10 Selecting the Priority Based Session Management

By means of softkey MST (Maximum Session Time) the operator can switch priority based session management on or off.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press four times.	The display changes:
3	2 ABC (MST)	Press.	Repetitively pressing this key switches the priority based session management on and off.

If MST is set to ON, an ALE-3G (xDL protocol) link will be released after a priority-based maximum session time of 180 sec.

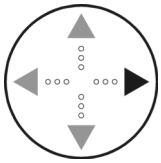
NOTICE

With activated MST it is possible for two or more stations to communicate with one single station concurrently. The communication sessions rotate depending on the priority of the data to transfer.

4.3.4.11 Selecting the Adaptive xDL Selection

By means of softkey XDM (xDL Mode) the operator can select the adaptive or manual selection of the xDL protocols.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press four times.	The display changes:
3	3 DEF (XDM)	Press.	Repetitively pressing this key toggles between following settings: • LDL • HDL • HDL+ • adaptive xDL+

If adaptive xDL selection is chosen, the ALE-3G chooses the best xDL selection based on the measured channel conditions and the used packet size.

It is recommended to use this mode, since it dynamically adapts the xDL protocol settings if the channel conditions get worse or better.

4.3.4.12 Selecting the HDL Number of Packets per TX Frame

By means of softkey HDP (HDL Packets) the operator can select the number of packets.

Starting point: Main page of ALE3G CFG1 menu

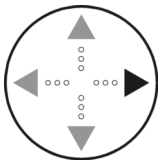
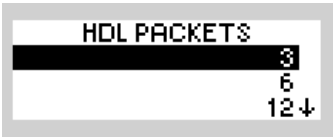
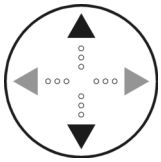
Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press four times.	The display changes:
3	4 GHI (HDP)	Press.	The display changes: 
4		Press several times until the desired number of packets is displayed.	Possible values: • 3 • 6 • 12 • 24
5	ENT	Press.	The selection window is closed. The new number of packets is now effective.

Table 4.6 Dependency between Packet Size and Packets per TX Frame

Traffic mode	Packet size / Payload
HDL 3	3x233 bytes = 699 bytes
HDL 6	6x233 bytes = 1398 bytes
HDL 12	12x233 bytes = 2796 bytes
HDL 24	24x233 bytes = 5592 bytes

4.3.4.13 Selecting the LDL Number of Bytes per TX Frame

By means of softkey LDB (LDL Bytes) the operator can select the number of bytes.

Starting point: Main page of ALE3G CFG1 menu

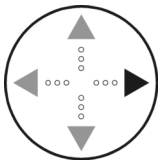
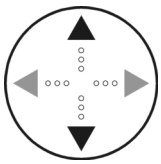
Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press four times.	The display changes:
3	5 JKL (LDB)	Press.	The display changes:
4		Press several times until the desired number of bytes is displayed.	Possible values: • 32 • 64 • 96 • 128 • 160 • 192 • 224 • 256 • 288 • 320 • 352 • 364 • 416 • 448 • 480 • 512
5	ENT	Press.	The selection window is closed. The new number of bytes is now effective.

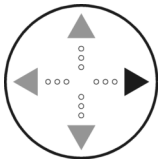
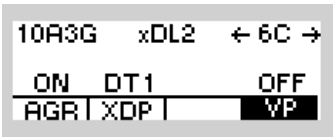
Table 4.7 Dependency between Packet Size and Bytes per TX Frame

Traffic mode	Packet size / payload
LDL 32	1x32 bytes = 32 bytes
LDL 64	2x32 bytes = 64 bytes
LDL 96	3x32 bytes = 96 bytes
LDL 128	4x32 bytes = 128 bytes
LDL 160	5x32 bytes = 160 bytes
LDL 192	6x32 bytes = 192 bytes
LDL 224	7x32 bytes = 224 bytes
LDL 256	8x32 bytes = 256 bytes
LDL 288	9x32 bytes = 288 bytes
LDL 320	10x32 bytes = 320 bytes
LDL 352	11x32 bytes = 352 bytes
LDL 384	12x32 bytes = 384 bytes
LDL 416	13x32 bytes = 416 bytes
LDL 448	14x32 bytes = 448 bytes
LDL 480	15x32 bytes = 480 bytes
LDL 512	16x32 bytes = 512 bytes

4.3.4.14 Displaying the Packet Aggregation Setting

The setting has to be identical for all radios in an ALE-3G net and can only be configured by R&S RNMS.

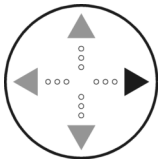
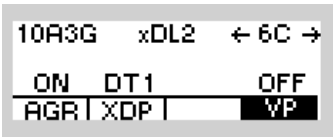
Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press five times.	The display changes: 

4.3.4.15 Displaying the xDL Port Setting

The setting has to be identical for all radios in an ALE-3G net and can only be configured by R&S RNMS.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press five times.	The display changes: 

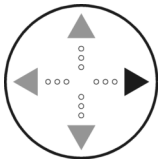
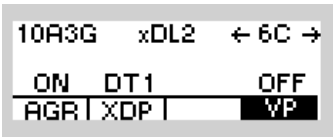
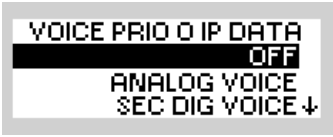
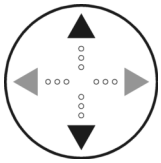
When DT1 is used as data source for xDL, the xDL protocols are used like a modem with a RS-232-C interface. The data will be internally packetized in 0 to 1500 byte packets and transferred with xDL to the next call address or the linked partner station.

If IPoA is used as data source the radio has a transparent IP interface based on Ethernet or PPP.

4.3.4.16 Selecting the Voice Priority over IP Data

By means of softkey VP (Voice Priority over IP Data) the operator can switch the voice priority over IP data feature on or off.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press five times.	The display changes: 
3	5 JKL (VP)	Press.	The display changes: 
4		Press several times until the desired value is displayed.	Possible values: • OFF • ANALOG VOICE • SEC DIG VOICE • LAST DITCH VOICE
5	ENT		The selection window is closed. The new setting is now effective.

NOTICE

The call address for a voice link is selected by the “next call address”, which is configurable by the user. When an IP-data link is established, the “next call address” is changed to the current link partner. After termination of the IP-data link the previous “next call address” is restored, except if it was changed by the user while the IP-data link was active.

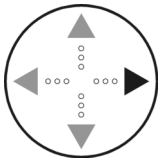
4.3.4.17 Switching the Time Server Function On or Off

By means of softkey TS (Time Server) the operator can define the radio as time master of the ALE-3G network.

NOTICE

Make sure that only one time server exists in an ALE-3G network.

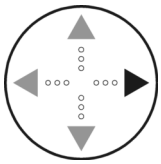
Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press six times.	The display changes:
3	2 ABC (TS)	Press.	Repetitively pressing this key switches the time server function on and off.

4.3.4.18 Selecting the Time Source

By means of softkey SRC (Source) the operator can select the time source.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press six times.	The display changes:
3	3 DEF (SRC)	Press.	Repetitively pressing this key toggles between following values: • RTC • GPS • UTC

NOTICE

The ALE-3G network time depends on the time source. The following table shows the different time sources and the resulting behavior for the ALE-3G network time.

Table 4.8 Dependency of Network Time on Time Source

Time source	Behavior
RTC	Network time depends on radio internal clock. Network time could be set by the user or synchronized over the air.
GPS	Network time depends on the Global Positioning System time.
UTC	Network time depends on the Global Positioning System time or on a configured Network Time Protocol server. If GPS time and NTP time are available, NTP time is used. If UTC time depends on GPS time, Leap seconds are added to the GPS time.

4.3.4.19 Switching the Passive Time Acquisition On or Off

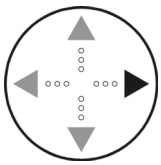
By means of softkey PTA (Passive Time Acquisition) the operator can switch the passive time acquisition on or off.

If PTA is switched on, a station, which is not time server and detects time synchronization calls over the air between other stations, uses the information in this call to update its local time.

NOTICE

If PTA is switched on, the network load can be reduced, especially if GPS cannot be used as time source.

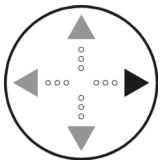
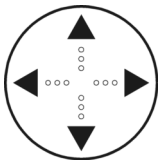
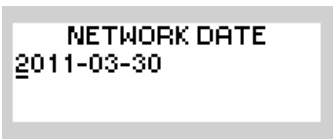
Starting point: Main page of ALE3G CFG1 menu

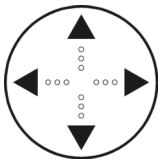
Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press six times.	The display changes:
3	4 GHI (PTA)	Press.	Repetitively pressing this key switches the passive time acquisition on and off.

4.3.4.20 Changing the Network Time and Date

By means of softkey TIM (Time) the operator can change the network time and / or date.

Starting point: Main page of ALE3G CFG1 menu

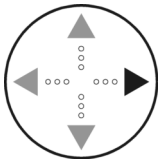
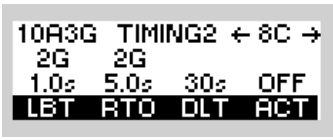
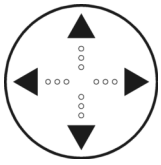
Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
1		Press six times	The display changes:
2	5 JKL (TIM)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new time. Change time selectively.	Format: hh:mm:ss Range: hh: 00 to 23 mm: 00 to 59 ss: 00 to 59
5	ENT	Press.	The display changes: 

Step	Control	Action	Note
6	0 _ * + to 9 WXYZ or 	Enter a new date. Change date selectively.	Format: yyyy:mm:dd Range: yyyy: 1970 to 2099 mm: 01 to 12 ss: 01 to 31
7	ENT	Press.	

4.3.4.21 Changing the Data Link Timeout

By means of softkey DLT (Data Link Timeout) the operator can change the data link timeout. A data link will be terminated if for the data link timeout interval no data is transmitted.

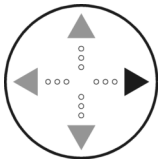
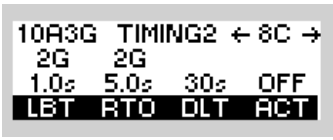
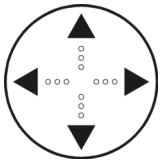
Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press seven times.	The display changes: 
3	4 GHI (DLT)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 s to 3600 s Step: 1 s **NOTICE** **0 s = OFF**
5	ENT	Press.	The editor window is closed. The new setting is now effective.

4.3.4.22 Changing the Activity Timeout

By means of softkey ACT (Activity) the operator can change the activity timeout. A voice link will be terminated if during the activity timeout interval no voice is transmitted.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press seven times.	The display changes: 
3	5 JKL (ACT)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 s to 5000 s Step: 1 s **NOTICE** **0 s = OFF**
5	ENT	Press.	The editor window is closed. The new setting is now effective.

NOTICE

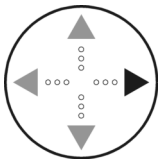
If the activity timeout is set to a value other than zero, it is recommended to set the RSSI squelch to ON (detection of activity!).

4.3.4.23 Switching Time Synchronization over the Air On or Off

By means of softkey TR (Time Synchronization) the operator can switch the time synchronization on or off.

ON is only displayed if the TRI (Time Request Interval) is not 0. If the TRI is 0 (single), a manual time request will be triggered by pressing the TR softkey.

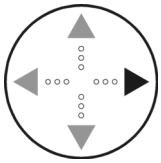
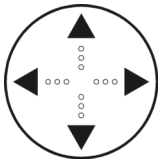
Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press eight times.	The display changes:
3	2 ABC (TR)	Press.	Repetitively pressing this key switches the time synchronization on and off.

4.3.4.24 Changing the Time Request Interval

By means of softkey TRI (Time Request Interval) the operator can change the time request interval.

Starting point: Main page of ALE3G CFG1 menu

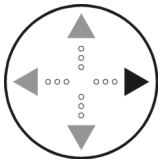
Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press eight times.	The display changes:
3	3 DEF (TRI)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 (single) to 255 minutes Step: 1 minute **NOTICE** **If the interval is set to '0', the time request is switched to 'single', so that the operator is able to make a single time request. If the softkey 'TR' (see sect. 4.3.4.23 Switching Time Synchronization over the Air On or Off) was previously ON, the user has switch OFF and then switch it ON again in order to perform the single time request.**
5	ENT	Press.	The editor window is closed. The new setting is now effective.

When the time quality of a station falls below a certain threshold, the time acquisition protocol is started automatically. Using this protocol the station tries to improve its time quality. The intervals between these attempts can be programmed via the function 'Time REQ INTV'. The protocol runs until the time quality reaches a sufficient value.

4.3.4.25 Changing the Linking Protection Key

By means of softkey KEY (Linking Protection Key) the operator can change the linking protection key.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press eight times.	The display changes:
3	4 GHI (KEY)	Press.	The display changes:
4	0 _ * + to 9 WXYZ	Enter the key.	
5	ENT	Press.	The editor window is closed. The new key is now effective.

The key can be 56 bits long.

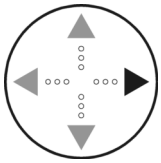
NOTICE

This key is used if linking protection is switched on (see sect. 4.3.4.26 Switching Linking Protection On or Off).

4.3.4.26 Switching Linking Protection On or Off

By means of softkey LPM (Linking Protection) the operator can switch linking protection on or off.

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press eight times.	The display changes:
3	5 JKL (LPM)	Press.	Repetitively pressing this key switches the linking protection on and off.

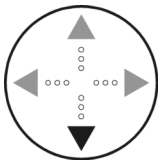
NOTICE

Linking protection is only applied to link setup, not to user data traffic.

4.3.4.27 Switching the ALM Function On or Off

By means of softkey EN (Enable) the operator can switch the ALM function on or off.

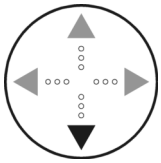
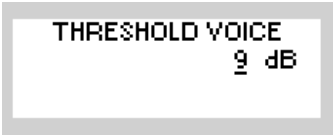
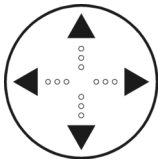
Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (EN)	Press.	Repetitively pressing this key switches the ALM function on and off.

4.3.4.28 Changing ALM Threshold for Voice/FF Links

By means of softkey THV (Threshold Voice) the operator can change the ALM threshold for voice links in dB (SNR). For a Last Ditch Voice message this threshold is not used.

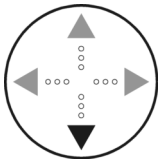
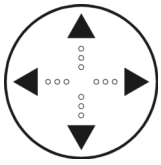
Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press once.	The display changes:
3	3 DEF (THV)	Press.	The display changes: 
4	0 _ * + to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 to 20 Step: 1
5	ENT	Press.	The editor window is closed. The new setting is now effective.

4.3.4.29 Changing ALM Threshold for Data Links

By means of softkey THD (Threshold Data) the operator can change the ALM threshold for HF modem data links in dB (SNR). This function shows only effect at link mode HF modem.

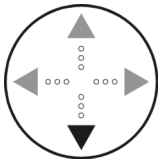
Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press once.	The display changes:
3	4 GHI (THD)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: -10 to 20 Step: 1
5	ENT	Press.	The editor window is closed. The new setting is now effective.

4.3.4.30 Changing ALM Channel Usage

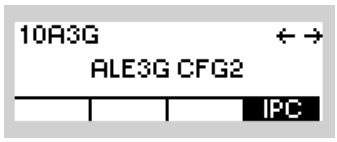
By means of softkey CHU (Channel Usage) the operator can choose whether the ALM function shall start relinking on the best channel “Best First”, on the current channel “Current First” or only on the current channel “Current Only”. Relink with "Current Only" is also called Late Link Entry (LLE).

Starting point: Main page of ALE3G CFG1 menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press once.	The display changes:
3	5 JKL (CHU)	Press.	Repetitively pressing this key toggles between following values: • Best First • Current First • Current Only

4.3.5 Settings in the Menu IPC (ALE3G CFG2, Configuration)

Starting point:



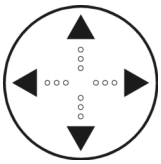
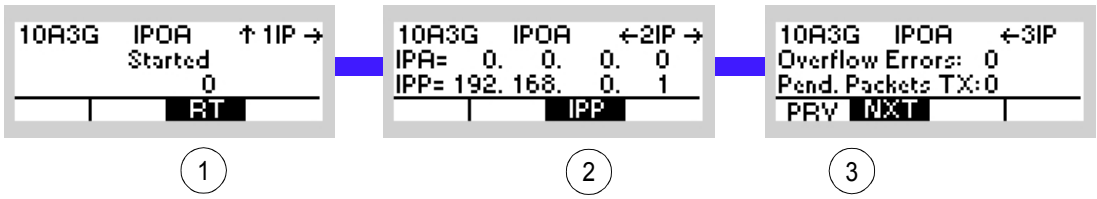
Step	Control	Action	Note
1	(IPC) 5 JKL	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired submenu is activated (see Figure 4.19).

Figure 4.18 Menu IPC (ALE-3G, Submenus)



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1 See sect. 5.3.3.3 Editing the Routing Table
2 See sect. 5.3.3.7 Changing the PPP IP Interface Address
3 See sect. 5.3.3.9 Switching the Local Voice Mode for Rebroadcast On or Off

4.4 HF Modem

4.4.1 Basics of HF Modem

The Rohde & Schwarz HF modem option provides transparent shortwave, non-hopping data communication capabilities, based on common STANAG (NATO Standardization Agreement) and MIL-STD (US Military Standard) publications. They allow the user to perform data transmission optimized for speed vs. robustness according to the present channel condition and the wanted communication scenario. There are a couple of different legacy data modems which have been promulgated by NATO or the US Department of Defense to ensure interoperability and performance issues.

The following communication waveforms are supported:

	R&S M3TR	R&S M3SR Series 4100
STANAG-4539	x	x
STANAG-4285	x	x
STANAG-4529	x	x
STANAG-4415 *)	x	x
MIL-STD-188-110B, Section 5.3 and App. C *)	x	x
STANAG-4481		x
STANAG-5065 (RX only)		x

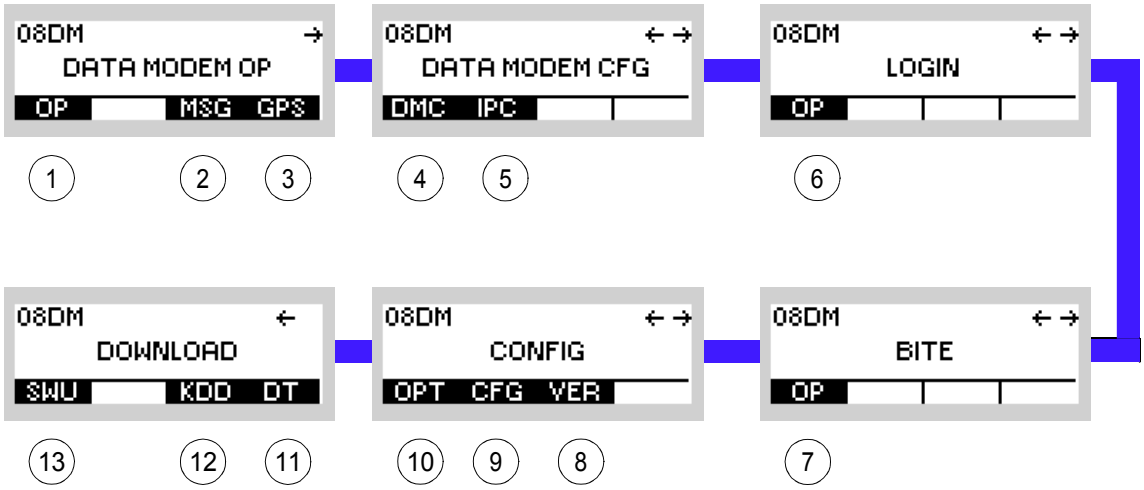
*) Those waveforms are not selectable directly, but they are interoperable with R&S STANAG-4539. Therefore one should adjust STANAG-4539 when communication with one of the mentioned waveforms is planned.

NOTICE

With ALE-2G and ALE-3G only waveforms STANAG-4539 and STANAG-4285 are supported.

4.4.1.1 Preset Page HFM (HF-MODEM)

Figure 4.19 Preset Page HFM (HF-MODEM)



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1 See sect. 4.4.2 Settings in the Menu OP (HF-MODEM, Operation)
2 See sect. 4.4.3 Settings in the Menu CFG (HF-MODEM, Configuration)
3 See sect. 5.2.2.1 Display of the Own GPS Position
4 See sect. 3.5 Login
5 See sect. 6.2.6 Settings in Menu OP (BITE, Operation)
6 See sect. 3.7.2 Settings in Menu VER (CONFIG, Inquiring the Software Version)
7 See sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters)
8 See sect. 3.7 Configuration
9 See sect. 3.7.3 Settings in Menu DT (DOWNLOAD, Loading Pre-configured Radio Parameters)
10 Not relevant in this application.
11 This function is described in the service documentation.

4.4.2 Settings in the Menu OP (HF-MODEM, Operation)

The menu OP is available for all preset pages. Each preset page main menu page holds a softkey labelled “OP” at the leftmost position.

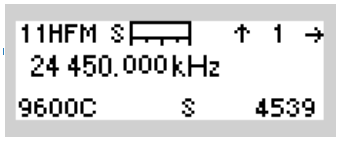
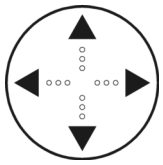
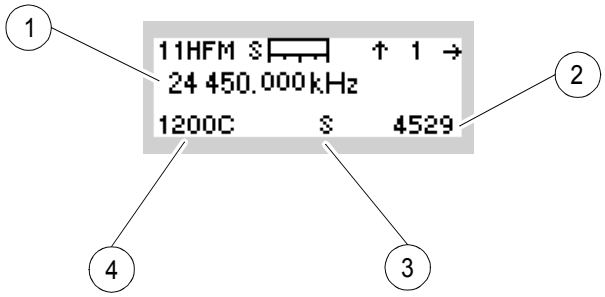
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes, e.g.: 
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes, e.g.:
3		Press.	Press several times until the desired submenu is activated (see Figure 4.21). The complete menu structure is shown in Figure 4.22. After a delay of approximately 10 seconds, the HFM operational page 1 is automatically reactivated.

Figure 4.20 HFM Operational Page 1



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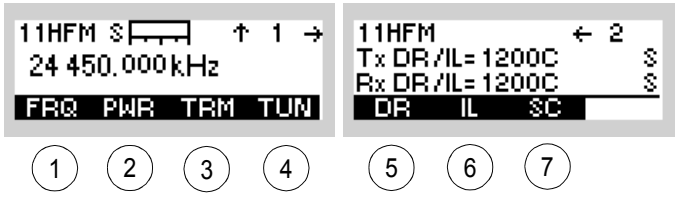
1 Effective RX frequency
2 Selected modem waveform
3 Effective RX interleaver length
4 Effective RX data rate

Figure 4.21 Menu OP (HF-MODEM, Submenus)



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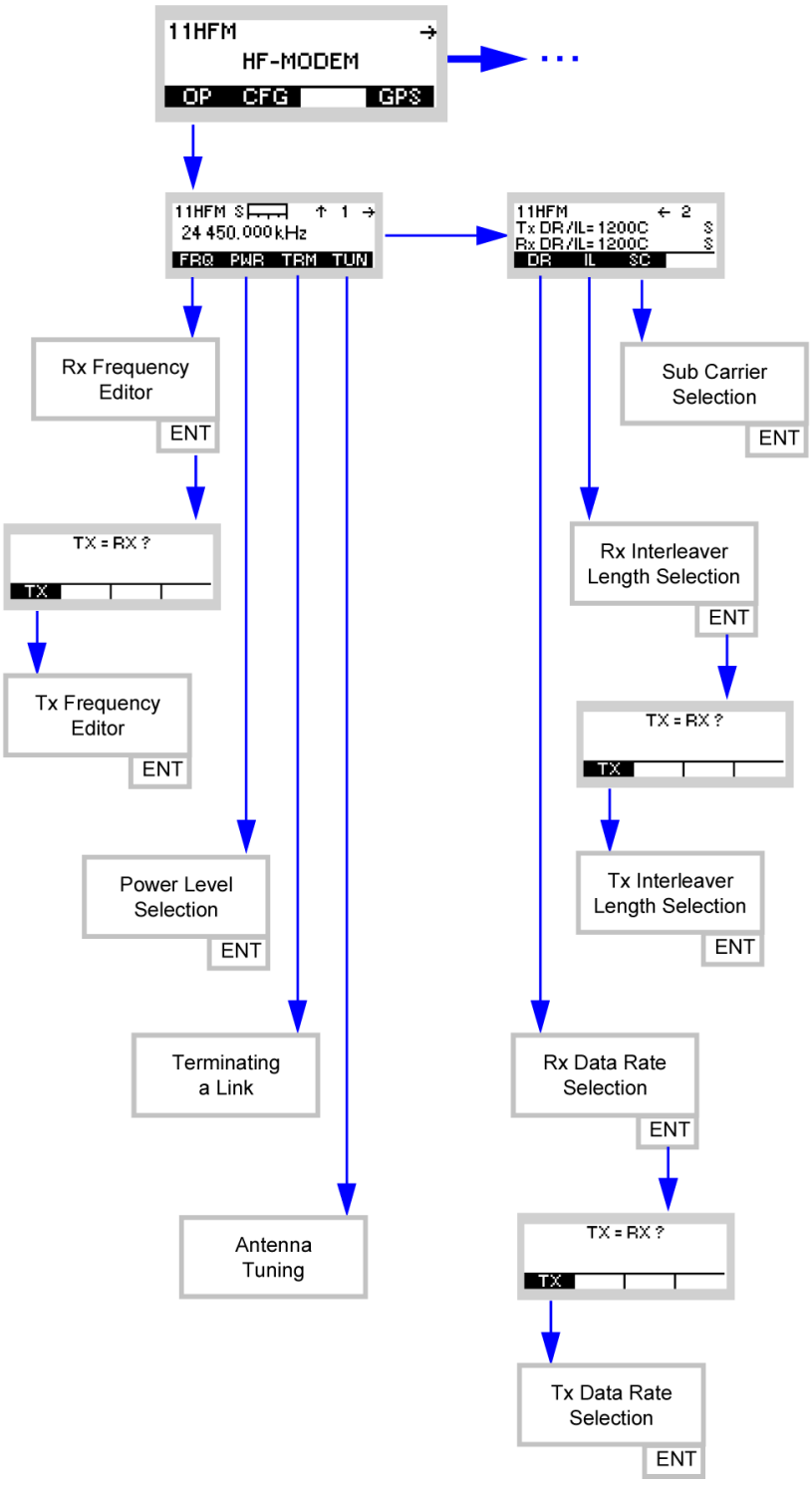
1 See sect. 4.4.2.1 Changing the Frequency for Data Transmission
2 See sect. 4.4.2.2 Changing the Power Level for Data Transmission
3 See sect. 4.4.2.3 Terminating the Data Transmission
4 See sect. 4.4.2.4 Tuning the Antenna
5 See sect. 4.4.2.5 Changing the Data Rate and Forward Error Correction for Data Transmission
6 See sect. 4.4.2.6 Changing the Interleaver Length for Data Transmission
7 See sect. 4.4.2.7 Changing the Sub Carrier for Data Transmission (STANAG-4529 only)

Figure 4.22 Menu OP (HF-MODEM, Structure)



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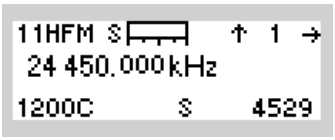
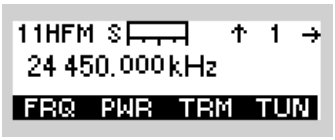
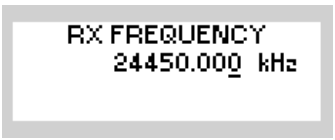
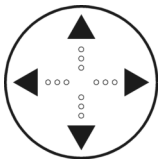
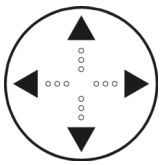
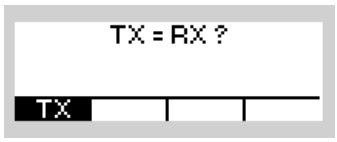
4.4.2.1 Changing the Frequency for Data Transmission

By means of softkey FRQ (Frequency) the operator can change the transmit and/or receive frequency.

Starting point: Main page of HF-MODEM menu

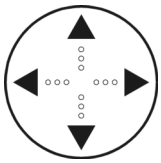
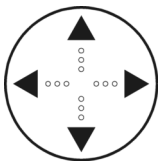
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes: 
3	2 ABC (FRQ)	Press.	The display changes: 

Step	Control	Action	Note
4	0 _ * + to 9 WXYZ and / or  or 	Enter the MHz and kHz digits. Change the Hz digits selectively. Change the RX frequency selectively.	Possible values: Range: 0.1 to 29.999 999 MHz Step: 1 Hz
5	ENT	Press.	The display changes: 

NOTICE

For operation with the same Rx and TX frequency, just press ENT to finish frequency setting. Continue with 6 if a TX frequency different from the RX frequency is required.

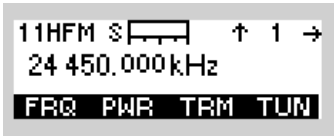
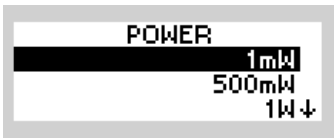
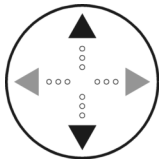
Step	Control	Action	Note
6	2 ABC (TX)	Press.	The display changes:

Step	Control	Action	Note
7	0 _ * + to 9 WXYZ and / or  or 	Enter the MHz and kHz digits. Change the Hz digits selectively. Change the TX frequency selectively.	Possible values: Range: 1.500 000 to 29.999 999 MHz Step: 1 Hz
8	ENT	Press.	The selection window is closed. The new setting is now effective.

4.4.2.2 Changing the Power Level for Data Transmission

By means of softkey PWR (Power) the operator can change the output power level.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes: 
3	3 DEF (PWR)	Press.	The display changes: 
4		Press several times until the desired value is displayed.	Possible values: see sect. 3.2.2.5 Changing the Power Level
5	ENT	Press.	The selection window is closed. The new setting is now effective.

4.4.2.3 Terminating the Data Transmission

By means of softkey TRM (Terminate) the operator can terminate an active data transmission immediately. Already buffered data within the radio will be discarded in such an event. An ongoing reception will be stopped, thus the radio has to hunt for a new synchronization sequence before restarting to decode a waveform.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _ * + to 9 WXYZ	Press any of these keys.	The display changes:
3	4 GHI (TRM)	Press.	The link is terminated manually.

4.4.2.4 Tuning the Antenna

By means of softkey TUN (Tune) the operator can tune the antenna.

After some seconds, the current antenna impedance is matched to the radio. Repeat this for instance after changing the antenna, antenna position or frequency. The tune result for this frequency is stored in the radio; it is not needed to retune when returning to this frequency or when switching the radio on again.

NOTICE

The TUNE output power does not depend on the output power setting described in sect. 4.4.2.2 Changing the Power Level for Data Transmission, a fixed output power of approximately 2 W is used to measure the current antenna impedance.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	5 JKL (TUN)	Press.	The display changes:

4.4.2.5 Changing the Data Rate and Forward Error Correction for Data Transmission

By means of softkey DR (Data Rate) the operator can change the data rate used for over-the-air data transmission and reception. The RX and TX data rates can be chosen separately.

The data rate reflects the total throughput of payload data which can be achieved with over-the-air data transmission. With higher data rates the total amount of payload data will be transmitted faster, but the occurrence of bit errors is more likely.

For waveforms with autobaud capability like STANAG-4539, the HF modem is able to detect the appropriate RX data rate automatically with the presence of a signal. Therefore an adjustment of the RX data rate is not possible for autobaud waveforms.

For waveforms without autobaud capability like STANAG-4285 and STANAG-4529, the data rate and coding chosen for the transmitter must match the adjusted data rate and coding at the receiver on the other end of the link.

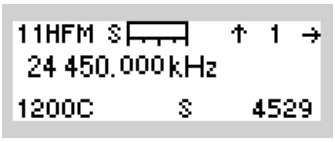
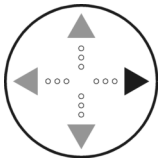
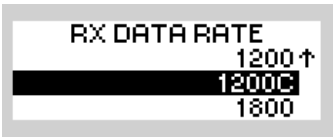
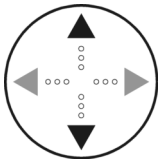
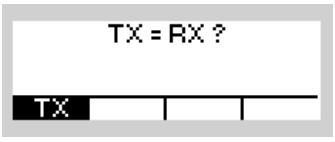
NOTICE

The data rate and coding should be chosen according to actual HF channel conditions. Channels degraded due to the presence of high noise and multipath fading will not work together at high data rates. Such constellations will result in high bit error rates or even the total failure to communicate.

The use of data rates without forward error correction (uncoded) is not advisable.

Further, uncoded data rates may not be compatible with other modems due to a lack of precision in the standard.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes:
3	2 ABC (DR)	Press.	The display changes: 
4		Press several times until the desired value is displayed.	Possible values: Depends on: • Selected HF modem waveform (sect. 4.4.3.1 Selecting the HF Modem Waveform). • Selected interleaver length for data transmission (sect. 4.4.2.6 Changing the Interleaver Length for Data Transmission). See also Table 4.9, Table 4.10 and Table 4.11
5	ENT	Press.	The display changes: 

NOTICE

For operation with the same RX and TX value, just press ENT to finish data rate setting. Continue with 6 if a TX value different from the RX value is required.

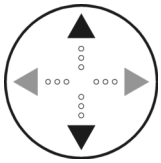
Step	Control	Action	Note
6	2 ABC (TX)	Press.	The display changes:
7		Press several times until the desired value is displayed.	Possible values: Depends on: • Selected HF modem waveform (sect. 4.4.3.1 Selecting the HF Modem Waveform). • Selected interleaver length for data transmission (sect. 4.4.2.6 Changing the Interleaver Length for Data Transmission). See also Table 4.9, Table 4.10 and Table 4.11
8	ENT	Press.	The selection window is closed. The new setting is now effective.

Table 4.9 Dependency Data Rate - Interleaver Length (STANAG-4539)

Data rate	Interleaver length						
	Zero	Ultra short	Very short	Short	Medium	Long	Very long
75 FEC	x			x		x	
150 FEC	x			x		x	
300 FEC	x			x		x	
600 FEC	x			x		x	
1200 FEC	x			x		x	
2400 FEC	x			x		x	
2400 Voice FEC *)	x			x			
3200 FEC		x	x	x	x	x	x
4800	x						
4800 FEC		x	x	x	x	x	x
6400 FEC		x	x	x	x	x	x
8000 FEC		x	x	x	x	x	x
9600 FEC		x	x	x	x	x	x
12800	x						

*) Can be used to automatically detect voice coded data (vocoder data) and transport the data to an external vocoder (not available within the radio).

Table 4.10 Dependency Data Rate - Interleaver Length (STANAG-4285)

Data rate	Interleaver length						
	Zero	Ultra short	Very short	Short	Medium	Long	Very long
75 FEC				x		x	
150 FEC				x		x	
300 FEC				x		x	
600 FEC				x		x	
1200	x						
1200 FEC				x		x	
2400	x						
2400 FEC				x		x	
3600	x						

Table 4.11 Dependency Data Rate - Interleaver Length (STANAG-4529)

Data rate	Interleaver length						
	Zero	Ultra short	Very short	Short	Medium	Long	Very long
75 FEC				x		x	
150 FEC				x		x	
300 FEC				x		x	
600	x						
600 FEC				x		x	
1200	x						
1200 FEC				x		x	
1800	x						

4.4.2.6 Changing the Interleaver Length for Data Transmission

By means of softkey IL (Interleaver) the operator can change the interleaver length used for over-the-air data transmission and reception. The RX and TX interleaver lengths can be chosen separately.

Interleaving is a mechanism to increase the modem performance in the presence of brief disturbances on the HF channel. Longer interleaver lengths usually perform better due to the possibility to handle longer disturbances, although this comes at the price of a higher latency in the data transmission.

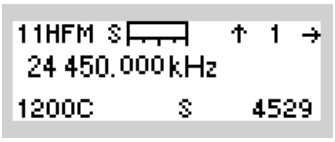
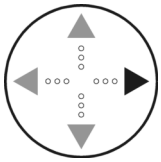
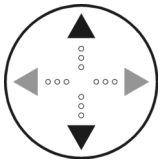
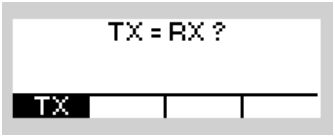
For waveforms with autobaud capability like STANAG-4539, the HF modem is able to detect the appropriate RX interleaver length automatically in the presence of a signal. Therefore an adjustment of the RX interleaver length is not possible for autobaud waveforms.

For waveforms without autobaud capability like STANAG-4285 and STANAG-4529, the interleaver length chosen for the transmitter must match the adjusted interleaver length at the receiver on the other end of the link.

NOTICE

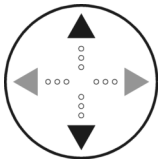
The automatic detection of the interleaver of an incoming STANAG-4539 waveform cannot distinguish between a zero and a short interleaver length due to the fact that the standardized symbol sequences are identical. Therefore in case of such a reception the modem decides that the used RX interleaver length is according to the adjusted TX interleaver length.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes:
3	3 DEF (IL)	Press.	The display changes:
4		Press several times until the desired value is displayed.	Possible values: Depends on: • Selected HF modem waveform (sect. 4.4.3.1 Selecting the HF Modem Waveform). • Selected data rate for data transmission (sect. 4.4.2.5 Changing the Data Rate and Forward Error Correction for Data Transmission).
5	ENT	Press.	The display changes: 

NOTICE

For operation with the same RX and TX value, just press ENT to finish interleaver setting. Continue with 6 if a TX value different from the RX value is required.

Step	Control	Action	Note
6	2 ABC (TX)	Press.	The display changes:
7		Press several times until the desired value is displayed.	Possible values: Depends on: • Selected HF modem waveform (sect. 4.4.3.1 Selecting the HF Modem Waveform). • Selected data rate for data transmission (sect. 4.4.2.5 Changing the Data Rate and Forward Error Correction for Data Transmission).
8	ENT	Press.	The selection window is closed. The new setting is now effective.

4.4.2.7 Changing the Sub Carrier for Data Transmission (STANAG-4529 only)

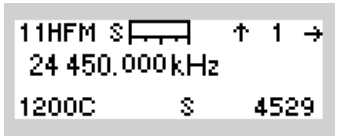
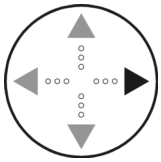
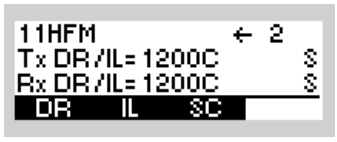
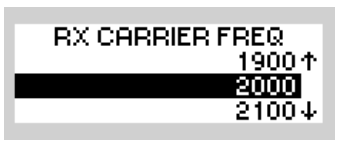
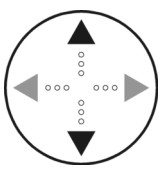
By means of softkey SC (Sub Carrier) the operator can change the sub carrier frequency used for over-the-air data transmission and reception. The RX and TX sub carriers can be chosen separately.

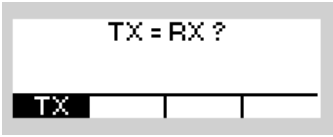
As STANAG-4539 and STANAG-4285 have a fixed standardized sub carrier frequency of 1 800 Hz, this parameter is not adjustable in those waveforms.

For STANAG-4529 the sub carrier can be adjusted between 800 and 2 400 Hz in steps of 100 Hz.

The sub carrier frequency chosen for the transmitter must match the adjusted sub carrier frequency at the receiver on the other end of the link.

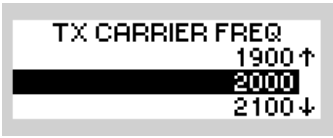
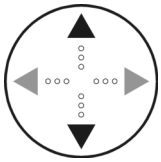
Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes: 
3	4 GHI (SC)	Press.	The display changes: 
4		Press several times until the desired value is displayed.	Possible values: Range: 800 Hz to 2 400 Hz Step: 100 Hz

Step	Control	Action	Note
5	ENT	Press.	The display changes: 

NOTICE

For operation with same the RX and TX value, just press ENT to finish frequency setting. Continue with 6 if a TX value different from the RX value is required.

6	2 ABC (TX)	Press.	The display changes: 
7		Press several times until the desired value is displayed.	Possible values: Range: 800 Hz to 2 400 Hz Step: 100 Hz
8	ENT	Press.	The selection window is closed. The new setting is now effective.

4.4.3 Settings in the Menu CFG (HF-MODEM, Configuration)

The menu CFG is available for all preset pages. Each preset page main menu page holds a softkey labelled “CFG”.

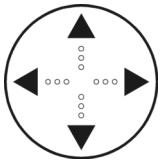
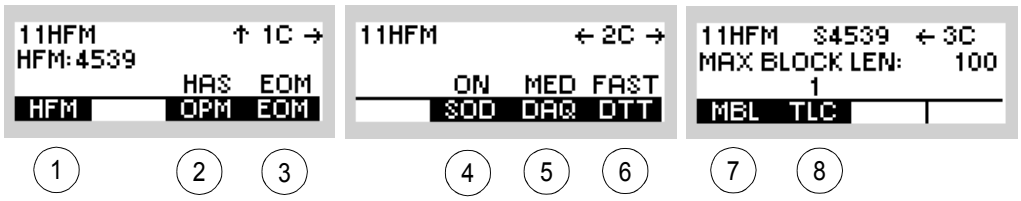
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired submenu is activated (see Figure 4.23). The complete menu structure is shown in Figure 4.24.

Figure 4.23 Menu CFG (HF-MODEM, Submenus)



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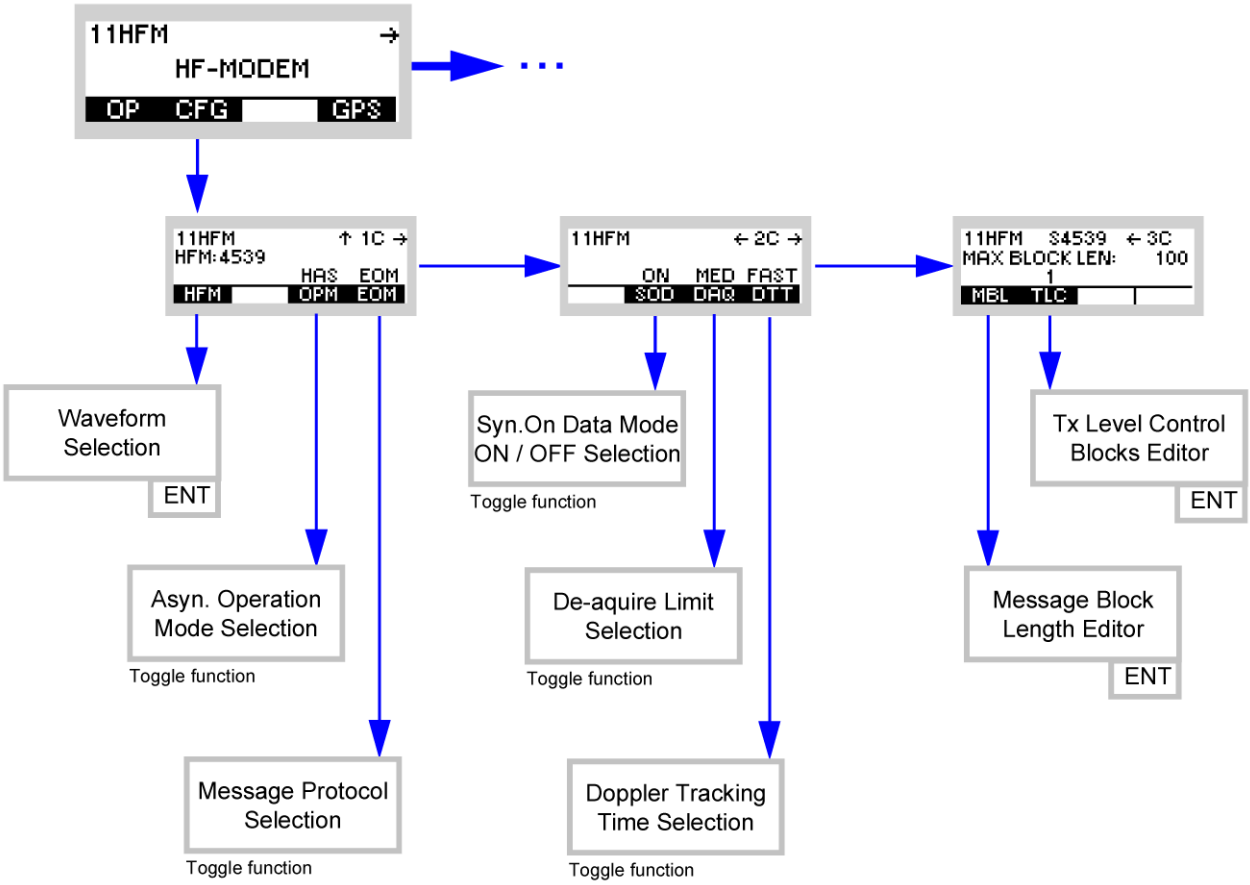
1 See sect. 4.4.3.1 Selecting the HF Modem Waveform
2 See sect. 4.4.3.2 Selecting the Asynchronous Modem Operation Mode
3 See sect. 4.4.3.3 Selecting the Modem Message Protocol
4 See sect. 4.4.3.4 Changing the Modem Synchronization on Data Mode
5 See sect. 4.4.3.5 Changing the Modem De-acquire Limit
6 See sect. 4.4.3.6 Changing the Modem Doppler Tracking Time
7 See sect. 4.4.3.7 Changing the Maximum Message Block Length
8 See sect. 4.4.3.8 Changing the Modem TX Level Control Blocks

Figure 4.24 Menu CFG (HF-MODEM, Structure)



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4.4.3.1 Selecting the HF Modem Waveform

By means of softkey HFM (HF Modem) the operator can select the required HF modem waveform.

The R&S M3TR Tactical Radio supports the following standardized HF modem waveforms:

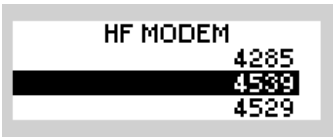
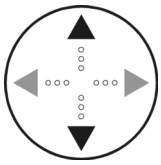
- STANAG-4539 NATO Technical Standard for HF Communication Waveform (75 bit/s to 12 800 bit/s, AUTOBAUD capability, best choice for external ARQ protocols)
- STANAG-4285 NATO Technical Standard for HF Communication Waveform (75 bit/s to 36 00 bit/s, best choice for BROADCAST applications)
- STANAG-4529 NATO Narrowband (1 240 Hz) Maritime Shore to Ship HF Traffic Waveform (75 bit/s to 1 800 bit/s, best choice for bandwidth-limited BROADCAST applications)
- STANAG-4415 *) NATO Robust Traffic Waveform for Severely Degraded HF Radio Links (75 bit/s)
- MIL-STD-188-110B, Section 5.3 and App. C *) US Department of Defense Interoperability and Performance Standards for Data Modems (75 bit/s to 12 800 bit/s)

*) Those waveforms are not selectable directly, but they are interoperable with STANAG-4539. Therefore one should adjust STANAG-4539 when communication with one of these waveforms is planned.

NOTICE

It is not possible to use the autobaud capability in combination with the synchronous interface.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2	2 ABC (HFM)	Press.	The display changes: 
3		Press several times until the desired waveform is displayed.	Possible values: • 4285 • 4539 • 4529
4	ENT	Press.	The selection window is closed. The new setting is now effective.

4.4.3.2 Selecting the Asynchronous Modem Operation Mode

By means of softkey OPM (Operation Mode) the operator can adjust how the payload will be formatted for over-the-air transmission.

The over-the-air payload data format is therefore not required to match the data format at the asynchronous Data Terminal Equipment (DTE) interface. This sophisticated implementation enables the user to use commercial asynchronous DTE hardware like standard PCs and nevertheless increases the throughput by not transmitting additional DTE start, stop or parity bits over the air. Of course it is even possible to do so for interoperability with legacy equipment.

There are two possible asynchronous operation modes:

Standard Asynchronous (SA)

The data format for the over-the-air payload data is according to the adjusted data format for the DTE interface (e.g. 8N1 = one start bit, 8 data bits, no parity bit, one stop bit). This mode is useful for interoperability with legacy modems, but reduces the total throughput.

High-Speed Asynchronous (HAS)

Additional start, parity and stop bits from the DTE interface are stripped and not sent over the air. Just the data bits from the DTE interface are transmitted. This mode is more efficient than Standard Asynchronous and is interoperable with synchronously working legacy modems.

NOTICE

This parameter is not adjustable when the DTE interface is configured to work in synchronous mode.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2	4 GHI (OPM)	Press.	Repetitively pressing this key toggles between SA and HAS.

4.4.3.3 Selecting the Modem Message Protocol

By means of softkey EOM (End Of Message) the operator can select whether an end of message sequence is sent at the end of a transmission or not.

The EOM sequence is used to inform the HF modem at the receiving end of the link that transmission has ended. By decoding EOM the HF modem will return to acquisition immediately, to be ready for the next transmission or reception.

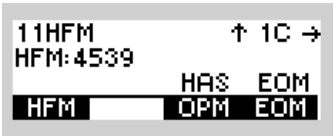
The use of an EOM is recommended. However, in conjunction with the use of a fixed maximum message block length e.g. with an external ARQ protocol, it can make sense to deactivate EOM to increase the throughput (see sect. 4.4.3.7 Changing the Maximum Message Block Length).

NOTICE

This parameter is adjustable for HF modem waveform STANAG-4539 only.

For STANAG-4285 and STANAG-4529, the use of an EOM is mandatory, therefore it cannot be adjusted for those waveforms.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2	5 JKL (EOM)	Press.	Repetitively pressing this key toggles between EOM and NONE.

4.4.3.4 Changing the Modem Synchronization on Data Mode

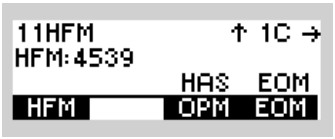
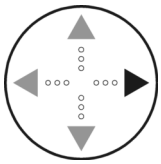
By means of softkey SOD (Synchronization On Data) the operator can adjust whether the modem shall perform late traffic entry or not.

In case of a missed synchronization preamble on the receiving end of the link, the HF modem can synchronize by using the known data probes of the waveforms.

Switch the SOD parameter ON if you wish to synchronize even when a preamble is missed, or OFF if not.

The use of SOD for broadcast applications is advisable; however, in ARQ protocol it might be better to switch SOD off.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes: 
2		Press once.	The display changes:
3	3 DEF (SOD)	Press.	Repetitively pressing this key switches the function on and off.

4.4.3.5 Changing the Modem De-acquire Limit

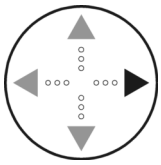
By means of softkey DAQ (De-acquire) the operator can change the modem de-acquire limit.

This setting determines the length of time that the HF modem at the receiving end of a link will continue to attempt to decode data after a loss of the signal. Such a loss of signal can be caused by termination of the transmission or due to significant fading.

Table 4.12 De-acquire Limit

De-acquire limit	Approximate duration [s]
Fast	1
Medium	5
Slow	20

Starting point: Main page of HF-MODEM menu

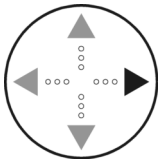
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2		Press once.	The display changes:
3	4 GHI (DAQ)	Press.	Repetitively pressing this key toggles the function between SLOW, MED and FAST.

4.4.3.6 Changing the Modem Doppler Tracking Time

By means of softkey DTT (Doppler Tracking Time) the operator can change the modem Doppler tracking behaviour.

The HF modem implementation is able to track the Doppler offset present in the signal at the receiving end of the link. Therefore the modem can handle such frequency offsets automatically and ensure excellent performance over a wide range of Doppler offsets. The tracking can either be SLOW or FAST. Slow tracking can handle higher offsets, but acquiring the signal takes longer. Fast tracking limits the range of frequency offsets which can be detected.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2		Press once.	The display changes:
3	5 JKL (DTT)	Press.	Repetitively pressing this key toggles the function between SLOW and FAST.

4.4.3.7 Changing the Maximum Message Block Length

By means of softkey MBL (Message Block Length) the operator can change the maximum message block length for transmission and reception.

Once the modem has decoded the number of bits corresponding to the configured maximum message block length, the HF modem returns to acquisition mode and terminates the delivery of decoded bits. Accordingly a transmission is terminated after the modem has modulated the number of bits corresponding to the configured maximum message block length.

The value 0 reflects an infinite message block length. In this case the modem will never return to acquisition as long as a valid modem signal is decoded. For transmission this means that the modem will never terminate a transmission as long as enough data bits are available.

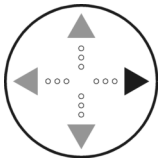
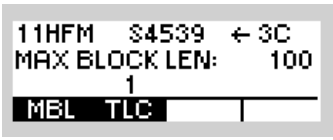
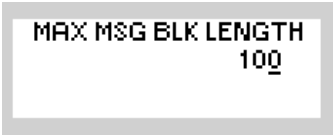
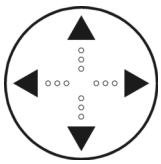
Operation with a specified number of input data blocks may be used by an external ARQ protocol where the size of the ARQ packet is fixed, or occasionally changed to accommodate changing propagation conditions. In this case we anticipate that this parameter (maximum message block length) will be sent to the receiving end of the link as part of the external ARQ protocol. It would then be sent to the receiving modem through the remote control interface, since it is not embedded in the waveform itself as the data rate and interleaver length parameters are.

In connection with the use of a fixed maximum message block length a deactivated message protocol (EOM) can be used to increase throughput (see sect. 4.4.3.3 Selecting the Modem Message Protocol).

NOTICE

This parameter is adjustable for HF modem waveform STANAG-4539 only.

Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2		Press twice.	The display changes: 
3	2 ABC (MBL)	Press.	The display changes: 
4	0 _ * + to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 to 100 000 **NOTICE** **0 = infinite**
5	ENT	Press.	The editor window is closed. The new value is now effective.

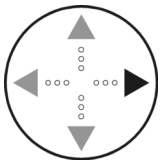
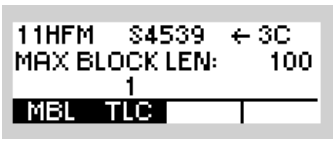
4.4.3.8 Changing the Modem TX Level Control Blocks

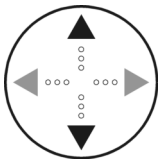
By means of softkey TLC (Transmitter Level Control) the operator can change the number of modem TX level control blocks used at the beginning of a transmission.

These additional data probes preceding a transmission enable the radio TLC as well as the radio and modem AGC (Automatic Gain Control) to settle the signal level without disturbing payload data.

This parameter should be increased if the used receiver automatic gain control attack time (e.g. from a third party radio or modem vendor) is high. The radio embedded STANAG-4539 implementation has been optimized, thus for consistency of Rohde & Schwarz equipment a value of 1 is recommended.

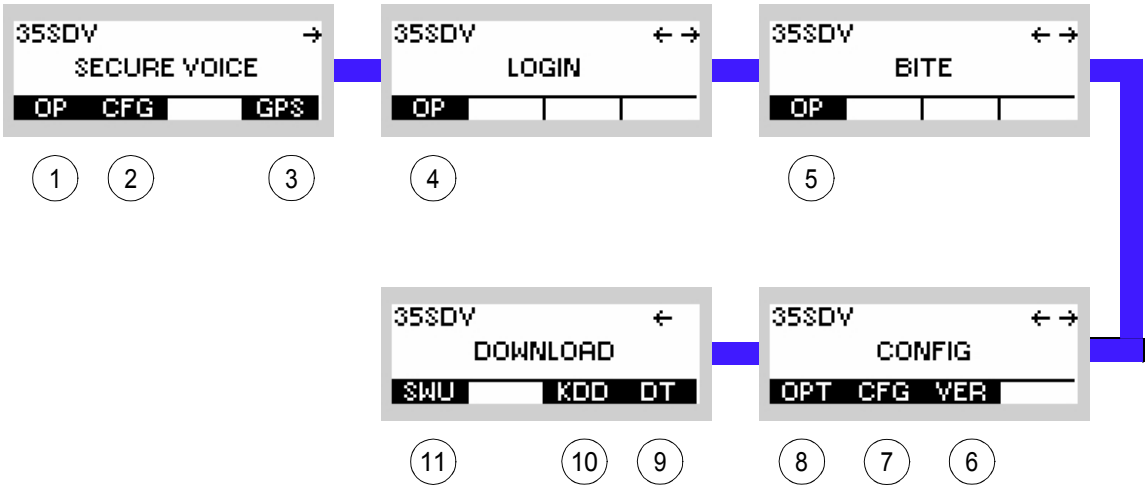
Starting point: Main page of HF-MODEM menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2		Press twice.	The display changes: 
3	3 DEF (TLC)	Press.	The display changes:

Step	Control	Action	Note
4	0 _ * + to 9 WXYZ or 	Enter a new value. Change value selectively.	Range: 0 to 7
5	ENT	Press.	The editor window is closed. The new value is now effective.

4.4.4 Preset Page SDV (Secure Digital Voice)

Figure 4.25 Preset Page SDV (Secure Digital Voice)



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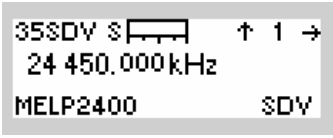
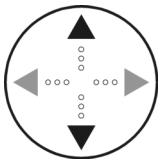
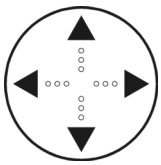
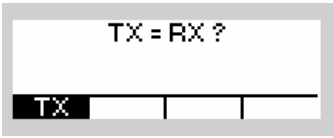
1 See sect. 4.5.3 Settings in the Menu OP (SECURE VOICE, Operation)
2 See sect. 4.4.5 Settings in the Menu CFG (SECURE VOICE, Configuration)
3 See sect. 5.2.2.1 Display of the Own GPS Position
4 See sect. 3.5 Login
5 See sect. 6.2.6 Settings in Menu OP (BITE, Operation)
6 See sect. 3.7.2 Settings in Menu VER (CONFIG, Inquiring the Software Version)
7 See sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters)
8 See sect. 3.7 Configuration
9 See sect. 3.7.3 Settings in Menu DT (DOWNLOAD, Loading Pre-configured Radio Parameters)
10 Not relevant in this application.
11 This function is described in the service documentation.

4.4.4.1 Changing the Frequency for SDV Communication

By means of softkey FRQ (Frequency) the operator can change the transmission and reception frequency.

Starting point: Main page of SDV menu

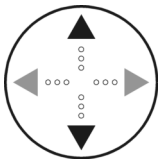
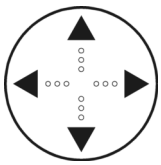
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2	0 _ * + to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (FRQ)	Press.	The display changes:

Step	Control	Action	Note
4	0 _ * + to 9 WXYZ and / or  or 	Enter the MHz and kHz digits. Change the Hz digits selectively. Change the Rx frequency selectively.	Possible values: Range: 0.1 to 107.999999 MHz Step: 1 Hz
5	ENT	Press.	the display changes: 

NOTICE

For operation with same Rx and TX frequency, just press enter to finish frequency setting. Continue with step 6 if a TX frequency different from the RX frequency is requested.

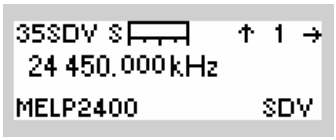
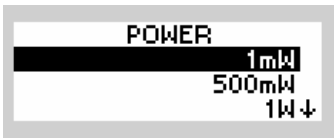
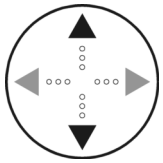
6	2 ABC (TX)	Press.	The display changes:

Step	Control	Action	Note
7	0 _ * + to 9 WXYZ and / or  or 	Enter the MHz and kHz digits. Change the Hz digits selectively. Change the Tx frequency selectively.	Possible values: Range: 1.500000 to 107.999999 MHz Step: 1 Hz
8	ENT	Press.	The editor window is closed. The new setting is now effective.

4.4.4.2 Changing the Power Level for SDV Communication

By means of softkey PWR (Power) the operator can change the output power level.

Starting point: Main page of SDV menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	3 DEF (PWR)	Press.	The display changes: 
4		Press several times until the desired power level is displayed.	Possible values: see sect. 3.2.2.5 Changing the Power Level
5	ENT	Press.	The selection window is closed. The new setting is now effective.

4.4.4.3 Changing the SDV Vocoder Mode

By means of softkey VOC (Vocoder) the operator can change the SDV communication mode for transmission. There are two modes available:

- MELP2400 (default)

  Good Speech quality for good channel conditions.

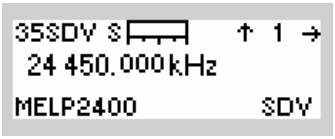
- MELP600

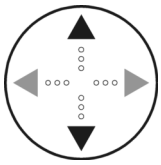
  Fair Speech quality for highly degraded channel conditions.

NOTICE

The receiver must not necessarily be adjusted to the same communication mode due to automode capability of SDV.

Starting point: Main page of SDV menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2	0 _ * + to 9 WXYZ	Press any of these keys.	The display changes:
3	4 GHI (VOC)	Press.	The display changes:

Step	Control	Action	Note
4		Press to switch between values.	Possible values: MELP0K6 (MELP600) MELP2K4 (MELP2400)
5	ENT	Press.	The selection window is closed. The new setting is now effective.

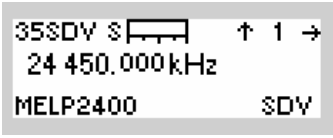
4.4.4.4 Tuning the Antenna

By means of softkey TUN (Tune) the operator can tune the antenna. After some seconds, the current antenna impedance is matched to the radio frequency. The operator needs to repeat this operation in case of changing the antenna, the antenna position or the frequency. The tune result for this frequency is stored in the radio; it is not needed to retune when returning to this frequency or after switching the radio on again.

NOTICE

The tune output power does not depend on the output power setting. For tuning the antenna a fixed output power is used to measure the current antenna impedance and after tuning, the output power is switched back to the value configured by the user.

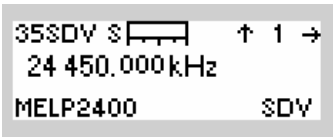
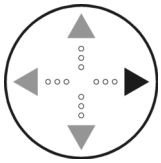
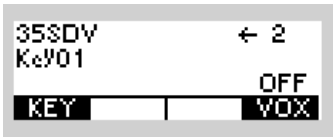
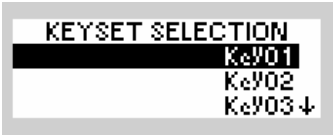
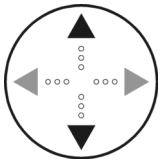
Starting point: Main page of SDV menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2	0 _ * + to 9 WXYZ	Press any of these keys.	The display changes:
3	5 JKL (TUN)	Press.	The display changes:

4.4.4.5 Selecting the Active COMSEC Key for SDV Communication

By means of softkey KEY the operator can select the active COMSEC key which shall be used for SDV communication.

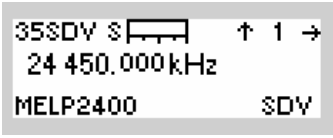
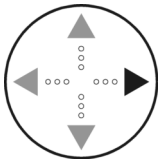
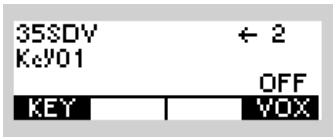
Starting point: Main page of SDV menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes: 
3	2 ABC (KEY)	Press.	The display changes: 
4		Press to select the desired keyset.	
5	ENT	Press.	The new key is selected and the selection window is closed.

4.4.4.6 Changing the VOX Function for SDV Communication

By means of softkey VOX (Voice Operated Transmission) the operator can change the VOX function which shall be used for SDV communication.

Starting point: Main page of SDV menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes: 
3	5 JKL (VOX)	Press.	Repetitively pressing this key changes the VOX function. Possible values: OFF → LIN → VOI

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface.
- If VOX set to VOI (Voice), the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

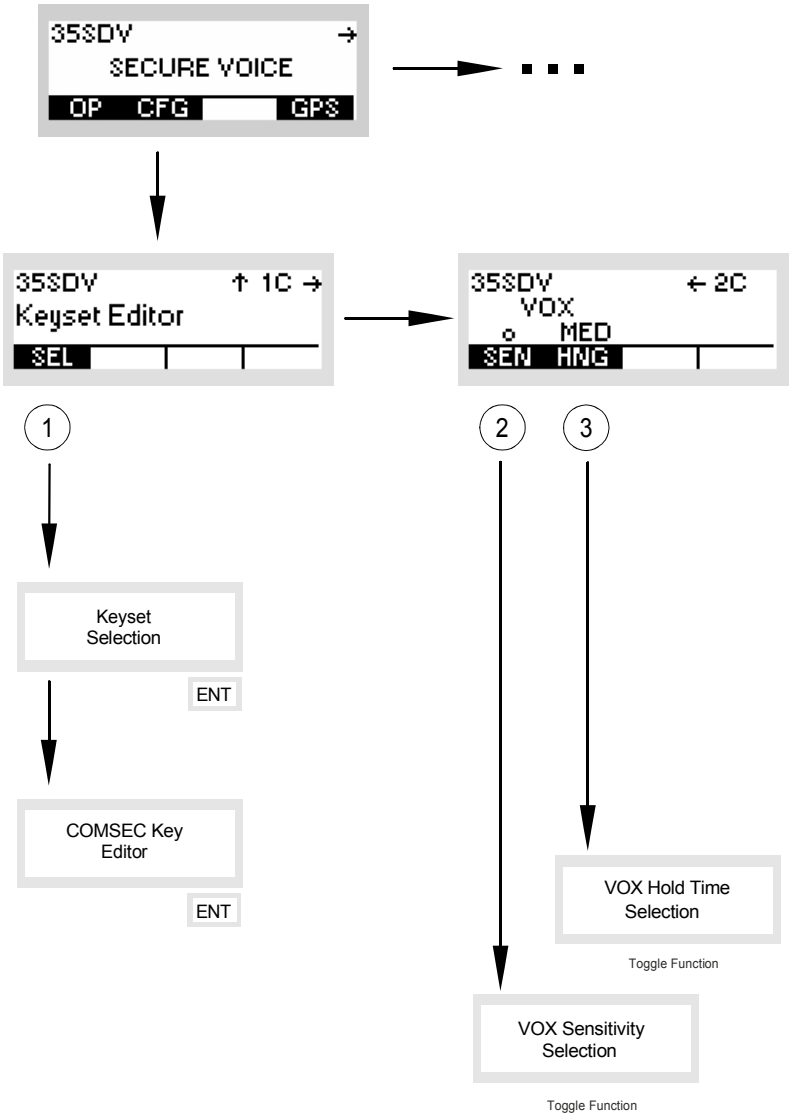
  VOX = VOI can only be used when a R&S GA3002 Headset is connected.
- If VOX set to LINE, the transmit mode is activated as soon as a voice signal at connector X5 is detected.
- Default: OFF

4.4.5 Settings in the Menu CFG (SECURE VOICE, Configuration)

Starting point:

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:

Figure 4.26 Menu CFG (SDV, Submenu)



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1 See sect. 4.4.5.1 Editing a User-defined COMSEC Key for SDV Communication
2 See sect. 4.4.5.2 Changing the VOX Sensitivity for SDV Communication
3 See sect. 4.4.5.3 Changing the VOX Holdtime for SDV Communication

4.4.5.1 Editing a User-defined COMSEC Key for SDV Communication

By means of softkey SEL (Selection) the operator can edit a user-defined COMSEC key for the SDV communication.

NOTICE

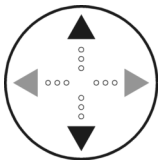
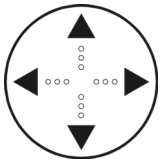
Please note that for security reasons the given key cannot be displayed again once it has been entered. Furthermore the key has to be selected as active COMSEC key (see sect. 4.4.4.5 Selecting the Active COMSEC Key for SDV Communication) before it is used for the SDV communication.

NOTICE

Voice communication will not be possible in case of using different keys at transmitter and receiver. Please note that there is no indication that the keys are different. The received voice would not be intelligible in this case.

Starting point: Main page of SDV menu

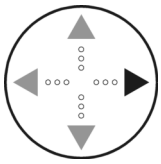
Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2	2 ABC (SEL)	Press.	The display changes:

Step	Control	Action	Note
3		Press to select the desired keyset.	Possible values: USER KEYSET1 to USER KEYSET5
4	ENT	Press.	The new key is selected and the selection window is closed.
5	0 _ * + to 9 WXYZ or 	Press several times until the character is displayed.	The key must contain between 8 and 32 characters. For the COMSEC key any alphanumerical characters are allowed. letters "A" to "Z" and "a" to "z" numerals "1" to "0" characters, for example: !, ", #, $, %
6	ENT		The selection window is closed.

4.4.5.2 Changing the VOX Sensitivity for SDV Communication

By means of softkey SEN (Sensitivity) the operator can change the sensitivity for the function VOX which shall be used for SDV communication. When VOX is selected, the sensitivity will become automatically activated.

Starting point: Main page of FF CFG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (SEN)	Press.	Repetitively pressing this key toggles between five sensitivity levels. Possible settings: -- very low - low o medium + high ++ very high

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface. If VOX is on, the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

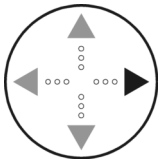
  Softkey SEN is used to change the VOX sensitivity in five steps, provided that VOX is on.

- Default: medium

4.4.5.3 Changing the VOX Holdtime for SDV Communication

By means of softkey HNG (Hang) the operator can change the holdtime for the function VOX which shall be used for SDV communication. When VOX is selected, the holdtime will become automatically activated.

Starting point: Main page of FF CFG menu

Step	Control	Action	Note
1	3 DEF (CFG)	Press.	The display changes:
2		Press once.	The display changes:
3	3 DEF (HNG)	Press.	Repetitively pressing this key toggles between three hold times. Possible settings: SHT short MED medium LNG long

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface. If VOX is on, the operator can switch to transmit mode (TX) by simply talking, and when he stops talking tactical radio automatically returns to receive mode (RX).

  The transmitter is keyed as long as a voice signal is present. When the voice stops the tactical radio will return to receive mode (RX) only after the holdtime has elapsed.

The settings SHT, MED, LNG represent the following values:

Short: 300 ms

Medium: 600 ms

Long: 900 ms

- Default: medium

4.5 SECOM-H

4.5.1 Basics of SECOM-H

A SECOM-H net is a system for voice and data communication in the HF range with protection by COMSEC (communication security) and TRANSEC (transmission security) procedures. It is configurable in many parameters. The configuration and net management for a SECOM-H communication system must be supported by a radio net management system (R&S RNMS3000).

The features of the SECOM-H system are grouped as follows:

- Configuration features
- Security features
- Synchronization features
- Communication features

4.5.1.1 SECOM-H Net

A SECOM-H net is a logical structure for setting up a communication network. It consists of a set of radios with assigned:

- Hopsets
- Net address and radio addresses
- Necessary radio / SECOM-H parameters
- Keys for TRANSEC and COMSEC

All radios operating in one SECOM-H net must have the same

- Time and date
- Hopset (frequencies for TRANSEC)
- Keyset (COMSEC and TRANSEC keys)
- Net address (unique address of each SECOM-H net)

4.5.1.2 COMSEC and TRANSEC

Communication security (COMSEC) for user and technical data is provided by ciphering before transmission and deciphering after reception:

- Ciphered voice/data transmission
- Digital voice with
  - AMBE (Advanced Multi-Band Excitation) vocoder, at 2400 bit/s
  - MELP (Mixed Excitation Linear Prediction) vocoder at 2400 and 600 bits/s
  - MMBE (Modified Multi-Band Excitation) vocoder at 2400 and 1200 bits/s

A COMSEC key used for ciphering/deciphering the transmitted data is valid for a certain period of time, e.g. one day.

Transmission security (TRANSEC) is provided by frequency hopping. The frequency range is from 1.5 MHz to 29.999990 MHz. The hopping frequencies are stored in so-called hopsets. The frequency to be used for a hop is selected pseudo-randomly by a crypto algorithm, controlled by the TRANSEC key, the time, the link type and the addresses of the participating units.

4.5.1.3 Time Synchronization

To ensure secure communication, all participating radios need to be adjusted to the same time. This can be achieved by using GPS as time source or by manual synchronization to a (Primary) Time Reference Unit ((P)TRU). The procedure for time synchronization of a radio to the TRU is called Time Acquisition (TAQ). The time difference between a requesting unit and the TRU must not be greater than five days for successful Time Acquisition. There must not be more than one TRU in a net at any time. If the pre-configured TRU fails, any other radio of the net can take over the TRU role when it is configured as TRU manually. Every net uses its own net time. Time synchronization must be performed separately in every net.

NOTICE

R&S M3TR: If all radios in a SECOM-H net use GPS as time source, no TRU is required.

NOTICE

R&S EK4100 Systems can not be synchronized with the net by means of a TAQ call, because it can not transmit the request.

For technical reasons, it is not possible to maintain synchronization forever. The R&S M3TR Series provides functions for automatic re-synchronization:

- GPS as time source: Whenever synchronization is lost, the radio will re-synchronize to the net by updating its time with the current GPS time. No further user interaction is required.
- Time Beacon (TB): The radio automatically takes care of new synchronization before synchronization is lost. If the TB function is not active, it may be required to perform a TAQ from time to time. This is indicated by the NSYN (not synchronized) message at the display. The Time Beacon function does not replace the need for an initial TAQ. Moreover, when switching TB functionality OFF and ON again, a new TAQ has to be performed, i.e. an initial TAQ is necessary every time TB functionality is enabled.

NOTICE

When the Time Beacon is active, the radio will transmit data automatically and without user interaction. Turn off the Time Beacon to avoid this.

When the radio is turned off, net time can only be updated with reduced accuracy. Manual TAQ may be necessary even if Time Beacon is active.

4.5.1.4 Linking

SECOM-H is a link-oriented communication system, using physical and logical links.

A physical link exists if at least two radios are able and prepared to receive one another. This means the participating units must be synchronized. So in general a link setup is required to establish a link. During this link setup SECOM-H provides for synchronization with the other participating units and transmits address and service information.

A logical link exists if one participating unit is transmitting and one or more other participating units are receiving this communication.

Simultaneous transmission and reception is not supported by SECOM-H.

SECOM-H supports two types of links:

- Point-to-Point link (PtP):

  Exactly 2 radios can communicate. The Station (STN) setting determines the radio which is called.

- Point-to-Multipoint link (PtM):

  The Group (GRP) setting determines the group of radios which is called. The BROADCAST_MP setting is a special group call, because it addresses all radios in a net. During a broadcast call, LTE is enabled. LTE offers the chance to join a broadcast call even if the initial link setup was missed or to re-connect to the link if the connection was lost.

NOTICE

It is always possible to receive all link types. Therefore, the radio is temporarily switched to the link type of the incoming call. It is necessary to select the destination address manually if a specific net member shall be addressed.

4.5.1.5 Free Hopset Search

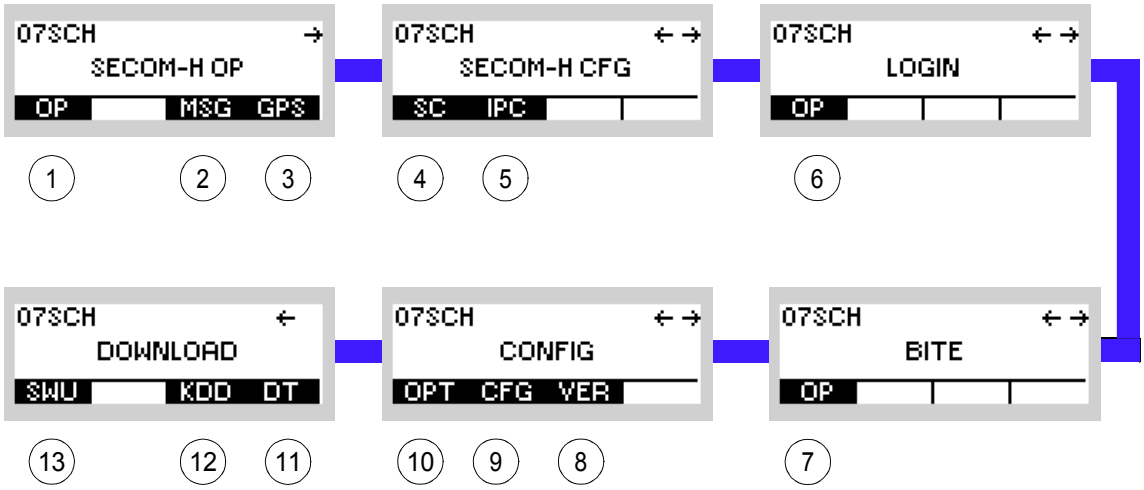
SECOM-H provides the Free Hopset Search (FHS) feature to improve communication quality for Point-to-Point links with difficult environmental conditions like fading channels or jamming. Therefore, connection quality for all channels in a hopset (max. 20) is analyzed and results in an Advanced Hopset (AHS) which contains only channels that provide suitable quality for the selected communication mode. Further, the number of channels in an AHS can be constrained (min/max) to guarantee TRANSEC. If FHS has found a sufficient number of channels, the AHS is automatically enabled for subsequent communication. If no channel of the hopset provides decent quality, only the best channel is picked for communication at the cost of transmission security (reduced hopset). As soon as another destination address is selected or a R&S RNMS3000 configurable time has expired, the AHS is deactivated.

NOTICE

R&S EK4100 Systems cannot improve communication quality by means of FHS.

4.5.2 Preset Page SCH (SECOM-H)

Figure 4.27 Preset Page SCH (SECOM-H)



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1 See sect. 4.5.3 Settings in the Menu OP (SECOM-H OP, Operation)
2 See sect. 5.4.2 Settings in Menu Message Service (M)
3 See sect. 5.2.2.1 Display of the Own GPS Position
4 See sect. 4.5.4 Settings in the Menu SC (SECOM-H CFG, Configuration)
5 See sect. 5.3.3 Settings in Menu IP OVER AIR (IP)
6 See sect. 3.5 Login
7 See sect. 6.2.6 Settings in Menu OP (BITE, Operation)
8 See sect. 3.7.2 Settings in Menu VER (CONFIG, Inquiring the Software Version)
9 See sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters)
10 See sect. 3.7 Configuration
11 See sect. 3.7.3 Settings in Menu DT (DOWNLOAD, Loading Pre-configured Radio Parameters)
12 Not relevant in this application.
13 This function is described in the service documentation.

4.5.3 Settings in the Menu OP (SECOM-H OP, Operation)

NOTICE

Rebroadcast with different search pattern: If different search patterns are adjusted on the two sides of the rebroadcast station, errors occur in connections from lower to higher search pattern side, for example SP16 → SP48. Data is lost for the first seconds of the transmission or failures with the coded audio occur, i.e. only the first three seconds of the transmission are audible, then the signal switches to vocoder jam.

Relay and rebroadcast operation only works properly if the receiving and the transmitting radios use the same vocoder and/or the same data rate. The data rate between the relay or rebroadcast stations has to be higher than the vocoder or data rate of the air connections.

If a SECOM-H subgroup or point-to-point connection is configured in RNMS, a change of the vocoder or the data service takes only effect on the subgroup or point-to-point preset page. If only the broadcast preset page is used or on the broadcast preset page the connection is changed to subgroup or point-to-point, the vocoder or data service setting of the broadcast preset page is used.

Starting point:

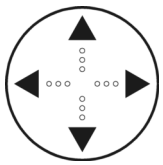
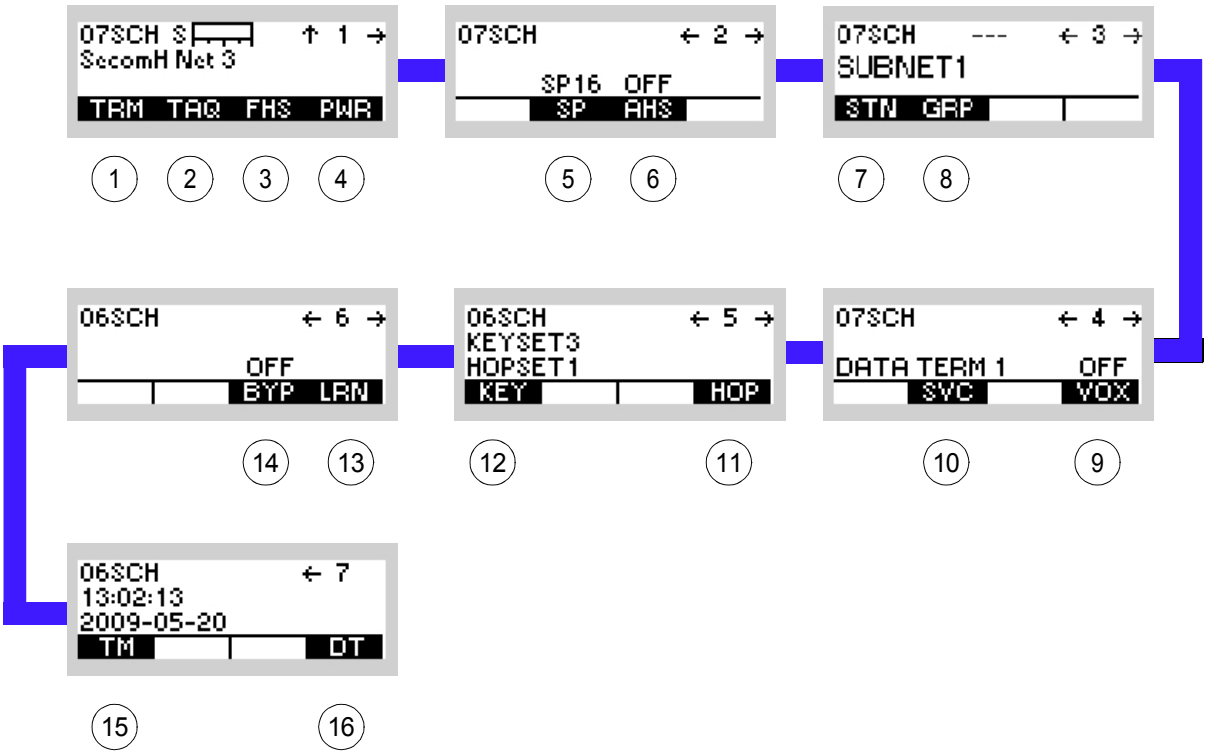
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes, e.g.:
2	0 _ * + to 9 WXYZ	Press any of these keys.	The display changes, e.g.:
3		Press.	Press several times until the desired subordinate menu is activated (see Figure 4.31). The menu structure is explained separately by Figure 4.29. After a delay of approximately 10 seconds, the SECOM-H operational page 1 is automatically reactivated.

Figure 4.28 Menu OP (SECOM-H, Submenus)



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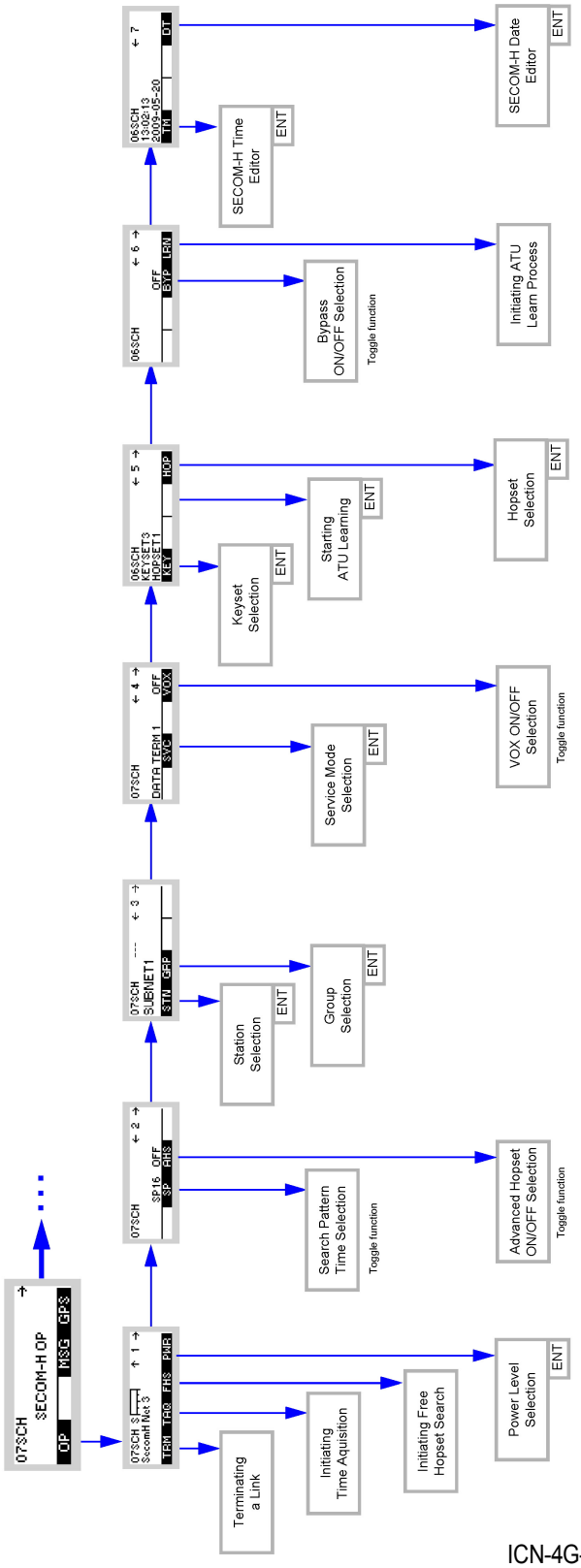
1 See sect. 4.5.3.1 Terminating a Link
2 See sect. 4.5.3.2 Initiating Time Acquisition
3 See sect. 4.5.3.3 Initiating a Free Hopset Search
4 See sect. 4.5.3.4 Changing the Power Level
5 See sect. 4.5.3.5 Changing the Search Pattern Time
6 See sect. 4.5.3.6 Switching the Advanced Hopset On or Off
7 See sect. 4.5.3.7 Addressing Different Link Types
8 See sect. 4.5.3.7 Addressing Different Link Types
9 See sect. 4.5.3.9 Selecting the VOX Function
10 See sect. 4.5.3.8 Selecting the Service Mode
11 See sect. 4.5.3.11 Selecting a Hopset
12 See sect. 4.5.3.10 Selecting a Keyset
13 See sect. 4.5.3.13 Learning of the ATU
14 See sect. 4.5.3.12 Bypassing the ATU
15 See sect. 4.5.3.14 Changing the SECOM-H Time
16 See sect. 4.5.3.15 Changing the SECOM-H Date

Figure 4.29 Menu OP (SECOM-H, Structure)



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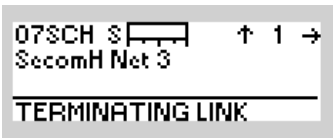
4.5.3.1 Terminating a Link

By means of softkey TRM (Terminate) the operator can terminate the running link.

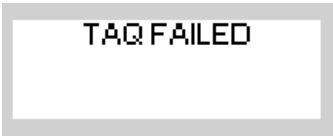
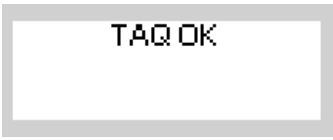
Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (TRM)	Press.	The link is terminated manually. 

4.5.3.2 Initiating Time Acquisition

By means of softkey TAQ (Time Acquisition) the operator can start net time synchronization.

Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	3 DEF (TAQ)	Press.	The display changes: The tactical radio tries to synchronize to the net time. The display changes:  Net time synchronization failed or The display changes:  Net time synchronization OK

- Normally the net time will be adjusted automatically as soon as a communication is taking place.

  Therefore manual net time adjustment as described above will only have to be performed in the case that communication was interrupted for quite a time.

NOTICE

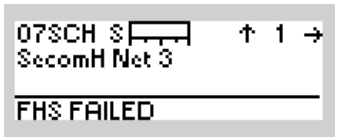
When pressing PTT while the TRU (time reference unit) is answering, the entire acquisition process is aborted.

4.5.3.3 Initiating a Free Hopset Search

By means of softkey FHS (Free Hopset Search) a free hopset search can be initiated if it is enabled in the SECOM-H CFG menu and a single station is addressed.

Starting point: Main page of SECOM-H OP menu

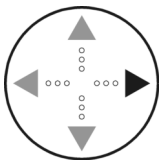
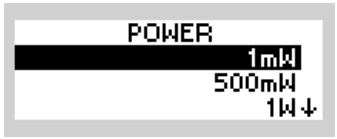
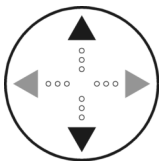
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
4	4 GHI (FHS)	Press.	The display changes:

Step	Control	Action	Note
3	ENT	Press.	The display changes: **NOTICE** **Once running, a FHS cannot be aborted.** The display changes: FHS was successful, the AHS is enabled. or The display changes: 

4.5.3.4 Changing the Power Level

By means of softkey PWR (Power) the operator can change the power level.

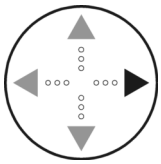
Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	(OP) 2 ABC	Press.	The display changes:
2		Press once.	The display changes:
3	(PWR) 5 JKL	Press.	The display changes: 
4		Press several times until the desired power level is displayed.	Possible values: see sect. 3.2.2.5 Changing the Power Level
5	ENT	Press.	The selection window is closed. The new power level is now effective.

4.5.3.5 Changing the Search Pattern Time

By means of softkey SP (Search Pattern) the operator can change the search pattern time.

Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes:
3	3 DEF (SP)	Press.	Repetitively pressing this key changes the value for SP. Possible values: SP1 → SP2 → SP3 → SP6 → SP16 → SP48 → SP192 The new setting is now effective.

NOTICE

Search Pattern 1 (SP1) reduces the time required for link setup so that the user can start talking sooner or data transmission can begin sooner. SP1 should be selected if synchronization within the SECOM-H net is good, i.e. if the last time acquisition took place not too long ago. Late Traffic Entry (LTE) is only supported up to Search Pattern 3.

- The greater the search pattern, i.e. the tolerable deviation, the longer the time required for link setup.
- The following table shows the search patterns representing the tolerable deviation:

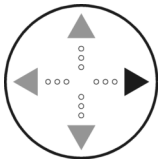
Search pattern	Tolerable deviation
SP1	37.1 ms
SP2	93.333 ms
SP3	149.6 ms
SP6	318.333 ms
SP16	880.8 ms
SP48	2 680.8 ms
SP192	10 780.8 ms

- Net parameter

4.5.3.6 Switching the Advanced Hopset On or Off

By means of softkey AHS (Advanced Hopset) the operator can switch the advanced hopset function on and off.

Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes:
3	4 GHI (AHS)	Press.	Repetitively pressing this key toggles the advanced hopset function on and off. The new setting is now effective.

NOTICE

As long as the AHS is active, it is only possible to communicate with the respective partner station that was addressed when the FHS (see sect. 4.5.3.3 Initiating a Free Hopset Search) was performed.

4.5.3.7 Addressing Different Link Types

The address system of SECOM-H supports two types of links:

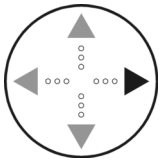
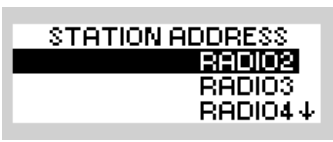
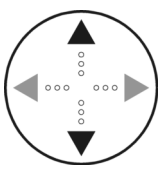
- STN: Link to one particular station (R&S MR300xH) of the network
- GRP: Link to a group of radios (R&S MR300xH) of the network

These different addressing possibilities are described below. Please note that for use within a network all participating units, radios, groups and nets need to be configured by using the R&S RNMS3000 (Radio Network Management System) software.

Addressing a Station

By means of softkey STN (Station) the operator can address a single radio.

Starting point: Main page of SECOM-H OP menu

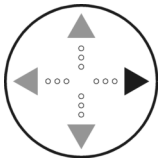
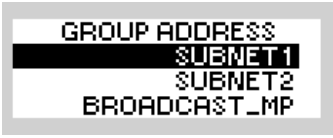
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press twice.	The display changes:
3	2 ABC (STN)	Press.	The display changes: 
4		Press several times until the desired station is displayed.	Possible values (example): RADIO1 to RADIO10

Step	Control	Action	Note
5	ENT	Press.	The selection window is closed. The station is selected for addressing.

Addressing a Group

By means of softkey GRP (Group) the operator can address a group of radios.

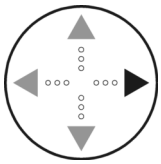
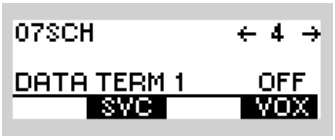
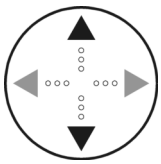
Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press twice.	The display changes:
3	3 DEF (GRP)	Press.	The display changes:  Possible value (example): SUBNET1
4	ENT	Press.	The selection window is closed.

4.5.3.8 Selecting the Service Mode

By means of softkey SVC (Service) the operator can select Voice or Data transmission.

Starting point: Main page of SECOM-H menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press three times.	The display changes: 
3	3 DEF (SVC)	Press.	The display changes:
4		Press to select the desired mode.	Possible values: • INT_VOCODER • DATA_TERM 1 • IP_DATA • IP_REBRO • VOICE_O_DATA • VOICE_O_IPD **NOTICE** **Be aware that changing the service between IP_REBRO and another IP service leads to a change of the Ethernet IP address. Due to this it additionally may become necessary to configure the routes and the gateway address for this preset page accordingly.**

Step	Control	Action	Note
5	ENT	Press.	The selection window is closed. The service mode INT VOCODER is now effective.

The SERVICE function is used to select the transmission mode (Voice or Data).

- INT VOCODER

  Transmission is started by initiating PTT, either via the PTT key (PTT1) or via line (PTT2).

- DATA_TERM_1

  The tactical radio automatically changes to TX mode as soon as data to be transmitted are detected at the RS232 interface (X5, DATA socket).

- IP_DATA

  The radio automatically changes to TX mode as soon as IP data is detected at one of the IP interfaces (Ethernet or PPP via serial interface). With this mode it is possible to connect two wired IP networks via an air IP net.

- IP_REBRO

  This service is used only for relay and rebroadcast stations. This way, it is possible to connect waveform nets (SECOM-H and/or SECOM-V) using the Voice over IP Data service. See sect. 5.3.2.2 Rebroadcast / Relay Mode for more details.

- VOICE_O_DATA

  Voice transmission can be initiated by the PTT key (PTT1) or by the line PTT (PTT2). Data transmission is started when data is detected at the RS-232-C interface (X5, DATA socket) if no voice PTT is active. When a PTT signal is activated during data transmission, the data link is interrupted and a voice link is established to the selected station(s). Voice has priority over data. The called station(s) automatically detects the service type and reacts adequately.

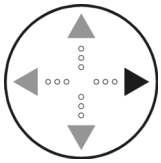
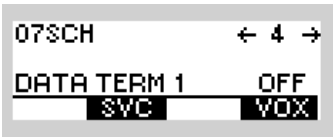
- VOICE_O_IPD

  Voice transmission can be initiated by the PTT key (PTT1) or by the line PTT (PTT2). Data transmission is started when IP data is detected at one of the IP interfaces (Ethernet or PPP via serial interface) if no voice PTT is active. If a PTT signal is activated during data transmission, the data link is interrupted and a voice link is established to the selected station(s). Voice has priority over data. The called station(s) automatically detects the service type and reacts adequately.

4.5.3.9 Selecting the VOX Function

By means of softkey VOX (Voice-Operated Transmission) the operator can select the VOX function.

Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press three times.	The display changes: 
3	5 JKL (VOX)	Press.	Repetitively pressing this key changes the VOX function. Possible settings: • OFF • LIN = Line • VOI = Voice The new setting is now effective.

- If VOX is set to VOI (Voice), the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

  VOX = VOI can only be used when a Headset R&S GA3002 is connected.
- If VOX set to LINE, the transmit mode is activated as soon as a voice signal at connector X5 is detected.
- If PTT is pressed when VOX is enabled, transmission is triggered even if no audio signal is present.
- To avoid coupling between receive and transmit audio lines the VOX function shall be only activated when squelch function is also enabled. If squelch is disabled, the VOX function shall not be activated.

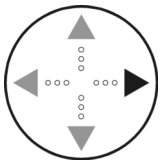
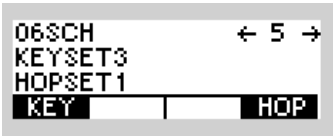
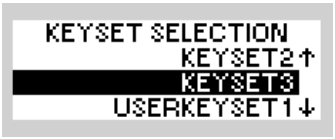
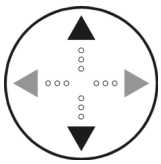
NOTICE

For VOX operation in SECOM-H a certain reaction delay is to be observed. Wait with transmission until a short sequence of beeps is heard. Otherwise no communication will take place.

4.5.3.10 Selecting a Keyset

By means of softkey KEY (Keyset) the operator can select a keyset.

Starting point: Main page of SECOM-H OP menu

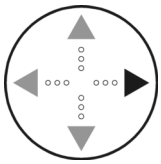
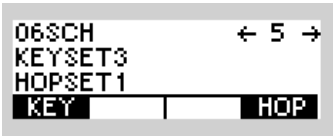
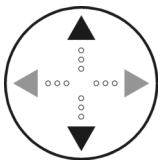
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press four times.	The display changes: 
3	2 ABC (KEY)	Press.	The display changes: 
4		Press several times until the desired keyset is displayed.	Possible values (example): Keyset 3 User Keyset 1 to User Keyset 5
5	ENT	Press.	The selection window is closed. The new keyset is now effective.

- Net parameter

4.5.3.11 Selecting a Hopset

By means of softkey HOP (Hopset) the operator can select a hopset.

Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press four times.	The display changes: 
3	5 JKL (HOP)	Press.	The display changes:
4		Press several times until the desired hopset is displayed.	Possible values (example): Hopset 1, Hopset 3 to Hopset 4 USERHOPSET 1 to USERHOPSET 4
5	ENT	Press.	The selection window is closed. The new hopset is now effective.

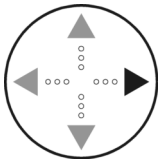
- In the hopset frequency ranges are defined for frequency hopping.

  Hopsets have to be configured using the R&S RNMS3000. User Hopsets (see sect. 4.5.4.2 Editing a User Hopset) are configured using the MMI.

4.5.3.12 Bypassing the ATU

By means of softkey BYP (Bypass) the operator can bypass the ATU. This results in a longer life cycle of the ATU relays, but will degrade reception performance.

Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press five times.	The display changes:
3	4 GHI (BYP)	Press.	Repetitively pressing this key toggles the bypass function on and off.

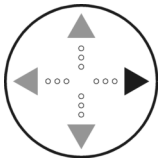
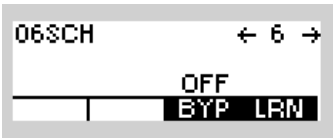
4.5.3.13 Learning of the ATU

NOTICE

If an R&S HX3000 Antenna is connected, hopsets must not contain frequencies lower than 1.6 MHz, otherwise ATU-LEARN will fail.

By means of softkey LRN (Learn) the operator can start ATU learning for the currently selected hopset.

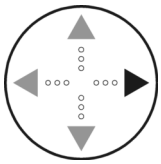
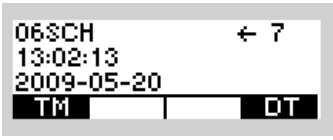
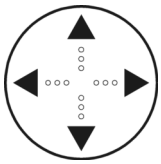
Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press five times.	The display changes:
3	5 JKL (LRN)	Press.	The display changes: After a few seconds the display changes: 

4.5.3.14 Changing the SECOM-H Time

By means of softkey TM (Time) the operator can change the SECOM-H net time.

Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press five times.	The display changes: 
3	2 ABC (TM)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new time. Change time selectively.	Format: hh:mm:ss Range: hh: 00 to 23 mm: 00 to 59 ss: 00 to 59
5	ENT	Press.	The selection window is closed. The new time is now effective.

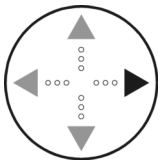
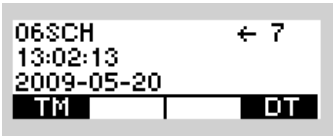
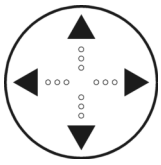
NOTICE

Once the internal net time has been changed, no SECOM-H operation is possible until a time acquisition has been initiated to re-acquire the net time.

4.5.3.15 Changing the SECOM-H Date

By means of softkey DT (Date) the operator can change the SECOM-H net date.

Starting point: Main page of SECOM-H OP menu

Step	Control	Action	Note
1	2 ABC	Press.	The display changes:
2		Press six times.	The display changes: 
3	5 JKL	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new date. Change date selectively.	Format: yyyy-mm-dd Range: yyyy: 1970 to 2099 mm: 01 to 12 dd: 01 to 31
5	ENT	Press.	The selection window is closed. The new date is now effective.

- The DT (Date) softkey is used to set the ultimate SECOM-H net date. All radios in the network need to be set to the same date.

4.5.4 Settings in the Menu SC (SECOM-H CFG, Configuration)

Starting point:

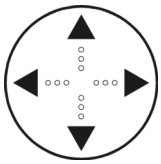
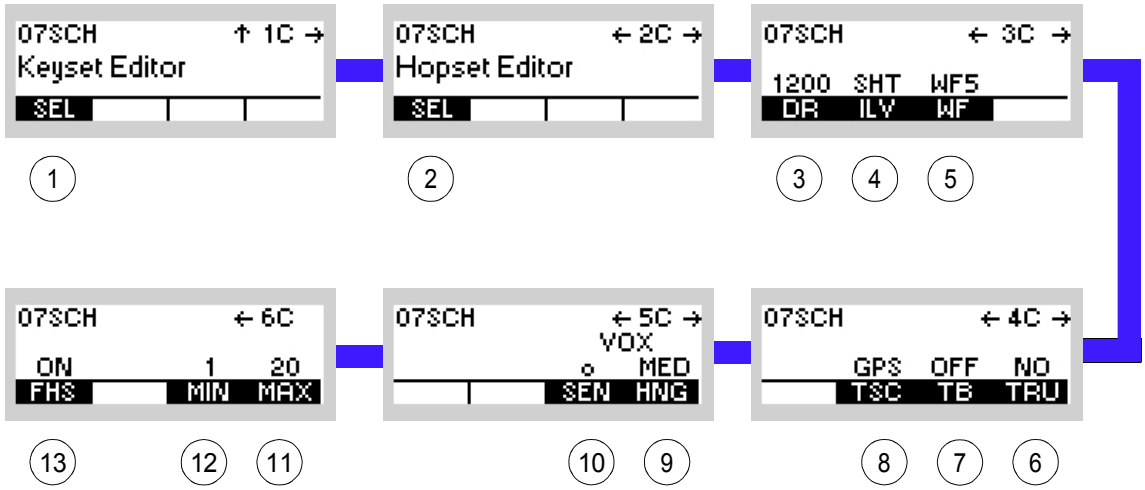
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired subordinate menu is activated (see Figure 4.33).

Figure 4.30 Menu SC (SECOM-H, Submenus)



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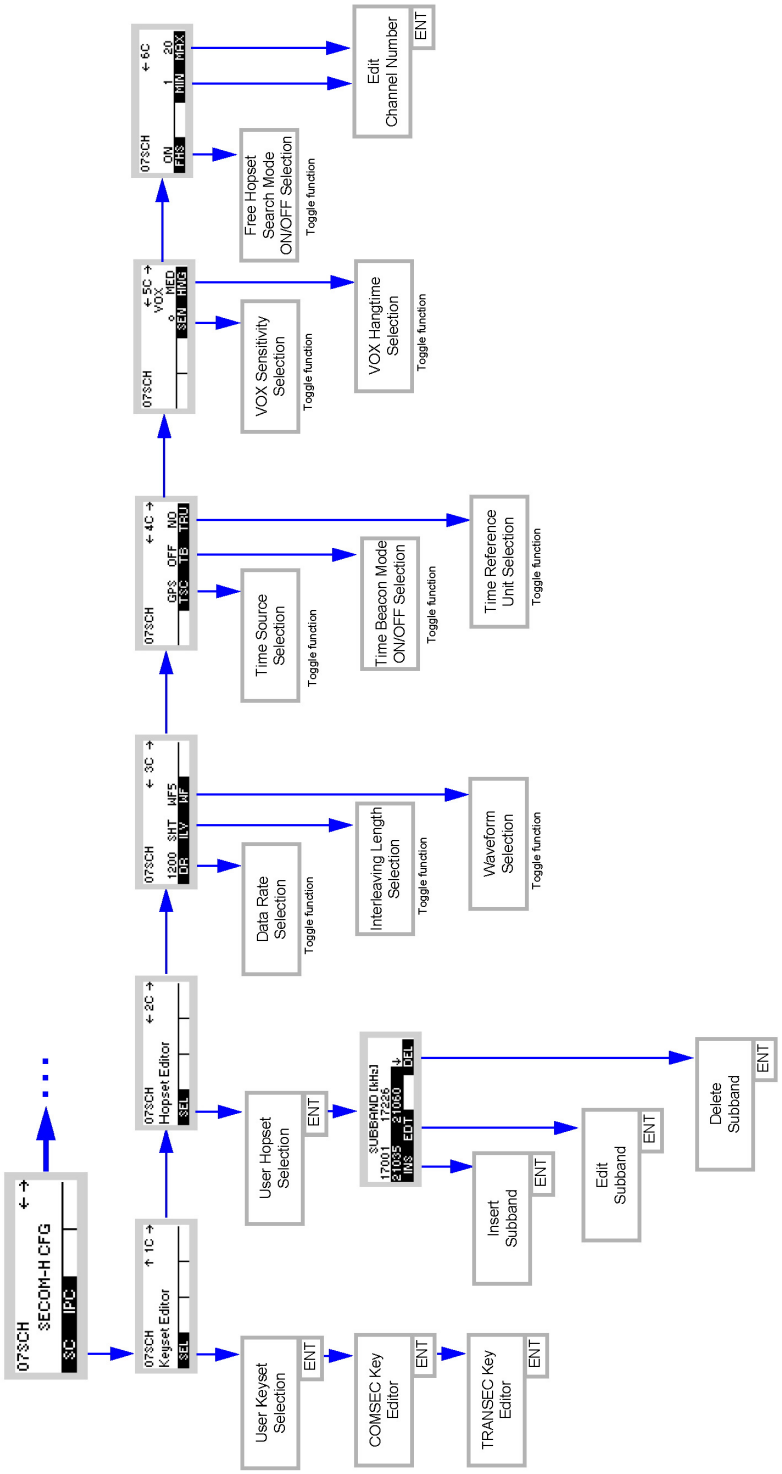
1 See sect. 4.5.4.1 Editing a User Keyset
2 See sect. 4.5.4.2 Editing a User Hopset
3 See sect. 4.5.4.3 Changing the Data Rate for SECOM-H Transmission
4 See sect. 4.5.4.4 Changing the Interleaver Length
5 See sect. 4.5.4.5 Changing the Waveform
6 See sect. 4.5.4.8 Defining a Radio as a Time Reference Unit
7 See sect. 4.5.4.7 Switching the Time Beacon Mode On or Off
8 See sect. 4.5.4.6 Selecting the Time Source
9 See sect. 4.5.4.10 Changing the VOX Hangtime
10 See sect. 4.5.4.9 Changing the VOX Sensitivity
11 See sect. 4.5.4.12 Changing the Number of Channels in an Advanced Hopset
12 See sect. 4.5.4.12 Changing the Number of Channels in an Advanced Hopset
13 See sect. 4.5.4.11 Switching the Free Hopset Search Mode On or Off

Figure 4.31 Menu SC (SECOM-H, Structure)



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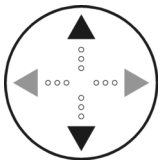
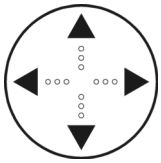
4.5.4.1 Editing a User Keyset

By means of softkey SEL (Selection) the operator can edit a user keyset for TRANSEC and COMSEC.

Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2	2 ABC (SEL)	Press.	The display changes:
3		Press to select the desired keyset.	Possible values: USERKEYSET1 to USERKEYSET5
4	ENT	Press.	The display changes:

Step	Control	Action	Note
5	0 _ * + to 9 WXYZ or 	Press several times until the character is displayed.	The key must contain between 8 and 32 characters. For the COMSEC key any alphanumerical characters are allowed. • letters "A" to "Z" and "a" to "z" • numerals "1" to "0" • characters, for example: !, ", #, $, %
6	ENT	Press.	The COMSEC selection window is closed. The display changes:
7			If required, change the TRANSEC key as described in step 5.
8	ENT	Press.	The TRANSEC selection window is closed.

NOTICE

When editing the currently active user keyset, the changes will take effect immediately. Otherwise the new settings will take effect only when the relevant user keyset is selected.

The SEL (Selection) softkey is used to edit any existing user keyset. All radios in a SECOM-H network must have this user keyset.

4.5.4.2 Editing a User Hopset

A user hopset, which may consist of several subbands and single frequencies, can be edited in several ways. Frequencies can be inserted, edited or deleted, or a completely new hopset may be defined. The following applies to all procedures:

NOTICE

When editing the currently active user hopset, the changes will take effect immediately. Otherwise the new settings will take effect only when the relevant user hopset is selected.

The hopset range is from 1.5 to 29.975 MHz. The frequency spacing in a hopset is configurable via R&S RNMS3000, with a default value of 25 kHz and a minimum of 10 Hz. Via the MMI the frequency spacing in a hopset cannot be changed and is fixed to 5 kHz.

NOTICE

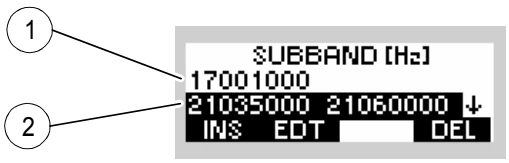
This frequency band must not overlap already existing frequency bands.

Invalid entries are automatically changed to the next possible value. This is indicated in the display, showing the current value that has been applied (e.g. APP 30000.00 kHz, APP = approve).

All radios in a SECOM-H network must have this user hopset.

Example (see Figure 4.32):

Figure 4.32 Hopset Editor



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1 Single frequency
2 Hopset frequency band

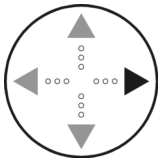
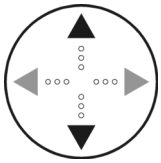
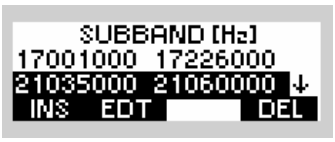
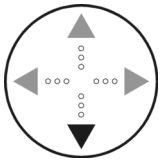
Defining a New Hopset

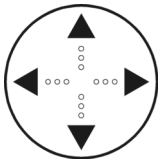
To define a new hopset, select the required hopset, delete any subbands and single frequencies, which may already be contained, acc. to ”Deleting a User Hopset Subband” on p. 4.303 and enter the new frequencies acc. to ”Inserting a User Hopset Subband” on p. 4.296.

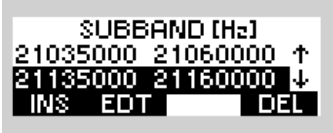
Inserting a User Hopset Subband

By means of softkeys SEL/INS (Select/Insert) the operator can insert a user hopset subband.

Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (SEL)	Press.	The display changes:
4		Press several times until the desired hopset is displayed.	Possible values (example): USERHOPSET1 to USERHOPSET5
5	ENT	Press.	The display changes: 
6		Press several times until a blank line appears in the display.	The display changes:

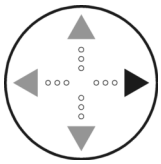
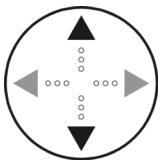
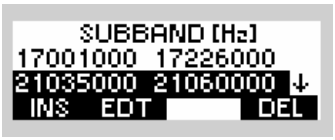
Step	Control	Action	Note
7	2 ABC (INS)	Press.	The display changes: EDIT LOWER FREQ 21060.001 kHz The suggested value is the value of the higher frequency defined for the last subband plus 1Hz.
8	0 _ * + to 9 WXYZ or 	Enter a new lower frequency. Change lower frequency selectively.	The display changes: EDIT LOWER FREQ 21135. kHz Range: 21060.001 kHz to 29995.001 kHz **NOTICE** **This frequency must not overlap already existing frequency bands.**
9	ENT	Press.	The display changes: EDIT HIGHER FREQ 21135.000 kHz
10		Enter a new higher frequency as described in step 8.	The display changes: EDIT HIGHER FREQ 21160. kHz The suggested value is the entered value for the lower frequency. If the higher frequency has the same value as the lower frequency, this subband will be composed of a single frequency. **NOTICE** **Step: 5 kHz (via MMI), configurable with the R&S RNMS3000.** **NOTICE** **The maximum number of frequencies in a hopset is 1024. If the operator tries to define a hopset with more than 1024 frequencies, this hopset will be rejected.**

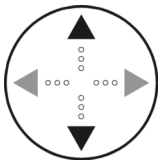
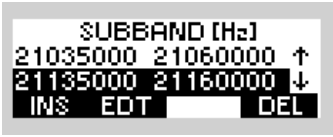
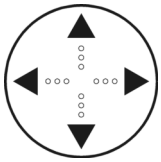
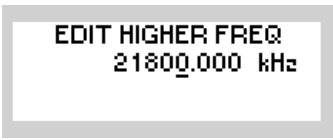
Step	Control	Action	Note
11	ENT	Press.	The display changes: 
12	ENT	Press.	The display changes: The new sub-band is now effective. After a short delay the display changes:

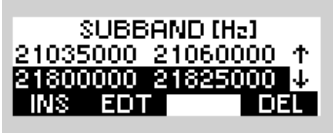
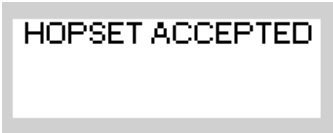
Editing a User Hopset Subband

By means of softkey SEL/EDT (Select/Edit) the operator can edit a user hopset subband.

Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (SEL)	Press.	The display changes:
4		Press several times until the desired hopset is displayed.	Possible values (example): USERHOPSET1 to USERHOPSET5
5	ENT	Press.	The display changes: 

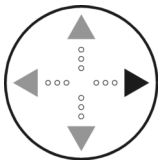
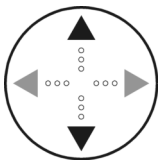
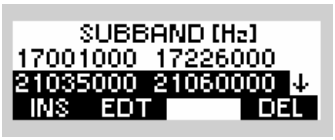
Step	Control	Action	Note
6		Press several times until the desired sub-band is displayed.	The display changes: 
7	3 DEF (EDT)	Press.	The display changes:
8	0 _*+ to 9 WXYZ or 	Enter a new lower frequency Change lower frequency selectively.	The display changes: Range: 21135.000 kHz to 29995.001 kHz **NOTICE** **This frequency must not overlap already existing frequency bands.**
9	ENT	Press.	The display changes: 
10		Enter a new higher frequency as described in step 8.	The display changes: The suggested value is the entered value for the lower frequency. If the higher frequency has the same value as the lower frequency, this subband will be composed of a single frequency. **NOTICE** **Step: 5 kHz (via MMI), configurable with the R&S RNMS3000.**

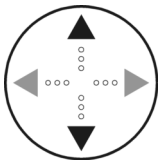
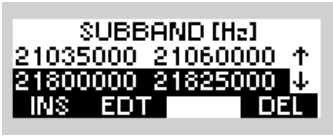
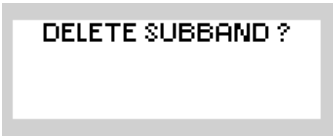
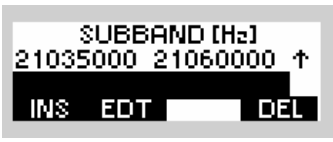
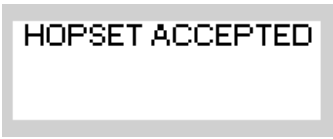
Step	Control	Action	Note
			NOTICE **The maximum number of frequencies in a hopset is 1024. If the operator tries to define a hopset with more than 1024 frequencies, this hopset will be rejected.**
11	ENT	Press.	The display changes: 
12	ENT	Press.	The display changes:  The new sub-band is now effective. After a short delay the display changes:

Deleting a User Hopset Subband

By means of softkeys SEL/DEL (Select/Delete) the operator can delete a user hopset subband.

Starting point: Main page of SECOM-H CFG menu

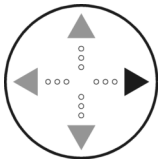
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (SEL)	Press several times until the desired hopset is displayed.	The display changes:
4		Press several times until the desired hopset is displayed.	Possible values (example): USERHOPSET1 to USERHOPSET5
5	ENT	Press.	The display changes: 

Step	Control	Action	Note
6		Press several times until the desired sub-band is displayed.	The display changes: 
7	5 JKL (DEL)	Press.	The display changes: 
8	ENT	Press.	The display changes: 
9	ENT	Press.	The display changes:  The new sub-band is now effective. After a short delay the display changes:

4.5.4.3 Changing the Data Rate for SECOM-H Transmission

By means of softkey DR (Data Rate) the operator can change the data rate for SECOM-H transmission.

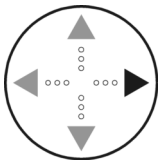
Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press twice.	The display changes:
3	2 ABC (DR)	Repetitively pressing this key changes the data rate.	Possible values for WF1: 75 - 150 - 300 - 600 Possible values for WF2: 300 - 600 - 1200 Possible values for WF3: 1200 Possible values for WF5: 1200 - 2400 The new setting is now effective.

4.5.4.4 Changing the Interleaver Length

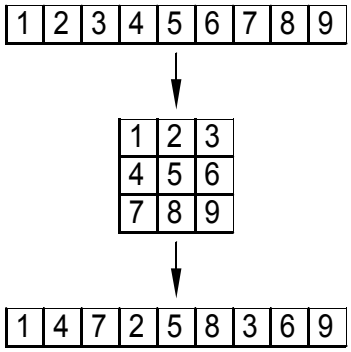
By means of softkey ILV (Interleaver) the operator can change the interleaver length.

Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press twice.	The display changes:
3	3 DEF (ILV)	Repetitively pressing this key changes the interleaving length.	Possible values: • NO • SHT (short) • MDL (middle) • LNG (long) The new setting is now effective.

Through the interleaver function, the data within the data block are rearranged. The extent of rearrangement is defined by the time factor short, middle or long. Rearrangement improves the error correction capability.

Figure 4.33 Data Flow with Interleaving



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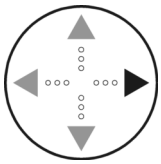
4.5.4.5 Changing the Waveform

By means of softkey WF (Waveform) the operator can change the waveform.

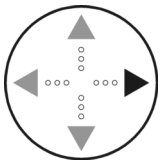
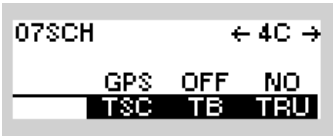
Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press twice.	The display changes:
3	4 GHI (WF)	Repetitively pressing this key changes the waveform.	Possible values: • WF1 • WF2 • WF3 • WF5 The new setting is now effective.

4.5.4.6 Selecting the Time Source

By means of softkey TSC (Time Source) the operator can select the time source.

Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (AC)	Press.	The display changes:
2		Press three times.	The display changes: 
3	3 DEF (TSC)	Press.	Repetitively pressing this key toggles between RTC and GPS.

4.5.4.7 Switching the Time Beacon Mode On or Off

If Time Beacon is enabled, the radio will go to TX mode from time to time:

- Non-TRU radios automatically request net synchronization from the TRU when necessary.
- The TRU radio automatically transmits synchronization information when necessary or requested.

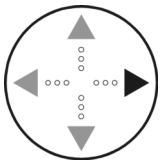
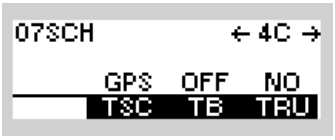
If this is not desired, turn Time Beacon OFF.

NOTICE

Be sure to perform at least one TAQ manually after activation of Time Beacon functionality. Time Beacon function will only work if it is enabled at least at the TRU. For optimal performance, the TRU has to be operated in broadcast mode. Otherwise, re-synchronization may be requested more often than actually necessary.

By means of softkey TB (Time Beacon) the operator can switch the time beacon mode on or off.

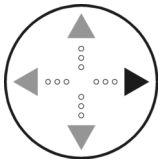
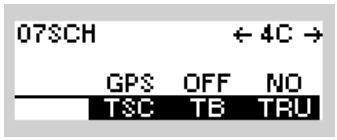
Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press three times.	The display changes: 
3	4 GHI (TB)	Press.	Repetitively pressing this key toggles the time beacon mode on and off.

4.5.4.8 Defining a Radio as a Time Reference Unit

By means of softkey TRU (Time Reference Unit) the operator can define the radio as time reference unit.

Starting point: Main page of SECOM-H CFG menu

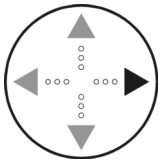
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press three times.	The display changes: 
3	5 JKL (TRU)	Repetitively pressing this key defines the kind of time reference unit.	Possible settings: • NO • PTRU The new setting is now effective.

- As soon as time acquisition has been initiated by radios, the radio defined as Primary Time Reference Unit (PTRU) provides the other radios with the current net time.
- Only one radio is allowed to be primary time reference unit.

4.5.4.9 Changing the VOX Sensitivity

By means of softkey SEN (Sensitivity) the operator can change the sensitivity for the function VOX. When VOX is selected, the sensitivity will become automatically activated.

Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press four times	The display changes:
3	4 GHI (SEN)	Repetitively pressing this key toggles between five sensitivity levels.	Possible settings: -- very low - low o medium + high ++ very high

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface. If VOX is on, the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

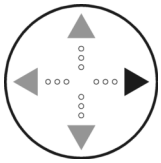
  Softkey SEN is used to change the VOX sensitivity in five steps, provided that VOX is on.

- Default: medium

4.5.4.10 Changing the VOX Hangtime

By means of softkey HNG (Hang) the operator can change the holdtime for the function VOX. When VOX is selected, the holdtime will be automatically activated.

Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press four times.	The display changes:
3	5 JKL (HNG)	Repetitively pressing this key toggles between three hold times.	Possible settings: SHT short MED medium LNG long

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface. If VOX is on, the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

  The transmitter is keyed as long as a voice signal is present. When the voice stops the tactical radio will return to receive mode (RX) only after the holdtime has elapsed.

  The settings SHT, MED, LNG represent the following values:

  Short: 300 ms

  Medium: 600 ms

  Long: 900 ms

- Default: medium

4.5.4.11 Switching the Free Hopset Search Mode On or Off

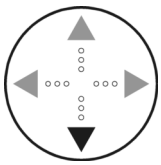
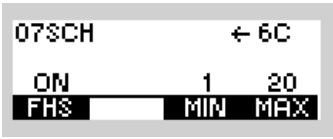
If Free Hopset Search (FHS) is enabled, the radio offers FHS for PtP (Point-to-Point) links and responds to an FHS when requested.

NOTICE

If FHS is successful, the resulting Advanced Hopset (AHS) is automatically enabled for subsequent communication. This implies that communication on the default hopset may only be possible after manually disabling the AHS.

By means of softkey FHS (Free Hopset Search Mode) the operator can switch the free hopset search mode on or off.

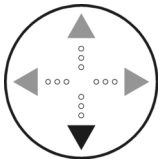
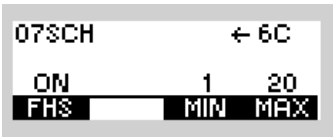
Starting point: Main page of SECOM-H CFG menu

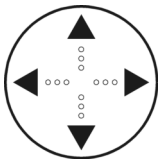
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once.	The display changes: 
3	2 ABC (FHS)	Press.	Repetitively pressing this key toggles the FHS mode on and off.

4.5.4.12 Changing the Number of Channels in an Advanced Hopset

By means of softkeys MIN (Minimum) or MAX (Maximum) the operator can change the number of channels in an advanced hopset.

Starting point: Main page of SECOM-H CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once.	The display changes: 
3	5 JKL (MAX) or 4 GHI (MIN)	Press.	The display changes:

Step	Control	Action	Note
4	0 _ * + to 9 WXYZ or 	Enter the relevant number. Change channel number selectively.	Range: 1 to 20
5	ENT	Press.	If the entered number is within the permitted entry range, the editor window will be closed.

4.5.5 Settings in Menu CFG (CONFIG, Global Radio Parameters)

The following SECOM parameters can be adjusted:

- Vocoder type and data rate
- Data Terminal 1 settings
- IP Port

Please refer to sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters).

4.6 SECOM-P

4.6.1 Basics of SECOM-P

A SECOM-P net is a system for voice and data communication in the VHF range which is protected by COMSEC (Communication Security) and TRANSEC (Transmission Security) procedures. It is configurable in many parameters. The configuration and net management for a SECOM-P communication system must be supported by a Radio Network Management System (RNMS).

The features of the SECOM-P system are grouped as follows:

- Communication features
- Synchronization features
- Security features
- Configuration features

4.6.1.1 COMSEC and TRANSEC

Communication Security (COMSEC) for user and technical data is provided by ciphering before transmission and deciphering after reception:

- Ciphered data transmission at 2 400, 4 800 and 7 100 bit/s
- Ciphered digital voice transmission with CVSD (Continuously Variable Slope Delta) vocoder at 16 000 bit/s

For ciphering/deciphering the transmitted data or digital voice a COMSEC key is used.

Transmission Security (TRANSEC) is provided by frequency hopping. The frequency range is from 30 MHz to 87.975 MHz. The hopping frequencies are stored in so-called hopsets. The minimum frequency increment in hopsets is 25 kHz. The frequency to be used for a hop is selected pseudo-randomly by the crypto algorithm, controlled by the TRANSEC key and a dynamic (time depending) counter system. The crypto algorithm can be made customer-specific.

TRANSEC keys are used for controlling TRANSEC e.g. for selection of the sequence of frequencies from the hopset.

COMSEC keys are used for ciphering the data to be transmitted (encrypting the useful data of a hop).

One keyset consists of a pair of COMSEC and TRANSEC keys. These keysets and the crypto algorithm must be identical at all the radios that want to communicate with each other.

The keysets need to be configured by using the RNMS (Radio Network Management System) software.

SECOM-P supports the following hopping modes:

- FH (Frequency Hop Mode): SECOM-P uses all available frequencies from the hopset.
- DFF (Digital Fixed Frequency): In this mode the hopset is reduced to one predefined frequency.
- FCS (Free Channel Search): In this mode, a free unjammed frequency (out of the hopset) is detected and selected for transmission of the data.
- MIX: Mix is a combination of FH and FCS - if more than a certain (configurable) percentage of the scanned frequencies (max. 48 frequencies per scan) are unjammed, FH is chosen, else FCS is chosen.

4.6.1.2 Linking

SECOM-P is a link-oriented communication system, using physical and logical links.

A physical link exists if at least two radios are able and prepared to receive one another. This means the participating units must be synchronized. So in general a logical link setup is required to establish a link. During this link setup, SECOM-P provides for synchronization with the other participating units and transmits address and service information.

A logical link exists if one participating unit is transmitting and one or more other participating units are receiving this communication.

Search is the default mode of SECOM-P. In search mode SECOM-P is searching for an incoming SECOM-P call or for a service transmission. If an incoming SECOM-P call has been detected, an automatic synchronization takes place and a logical link to the calling participating unit will be established.

Simultaneous transmission and reception is not supported by SECOM-P.

As far as addressing is concerned, there are two types of links:

- Point-to-point (selective communication) link: exactly 2 radios can communicate using this link type.

  Only the master station can perform a point-to-point link setup calling one dedicated (addressed) slave. The master station commands the slave to perform the link setup on a shifted hopset. Hence, other stations cannot hear or interfere with the point-to-point link. On the other hand, 2 radios taking part in a private point-to-point communication cannot take part in concurrent broadcast calls. Once the point-to-point link has been terminated ("hangup"), master and slave are free again to initiate or receive broadcast calls.

  A selective communication link is terminated after approx. 30 s of idle time.
- Broadcast link: all radios of a net can communicate with each other (except master and one slave already executing a point-to-point link).

4.6.1.3 SECOM-P Net

A SECOM-P net is a logical structure for setting up a communication network. It consists of a set of R&S M3TR or R&S MR3000P radios with assigned:

- Hopsets
- Net address (net ID) and radio addresses (user ID)
- Necessary radio / SECOM-P parameters
- Keys for TRANSEC and COMSEC

All radios operating in one SECOM-P net must have the same

- Synchronized network time
- Hopset (TRANSEC)
- Keyset (COMSEC)
- Net address (net ID as unique address of each SECOM-P net)
- Crypto algorithm in order to be able to communicate with each other

4.6.1.4 Net Entry

To ensure that all participating radios are synchronized in a SECOM-P net, they all need to be adjusted to exactly the same network time. A Net Entry (NE) is the procedure to inquire the current net time from the master unit (in SECOM-P, the master unit is called Network Control Station = NCS while in SECOM-H/V the master unit is called Time Reference Unit = TRU).

- Application: Figure 4.34

  As soon as a Net Entry request has been initiated by one Radio 2, 3 or 4 (acting as slaves) it becomes visible on the MMI of Radio 1 (acting as master). If the operator of Radio 1 accepts the NE request, Radio 1 provides Radio 2, Radio 3 and Radio 4 with the current net time.
- The NE request needs only to be initiated by one of these radios (2, 3, or 4) – the other radios obtain the net entry time passively (without requesting it).
- Radios 2 to 4 must not be defined as master unit (there is only one master unit in the net).

SECOM-P uses three clocks: a foreground clock, a background clock and a backup clock.

The foreground clock holding the link time is used for tracking and for all operating modes. The background clock runs independently of the mode of operation. It is mainly used to restore the foreground clock and it controls the TRANSEC and COMSEC calculation.

The backup clock is a special hardware device that stores the time in case of power-down.

The time accuracy of the foreground and the background clock is 0.5 ppm, the time accuracy of the backup clock is 7.5 ppm.

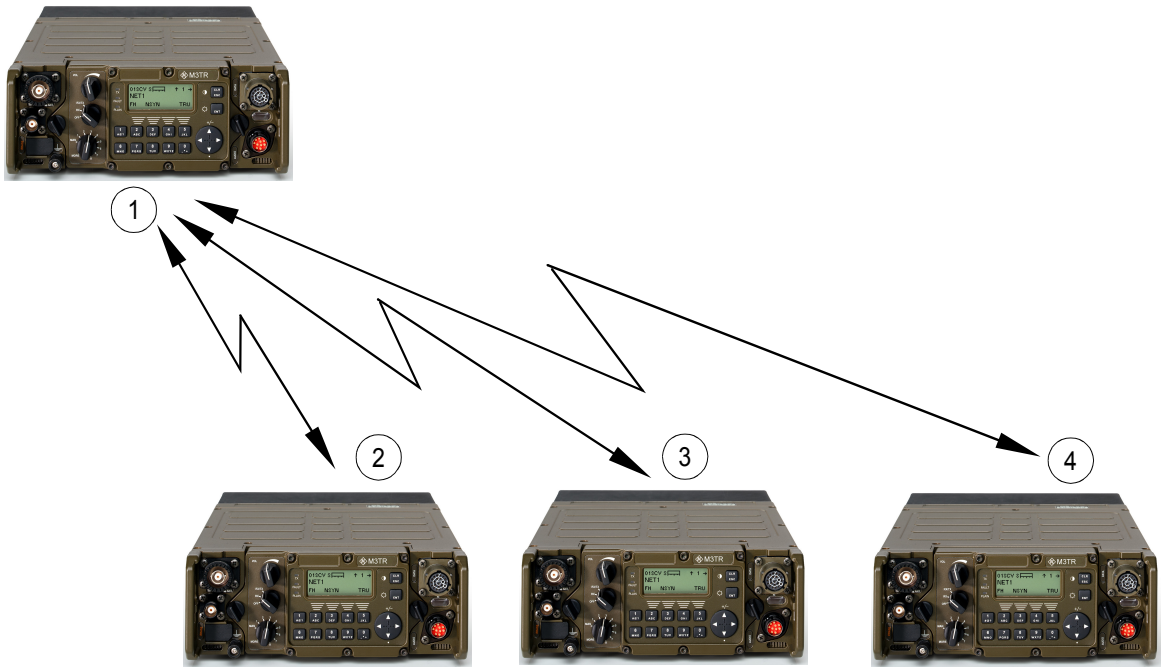
The synchronization of a radio expires after 52 hours of radio silence (if no transmission of voice / data / service / or sync occurred in the net – excluding selective communication – assuming the power-on vs. power-off time ratio is 1:1 or better).

Only those radios that are still synchronous with the network can take part in a SECOM-P communication. Any radio transmitting user data or voice is also transmitting Late Traffic Entry (LTE) information on the traffic frequencies.

This LTE information is used by a receiver for link detection (implicit link setup), for re-connection if the link is lost and for tracking during data reception.

Each net uses a different clock. Time synchronization (NE) must be performed separately in each net.

Figure 4.34 Application: Net Entry Call



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1 RADIO1 defined as Network Control Station
2 RADIO2 (NE requesting devices / slaves)
3 RADIO3 (NE requesting devices / slaves)
4 RADIO4 (NE requesting devices / slaves)

4.6.1.5 Late Net Entry

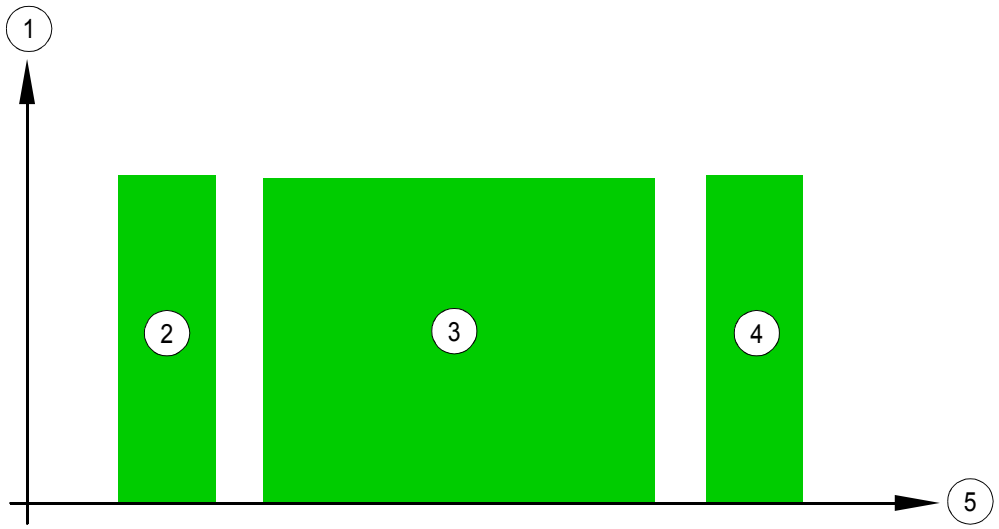
In Net Entry, 24 special frequencies are defined for broadcasting Net Entry information (Example: Figure 4.35) from the master unit.

These 24 NE frequencies (separated from the main hopset) are used to synchronize all slaves participating in the SECOM-P network.

Net Entry synchronization information is broadcast to all slaves (e.g. when starting the network) when the master operator presses the SYN button on his MMI.

In contrast, Late Net Entry (LNE) is a user-initiated, active method for the time acquisition. LNE works with a second set of 24 special frequencies used to transmit Late Net Entry request information from a slave to the master unit. The requesting slave unit sends a Net Entry request to the master on this second set of frequencies. The master unit sends back the Net Entry response on the first set of 24 frequencies.

Figure 4.35 Example: Net Entry Frequencies



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1. Amplitude
2. Range of 24 Net Entry frequencies used by the master unit to broadcast NE information
3. Broad range of N hopset frequencies ($4 \leq N \leq 2320$)
4. Range of 24 Late Net Entry frequencies used by the slave unit to request NE information
5. Frequency

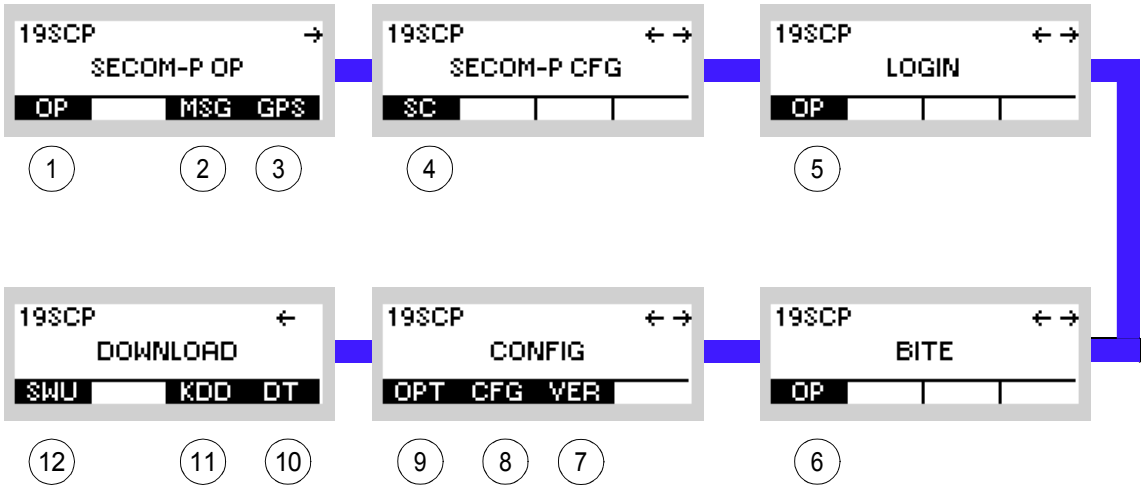
4.6.1.6 Hailing

Three designated hailing frequencies can be used by a fixed frequency radio to call the radios in the SECOM-P net. The net hailing frequency is used to call the radios of a particular net. If further nets are to be included in the call, the general hailing frequency is used. The airborne hailing frequency is used to indicate activity on an airborne channel.

The hailing call is always a fixed frequency call. When such a call is received by a SECOM-P enabled radio, a message will be indicated on the display. Hence, the operator can decide to switch to FF operation in order to take part in the communication.

4.6.2 Preset Page SCP (SECOM-P)

Figure 4.36 Preset Page SCP (SECOM-P)



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1 See sect. 4.6.3 Settings in the Menu OP (SECOM-P OP, Operation)
2 See sect. 5.4.2 Settings in Menu Message Service (M)
3 See sect. 5.2.2.1 Display of the Own GPS Position
4 See sect. 4.6.4 Settings in Menu SC (SECOM-P CFG, Configuration)
5 See sect. 3.5 Login
6 See sect. 6.2.6 Settings in Menu OP (BITE, Operation)
7 See sect. 3.7.2 Settings in Menu VER (CONFIG, Inquiring the Software Version)
8 See sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters)
9 See sect. 3.3.3.11 Changing the Channel Spacing
10 See sect. 3.7.3 Settings in Menu DT (DOWNLOAD, Loading Pre-configured Radio Parameters)
11 Not relevant in this application.
12 This function is described in the service documentation.

4.6.3 Settings in the Menu OP (SECOM-P OP, Operation)

Starting point:

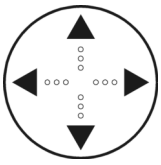
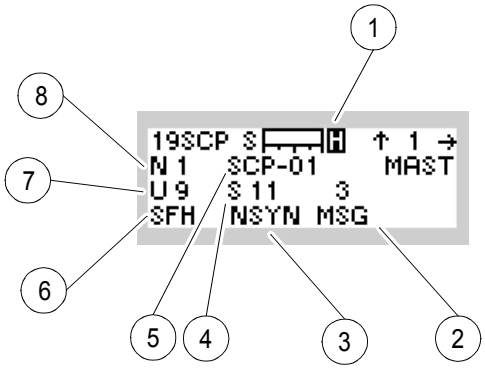
Step	Control	Action	Note
1	(OP) 2 ABC	Press.	The display changes, e.g.: **NOTICE** **For further information see Figure 4.40.**
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes, e.g.:
3		Press.	Press several times until the desired submenu is activated (see Figure 4.38). The complete menu structure is shown in Figure 4.39. After a delay of approximately 10 seconds, the SECOM-P operational page 1 is automatically reactivated. If ESC is pressed, the display in the lower status line changes, it now shows the active scan group and the precision of the clock.

Figure 4.37 SECOM-P Operational Page 1



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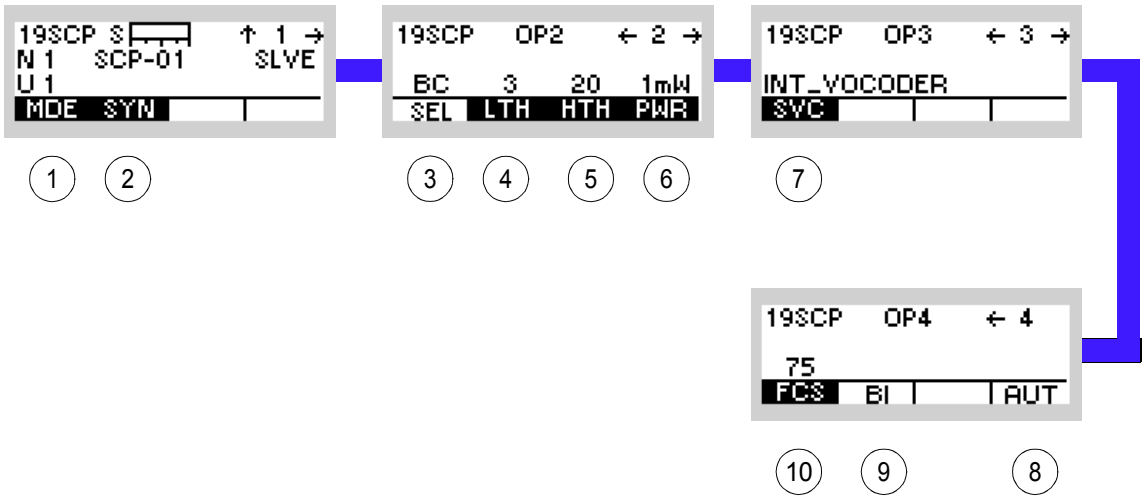
1 Selected Power Management Mode
blank: sleep mode
H: High
L: Low (economy)
2 Received Messages
blank: no message
NEW MSG: one or more new messages
3 MSG: e.g. three viewed messages in the list
3 Synchronization Status
NSYN: press softkey SYN
SYN: ok
4 Link Type
blank: broadcast link
S 11: e.g. SELCOM link with slave 11
5 Name of Service (configured via R&S RNMS)
6 Hopping Mode (COMSEC inactive)
FH: frequency hopping
DFF: digital fixed frequency
FCS: free channel search
MIX: combination of FH and FCS
Hopping Mode (COMSEC active)
SFH: secured frequency hopping
SDFF: secured digital fixed frequency
SFCS: secured free channel search
SMIX: combination of SFH and SFCS
7 User ID
8 Network ID

Figure 4.38 Menu OP (SECOM-P, Submenus)



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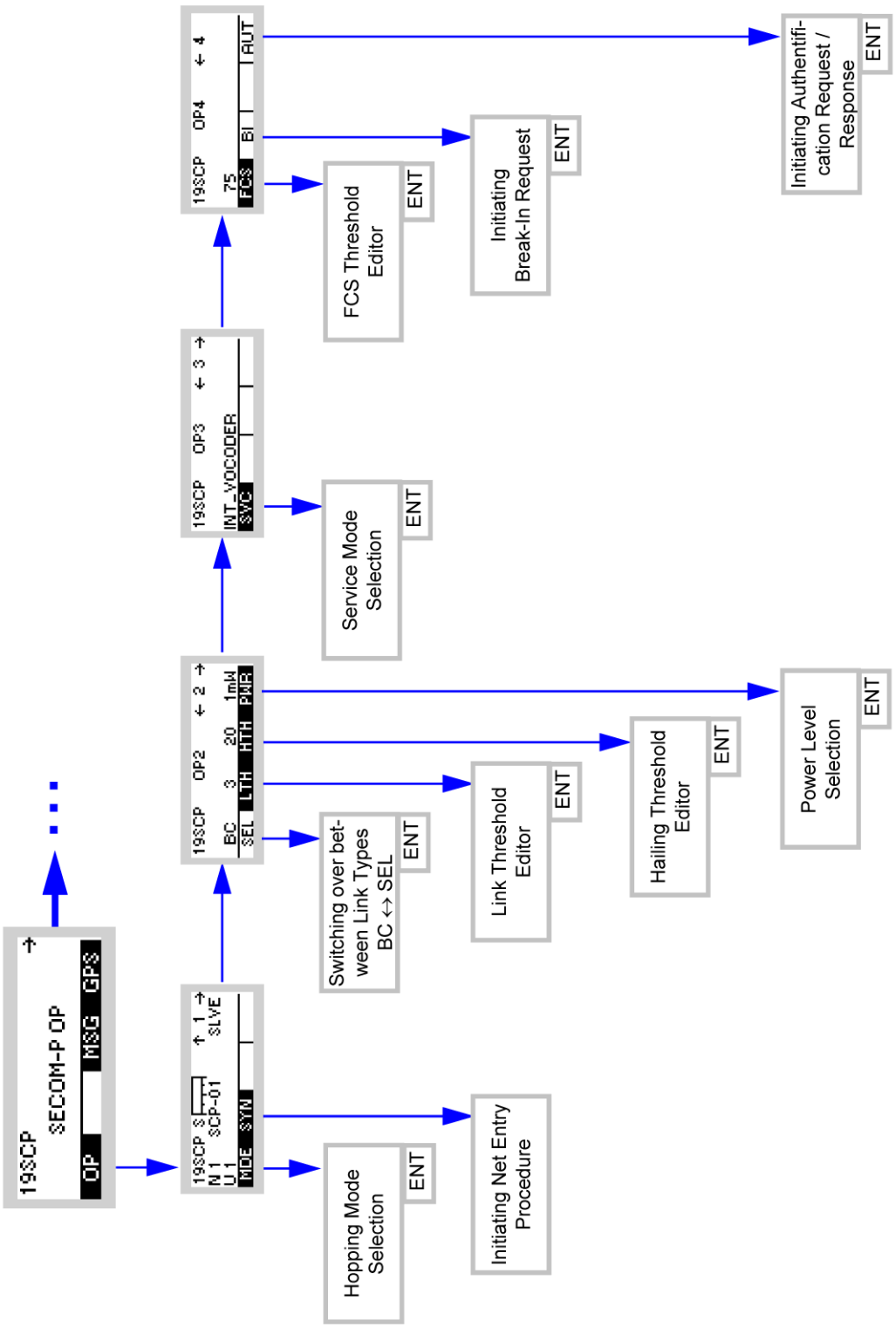
1 See sect. 4.6.3.1 Changing the Hopping Mode
2 See sect. 4.6.3.2 Initiating a Net Entry
3 See sect. 4.6.3.3 Link Types
4 See sect. 4.6.3.4 Changing the Link Threshold
5 See sect. 4.6.3.5 Changing the Hailing Threshold
6 See sect. 4.6.3.6 Changing the Power Level
7 See sect. 4.6.3.7 Changing the Service Mode
8 See sect. 4.6.3.10 Authentication
9 See sect. 4.6.3.9 Initiating a Break-In Request
10 See sect. 4.6.3.8 Changing the Free Channel Search Threshold

Figure 4.39 Menu OP (SECOM-P, Structure)



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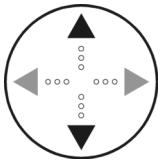
4.6.3.1 Changing the Hopping Mode

By means of softkey MDE (Mode) the operator can change the frequency hopping mode.

Starting point: Main page of SECOM-P menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _ * + to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (MDE)	Press.	The display changes:
4		Press several times until the desired frequency hopping mode is displayed.	Possible values: • FH = Frequency Hopping • DFF = Digital Fixed Frequency • FCS = Free Channel Search • MIX = Mix operation
5	ENT	Press.	The selection window is closed. The new frequency hopping mode is now effective.

SECOM-P supports the following hopping modes:

- FH (Frequency Hop Mode):

  SECOM-P uses all available frequencies from the hopset.

- DFF (Digital Fixed Frequency):

  In this mode the hopset is reduced to one predefined frequency.

- FCS (Free Channel Search):

  In this mode, a free unjammed frequency (out of the hopset) is detected and selected for transmission of the data.

- MIX:

  Mix is a combination of FH and FCS - if less than a certain (configurable) percentage of the scanned frequencies (max. 48 frequencies per scan) are unjammed, FH is chosen, else FCS is chosen.

Frequency hopping mode can be operated with COMSEC protection enabled (leading to e.g. SFH mode) or without COMSEC protection (leading to e.g. FH mode).

4.6.3.2 Initiating a Net Entry

By means of softkey SYN (Synchronization) the operator can initiate the Net Entry procedure.

The sequence of operations depends on the master / slave configuration of the radio. For master / slave configuration please refer to sect. 4.6.4.11 Changing the Master / Slave Role.

SYNC Request (Slave)

Starting point: Main page of SECOM-P menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	3 DEF (SYN)	Press.	The display changes: SYNC REQ is sent to master station. Assuming the operator of the master station accepts the incoming Net Entry / SYNC REQ and sends SYNC / Net Entry information back.

Step	Control	Action	Note
			The display changes:
4	ENT	Press.	The display changes:

NOTICE

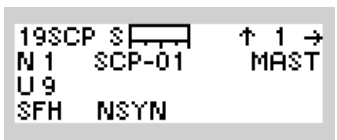
If the operator of the master station is absent or denies the Net Entry request of a slave station, then the sync status of the slave remains NSYN (not synchronized). Also, if no master station has been configured or the master station is not functional, then no Net Entry can be performed.

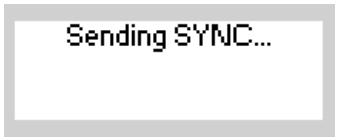
SYNC Response (Master)

Reasons for the master stations to send Net Entry (SYNC) information are:

- Responding to a Net Entry request received from a slave
- Broadcasting Net Entry information to all slaves when starting the network (without explicit request from a slave)
- Broadcasting Net Entry information to all slaves after a period of radio silence (in order to refresh synchronization of all slaves)

Starting point: Spontaneous Message

Step	Control	Action	Note
1	ENT (OP)	Press.	The display changes: 

Step	Control	Action	Note
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	3 DEF (SYN)	Press.	The display changes:  SYNC is sent to slave station. **NOTICE** **SYNC is sent in broadcast mode from master station to all slave stations in the network.** The display changes:

NOTICE

There is no acknowledgement that the slaves have received the NET Entry/SYNC Information. The changing status NSYN → SYN on the master station indicates only that Net Entry / SYNC information has been sent.

4.6.3.3 Link Types

There are two Link Types supported by SECOM-P:

- point-to-multipoint (broadcast) links
- point-to-point (selective communication = SELCOM) links

Selective communication (SELCOM) takes place on a shifted hopset. Only the master station can initiate SELCOM. Once in private SELCOM mode, master and addressed slave cannot receive and interfere with broadcast communication (and vice versa). Once the point-to-point link has been terminated ("hangup"), master and slave are free again to initiate or receive broadcast calls.

By means of a softkey the operator of the master station can initiate a private SELCOM communication with an addressed slave (if current mode is BC = Broadcast) or switch back to Broadcast transmission mode (if current mode is SELCOM).

The slave station automatically enters SELCOM mode if the master station requests it to do so (no operator interaction required, operator of slave cannot deny / terminate SELCOM mode).

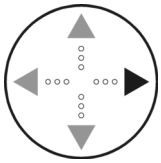
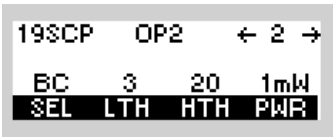
Switching over between Link Types BC -> SEL (Master only)

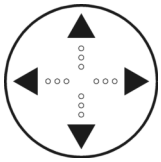
By means of softkey SEL (Selective) the operator can initiate a SELCOM.

Starting point: Main page of SECOM-P menu

NOTICE

Broadcast mode is active.

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 

Step	Control	Action	Note
3	2 ABC (SEL)	Press.	The display changes: SELCOM REQ TO 1
4	0 _ * + to 9 WXYZ or 	Enter a new destination address. Change the destination address selectively.	Range: 00 to 99
5	ENT	Press.	The display changes: Activating SELCOM... SELCOM success Example: 19SCP S ↑ 1 → N 1 SCP-01 MAST U 9 S 11 3 SFH NSYN MSG

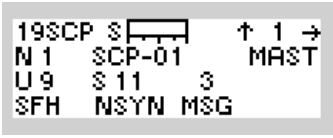
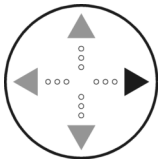
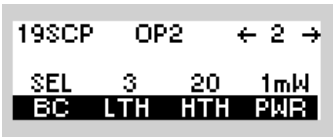
Switching over between Link Types SEL -> BC (Master only)

By means of softkey BC (Broadcast) the operator can terminate a SELCOM and return to broadcast.

Starting point: Main page of SECOM-P menu

NOTICE

SELCOM mode is active.

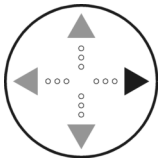
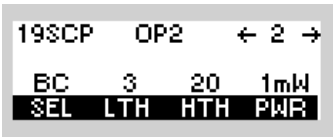
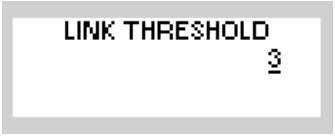
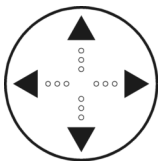
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes: 
3	2 ABC (BC)	Press.	The display changes:

4.6.3.4 Changing the Link Threshold

The Link Threshold is defined as the minimum number of hops that must be received and decoded correctly within a group of 16 consecutive hops in order to maintain the link. If less hops are received correctly within a group, then the link is being terminated automatically by the receiver (implicit end-of-link).

By means of softkey LTH (Link Threshold) the operator can change the link threshold.

Starting point: Main page of SECOM-P menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 
3	3 DEF (LTH)	Press.	The display changes: 
4	0 _*+ to 9 WXYZ or 	Enter a new link threshold. Change the link threshold selectively.	Range: 01 to 16

Step	Control	Action	Note
5	ENT	Press.	The editor window is closed. The new link threshold is now effective.

NOTICE

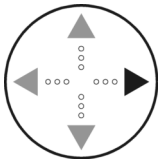
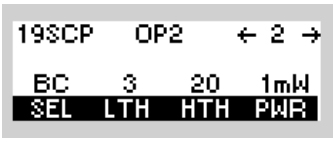
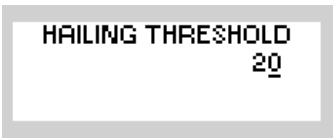
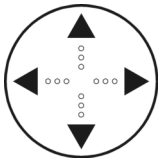
Valid values for LTH are in the range of 01 to 16. If an invalid value is entered, the maximum Link Threshold of 16 (all hops within a group of 16 must be ok) is applied (display shows 16 APP).

4.6.3.5 Changing the Hailing Threshold

The Hailing Threshold is defined as percentage (0 to 100 %) of the RSSI signal range, which is required to trigger the hailing detection of fixed frequency calls.

By means of softkey HTH (Hailing Threshold) the operator can change the hailing threshold.

Starting point: Main page of SECOM-P menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 
3	4 GHI (HTH)	Press.	The display changes: 
4	0 _ * + to 9 WXYZ or 	Enter a new hailing threshold. Change the hailing threshold selectively.	Range: 01 to 100 %

Step	Control	Action	Note
5	ENT	Press.	The editor window is closed. The new hailing threshold is now effective.

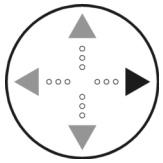
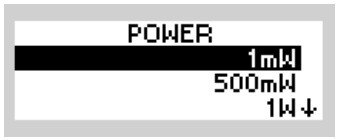
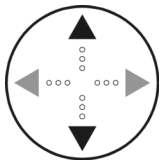
NOTICE

Valid values for HTH are in the range of 01 to 100 %. If an invalid value is entered, the maximum Hailing Threshold of 100 % (maximum RSSI level) is applied (display shows 100 APP).

4.6.3.6 Changing the Power Level

By means of softkey PWR (Power) the operator can change the power level. When the PTT key is pressed, the effective power level, e.g. 1 mW, will be displayed.

Starting point: Main page of SECOM-P menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes:
3	5 JKL (PWR)	Press.	The display changes: Example: 
4		Press several times until the desired power level is displayed.	Possible values: see sect. 3.2.2.5 Changing the Power Level
5	ENT	Press.	The selection window is closed. The new power level is now effective.

- The PWR softkey is used to select from a choice of transmit powers. By selecting a higher transmit power the coverage for radiocommunication is extended. The nature of the terrain also needs to be considered when selecting the transmit power.

4.6.3.7 Changing the Service Mode

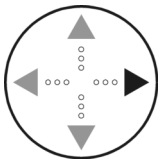
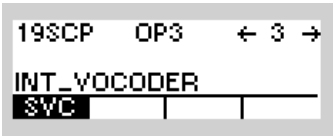
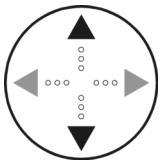
There are two Service Modes supported by SECOM-P:

- Voice links (INT_VOCODER = CVSD vocoded voice)
- Data links (DATA_TERM_1 = connection to external data terminal equipment with 2 400 bit/s, 4 800 bit/s or 7 100 bit/s)
- (VOICE_O_DATA)

Any station wanting to participate in the desired Service Mode must select their SVC (service) accordingly. For setup of data rates and interface properties in Data mode, see sect. 4.6.4.6 Changing the Data Rate for SECOM-P Transmission.

By means of softkey SVC (Service) the operator can change the service mode.

Starting point: Main page of SECOM-P menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press twice.	The display changes: 
3	2 ABC (SVC)	Press.	The display changes:
4		Press several times until the desired service mode is displayed.	Possible values: • INT_VOCODER • DATA_TERM 1 • VOICE_O_DATA

Step	Control	Action	Note
5	ENT	Press.	The selection window is closed. The new service mode is now effective.

The SERVICE function is used to select the transmission mode (Voice or Data).

- INT VOCODER

  Transmission is started by initiating PTT, either via the PTT key (PTT1) or via line (PTT2).

- DATA_TERM_1

  The tactical radio automatically changes to TX mode as soon as data to be transmitted are detected at the RS232 interface (X5, DATA socket).

- VOICE_O_DATA

  Voice transmission can be initiated by the PTT key (PTT1) or by the line PTT (PTT2). Data transmission is started when data is detected at the RS-232-C interface (X5, DATA socket) if no voice PTT is active. When a PTT signal is activated during data transmission, the data link is interrupted and a voice link is established to the selected station(s). Voice has priority over data. The called station(s) automatically detects the service type and reacts adequately.

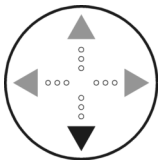
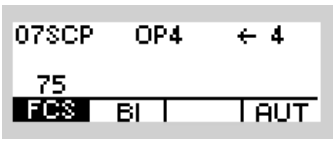
4.6.3.8 Changing the Free Channel Search Threshold

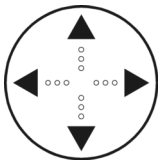
The Free Channel Search (FCS) Threshold is defined as the percentage (0 to 100 %) of frequencies which must be detected as unjammed for SECOM-P to remain in FH when performing a frequency scan in MIX mode (see sect. 4.6.3.1 Changing the Hopping Mode).

Example: FCS Threshold is set to 75 %. Hence, when performing MIX-mode, 75 % of the scanned frequencies (max. 48 per scan) must be unjammed in order to maintain FH. Thus, if more than 25 % of the frequencies are jammed, then SECOM-P automatically switches to FCS (selecting one unjammed DFF frequency).

By means of softkey FCS (Free Channel Search) the operator can change the FCS threshold.

Starting point: Main page of SECOM-P menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 
3	4 GHI (FCS)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or	Enter a new FCS threshold.	Range: 01 to 100 %

Step	Control	Action	Note
		Change the FCS threshold selectively.	
5	ENT	Press.	The editor window is closed. The new FCS threshold is now effective.

NOTICE

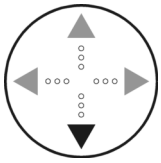
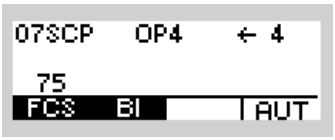
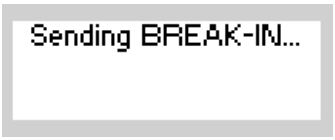
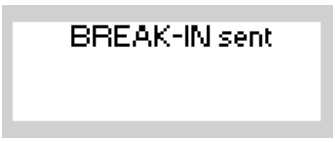
Valid values for FCS are in the range from 001 to 100 %. If an invalid value is entered, the maximum FCS Threshold of 100 % (all frequencies must be unjammed) is applied (display shows 100 APP).

4.6.3.9 Initiating a Break-In Request

A Break-In request can be sent as service information during an ongoing transmission by any receiver of the transmission. Break-In requests are sent in order to indicate a need to gain access to the transmission channel. It is the free choice of the transmitter's operator to release the channel (PTT key) when receiving a BI request.

By means of softkey BI (Break-In) the operator can initiate a break-in.

Starting point: Main page of SECOM-P menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 
3	3 DEF (BI)	Press.	The display changes:  

NOTICE

If no transmission is in progress, BI functionality is not available on the receiver. The signalling of incoming Break-In requests can be disabled (BIE). For configuration of BI signalling, see sect. 4.6.4.10 Switching the Break-In Signalling On or Off.

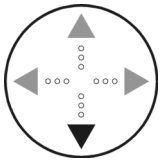
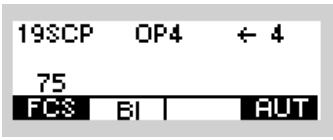
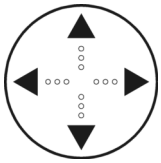
4.6.3.10 Authentication

Authentication of a dedicated slave station can be requested by the master station only. The sequence of operations for authorization depends on the master / slave configuration of the radio. For master / slave configuration see sect. 4.6.4.11 Changing the Master / Slave Role.

By means of softkey AUTH (Authentication) the operator can initiate an authentication request / response.

Initiating an Authentication Request (Master)

Starting point: Main page of SECOM-P menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 
3	5 JKL (AUTH)	Press.	The display changes:
4	ENT or 	Enter a new destination address (User ID). Change destination address selectively.	Range: 01 to 99

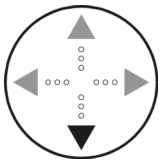
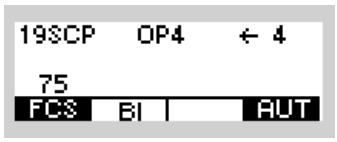
Step	Control	Action	Note
5	ENT	Press.	The display changes:

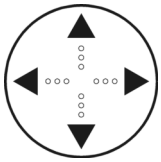
NOTICE

An incoming AUTH REQ is displayed on the MMI of the addressed slave as spontaneous message. It can be deleted by pressing ENT or suppressed by pressing CLR/ESC. The AUTH REQ can be responded to by using the following sequence.

Initiating an Authentication Response (Slave)

Starting point: Spontaneous Message

Step	Control	Action	Note
1	ENT (OP)	Press.	The display changes:
2		Press once.	The display changes: 

Step	Control	Action	Note
3	5 JKL (AUTH)	Press.	The display changes: AUTH CODE 0
6	ENT or 	Enter the authentication code. Change authentication code selectively.	Range: 0 to 9999
7	ENT	Press.	The display changes: Sending AUTH... AUTH sent

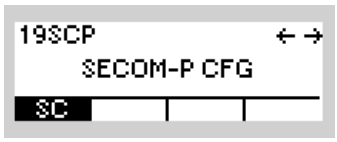
NOTICE

An incoming AUTH response (AUTH “code” from “x”) is displayed on the MMI of the requesting master as a spontaneous message. It can be deleted by pressing ENT or suppressed by pressing CLR/ESC.

The authorization itself is implicit: Before starting the mission, operators of master and slaves shall agree on a secret 4-digit authorization code (pre-shared secret). If the operator of the master requests authorization, the operator of the addressed slave shall respond with the pre-shared secret code. The operator of the master can visually compare the received code in order to decide if this slave is “authentic”.

4.6.4 Settings in Menu SC (SECOM-P CFG, Configuration)

Starting point:



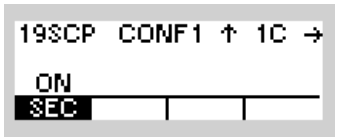
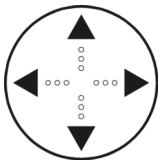
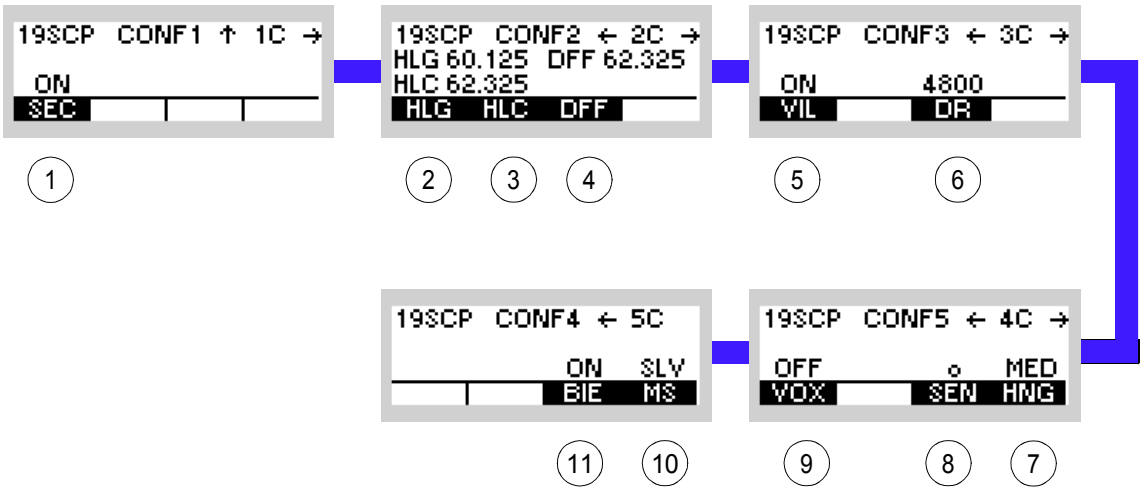
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes, e.g.: 
2		Press.	Press several times until the desired subordinate menu is activated (see Figure 4.43). The menu structure is explained separately by Figure 4.41.

Figure 4.40 Menu SC (SECOM-P, Submenus)



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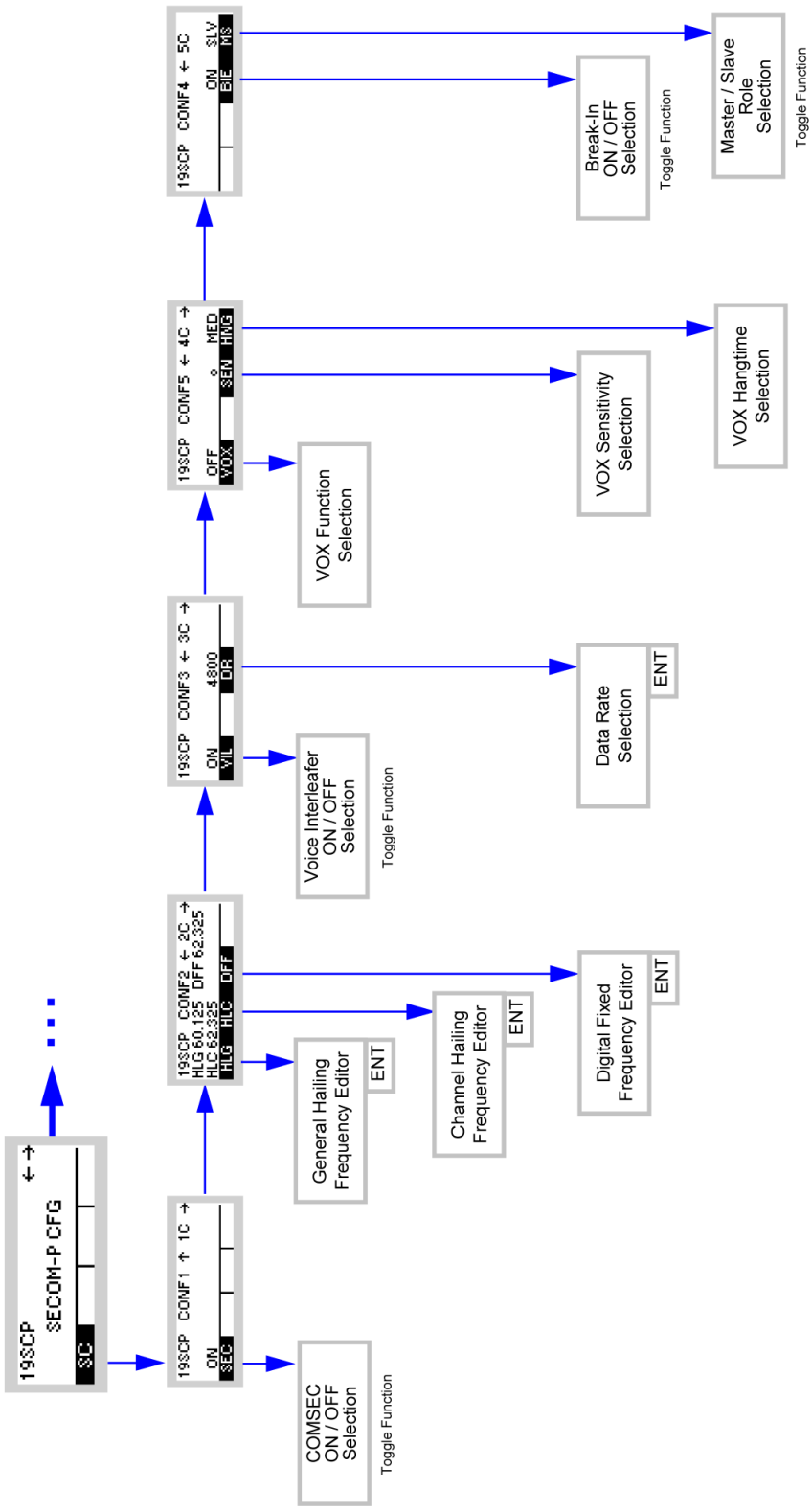
1 See sect. 4.6.4.1 Switching the COMSEC Mode On or Off
2 see sect. 4.6.4.2 Changing the General Hailing Frequency
3 See sect. 4.6.4.3 Changing the Channel Hailing Frequency
4 See sect. 4.6.4.4 Changing the Digital Fixed Frequency
5 See sect. 4.6.4.5 Switching the Voice Interleaver Mode On or Off
6 See sect. 4.6.4.6 Changing the Data Rate for SECOM-P Transmission
7 See sect. 4.6.4.9 Changing the VOX Hangtime
8 See sect. 4.6.4.8 Changing the VOX Sensitivity
9 See sect. 4.6.4.7 Selecting the VOX Function
10 See sect. 4.6.4.11 Changing the Master / Slave Role
11 See sect. 4.6.4.10 Switching the Break-In Signalling On or Off

Figure 4.41 Menu SC (SECOM-P, Structure)



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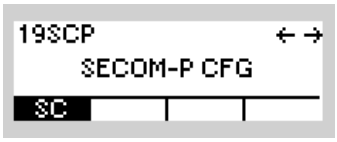
4.6.4.1 Switching the COMSEC Mode On or Off

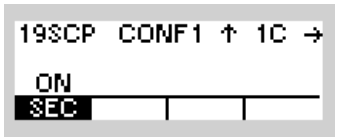
In secure COMSEC mode, strong communication security (COMSEC) measures are applied for SECOM-P user data and service data. Hence, SECOM-P data are ciphered before transmission and deciphered after reception with a strong crypto algorithm and a mission-specific secret COMSEC key. This secret COMSEC key is part of the mission configuration data generated with R&S RNMS3000 (Radio Network Management System).

In operational scenarios where a secret COMSEC key is not available to all participating radios, the secure COMSEC mode key can be disabled on the MMI. In the mode SEC = OFF, a default network depending key is used for COMSEC ciphering. Although the PLAIN LED is lighted in the mode SEC = OFF, COMSEC ciphering is still active (using the default key instead of a mission-specific secret key). SEC = OFF should only be used if no secret COMSEC key is available to the network participants and an emergency communication is required.

By means of softkey SEC (Secure) the operator can enable (ON) or disable (OFF) the COMSEC mode.

Starting point: Main page of SECOM-P menu



Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2	2 ABC (SEC)	Press this key repetitively to toggle COMSEC mode on or off.	

NOTICE

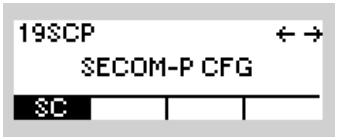
The secure COMSEC mode is also indicated by SFH/SDFF/SFCS/SMIX mode icons.

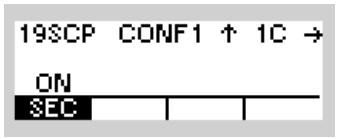
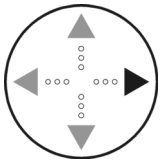
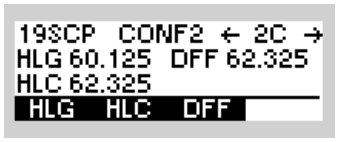
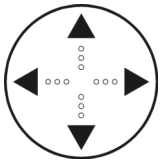
The less secure COMSEC mode is also indicated by FH/DFF/FCS/MIX mode icons and the PLAIN LED.

4.6.4.2 Changing the General Hailing Frequency

By means of softkey HLG (Hailing General) the operator can change the general hailing frequency. The general hailing frequency is used by all SECOM-P networks to scan for activity on a designated fixed frequency.

Starting point: Main page of SECOM-P menu



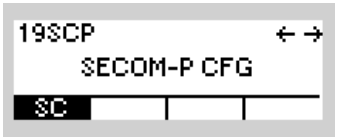
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2		Press once.	The display changes: 
3	2 ABC (HLG)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter a new frequency. Change frequency selectively.	Range: 30.000 to 87.975 MHz Step: 25 kHz

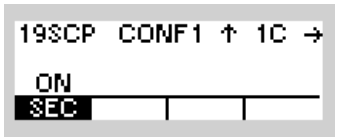
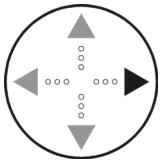
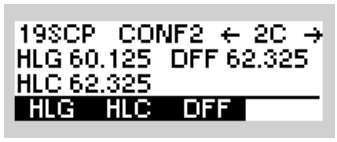
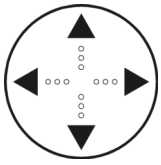
Step	Control	Action	Note
5		Press.	The editor window is closed. The new hailing frequency is now effective.

4.6.4.3 Changing the Channel Hailing Frequency

By means of softkey HLC (Hailing Channel) the operator can change the channel hailing frequency. The channel hailing frequency is used by the currently selected SECOM-P network (i.e. network = channel) to scan for activity on a designated fixed frequency.

Starting point: Main page of SECOM-P menu



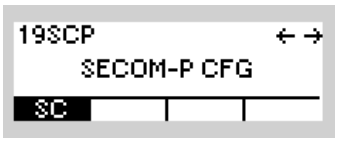
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2		Press once.	The display changes: 
3	3 DEF (HLC)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter a new frequency. Change frequency selectively.	Range: 30.000 to 87.975 MHz Step: 25 kHz

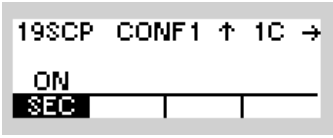
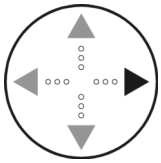
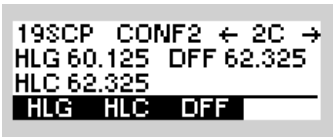
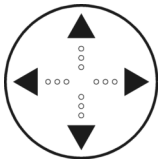
Step	Control	Action	Note
5		Press.	The editor window is closed. The new hailing frequency is now effective.

4.6.4.4 Changing the Digital Fixed Frequency

By means of softkey DFF (Digital Fixed Frequency) the operator can change the digital fixed frequency.

Starting point: Main page of SECOM-P menu



Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2		Press once.	The display changes: 
3	4 GHI (DFF)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter a new frequency. Change frequency selectively.	Range: 30.000 to 87.975 MHz Step: 25 kHz

Step	Control	Action	Note
5	ENT	Press.	The editor window is closed. The new digital fixed frequency is now effective.

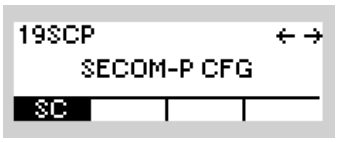
SECOM-P supports two hopping modes:

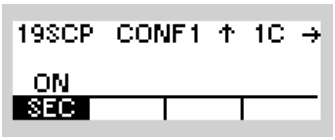
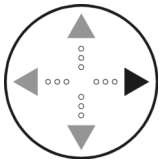
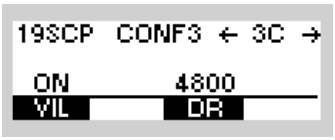
- FH (Frequency Hop Mode): SECOM-P uses all available frequencies from the hopset.
- DFF (Digital Fixed Frequency): In this mode the hopset is reduced to one predefined frequency.

4.6.4.5 Switching the Voice Interleaver Mode On or Off

By means of softkey VIL (Voice Interleaver) the operator can switch the voice interleaver mode on or off.

Starting point: Main page of SECOM-P menu



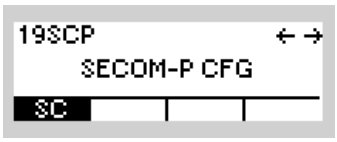
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	2 ABC (VIL)	Press repetitively to toggle voice interleaver mode on or off	

By default, voice interleaving is enabled in SECOM-P. Thus, interleaving is applied to all SECOM-P voice data to protect the transmission against the effects of burst errors. This leads to a better intelligibility under adverse environmental conditions. Alternatively, voice interleaving can be disabled.

4.6.4.6 Changing the Data Rate for SECOM-P Transmission

By means of softkey DR (Data Rate) the operator can change the data rate for SECOM-P transmission.

Starting point: Main page of SECOM-P menu



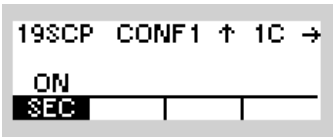
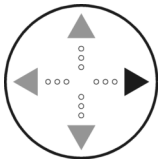
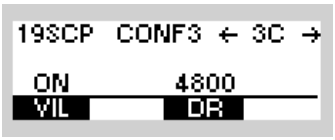
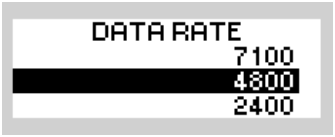
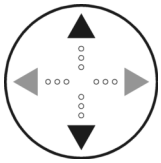
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2		Press twice.	The display changes: 
3	4 GHI (DR)	Press.	The display changes: 
4		Press several times until the desired data rate is displayed.	Possible values: • 2 400 • 4 800 • 7 100
5	ENT	Press.	The selection window is closed. The new data rate is now effective.

Table 4.13 Dependency of Data Rate and FEC (Forward Error Correction)

Data rate	Forward Error Correction (FEC)	Application
2 400 bit/s	Bit FEC + Block FEC (high error correction capabilities)	Data transmission using low data rate and strong FEC (applicable in disturbed environmental conditions or if only low bit error rates can be tolerated)
4 800 bit/s	Bit FEC + Block FEC (normal error correction capabilities)	Data transmission using medium data rate and moderate FEC (applicable in average environmental conditions)
7 100 bit/s	Interleaving + Bit FEC (low error correction capabilities)	Data transmission using the highest data rate and less FEC (applicable in good environmental conditions or if higher bit error rates can be tolerated)

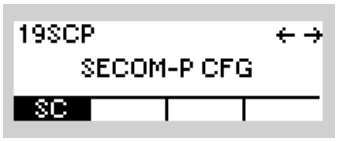
4.6.4.7 Selecting the VOX Function

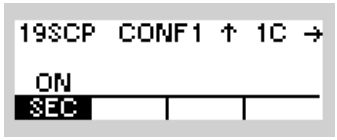
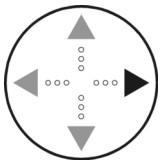
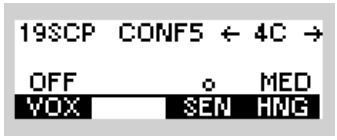
In VOX mode (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface. The operator can disable the VOX mode (VOX OFF) or enable VOX with the audio (VOI) or line (LIN) interface.

If VOX is on, the operator can switch to transmit mode (TX) by simply talking into the selected interface. The transmitter is keyed as long as a voice signal is present. When the voice stops, the tactical radio will return to receive mode (RX) only after the hold-time has elapsed.

By means of softkey VOX (Voice-Operated Transmission) the operator can select the VOX function.

Starting point: Main page of SECOM-P menu

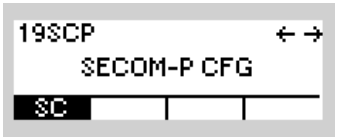


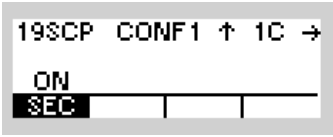
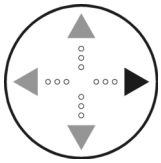
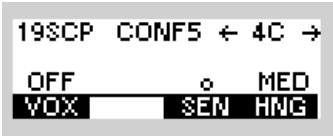
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	2 ABC (VOX)	Press repetitively to change the VOX function.	Possible settings: • OFF • LIN = Line • VOI = Voice The new setting is now effective.

4.6.4.8 Changing the VOX Sensitivity

By means of softkey SEN (Sensitivity) the operator can change the sensitivity for the function VOX. When VOX is selected (see sect. 4.6.4.7 Selecting the VOX Function), the sensitivity will become automatically activated.

Starting point: Main page of SECOM-P menu

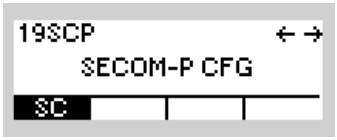


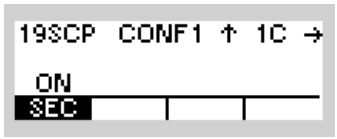
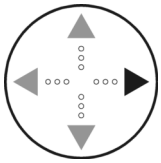
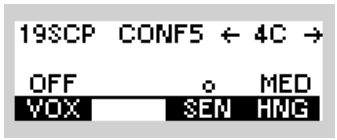
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2		Press three times	The display changes: 
3	4 GHI (SEN)	Press repetitively to toggle between five sensitivity levels.	Possible settings: -- very low - low o medium + high ++ very high

4.6.4.9 Changing the VOX Hangtime

By means of softkey HNG (Hang) the operator can change the hangtime for the function VOX. When VOX is selected (see sect. 4.6.4.7 Selecting the VOX Function), the hangtime will be automatically activated.

Starting point: Main page of SECOM-P menu



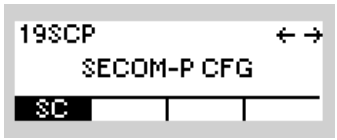
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2		Press three times.	The display changes: 
3	5 JKL (HNG)	Press repetitively to toggle between three hangtimes.	Possible settings: SHT short MED medium LNG long

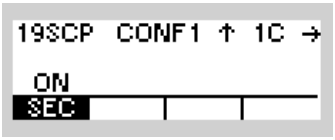
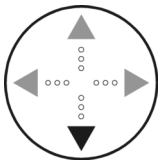
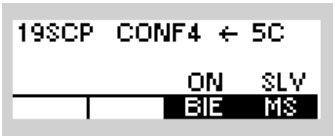
4.6.4.10 Switching the Break-In Signalling On or Off

A Break-In request can be sent as service information during an ongoing transmission by any receiver of the transmission. Break-In requests are sent in order to indicate a need to gain access to the transmission channel. Incoming Break-In requests are signalled per default to the operator of the transmitting radio as a spontaneous message (BREAK-IN) on the MMI and as an audio indication.

By means of softkey BIE (Break-In Enable) the operator can enable (On) or disable (off) the break-in signalling.

Starting point: Main page of SECOM-P menu



Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2		Press once.	The display changes: 
3	4 GHI (BIE)	Press repetitively to toggle break-in signalling on or off.	

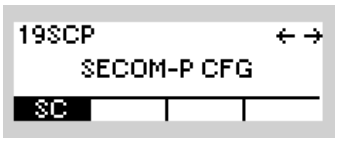
NOTICE

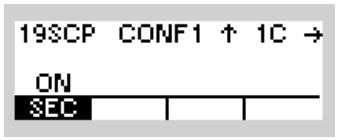
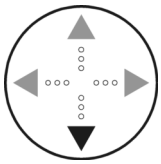
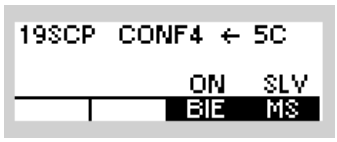
When receiving a BI request, the transmitter operator can release the channel (PTT key) at his own discretion. Disabling incoming Break-In signalling does not disable the capability to send outgoing Break-In requests.

4.6.4.11 Changing the Master / Slave Role

By means of softkey MS (Master Slave) the operator can change the master / slave role.

Starting point: Main page of SECOM-P menu



Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes: 
2		Press once.	The display changes: 
3	5 JKL	Press repetitively to change the role.	

NOTICE

If a radio is defined as master, it can send network entry (SYNC) information. Only one radio must be defined as master / time reference unit within one net. If a radio is defined as master, it can initiate a SELCOM link (see sect. 4.6.4.2 Changing the General Hailing Frequency).

If a radio is defined as slave, it can send network entry (SYNC) requests but cannot initiate a SELCOM link.

4.7 SECOM-V

4.7.1 Basics of SECOM-V

A SECOM-V net is a system for voice and data communication in the VHF/UHF range which is protected by COMSEC (Communication Security) and TRANSEC (Transmission Security) procedures. It is configurable in many parameters. The configuration and net management for a SECOM-V communication system must be supported by a Radio Network Management System (RNMS).

The features of the SECOM-V system are grouped as follows:

- Configuration features
- Security features
- Synchronization features
- Communication features

4.7.1.1 SECOM-V Net

A SECOM-V net is a logical structure for setting up a communication network. It consists of a set of R&S M3TR radios with assigned:

- Hopsets
- Net address and radio addresses
- Necessary radio / SECOM-V parameters
- Keys for TRANSEC and COMSEC

All radios operating in one SECOM-V net must have the same

- Time and date
- Hopset (TRANSEC)
- Keyset (COMSEC)
- Net address (unique address of each SECOM-V net)

4.7.1.2 COMSEC and TRANSEC

Communication Security (COMSEC) for user and technical data is provided by ciphering before transmission and deciphering after reception:

- Ciphered voice/data transmission
- Digital voice with
  - AMBE (Advanced Multi-Band Excitation) vocoder, at 2400 bit/s, 4800 bit/s, 9600 bit/s and 16000 bit/s
  - CVSD (Continuously Variable Slope Delta-modulation) vocoder at 16000 bit/s
  - MELP (Mixed Excitation Linear Prediction) vocoder at 2400 bit/s

For ciphering/deciphering the transmitted data or digital voice a COMSEC key is used.

Transmission Security (TRANSEC) is provided by frequency hopping with a high hopping rate. The hopping frequencies are stored in so-called hopsets which can contain either frequencies from the VHF range (30 MHz to 108 MHz) or from the UHF range (121 MHz to 512 MHz). The frequency spacing in a hopset can be configured via R&S RNMS3000, with possible values 25 kHz and 50 kHz. Via the MMI the frequency spacing in a hopset cannot be changed and is fixed to 25 kHz. The frequency to be used for a hop is selected pseudo-randomly by a crypto algorithm, controlled by the TRANSEC key, the time, the link type and the addresses of the participating units.

TRANSEC keys are used for controlling TRANSEC e.g. for selection of the sequence of frequencies from the hopset.

COMSEC keys are used for ciphering the data to be transmitted (encrypting the useful data of a hop).

One keyset consists of a pair of COMSEC and TRANSEC keys. These keysets must be identical at all the radios that want to communicate with each other.

The keysets need to be configured by using the RNMS (Radio Network Management System) software. User keysets may also be defined via MMI and selected.

SECOM-V supports two hopping modes:

- FH (Frequency Hop Mode): SECOM-V uses all available frequencies from the hopset.
- DFF (Digital Fixed Frequency): In this mode the hopset is reduced to one predefined frequency.

4.7.1.3 Net Entry

To ensure communication, all participating radios need to be adjusted to the same time. The procedure for time synchronization of a radio to the Time Reference Unit (TRU) is called Net Entry (NE). The time difference between a requesting unit and the TRU must not be greater than five days for successful Net Entry. There must not be more than one TRU in a net at any time. If the pre-configured TRU fails, any other radio of the net can take over the TRU role when it is configured as TRU manually. Every net uses its own net time. Time synchronization (NE) must be performed separately in every net.

It is possible to manually define two frequencies that are used for Net Entry via MMI or RNMS.

For technical reasons, it is not possible to maintain synchronization forever. The R&S M3TR Series provides two functions for automatic synchronization:

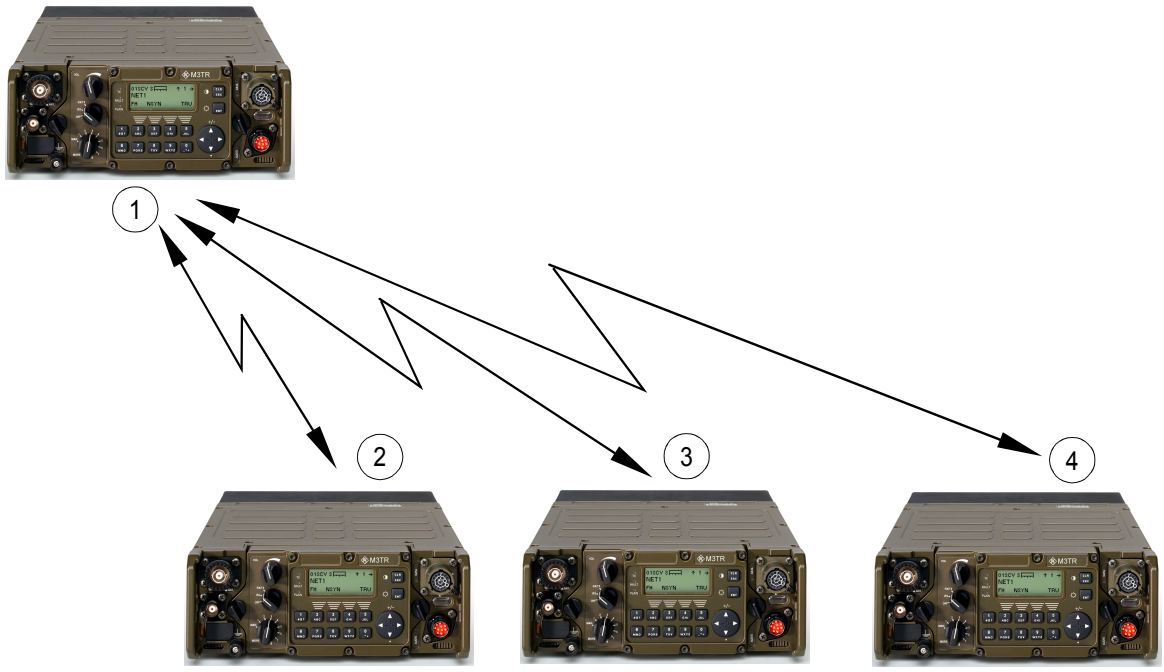
- Time Beacon (TB): The radio automatically takes care of new synchronization before synchronization is lost. If the TB function is not active, it may be required to perform a Net Entry from time to time. This is indicated by the NSYN message at the display. Nevertheless, it is necessary to initially perform one Net Entry when entering a SECOM-V net, even when TB is enabled. Moreover, when switching TB functionality OFF and ON again, a Net Entry has to be performed, i.e. an initial Net Entry is necessary every time TB functionality is enabled.
- Automatic Net Entry (ANE): The radio automatically performs a Net Entry whenever synchronization is lost (NSYN).

NOTICE

When the Time Beacon is active, the radio will transmit data automatically and without user interaction. Turn off the Time Beacon to avoid this.

When the radio is turned off, net time can only be updated with reduced accuracy. Manual Net Entry may be necessary even if Time Beacon is active.

Figure 4.42 Net Entry Example



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1 RADIO1 defined as TRU
2 RADIO2 (NE requesting device)
3 RADIO3 (NE requesting device)
4 RADIO4 (NE requesting device)

When a Net Entry request has been initiated by one of the radios 2 to 4, the TRU (RADIO1) provides the current net time for the requesting radio.

Every non-TRU radio in a net has to perform a separate Net Entry.

4.7.1.4 Linking

SECOM-V is a link-oriented communication system, using physical and logical links.

A physical link exists if at least two radios are able and prepared to receive one another. This means the participating units must be synchronized. So in general a link setup is required to establish a link. During this link setup SECOM-V provides for synchronization with the other participating units and transmits address and service information.

A logical link exists if one participating unit is transmitting and one or more other participating units are receiving this communication.

Search is the default mode of SECOM-V. In search mode SECOM-V is searching for an incoming SECOM-V call. If an incoming SECOM-V call has been detected, an automatic synchronization takes place and a link to the calling participating unit will be established. It has to be defined during radio configuration which time deviation between the two radios will be tolerated during link setup. This is done with the so-called parameter Search Pattern.

Simultaneous transmission and reception is not supported by SECOM-V.

SECOM-V supports three types of links:

- Point-to-Point link: Exactly two radios can communicate. The Station (STN) setting determines the radio which is called.
- Point-to-Multipoint link: A group of radios within the net can communicate. The Group (GRP) setting determines the group of radios which is called.
- Broadcast link: All radios of a net can communicate. The Broadcast (BC) setting selects all radios within the net for outgoing calls. During a broadcast call, Late Traffic Entry (LTE) is enabled. LTE offers the chance to join a broadcast call even if the initial link setup was missed or to re-connect to the link if the connection was lost.

NOTICE

It is always possible to receive and answer all link types. Therefore, the radio is temporarily switched to the link type of the incoming call until the link is terminated (TRM).

4.7.1.5 Hailing

Hailing can be used by fixed frequency radios to call radios in SECOM-V operation mode. When a Hailing call is detected, there is an indication at the MMI and an audio indication (if enabled). In case the operator wants to answer the call, it is possible to switch over to a fixed frequency preset page and load the respective channel settings. The following types of Hailing are supported:

- General Hailing: Used to call all radios in a SECOM-V Net Group (configurable by RNMS). General Hailing is only available if the selected Hopset is in the VHF frequency range (30 MHz to 107.075 MHz). The General Hailing frequency can be chosen from the VHF band. The modulation of the call has to be F3E with a 150 Hz signal tone.
- Net Hailing: Used to call all radios in a SECOM-V Net. Net Hailing is available in the VHF (30 MHz to 107.075 MHz) and UHF (121 MHz to 511.975 MHz) frequency ranges. The Net Hailing frequency must be in the same band as the Hopset. Net Hailing has priority over general hailing calls. The modulation of the call has to be F3E with a 150 Hz signal tone.
- Out-of-Band Hailing: Used to monitor frequencies in the HF, VHF and UHF frequency ranges, even if they are outside of the hopset band. It is possible to monitor two channels at a time, freely selectable from a total of seven stored channels (two user-configurable channels, two fixed emergency channels at 243 MHz and 121.5 MHz, three pre-config-

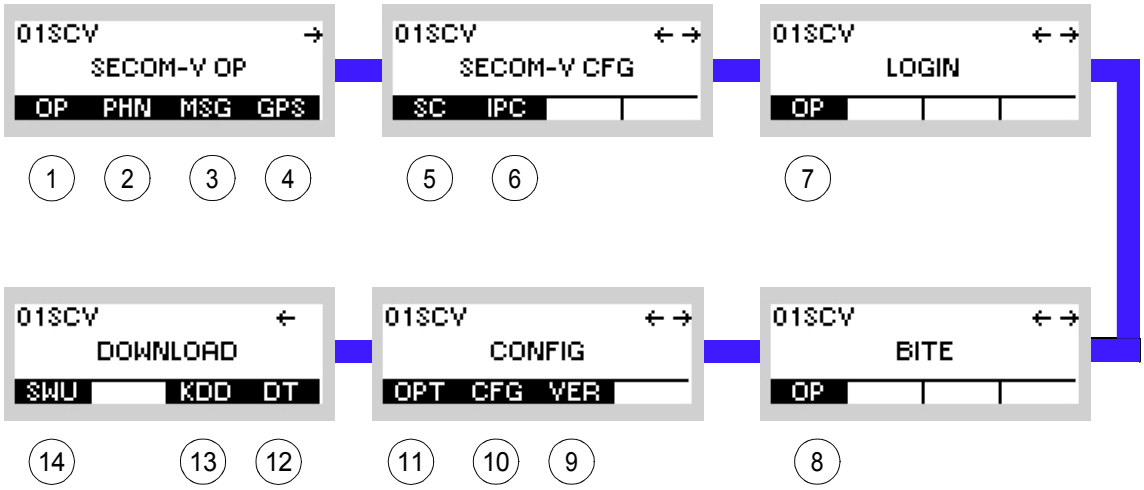
urable channels). The modulation mode of the monitored channels may be A1A, A3E, F3E or J3E. Hailing calls can be detected by signal strength, signal-to-noise ratio, 150 Hz tone or a signal squelch tone.

NOTICE

Out-of-Band Hailing can degrade the performance or increase the time for detection of Net Entry, Link Setup, Late Traffic Entry and other Hailing types if activated. Performance of voice or data transmission is not degraded.

4.7.1.6 Preset Page SCH (SECOM-H)

Figure 4.43 Preset Page SCH (SECOM-H)



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1 See sect. 4.7.2 Settings in the Menu OP (SECOM-V OP, Operation)
2 See sect. 5.5.2 Settings in Menu PHN (SECOM-V OP, Operation)
3 See sect. 5.4.2 Settings in Menu Message Service (M)
4 See sect. 5.2.2.1 Display of the Own GPS Position
5 See sect. 4.7.3 Settings in the Menu SC (SECOM-V CFG, Configuration)
6 See sect. 5.3.3 Settings in Menu IP OVER AIR (IP)
7 See sect. 3.5 Login
8 See sect. 6.2.6 Settings in Menu OP (BITE, Operation)
9 See sect. 3.7.2 Settings in Menu VER (CONFIG, Inquiring the Software Version)
10 See sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters)
11 See sect. 3.7 Configuration
12 See sect. 3.7.3 Settings in Menu DT (DOWNLOAD, Loading Pre-configured Radio Parameters)
13 Not relevant in this application.
14 This function is described in the service documentation.

4.7.2 Settings in the Menu OP (SECOM-V OP, Operation)

NOTICE

After a long continuous link (e.g. 24 h with SP5) between two radios with only one initial link setup the two radios will lose synchronization after this link is terminated, because net time synchronization only occurs when the link is being set up (with link setup).

For R&S VT3050 systems with Cosite Filter is it not possible to perform ECCM operation crossing 88 MHz due to bypass relays.

For relay and rebroadcast operation with SP800: The first 10 s of connection are lost. If the connection is shorter than 10 s, no further connection from the relay/rebroadcast transmitter is established.

Starting point:

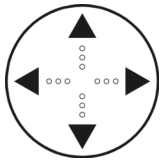
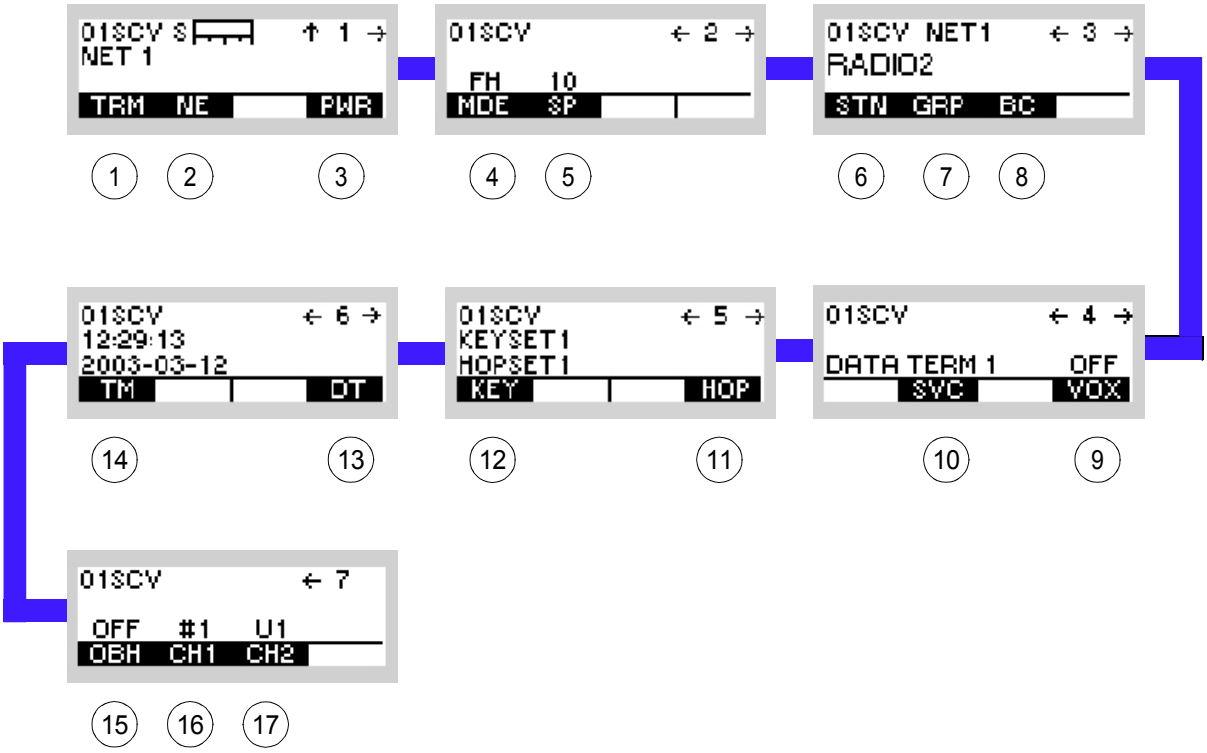
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes, e.g.:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes, e.g.:
3		Press.	Press several times until the desired subordinate menu is activated (see Figure 4.47). The menu structure is explained separately by Figure 4.45. After a delay of approximately 10 seconds, the SECOM-V operational page 1 is automatically reactivated.

Figure 4.44 Menu OP (SECOM-V, Submenus)



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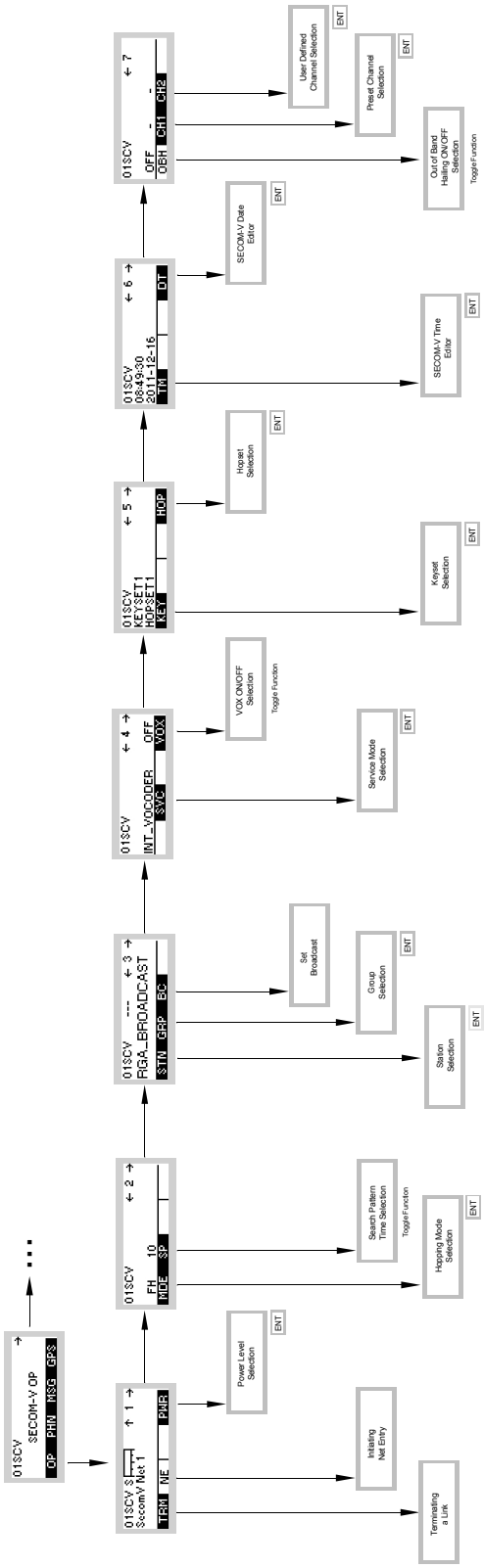
1 See sect. 4.7.2.1 Terminating a Link
2 See sect. 4.7.2.2 Initiating Net Entry
3 See sect. 4.7.2.3 Changing the Power Level
4 See sect. 4.7.2.4 Changing the Hopping Mode
5 See sect. 4.7.2.5 Changing the Search Pattern Time
6 See sect. 4.7.2.6 Addressing Different Link Types
7 See sect. 4.7.2.6 Addressing Different Link Types
8 See sect. 4.7.2.6 Addressing Different Link Types
9 See sect. 4.7.2.7 Selecting the Service Mode
10 See sect. 4.7.2.8 Selecting the VOX Function
11 See sect. 4.7.2.9 Selecting a Keyset
12 See sect. 4.7.2.10 Selecting a Hopset
13 See sect. 4.7.2.11 Changing the SECOM-V Time
14 See sect. 4.7.2.12 Changing the SECOM-V Date
15 See sect. 4.7.2.13 Switching the Out-of-Band Hailing Function On or Off
16 See sect. 4.7.2.14 Selecting the Out-of-Band Hailing Channels
17 See sect. 4.7.2.14 Selecting the Out-of-Band Hailing Channels

Figure 4.45 Menu OP (SECOM-V, Structure)



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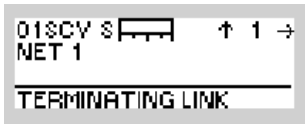
4.7.2.1 Terminating a Link

By means of softkey TRM (Terminate) the operator can terminate the running link.

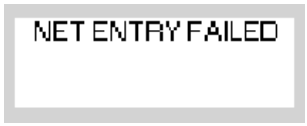
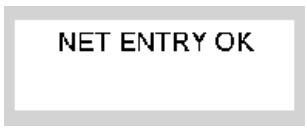
Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (TRM)	Press.	The link is terminated manually. 

4.7.2.2 Initiating Net Entry

By means of softkey NE (Net Entry) the operator can start a Net Entry request.

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	3 DEF (NE)	Press.	The display changes: The tactical radio tries to log into a SECOM-V net. The display changes: Net entry failed  or The display changes: Net entry OK  After a few seconds the window shown above is closed. The display changes:

- Normally the net time will be adjusted automatically as soon as a communication is taking place.

  Therefore manual net time adjustment as described above will only have to be performed in the case that communication was interrupted for quite a time.

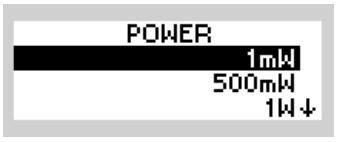
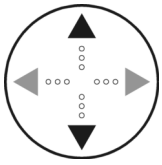
NOTICE

The Time Reference Unit does not respond to NE requests while it has an active link. Only one radio can perform NE at a time.

4.7.2.3 Changing the Power Level

By means of softkey PWR (Power) the operator can change the power level.

Starting point: Main page of SECOM-V OP menu

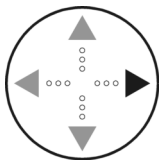
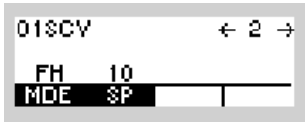
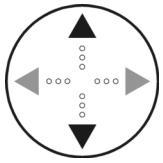
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (PWR)	Press.	The display changes: Example: 
4		Press several times until the desired power level is displayed.	Possible values: see sect. 3.2.2.5 Changing the Power Level
5	ENT	Press.	The selection window is closed. The new power level is now effective.

- The PWR softkey is used to select from a choice of transmit powers. By selecting a higher transmit power the coverage for radiocommunication is extended. The nature of the terrain also needs to be considered when selecting the transmit power.

4.7.2.4 Changing the Hopping Mode

By means of softkey MDE (Mode) the operator can change the frequency hopping mode.

Starting point: Main page of SECOM-V OP menu

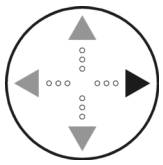
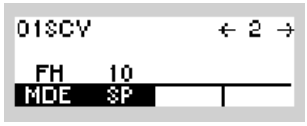
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 
3	2 ABC (MDE)	Press.	The display changes:
4		Press to select the desired setting.	Possible values: FH DFF
5	ENT	Press.	The selection window is closed. The hopping mode DFF is now effective.

- SECOM-V supports two hopping modes:
  - FH (Frequency Hop Mode): SECOM-V uses all available frequencies from the hopset.
  - DFF (Digital Fixed Frequency): In this mode the hopset is reduced to one predefined frequency. In this case: No TRANSEC - only COMSEC!
- Net parameter

4.7.2.5 Changing the Search Pattern Time

By means of softkey SP (Search Pattern) the operator can change the search pattern time.

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes: 
3	3 DEF (SP)	Press.	Repetitively pressing this key changes the value for SP. Possible values: SP5 → SP10 → SP20 → SP60 → SP800 The new setting is now effective.

- The longer the search pattern, i.e. the tolerable time error, the longer the time required for link setup.
- The following table shows the search patterns representing the tolerable time errors:

Search pattern	Radio switched off [s]
Short (SP5)	1250
MEDIUM (SP10)	2500
LONG (SP20)	5000
VERY LONG (SP60)	15000
MAX (SP800)	200000

- Net parameter

4.7.2.6 Addressing Different Link Types

The address system of SECOM-V supports 3 types of links:

- STN: Link to one particular station of the network
- GRP: Link to a group of radios of the network
- BC: Link to all radios of the network

These different addressing possibilities are described below. Please note that for use within a network all participating units, radios, groups and nets need to be configured by using the RNMS (Radio Network Management System) software.

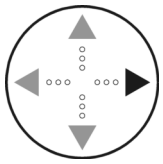
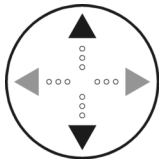
NOTICE

If the link hang-up time is set to 0 s via the RNMS, a called station has no possibility to answer an incoming call. Instead, a new link with the selected link type and destination will be set up when trying to answer. This is not the typical application, because it may happen that the selected station(s) is not the originally calling one. Further, a delay for the new link setup is added.

Addressing a Station

By means of softkey STN (Station) the operator can address a single radio.

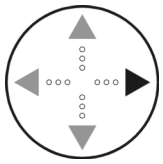
Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press twice.	The display changes:
3	2 ABC (STN)	Press.	The display changes:
4		Press several times until the desired station is displayed.	Possible values (example): RADIO1 to RADIO10
5	ENT	Press.	The selection window is closed. The station is selected for addressing.

Addressing a Group

By means of softkey GRP (Group) the operator can address a group of radios.

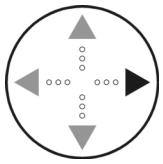
Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press twice.	The display changes:
3	3 DEF (GRP)	Press.	The display changes: Possible values (example): MULTIGROUP_ODD
4	ENT	Press.	The selection window is closed.

Addressing for Broadcast

By means of softkey BC (Broadcast) the operator can set the broadcast link.

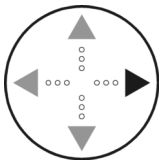
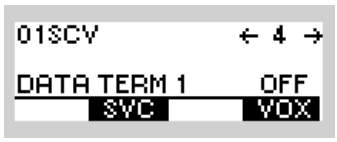
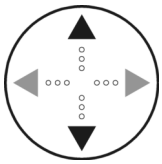
Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press twice.	The display changes:
3	4 GHI (BC)	Press.	The display changes:

4.7.2.7 Selecting the Service Mode

By means of softkey SVC (Service) the operator can select Voice or Data transmission.

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	(OP) 2 ABC	Press.	The display changes:
2		Press three times.	The display changes: 
3	(SVC) 3 DEF	Press.	The display changes:
4		Press to select the desired mode.	Possible values: • INT_VOCODER • DATA_TERM 1 • IP_DATA • IP_REBRO • VOICE_O_DATA • VOICE_O_IPD **NOTICE** **Be aware that changing the service between IP_REBRO and another IP service leads to a change of the Ethernet IP address. Due to this it additionally may become necessary to configure the routes and the gateway address for this preset page accordingly.**
5	ENT	Press.	The selection window is closed. The new service mode is now effective.

The SERVICE function is used to select the transmission mode (Voice or Data).

- INT VOCODER

  Transmission is started by initiating PTT, either via the PTT key (PTT1) or via line (PTT2).

- DATA_TERM_1

  The tactical radio automatically changes to TX mode as soon as data to be transmitted are detected at the RS-232-C interface (X5, DATA socket).

- IP_DATA

  The radio automatically changes to TX mode as soon as IP data is detected at one of the IP interfaces (Ethernet or PPP via serial interface). With this mode it is possible to connect two wired IP networks via an air IP net.

- IP_REBRO

  This service is used only for relay and rebroadcast stations. This way, it is possible to connect waveform nets (SECOM-H and/or SECOM-V) using the Voice over IP Data service. See sect. 5.3.2.2 Rebroadcast / Relay Mode for more details.

- VOICE_O_DATA

  Voice transmission can be initiated by the PTT key (PTT1) or by the line PTT (PTT2). Data transmission is started when data is detected at the RS-232-C interface (X5, DATA socket) if no voice PTT is active. If a PTT signal is activated during data transmission, the data link is interrupted and a voice link is established to the selected station(s). Voice has priority over data. The called station(s) automatically detects the service type and reacts adequately.

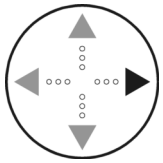
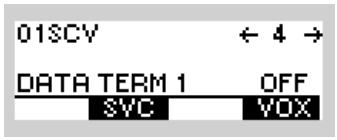
- VOICE_O_IPD

  Voice transmission can be initiated by the PTT key (PTT1) or by the line PTT (PTT2). Data transmission is started when IP data is detected at one of the IP interfaces (Ethernet or PPP via serial interface) if no voice PTT is active. If a PTT signal is activated during data transmission, the data link is interrupted and a voice link is established to the selected station(s). Voice has priority over data. The called station(s) automatically detects the service type and reacts adequately.

4.7.2.8 Selecting the VOX Function

By means of softkey VOX (Voice-Operated Transmission) the operator can select the VOX function.

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press three times.	The display changes: 
3	5 JKL (VOX)	Press.	Repetitively pressing this key changes the VOX function. Possible settings: • OFF • LIN = Line • VOI = Voice The new setting is now effective.

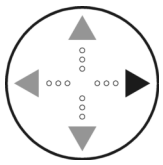
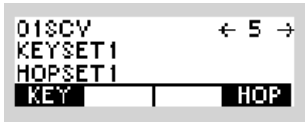
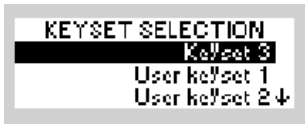
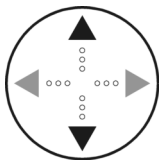
- If VOX is set to VOI (Voice), the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

  VOX = VOI can only be used when a Headset R&S GA3002 is connected.
- If VOX set to LINE, the transmit mode is activated as soon as a voice signal at connector X5 is detected.
- If PTT is pressed when VOX is enabled, transmission is triggered even if no audio signal is present.

4.7.2.9 Selecting a Keyset

By means of softkey KEY (Keyset) the operator can select a keyset.

Starting point: Main page of SECOM-V OP menu

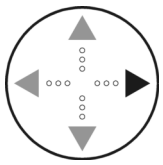
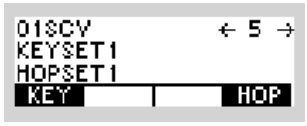
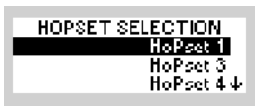
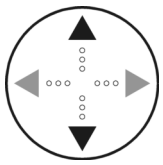
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press four times.	The display changes: 
3	2 ABC (KEY)	Press.	The display changes: 
4		Press several times until the desired keyset is displayed.	Possible values (example): Keyset 3 User Keyset 1 to User Keyset 5
5	ENT	Press.	The selection window is closed. The new keyset is now effective.

- Net parameter

4.7.2.10 Selecting a Hopset

By means of softkey HOP (Hopset) the operator can select a hopset.

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press four times.	The display changes: 
3	5 JKL (HOP)	Press.	The display changes: 
4		Press several times until the desired hopset is displayed.	Possible values (example): • Hopset 1, Hopset 3 to Hopset 4 • USERHOPSET 1 to USERHOPSET 4
5	ENT	Press.	The selection window is closed. The new hopset is now effective.

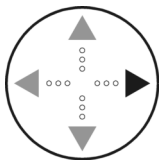
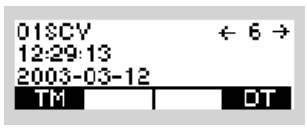
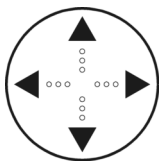
- In the hopset frequency ranges are defined for frequency hopping.

  Hopsets have to be configured using the R&S RNMS3000. User Hopsets (see sect. 4.7.3.2 Editing a User Hopset) are configured using the MMI.

4.7.2.11 Changing the SECOM-V Time

By means of softkey TM (Time) the operator can change the SECOM-V net time.

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press five times.	The display changes: 
3	2 ABC (TM)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter a new time. Change time selectively.	Format: hh:mm:ss Range: hh: 00 to 23 mm: 00 to 59 ss: 00 to 59
5	ENT	Press.	The selection window is closed. The new time is now effective.

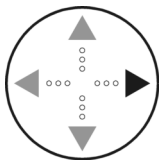
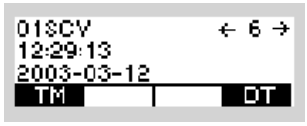
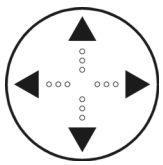
NOTICE

Once the internal net time has been changed, no SECOM-V operation is possible until a Net Entry has been initiated to re-acquire the net time.

4.7.2.12 Changing the SECOM-V Date

By means of softkey DT (Date) the operator can change the SECOM-V net date.

Starting point: Main page of SECOM-V OP menu

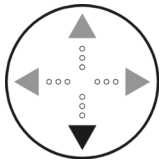
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press five times.	The display changes: 
3	5 JKL (DT)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or 	Enter a new date. Change date selectively.	Format: yyyy-mm-dd Range: yyyy: 1970 to 2099 mm: 01 to 12 dd: 01 to 31
5	ENT	Press.	The selection window is closed. The new date is now effective.

- The DT (Date) softkey is used to set the ultimate SECOM-V net date. All radios in the same network need to be set to the same date.

4.7.2.13 Switching the Out-of-Band Hailing Function On or Off

By means of softkey OBH (Out-of-Band Hailing) the operator can switch the out-of-band hailing function on or off.

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (OBH)	Press.	Repetitively pressing this key toggles the out-of-band hailing function on and off. **NOTICE** **It is not possible to activate out-of-band hailing if no channel is selected.**

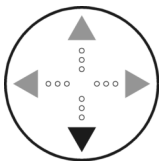
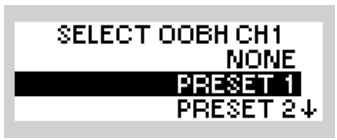
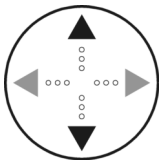
NOTICE

Out-of-band hailing can degrade the performance or increase the time for detection of net entry, link setup, late traffic entry and other hailing types if activated. Performance of voice or data transmission is not degraded.

4.7.2.14 Selecting the Out-of-Band Hailing Channels

By means of softkeys CH1 or CH2 the operator can select channels for the out-of-band hailing function.

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	(OP) **2 ABC**	Press.	The display changes:
2		Press once.	The display changes:
	(CH1) **3 DEF** or (CH2) **4 GHI**	Press to select channel 1 or channel 2 respectively.	The display changes: Example: 
		Press to select the desired preset or user defined channel.	Possible Values (example): • NONE • PRESET 1 to PRESET 5 • USER 1 to USER 2 **NOTICE** **Channels for Out-of-Band Hailing have to be defined using R&S RNMS or the SECOM-V configuration menu. The number of actually available channels depends on the configuration.**
3	**ENT**	Press.	The selection window is closed. The new channel number is now effective.

NOTICE

When two channels are selected for Out-of-Band Hailing, they are scanned alternately.

4.7.3 Settings in the Menu SC (SECOM-V CFG, Configuration)

Starting point:

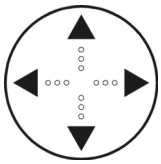
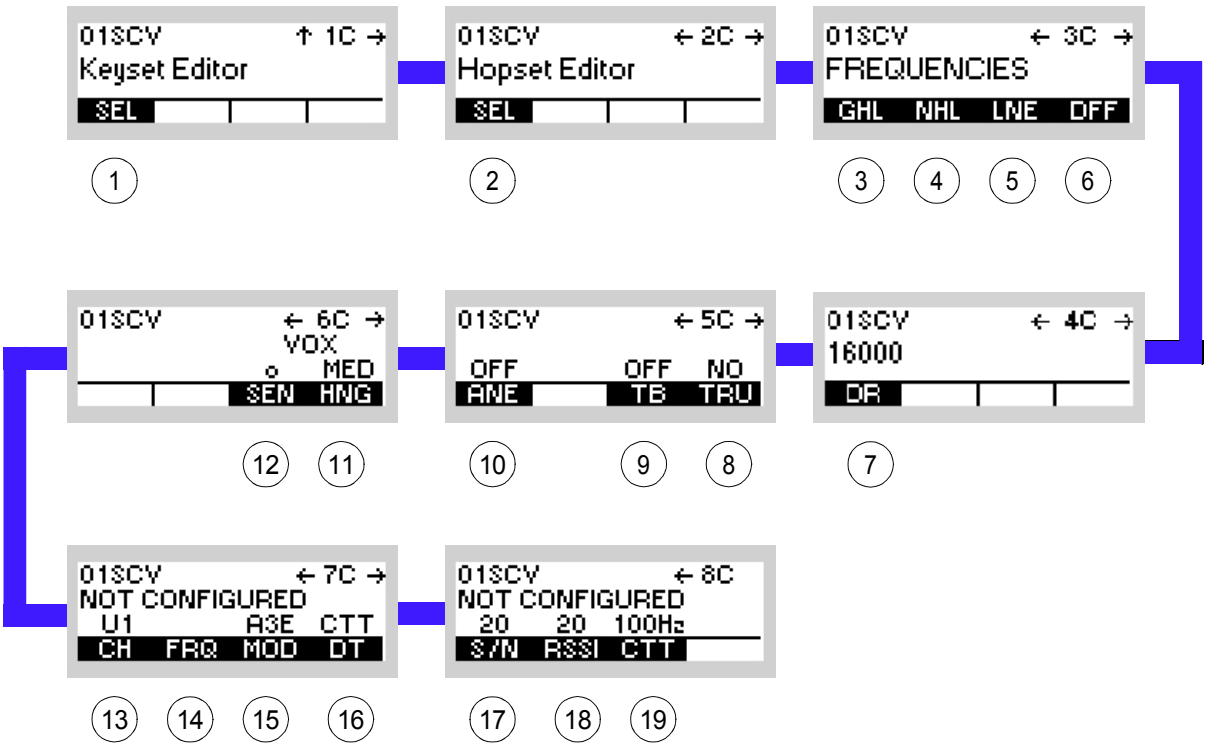
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired subordinate menu is activated (see Figure 4.49).

Figure 4.46 Menu SC (SECOM-V, Submenus)



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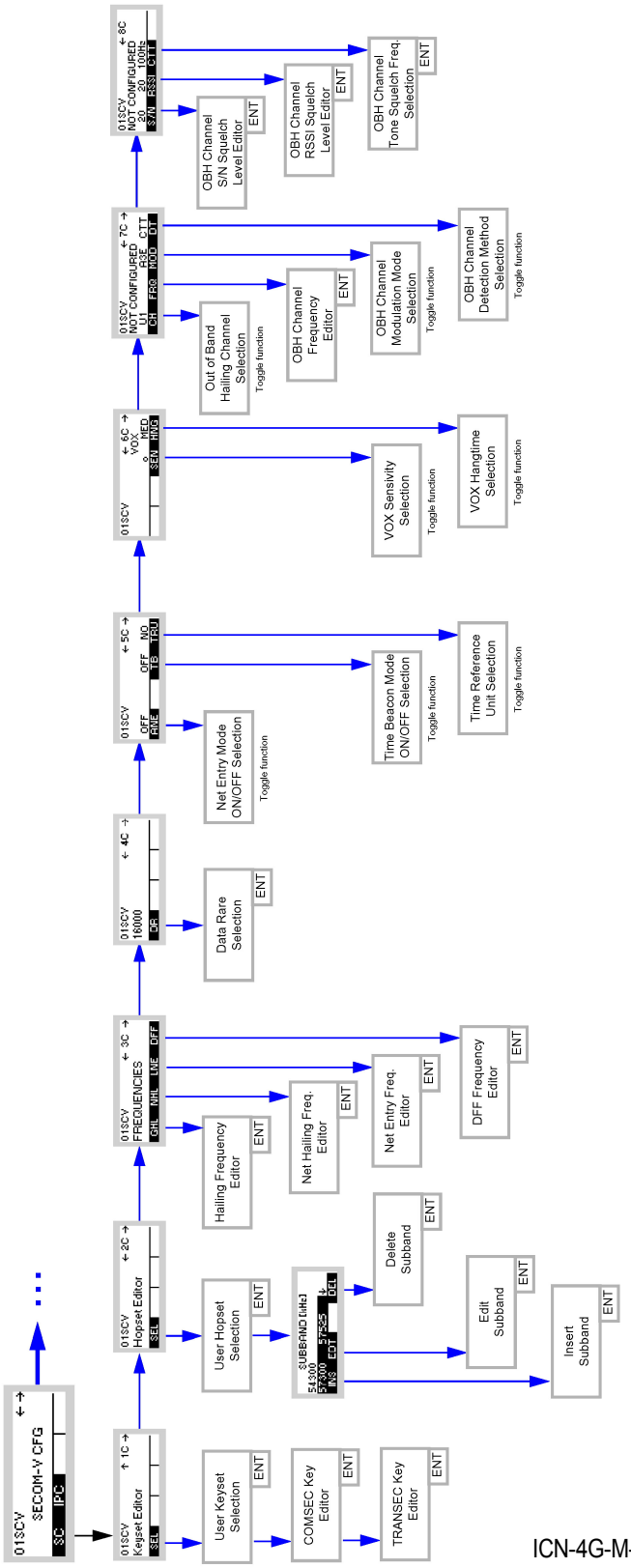
1 See sect. 4.7.3.1 Editing a User Keyset
2 See sect. 4.7.3.2 Editing a User Hopset
3 See sect. 4.7.3.3 Changing the General Hailing Frequency
4 See sect. 4.7.3.4 Changing the Net Hailing Frequency
5 See sect. 4.7.3.5 Changing the Net Entry Frequency
6 See sect. 4.7.3.6 Changing the Digital Fixed Frequency
7 See sect. 4.7.3.7 Changing the Data Rate for SECOM-V Transmission
8 See sect. 4.7.3.8 Switching the Automatic Net Entry Mode On or Off
9 See sect. 4.7.3.9 Switching the Time Beacon Mode On or Off
10 See sect. 4.7.3.10 Defining a Radio as a Time Reference Unit
11 See sect. 4.7.3.11 Changing the VOX Sensitivity
12 See sect. 4.7.3.12 Changing the VOX Hangtime
13 See sect. 4.7.3.13 Changing the Out-of-Band Hailing Channel
14 See sect. 4.7.3.14 Changing the Out-of-Band Hailing Channel Frequency
15 See sect. 4.7.3.15 Changing the Out-of-Band Hailing Channel Modulation Mode
16 See sect. 4.7.3.16 Changing the Out-of-Band Hailing Channel Detection Method
17 See sect. 4.7.3.17 Changing the Signal-to-Noise Level of the Out-of-Band Channel Signal
18 See sect. 4.7.3.18 Changing the Out-of-Band Hailing Channel RSSI Squelch Level
19 See sect. 4.7.3.19 Selecting the Out-of-Band Hailing Channel Tone Squelch Frequency

Figure 4.47 Menu SC (SECOM-V, Structure)



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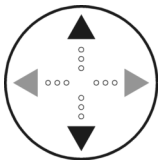
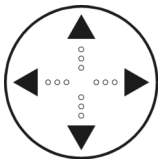
4.7.3.1 Editing a User Keyset

By means of softkey SEL (Selection) the operator can edit a user keyset for TRANSEC and COMSEC.

Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2	2 ABC (SEL)	Press.	The display changes:
3		Press to select the desired keyset.	Possible values: USERKEYSET1 to USERKEYSET5
4	ENT	Press.	The display changes:

Step	Control	Action	Note
5	0 _ * + to 9 WXYZ or 	Press several times until the character is displayed.	The key must contain between 8 and 32 characters. For the COMSEC key any alphanumerical characters are allowed. • letters "A" to "Z" and "a" to "z" • numerals "1" to "0" • characters, for example: !, ", #, $, %
6	ENT	Press.	The COMSEC selection window is closed. The display changes:
7			If required, change the TRANSEC key as described in step 5.
8	ENT	Press.	The TRANSEC selection window is closed.

The SEL (Selection) softkey is used to edit any existing user keyset. All radios in a SECOM-V network must have this user keyset.

4.7.3.2 Editing a User Hopset

A user hopset, which may consist of several subbands and single frequencies, can be edited in several ways. Frequencies can be inserted, edited or deleted, or a completely new hopset may be defined. The following applies to all procedures:

NOTICE

When editing the currently active user hopset, the changes will take effect immediately. Otherwise the new settings will take effect only when the relevant user hopset is selected.

The hopset range is from 30 MHz to 108 MHz (VHF range) and from 121 MHz to 512 MHz (UHF range). The frequency spacing in a hopset can be configured via R&S RNMS3000, with possible values 25 kHz and 50 kHz. Via the MMI the frequency spacing in a hopset cannot be changed and is fixed to 25 kHz.

NOTICE

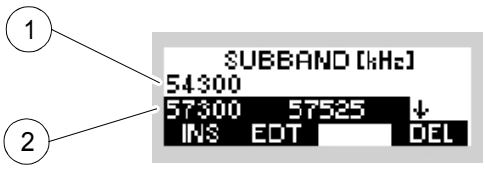
This frequency band must not overlap already existing frequency bands.

Invalid entries are automatically changed to the next possible value. This is indicated in the display, showing the current value that has been applied (e.g. APP 30000.00 kHz, APP = approve).

All radios in a SECOM-V network must have this user hopset.

Example (see Figure 4.48):

Figure 4.48 Hopset Editor



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1 Single frequency
2 Hopset frequency band

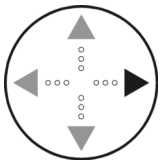
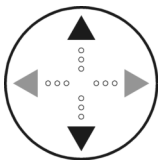
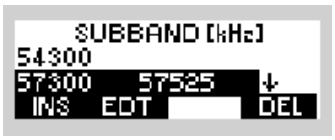
Defining a New Hopset

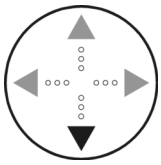
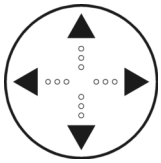
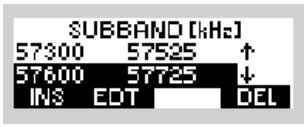
To define a new hopset, select the required hopset, delete any subbands and single frequencies, which may be already be contained, acc. to ”Deleting a User Hopset Subband” on p. 4.413 and enter the new frequencies acc. to ”Inserting a User Hopset Subband” on p. 4.409.

Inserting a User Hopset Subband

By means of softkeys SEL/INS (Select/Insert) the operator can insert a user hopset subband.

Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (CFG)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (SEL)	Press.	The display changes:
4		Press several times until the desired hopset is displayed.	Possible values (example): USERHOPSET1 to USERHOPSET5
5	ENT	Press.	The display changes: 

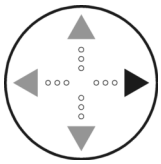
Step	Control	Action	Note
6		Press several times until a blank line appears in the display.	The display changes: Please note that a new subband must be inserted in the list where the values actually belong.
7	2 ABC (INS)	Press.	The display changes: The suggested value is the last value used plus 25 kHz.
8	0 _ * + to 9 WXYZ or 	Enter a new lower frequency. Change lower frequency selectively.	Range: 25000.000 kHz to 107975.000 kHz Range: 121000.000 kHz to 107975.000 kHz Step: 25.000 kHz (via MMI), configurable with the R&S RNMS3000 **NOTICE** **Note: This frequency must not overlap already existing frequency bands.**
9	ENT	Press.	The display changes: The suggested value is the entered value for the lower frequency.
10			Enter a new higher frequency as described in step 8.
11	ENT	Press.	The display changes: 

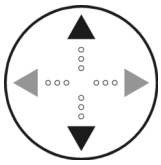
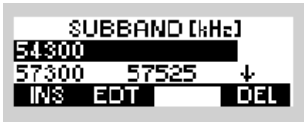
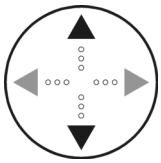
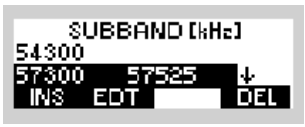
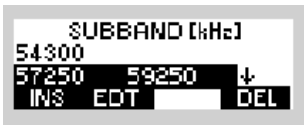
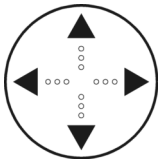
Step	Control	Action	Note
12	ENT	Press.	The display changes: The new subband is now effective. After a short delay the display changes:

Editing a User Hopset Subband

By means of softkey SEL/EDT (Select/Edit) the operator can edit a user hopset subband.

Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (SEL)	Press.	The display changes:

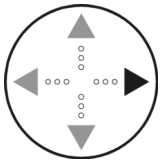
Step	Control	Action	Note
4		Press several times until the desired hopset is displayed.	Possible values (example): USERHOPSET1 to USERHOPSET5
5	ENT (EDT)	Press.	The display changes: 
6		Press several times until the desired sub-band is displayed.	The display changes: 
7	3 DEF	Press.	The display changes: 
8	0 _ * + to 9 WXYZ or 	Enter a new lower frequency Change lower frequency selectively.	Range: 25000.000 kHz to 107975.000 kHz Range: 121000.000 kHz to 107975.000 kHz Step: 25.000 kHz (via MMI), configurable with the R&S RNMS3000 **NOTICE** **This frequency must not overlap already existing frequency bands.**
9	ENT	Press.	The display changes:
10			Enter a new higher frequency as described in step 8.
11	ENT	Press.	The display changes:

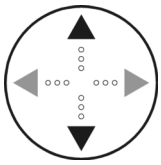
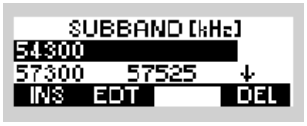
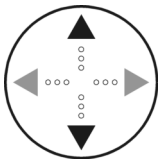
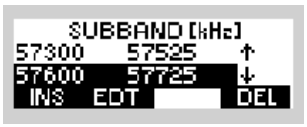
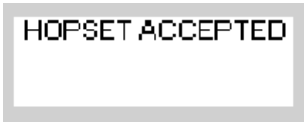
Step	Control	Action	Note
12	ENT	Press.	The display changes: The new subband is now effective. After a short delay the display changes:

Deleting a User Hopset Subband

By means of softkeys SEL/DEL (Select/Delete) the operator can delete a user hopset subband.

Starting point: Main page of SECOM-V CFG menu

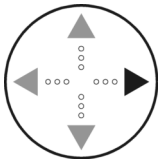
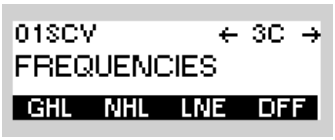
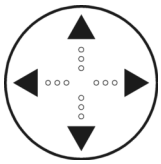
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (SEL)	Press.	The display changes:

Step	Control	Action	Note
4		Press several times until the desired hopset is displayed.	Possible values (example): USERHOPSET1 to USERHOPSET5
5	ENT (DEL)	Press.	The display changes: 
6		Press several times until the desired sub-band is displayed.	The display changes: 
7	5 JKL	Press.	The display changes:
8	ENT	Press.	The display changes:
9	ENT	Press.	The display changes:  The new sub-band is now effective. After a short delay the display changes:

4.7.3.3 Changing the General Hailing Frequency

By means of softkey GHL (General Hailing) the operator can change a general hailing frequency.

Starting point: Main page of SECOM-V CFG menu

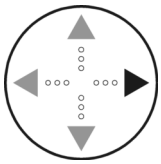
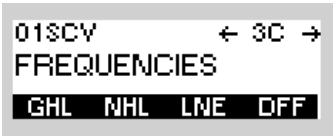
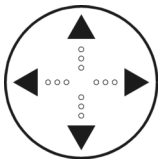
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press twice.	The display changes: 
3	2 ABC (GHL)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new frequency. Change frequency selectively.	Range: 25000.000 kHz to 107975.000 kHz 121000.000 kHz to 511975.000 kHz Step: 25.000 kHz
5	ENT	Press.	The selection window is closed. The new general hailing frequency is now effective.

- Invalid entries are automatically changed to the next possible value. This is indicated in the display, showing the current value that has been applied (e.g. APP 30000.00 kHz, APP = approve).

4.7.3.4 Changing the Net Hailing Frequency

By means of softkey NHL (Net Hailing) the operator can change a net hailing frequency.

Starting point: Main page of SECOM-V CFG menu

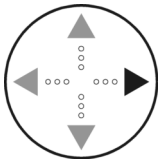
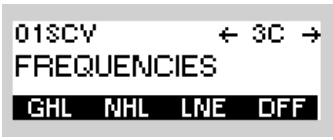
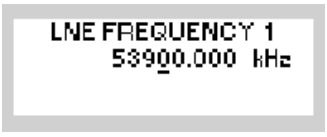
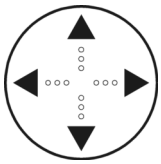
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press twice.	The display changes: 
3	3 DEF (NHL)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new frequency. Change frequency selectively.	Range: 25000.000 kHz to 107975.000 kHz 121000.000 kHz to 511975.000 kHz Step: 25.000 kHz
5	ENT	Press.	The selection window is closed. The new net hailing frequency is now effective.

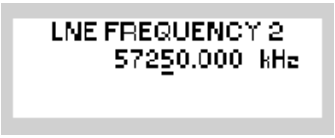
- Invalid entries are automatically changed to the next possible value. This is indicated in the display, showing the current value that has been applied (e.g. APP 30000.00 kHz, APP = approve).

4.7.3.5 Changing the Net Entry Frequency

By means of softkey LNE (Late Net Entry) the operator can change the Net Entry frequencies (2 are available).

Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press twice.	The display changes: 
3	5 JKL (LNE)	Press.	The display changes: 
4	0 _ * + to 9 WXYZ or 	Enter a new frequency. Change frequency selectively.	Range: 25000.000 kHz to 107975.000 kHz 121000.000 kHz to 511975.000 kHz Step: 25.000 kHz

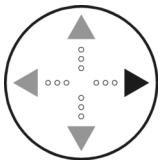
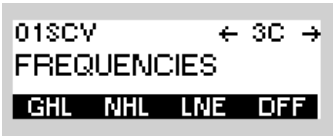
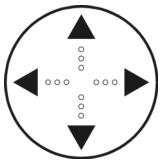
Step	Control	Action	Note
5	ENT	Press.	The display changes: 
6			Enter a new frequency as described in step 4.
7	ENT	Press.	The selection window is closed. The new late Net Entry frequencies are now effective.

- Invalid entries are automatically changed to the next possible value. This is indicated in the display, showing the current value that has been applied (e.g. APP 30000.00 kHz, APP = approve).

4.7.3.6 Changing the Digital Fixed Frequency

By means of softkey DFF (Digital Fixed Frequency) the operator can change this frequency.

Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press twice.	The display changes: 
3	5 JKL (DFF)	Press.	The display changes:
4	0 _ * + to 9 WXYZ or 	Enter a new frequency. Change frequency selectively.	Range: 25000.000 kHz to 107975.000 kHz 121000.000 kHz to 511975.000 kHz Step: 25.000 kHz
5	ENT	Press.	The selection window is closed. The new digital fixed frequency is now effective.

SECOM-V supports two hopping modes:

- FH (Frequency Hop Mode): SECOM-V uses all available frequencies from the hopset.
- DFF (Digital Fixed Frequency): In this mode the hopset is reduced to one predefined frequency.

4.7.3.7 Changing the Data Rate for SECOM-V Transmission

By means of softkey DR (Data Rate) the operator can change the data rate for SECOM-V transmission.

Starting point: Main page of SECOM-V CFG menu

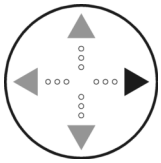
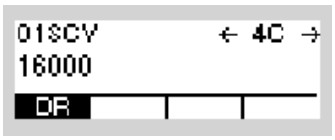
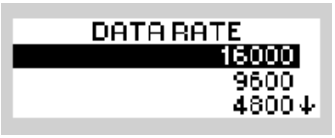
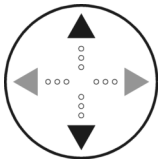
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press three times.	The display changes: 
3	2 ABC (DR)	Press.	The display changes: 
4		Press several times until the desired data rate is displayed.	Possible values:16000, 9600, 4800, 2400, 1200, 600
5	ENT	Press.	The selection window is closed. The new data rate is now effective.

Table 4.14 Dependency of Data Rate and FEC (Forward Error Correction)

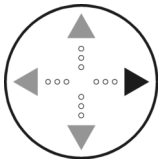
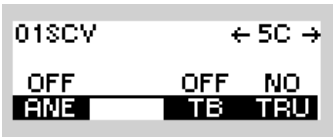
Data rate	Error correction	Application
16 000 bit/s	none	Voice transmission with vocoder external synchronous terminals
9 600 bit/s	RS(31,20)	Data transmission
4 800 bit/s	RS(31,20) 2 repetitive transmissions	Voice transmission with vocoder
2 400 bit/s	RS(31,20) 4 repetitive transmissions	Data transmission
1 200 bit/s	RS(31,20) 8 repetitive transmissions	Data transmission
600 bit/s	RS(31,20) 16 repetitive transmissions	Data transmission

RS = Reed Solomon Coding

4.7.3.8 Switching the Automatic Net Entry Mode On or Off

By means of softkey ANE (Automatic Net Entry) the operator can switch the automatic net entry mode on or off.

Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press four times.	The display changes: 
3	2 ABC (ANE)	Press.	Repetitively pressing this key toggles the automatic net entry mode on and off.

If Automatic Net Entry is enabled, the radio may go to TX mode when net synchronization is lost. If this is not desired, switch ANE OFF.

4.7.3.9 Switching the Time Beacon Mode On or Off

If Time Beacon is enabled, the radio will go to TX mode from time to time:

- Non-TRU radios automatically request net synchronization from the TRU when necessary.
- The TRU radio automatically transmits synchronization information when necessary or requested.

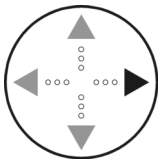
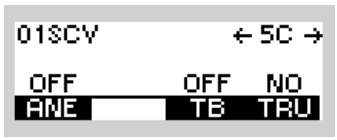
If this is not desired, switch Time Beacon off.

NOTICE

Be sure to perform at least one Net Entry manually after activation of Time Beacon functionality. Time Beacon function will only work if it is enabled at least at the TRU. For optimal performance, the TRU has to be operated in broadcast mode. Otherwise, resynchronization may be requested more often than actually necessary.

By means of softkey TB (Time Beacon) the operator can switch the time beacon mode on or off.

Starting point: Main page of SECOM-V CFG menu

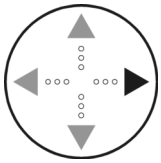
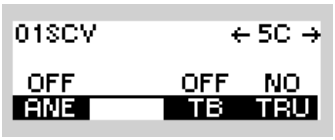
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press four times.	The display changes: 

Step	Control	Action	Note
3	4 GHI (TB)	Press.	Repetitively pressing this key toggles the time beacon mode on and off.

4.7.3.10 Defining a Radio as a Time Reference Unit

By means of softkey TRU (Time Reference Unit) the operator can define the radio as time reference unit.

Starting point: Main page of SECOM-V CFG menu

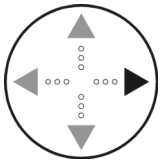
Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press four times.	The display changes: 
3	5 JKL (TRU)	Repetitively pressing this key defines the unit as time reference unit or as time slave.	Possible settings: • NO • TRU The new setting is now effective.

- As soon as a Net Entry request has been initiated by radios, the radio defined as time reference unit provides the other radios with the current net time.
- Only one radio is allowed to be time reference unit within one net.

4.7.3.11 Changing the VOX Sensitivity

By means of softkey SEN (Sensitivity) the operator can change the sensitivity for the function VOX. When VOX is selected, the sensitivity will become automatically activated.

Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press five times	The display changes:
3	4 GHI (SEN)	Repetitively pressing this key toggles between five sensitivity levels.	Possible settings: -- very low - low o medium + high ++ very high

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface. If VOX is on, the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

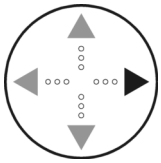
  Softkey SEN is used to change the VOX sensitivity in five steps, provided that VOX is on.

- Default: medium

4.7.3.12 Changing the VOX Hangtime

By means of softkey HNG (Hang) the operator can change the holdtime for the function VOX. When VOX is selected, the holdtime will be automatically activated.

Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once	The display changes:
3	5 JKL (HNG)	Repetitively pressing this key toggles between three hold times.	Possible settings: SHT short MED medium LNG long

- In VOX (Voice-Operated Transmission) the radio is keyed when a voice signal is present on the audio or line interface. If VOX is on, the operator can switch to transmit mode (TX) by simply talking, and when he stops talking the tactical radio automatically returns to receive mode (RX).

  The transmitter is keyed as long as a voice signal is present. When the voice stops tactical radio will return to receive mode (RX) only after the holdtime has elapsed.

  The settings SHT, MED, LNG represent the following values:

  Short: 300 ms

  Medium: 600 ms

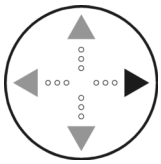
  Long: 900 ms

- Default: medium

4.7.3.13 Changing the Out-of-Band Hailing Channel

By means of softkey CH (Channel) the operator can change the out-of-band hailing channel.

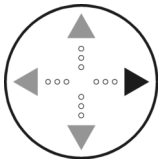
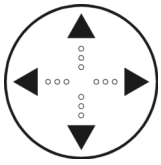
Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press six times.	The display changes:
3	2 ABC (CH)	Repetitively pressing this key cycles through the user defined and preconfig-ured out-of-band hailing channels for configuration.	Possible settings: U1, U2, #1 to #5 **NOTICE** **Depending on the SECOM-V configuration, the number of available channels may vary. All out-of-band hailing settings are stored for the selected channel.**

4.7.3.14 Changing the Out-of-Band Hailing Channel Frequency

By means of softkey FRQ (Frequency) the operator can change the out-of-band hailing channel frequency.

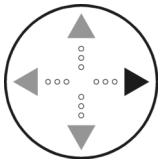
Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press six times.	The display changes:
3	3 DEF (FRQ)	Press.	The display changes:
4	0 _ * + to 9 WXYZ 	Enter a new frequency Change frequency selectively.	Range: 1.5 MHzto 512 MHz
5	ENT		If the entered frequency is within the permitted entry range, the editor window will be closed.

4.7.3.15 Changing the Out-of-Band Hailing Channel Modulation Mode

By means of softkey MOD (Modulation) the operator can change the out-of-band hailing channel modulation mode.

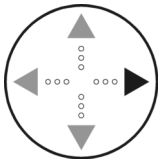
Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press six times.	The display changes:
3	4 GHI (MOD)	Repetitively pressing this key cycles through the available modulation modes	Possible settings: • A1A • A3E • -J3E • J3E • F3E

4.7.3.16 Changing the Out-of-Band Hailing Channel Detection Method

By means of softkey DT (Detection) the operator can change the out-of-band hailing channel detection method.

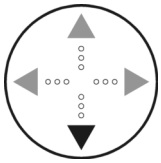
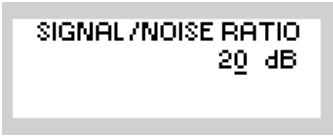
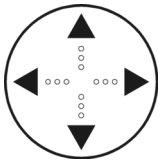
Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press six times.	The display changes:
3	5 JKL (DT)	Repetitively pressing this key cycles through the available detection methods.	Possible settings: • 150 Hz tone • CTT (Continuous Tone Coded Subaudio Squelch) • S/N (signal to noise) • RSSI (Received Signal Strength Indication) **NOTICE** **Not all detection methods are available for some modulation modes.**

4.7.3.17 Changing the Signal-to-Noise Level of the Out-of-Band Channel Signal

By means of softkey S/N (Signal-to-Noise) the operator can change the out-of-band hailing signal to noise squelch level.

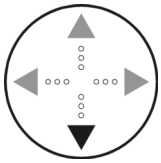
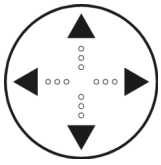
Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once.	The display changes:
3	2 ABC (S/N)	Press.	The display changes: 
4	0 _*+ to 9 WXYZ 	Enter a new squelch level change squelch level selectively.	Range: 10 dB to 30 dB
5	ENT		If the entered squelch level is within the permitted entry range, the editor window will be closed.

4.7.3.18 Changing the Out-of-Band Hailing Channel RSSI Squelch Level

By means of softkey RSSI (Received Signal Strength Indication) the operator can change the out-of-band hailing channel RSSI squelch level.

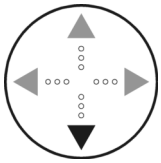
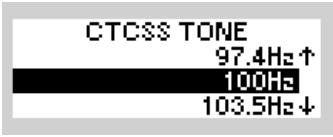
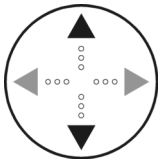
Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once.	The display changes:
3	3 DEF (RSSI)	Press.	The display changes:
4	0 _*+ to 9 WXYZ 	Enter a new squelch level change squelch level selectively.	Range: 10 dB to 30 dB
5	ENT		If the entered squelch level is within the permitted entry range, the editor window will be closed.

4.7.3.19 Selecting the Out-of-Band Hailing Channel Tone Squelch Frequency

By means of softkey CTT (Continuous Tone Coded Subaudio Squelch) the operator can select the out-of-band hailing channel tone squelch frequency.

Starting point: Main page of SECOM-V CFG menu

Step	Control	Action	Note
1	2 ABC (SC)	Press.	The display changes:
2		Press once.	The display changes:
3	4 GHI (CTT)	Press.	The display changes: 
4		Press several times until the desired frequency is displayed.	Possible Settings (Hz): 67.0 - 69.3 - 71.9 - 74.4 - 77.0 - 79.7 - 82.5 - 85.4 - 88.5 - 91.5 - 94.8 - 97.4 - 100.0 - 103.5 - 107.2 - 110.9 - 114.8 - 118.8 - 123.0 - 127.3 - 131.8 - 136,5 - 141.3 - 146.2 - 151.4 - 156.7 - 162.2 - 167.9 - 173.8 - 177.3 - 179.9 - 186.2 - 189.9 - 192.8 - 199.5 - 203.5 - 206.5 - 210.7 - 218.1 - 225.7 - 233.6 - 241.8 - 250.3
5	ENT		The selection window is closed. The new frequency is now effective.

4.7.4 Settings in Menu CFG (CONFIG, Global Radio Parameters)

The following SECOM parameters can be adjusted:

- Vocoder type and data rate
- Data Terminal 1 settings
- IP Port

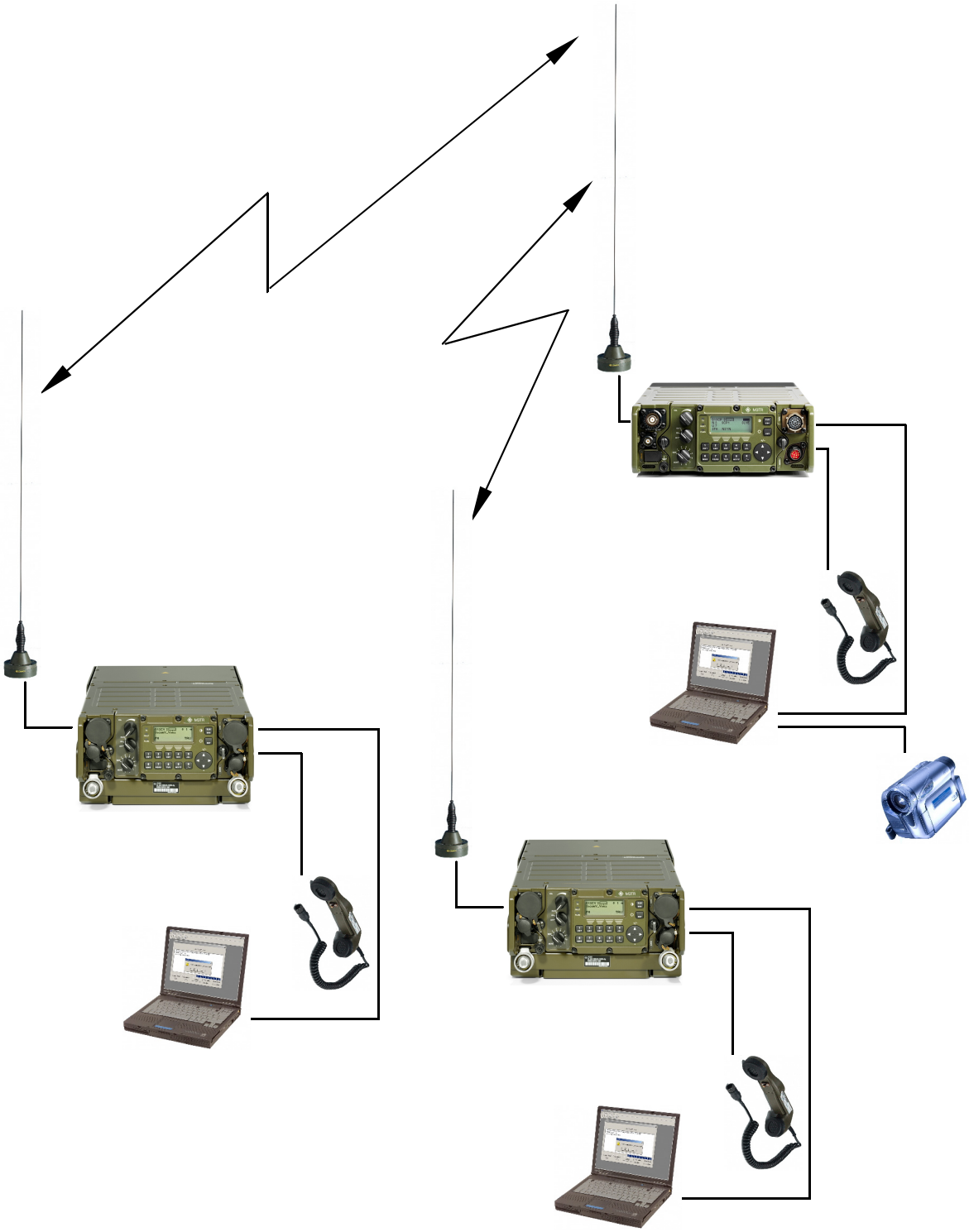
See sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters).

4.8 OFDM Data Modem

4.8.1 Basics of OFDM Data Modem Mode

OFDM (Orthogonal Frequency Division Multiplex) data mode is used for high data rate transmission by means of the integrated data modem of the tactical radio (Application: Figure 4.49). The modem operates at a data rate which is variable between 16 kbit/s and 72 kbit/s together with the bandwidth. It uses the digital modulation procedure OFDM (Orthogonal Frequency Division Multiplex).

Figure 4.49 Application: OFDM Data Modem



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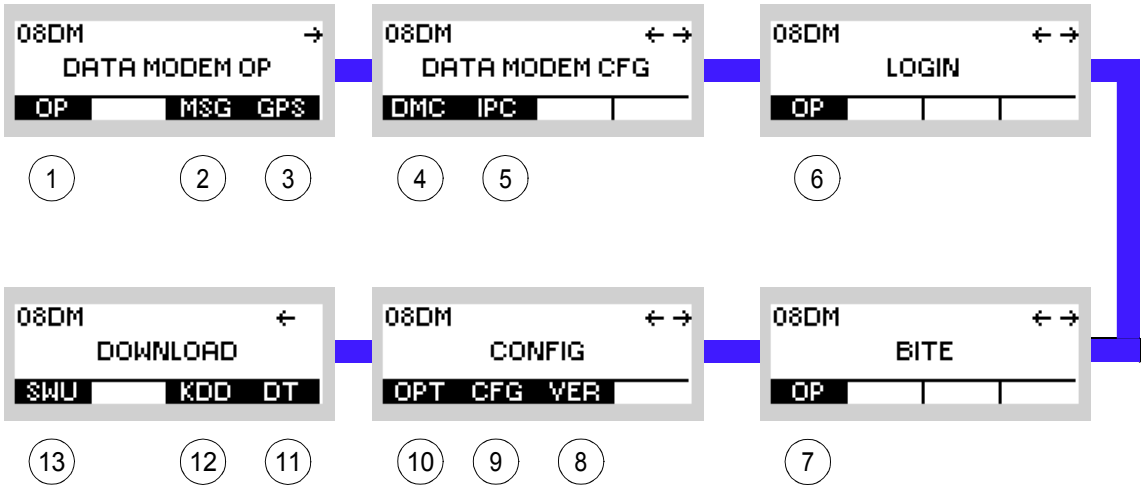
4.8.2 Preset Page DM (Data Modem)

Figure 4.50 Preset Page DM (Data Modem)



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1 See sect. 4.8.3 Settings in the Menu OP (DATA MODEM OP, Operation)
2 See sect. 5.4.2 Settings in Menu Message Service (M)
3 See sect. 5.2.2.1 Display of the Own GPS Position
4 See sect. 4.8.4 Settings in the Menu DMC (DATA MODEM CFG, Configuration)
5 See sect. 5.3.3 Settings in Menu IP OVER AIR (IP)
6 See sect. 3.5 Login
7 See sect. 6.2.6 Settings in Menu OP (BITE, Operation)
8 See sect. 3.7.2 Settings in Menu VER (CONFIG, Inquiring the Software Version)
9 See sect. 3.7.2 Settings in Menu CFG (CONFIG, Global Radio Parameters)
10 See sect. 3.7 Configuration
11 See sect. 3.7.3 Settings in Menu DT (DOWNLOAD, Loading Pre-configured Radio Parameters)
12 Not relevant in this application.
13 This function is described in the service documentation.

4.8.3 Settings in the Menu OP (DATA MODEM OP, Operation)

Starting point:

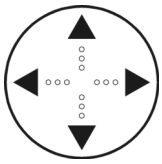
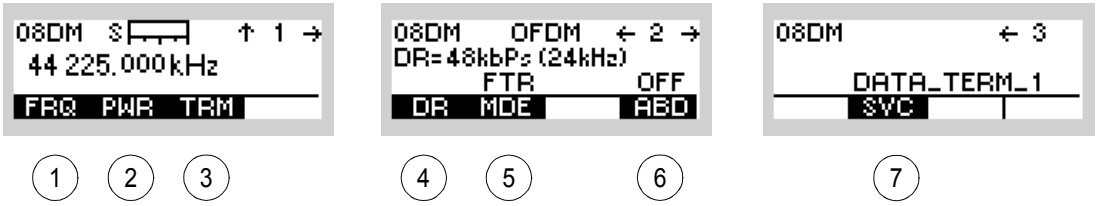
Step	Control	Action	Note
1	(OP) 2 ABC	Press.	The display changes, e.g.:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes, e.g.:
3		Press.	Press several times until the desired subordinate menu is activated (see Figure 4.54). The menu structure is explained separately by Figure 4.52. After a delay of approximately 10 seconds, the ALE operational page 1 is automatically reactivated.

Figure 4.51 Menu OP (Data Modem, Submenus)



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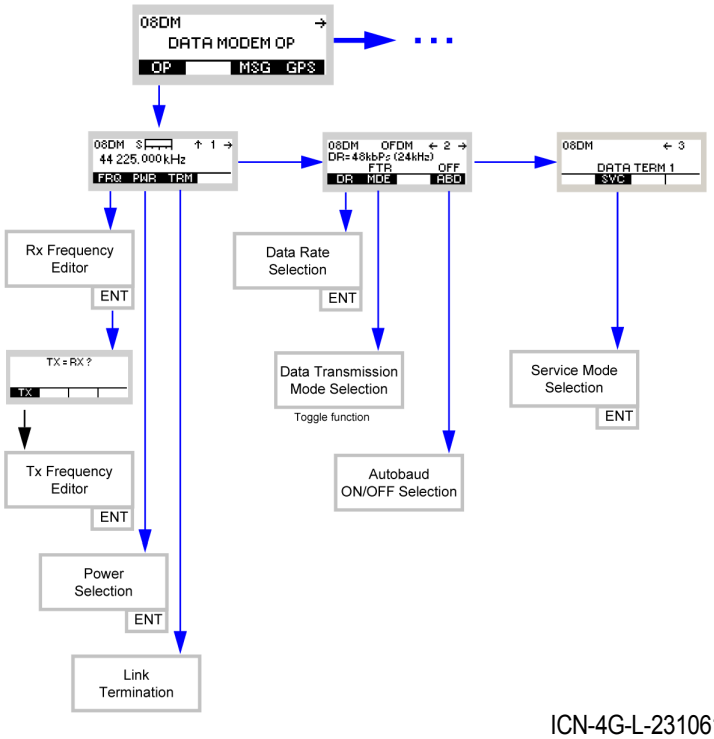
1 See sect. 4.8.3.1 Changing the Frequency for Data Transmission
2 See sect. 4.8.3.2 Changing the Power Level for Data Transmission
3 See sect. 4.8.3.3 Terminating a Link
4 See sect. 4.8.3.4 Changing the Data Rate and Bandwidth for Data Transmission
5 See sect. 4.8.3.5 Changing the Mode for Data Transmission
6 See sect. 4.8.3.6 Switching Autobaud On and Off
7 See sect. 4.8.3.7 Changing the Service Mode

Figure 4.52 Menu OP (Data Modem, Structure)



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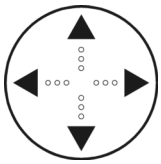
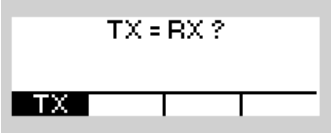
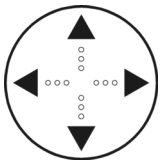
4.8.3.1 Changing the Frequency for Data Transmission

By means of softkey FRQ (Frequency) the operator can change the transmit and/or receive frequency.

Starting point: Main page of Data Modem menu

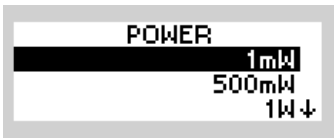
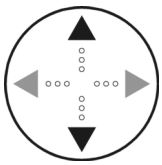
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (FRQ)	Press.	The display changes:
4	0 _*+ to 9 WXYZ or  .	Enter a new RX frequency. Change RX frequency selectively	Range: 30 MHz to 511.975 MHz Step: 25 kHz

Step	Control	Action	Note
5	ENT	Press. For RX = TX press ENT. For RX <> TX enter new TX frequency as follows.	If the entered RX frequency is within the permitted entry range, the display changes: 
6	2 ABC (TX)	Press.	The display changes:
7	0 _ * + to 9 WXYZ or 	Enter a new TX frequency Change TX frequency selectively.	Range: 30 MHz to 511.975 MHz Step: 25 kHz
8	ENT	Press.	If the entered TX frequency is within the permitted entry range, the editor window will be closed

4.8.3.2 Changing the Power Level for Data Transmission

By means of softkey PWR (Power) the operator can change the power level.

Starting point: Main page of Data Modem menu

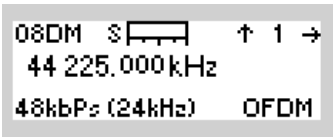
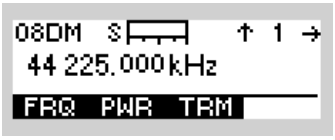
Step	Control	Action	Note
1	2 ABC	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	3 DEF	Press.	The display changes: 
4		Press several times until the desired power level is displayed.	Possible values: see sect. 3.2.2.5 Changing the Power Level
5	ENT	Press.	The selection window is closed. The new power level is now effective.

- The PWR softkey is used to select from a choice of transmit powers. By selecting a higher transmit power the coverage for radiocommunication is extended. The nature of the terrain also needs to be considered when selecting the transmit power.

4.8.3.3 Terminating a Link

By means of softkey TRM (Terminate) the operator can terminate the running link.

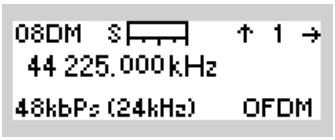
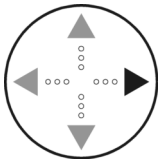
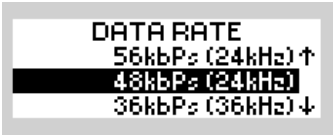
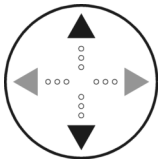
Starting point: Main page of Data Modem menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes: 
3	3 DEF (TRM)	Press.	The link is terminated manually.

4.8.3.4 Changing the Data Rate and Bandwidth for Data Transmission

By means of softkey DR (Data Rate) the operator can change the data rate and associated bandwidth for data transmission.

Starting point: Main page of Data Modem menu

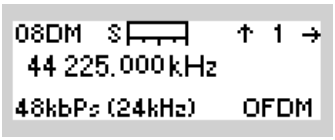
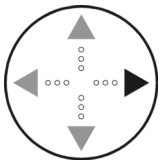
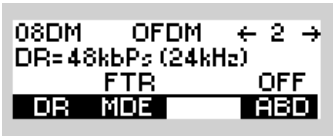
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes:
3	2 ABC (DR)	Press.	The display changes: 
4		Press several times until the desired data rate is displayed.	Possible values: 16 kb/s (12 kHz) -> 24 kb/s (24 kHz) -> 32 kb/s (24 kHz) -> 36 kb/s (36 kHz) -> 48 kb/s (24 kHz) -> 56 kb/s (24 kHz) -> 64 kb/s (24 kHz) -> 64 kb/s (36 kHz) -> 72 kb/s (24 kHz) -> 72 kb/s (36 kHz)
5	ENT	Press.	The selection window is closed. The new data rate is now effective.

- The DR softkey is used to select the data rate for transmission via air (radio link).

4.8.3.5 Changing the Mode for Data Transmission

By means of softkey MDE (Mode) the operator can select the mode for modem operation.

Starting point: Main page of Data Modem menu

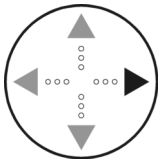
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes: 
3	3 DEF (MDE)	Press.	Repetitively pressing key toggles the mode between FTR (fast train) and LTE (late entry).

- The MDE softkey is used to select between two modem operating modes. In Fast Train mode the modem uses a preamble to synchronize the signal to be transmitted. In Late Entry mode the modem synchronizes by means of 2-D search in time and frequency.

4.8.3.6 Switching Autobaud On and Off

By means of softkey ABD (Autobaud) the operator can switch the autobaud selection on and off.

Starting point: Main page of Data Modem menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes:
2		Press once.	The display changes:
3	5 JKL (ABD)	Press.	Repetitively pressing this key switches the function on and off.

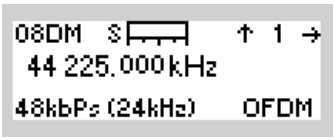
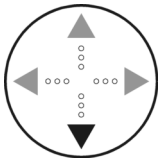
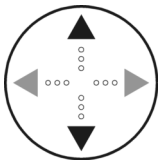
4.8.3.7 Changing the Service Mode

There are two Service Modes supported by OFDM Modem:

- Data links (DATA_TERM_1 = connection to external data terminal)
- (IP_DATA)

By means of softkey SVC (Service) the operator can change the service mode.

Starting point: Main page of Data Modem menu

Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes:
3	3 DEF (SVC)	Press.	The display changes:
4		Press several times until the desired service mode is displayed.	Possible values: • DATA_TERM 1 • IP_DATA
5	ENT	Press.	The selection window is closed. The new service mode is now effective.

4.8.4 Settings in the Menu DMC (DATA MODEM CFG, Configuration)

Starting point:

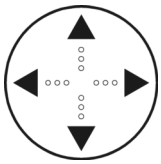
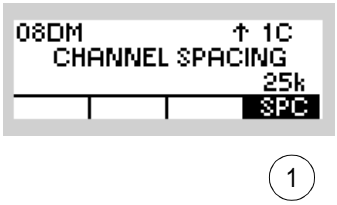
Step	Control	Action	Note
1	2 ABC (DMC)	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired subordinate menu is activated (see Figure 4.56).

Figure 4.53 Menu DMC (Data Modem, Submenus)



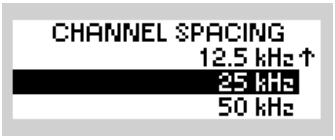
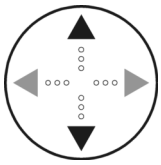
ICN-4G-L-231061-R-D0894-00011-A-01-1

1 See sect. 4.8.4.1 Changing the Channel Spacing

4.8.4.1 Changing the Channel Spacing

By means of softkey SPC (Spacing) the operator can change the channel spacing.

Starting point: Main page of Data Modem menu

Step	Control	Action	Note
1	3 DEF	Press.	The display changes:
2	5 JKL	Press.	The display changes: 
3		Press several times until the desired setting is displayed.	Possible values: 1 Hz - 5 kHz - 6.25 kHz - 8 1/3 kHz - 12.5 kHz - 25 kHz - 50 kHz
4	ENT	Press.	The selection window is closed. The new channel spacing is now effective.

5 Services

5.1 Introduction

This documentation gives information about the optional services provided by the optional software:

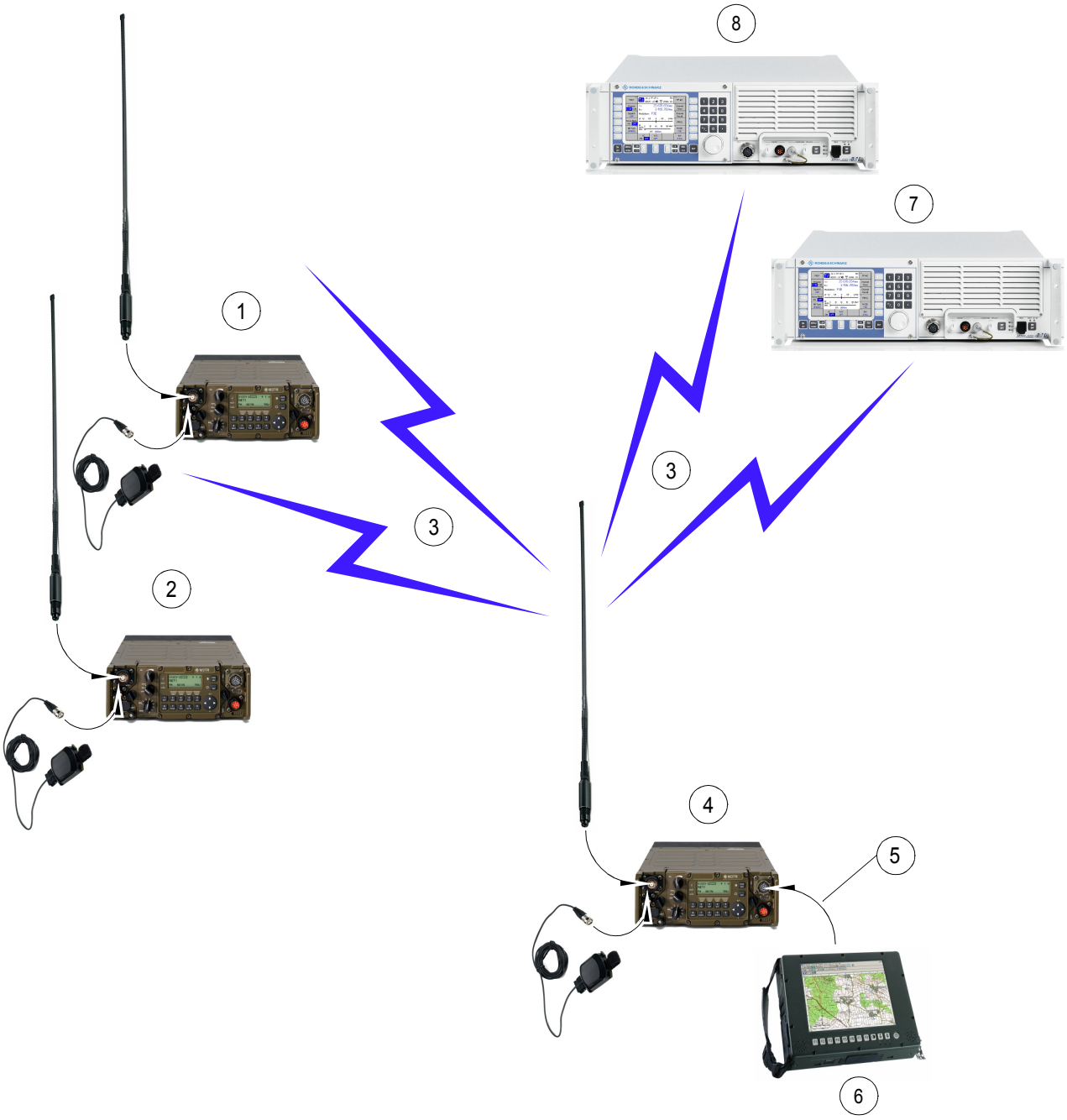
- See sect. 5.2.2 Settings in Menu GPS (e.g. SECOM-P OP, Operation)
- See sect. 5.3.3 Settings in Menu IP OVER AIR (IP)
- See sect. 5.4.2 Settings in Menu Message Service (M)
- See sect. 5.5.2 Settings in Menu PHN (SECOM-V OP, Operation)

5.2 GPS Reporting

5.2.1 Basics of GPS Reporting

GPS position information from mobile forces being equipped with either R&S M3TR Tactical radios and / or R&S M3SR Series 4100 radios. The following figure shows an example of a GPS reporting system using tactical radios (R&S MR300xH Manpack Transceivers) and R&S XK4115A Transceivers.

Figure 5.1 GPS Reporting System



ICN-4G-N-231052-R-D0894-00001-A-01-1

1 R&S MR300xH_2 equipped with R&S HV3003 and R&S HV3004 acting as GPS provider
2 R&S MR300xH_3 equipped with R&S HV3003 and R&S HV3004 acting as GPS provider
3 SECOM-H network transmitting GPS data and control signals
4 R&S MR300xH_1 equipped with R&S HV3003 and R&S HV3004 acting as GPS controller
5 GPS data and control signals via REMOTE
6 GPS position display:
M3TR_MP1
M3TR_MP2
M3TR_MP3
M3SR_1
M3SR_2
7 R&S XK4115_1 acting as GPS provider
8 R&S XK4115_2 acting as GPS provider

In order to participate in GPS reporting, these radios must be equipped with a GPS hardware receiver and dedicated over-the-air GPS transmission software. GPS transmission is supported by SECOM-H, SECOM-P and SECOM-V waveforms. In addition GPS transmission is also supported by ALE-3G for Link Mode xDL. As a general requirement, a radio needs to be synchronous with its waveform-specific network in order to be able to receive or transmit GPS information.

	R&S M3TR	R&S M3SR Series 4100
SECOM-H	**x**	**x**
SECOM-P	**x**	
SECOM-V	**x**	
ALE-3G / xDL	**x**	**x**

The radio shall have clear satellite visibility in order to be able to retrieve its current GPS position and GPS timing information. If GPS reception is temporarily lost or satellite visibility is limited, empty GPS positioning information is transmitted. Since the GPS time signal is required for synchronization of the system, scheduled transmissions (see sect. 5.2.1.2 Types of GPS Transmission) are not supported if the GPS time signal has never been received (see also sect. 5.2.1.4 General Requirements and Valid Combinations of GPS Reporting Features).

Participation in GPS reporting must furthermore be enabled in the network / mission configuration dialog of R&S RNMS3000. The functionality of R&S RNMS3000 is not in the scope of this documentation (see the relevant R&S RNMS3000 Documentation).

GPS information and control is usually broadcast to all GPS participants (except when using dedicated point-to-point addressing). Received GPS position information is stored within the radio and can be accessed via its MMI (Man-Machine Interface) and REMOTE control interfaces. An external PC-based application may be used for accessing / displaying or further processing the stored GPS information and to control / configure the GPS reporting system. The functionality of this application is not in the scope of this documentation.

R&S MR3000P requires an external R&S HV3031 GPS Receiver for the GPS reporting system to function. The R&S MR300xH/U and R&S M3SR Series 4100 radios have an internal GPS receiver chipset to be connected to the R&S HV3003 antenna.

The features of the GPS reporting system on the radio are grouped as follows:

- sect. 5.2.1.1 Roles of Radios Supporting GPS Reporting
- sect. 5.2.1.2 Types of GPS Transmission
- sect. 5.2.1.3 Addressing of GPS Transmissions
- sect. 5.2.1.4 General Requirements and Valid Combinations of GPS Reporting Features
- sect. 5.2.1.5 SECOM-H Specifics of GPS Reporting (Option)
- sect. 5.2.1.6 ALE-3G Specifics of GPS Reporting (Option)

5.2.1.1 Roles of Radios Supporting GPS Reporting

The role of a radio participating in GPS (Global Positioning System) reporting can be pre-selected via R&S RNMS3000 or dynamically selected via MMI (Man-Machine Interface) / REMOTE interfaces.

Provider

A GPS provider is a radio providing GPS positioning data to other GPS participants. It does so by

- manually or automatically pushing its current GPS position information onto the network,
- responding to GPS control / configuration requests being received over the air from another, dedicated radio GPS participant called GPS controller.

Controller

A GPS controller is a dedicated radio GPS participant being able to

- request (pull) GPS positioning information from other participants and
- control / configure the automatic GPS transmission of other participants.

The controller commands other GPS participants over the air by using the radio dedicated GPS control commands. The transmission of these commands can be initiated manually via the MMI or via the radio REMOTE interface by an external application.

There can be one or multiple GPS controllers in a waveform specific network. It is an organizational challenge to ensure that control requests of multiple controllers do not conflict.

Controller Acting as Provider

In order to ensure that the GPS positioning information of a controller radio remains “hidden”, by default a controller does not respond to pull and control / configuration messages received from another controller. Also, it does by default not take part in automatic GPS reporting (see sect. 5.2.1.2 Types of GPS Transmission). If a controller shall exceptionally support the above actions, the mode "Controller Reports Position (CRP)", needs to be enabled. The CRP state (enabled or disabled) can be pre-selected via R&S RNMS3000 or dynamically enabled / disabled via the MMI / REMOTE interfaces. When CRP is enabled, a controller also automatically transmits its own GPS positioning information when pulling or configuring other GPS participants.

5.2.1.2 Types of GPS Transmission

Pull Request and Response

A GPS (Global Positioning System) pull request is issued by a GPS controller in order to request the transmission of current GPS positioning information from other GPS participants.

Addressed providers and other controllers with CRP (Controller Reports Position) enabled having received the request do respond by transmitting their current GPS position (if available). If an addressed GPS participant has currently no GPS satellite visibility, it will respond by transmitting empty GPS positioning information. If a participant has never received the GPS signal (required for scheduled transmissions), it will not respond to a standard (scheduled) pull request since in this case it can only support unscheduled / immediate pull actions (see sect. 5.2.1.4 General Requirements and Valid Combinations of GPS Reporting Features and ”Immediate (Unscheduled) Transmission” on p. 5.9).

Push

Manual Push

GPS participants can manually push their current GPS position onto the network. A manual push can be initiated via an MMI (Man-Machine Interface) pushbutton or via the REMOTE interface (for radios only).

If a GPS participant has currently only limited or no GPS satellite visibility, it will push empty GPS positioning information onto the network. If a GPS participant has never received the GPS signal (required for scheduled transmissions), it can only support immediate push actions (see sect. 5.2.1.4 General Requirements and Valid Combinations of GPS Reporting Features).

Received pull and push data are internally stored by the receiving radios (participating in GPS reporting) in a list and can be accessed in different formats via the MMI and REMOTE interfaces.

Automatic Push

Tactical radio GPS participants can automatically push their current GPS position onto the network.

Periodic (Timer Initiated) Transmission of GPS Information

An auto push time interval [in seconds] can be pre-configured statically via R&S RNMS3000 or dynamically by receiving an Auto Push Configuration Request (APR) from a GPS controller.

Selected / addressed provider radios and controller radios with CRP enabled start to periodically transmit their current GPS position using the configured time interval. For this to function, network and GPS time synchronization must have been received. The time interval can only be set an integer multiple of the scheduling round time (see ”Standard (Scheduled) Transmission” on p. 5.8).

If a GPS participant has currently only limited or no GPS satellite visibility, it will automatically push empty GPS positioning information onto the network. If a participant has never received the GPS signal (required for scheduled transmissions), it cannot take part in periodic GPS reporting.

GPS Configuration (Automatic Push Configuration Request)

A controller radio can send a GPS control / configuration command to radio GPS participants in order to configure the auto push features of addressed participants.

Configure Periodic (Timer Initiated) Transmission of GPS Information

An auto push time interval [in seconds] of the addressed participants can be pre-configured on-air by sending an Auto Push Configuration Request (APR) from a controller radio.

Selected / addressed provider radios and controller radios with CRP enabled start to periodically transmit their current GPS position (if available) using the configured time interval (assuming network and GPS time synchronization is given). The time interval can only be set an integer multiple of the scheduling round time (see ”Standard (Scheduled) Transmission” on p. 5.8).

If a controller has never received the GPS signal (required for scheduled transmissions), it cannot transmit an auto push configuration request.

It should be noted that transmitting a dynamic Auto Push Configuration Request will override the Auto Push Time settings as configured by R&S RNMS3000. Thus, if the Auto Push (Time) operation has for example been disabled in the R&S RNMS3000 mission planning and the radio receives a dynamic APR request from a controller, the dynamic setting will be remembered by the radio. Thus, the radio may start an Auto Push Time operation according to the last APR configuration request (even if the initial mission planning had disabled APT) when the radio is switched to this preset page next time. Hence, it is the responsibility of the controller's operator to ensure that an APR operation (of a temporary nature) is disabled (by sending an APR/APT=0 request to all radios) if the resumption of automatic reporting is not desired (when the radio is switched on next time).

Standard (Scheduled) Transmission

On the radio, a transmission scheduling scheme has been implemented in order to prevent multiple GPS participants transmitting on the air channel at the same time (either accidentally or incidentally). There is a potential for collisions between push, pull and auto push GPS data being transmitted concurrently. Also, collision potential exists between GPS and other services like voice / data and network service transmissions. Collisions of GPS data with other services cannot be avoided by the scheduling.

In order to prevent the problem of on-air collisions, a scheduling scheme is applied to standard (i.e. non-immediate) GPS transmissions. In SECOM-P and SECOM-V these GPS transmissions occupy the air channel for less than one second. Hence, the scheduling round time (for one scheduling cycle) is equal to the number of GPS participants configured by R&S RNMS3000.

The maximum configurable number of GPS reporting participants has been limited in R&S RNMS3000 to 32 participants. Thus, the network is occupied by GPS traffic for maximally 32 seconds, assuming all participants transmit their position information sequentially scheduled (one after each other) in a scheduling round.

Based on a common GPS time reference, the scheduling scheme gives each participant an exclusive slot access right once per scheduling round.

By binding the right to transmit GPS information to one exclusive scheduling slot, on-air collisions between scheduled GPS data and control may be avoided. On the other hand, a GPS participant has to wait until its assigned scheduling slot is due before it can transmit. In SECOM-P and SECOM-V, the maximum number of GPS participants is limited to 32 participants resulting in a worst case transmission delay (i.e. a “waiting time”) of 31 seconds.

In order to use the scheduling scheme, after entering a preset page supporting GPS reporting, any GPS participant must have received the GPS time signal at least once in order to “synchronize” its scheduling algorithm with the other participants. If the GPS time signal reception is temporarily limited or lost, a back-up clock will maintain the synchronism.

However, if the GPS time signal has never been received after entering the preset page, the participant cannot support scheduled GPS transmissions (see sect. 5.2.1.4 General Requirements and Valid Combinations of GPS Reporting Features).

Immediate (Unscheduled) Transmission

Immediate GPS transmissions are sent immediately, i.e. without using the scheduling scheme (see ”Standard (Scheduled) Transmission” on p. 5.8). Hence, there is some potential that any non-scheduled transmission conflicts on-air with other (scheduled or non-scheduled) GPS transmissions and cannot be received by other GPS participants.

On the other hand, an immediate GPS transmission is executed without any scheduling delay and the GPS time signal reception is not required for synchronizing the scheduling transmissions with other GPS participants.

Therefore immediate GPS transmissions should be used in situations when a delay in transmitting GPS data or control cannot be accepted or in case the GPS time signal (required for scheduling) has never been received before (after entering the preset page).

5.2.1.3 Addressing of GPS Transmissions

Broadcast

In broadcast addressing mode, GPS (Global Positioning System) pull and configuration requests are transmitted to all participants and all participants (within operational reach and being synchronized to the network and GPS system) respond by broadcasting their GPS information (if available) to the network.

Also, all push data (see sect. 5.2.1.2 Types of GPS Transmission) are transmitted as broadcast.

Point-to-Point

In Point-to Point (P2P) addressing mode, GPS pull and configuration requests are sent to a single GPS participant and only this participant responds. The response, however, is sent as broadcast to the whole network.

In order to avoid on-air collisions, Immediate Pull (IPL (R&S M3TR) or 'Immediate PULL' (R&S M3SR Series 4100)) requests can only be used in connection with point-to-point addressing.

Participant Selection List

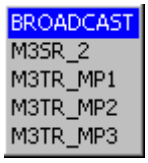
The selection list for the addressable GPS participants supports the selection of

- a single GPS participant (point-to-point)
- all GPS participants (broadcast)

when sending controller initiated command requests (IPL (Immediate PULL), PUL (Scheduled PULL) and APR (Auto Push List] commands)). After a command softkey is pressed, the user is presented with a selection list of R&S RNMS3000 configured radios participating in GPS reporting:

R&S M3TR

R&S M3SR Series 4100



The list contains

- an entry for broadcast sending and
- the names of all configured GPS participants except for the own radio.

For immediate pull (IPL (R&S M3TR) or 'Immediate PULL' (R&S M3SR Series 4100)), the broadcast entry is not displayed as this would result in an on-air collision of incoming GPS reports (since all providers would try to respond at once / immediately).

GPS participant entries can be scrolled using the up and down arrow keys. Pressing ESC will leave the editor, aborting the command request. Pressing ENT will continue the command with the selected GPS participant.

5.2.1.4 General Requirements and Valid Combinations of GPS Reporting Features

Table 5.1 shows which requirements must be fulfilled and which combinations of addressing features are valid for the GPS reporting features to function:

Table 5.1 Requirements and Valid Combinations of GPS Reporting

Feature	Network synch. required	GPS signal reception / satellite visibility required	Broadcast addressing supported	P2P addressing supported
Standard pull request issued by controller radio	Yes	At least once, can be lost temporarily lost; if never received, standard pull requests cannot be sent.	Yes	Yes
Immediate pull request issued by controller radio	Yes	Not required, immediate pull requests can be sent without current or former GPS reception.	No	Yes
Standard pull response from radio participant(s)	Yes	At least once, can be lost temporarily; if never received, standard pull responses cannot be sent.	Yes	No
Immediate pull response from radio participant(s)	Yes	Not required, immediate pull response with empty data can be sent without current or former GPS reception.	Yes	No
Standard push data transmitted by radio participant(s)	Yes	At least once, can be lost temporarily; if never received, standard push data cannot be sent.	Yes	No
Immediate push data transmitted by radio participant(s)	Yes	Not required, immediate empty push data can be sent without current or former GPS reception.	Yes	No
Auto Push Configuration Request (APR) issued by controller radio	Yes	At least once, can be lost temporarily; if never received, Auto Push Requests (APR) cannot be sent.	Yes	Yes
Auto push data (response) transmitted by radio participant(s)	Yes	At least once, can be lost temporarily; if never received, auto push GPS data cannot be sent, if GPS reception is given at a later point in time, auto push operation starts automatically.	Yes	No
Auto push data (initiated due to R&S RNMS3000 mission planning) transmitted by radio participant(s)	Yes	At least once, can be lost temporarily; if never received, auto push GPS data cannot be sent, if GPS reception is given at a later point in time, auto push operation starts automatically.	Yes	No

The terms "at least once" and "never received" refer to the GPS satellite reception after the preset page supporting GPS reporting has been selected.

5.2.1.5 SECOM-P Specifics of GPS Reporting

See sect. 5.2 GPS Reporting.

GPS (Global Positioning System) reporting can be used under SECOM-P in combination with all waveform services (voice, data or voice-over-data).

As a prerequisite, the waveform synchronization (transmitted by master station) must have been received by all GPS participants for the exchange of GPS information to function.

If the SECOM-P on-air channel is currently occupied by transmitting voice, data or network service information, no GPS information can be transmitted and vice versa.

If a master station and one slave station are currently executing a SelCom (Point-to-Point) call, these radios will not receive GPS information being transmitted in the network and vice versa.

5.2.1.6 SECOM-V Specifics of GPS Reporting (Option)

See sect. 5.2 GPS Reporting.

GPS (Global Positioning System) reporting can be used under SECOM-V only in combination with the waveform services IP-Data, IP-Repro or Voice-over-IP Data.

As prerequisites,

- a net entry (requested from non-TRU stations from the timing reference unit (TRU) station) must have been executed successfully by all GPS participants,
- the service selection IP-Data, IP-Repro or Voice-over-IP Data must be chosen in R&S RNMS3000,
- a valid IPoA (IP over Air) net must be configured in R&S RNMS3000 (regarding IP-air addresses, the IPoA operation mode, routing tables.

for the exchange of GPS information to function.

If the SECOM-V on-air channel is currently occupied by transmitting voice, data or network service information, no GPS information can be transmitted and vice versa.

5.2.1.7 SECOM-H Specifics of GPS Reporting (Option)

See sect. 5.2 GPS Reporting.

GPS (Global Positioning System) reporting can be used under SECOM-H only in combination with the waveform services IP-Data, IP-Repro or Voice-over-IP Data.

As prerequisites,

- a net entry (requested from non-TRU stations from the timing reference unit (TRU) station must have been executed successfully by all GPS participants,
- the service selection IP-Data, IP-Repro or Voice-over-IP Data must be chosen in R&S RNMS3000
- a valid IPoA (IP over Air) net must be configured in R&S RNMS3000 (regarding IP-Air addresses, the IPoA operation mode, routing tables)

for the exchange of GPS information to function.

If the SECOM-H on-air channel is currently occupied by transmitting voice, data or network service information, no GPS information can be transmitted and vice versa.

NOTICE

Compared to other waveforms the timings for SECOM-H are extended. Depending on the number of radios within the network and the used search pattern the minimum cycle time is 4 s.

5.2.1.8 ALE-3G Specifics of GPS Reporting (Option)

Refer to sect. 5.2 GPS Reporting.

GPS (Global Positioning System) reporting can be used under ALE-3G only in combination with Link Mode xDL.

As prerequisite IPoA must be configured in R&S RNMS3000.

NOTICE

In contrast to waveforms SECOM-V, SECOM-H and SECOM-P, in this case only PULL requests are supported for GPS Reporting and controller role. For GPS Reporting provider neither PULL nor PUSH is supported.

For ALE-3G only Point-To-Point requests are supported.

GPS reporting under ALE-3G works independent of Time Source and LSU-Mode settings.

5.2.2 Settings in Menu GPS (e.g. SECOM-P OP, Operation)

The menu GPS is available for all preset pages. Each preset page main menu page holds a softkey labelled “GPS” at the rightmost position. As an example, the “SECOM-P” main menu page is shown.

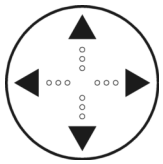
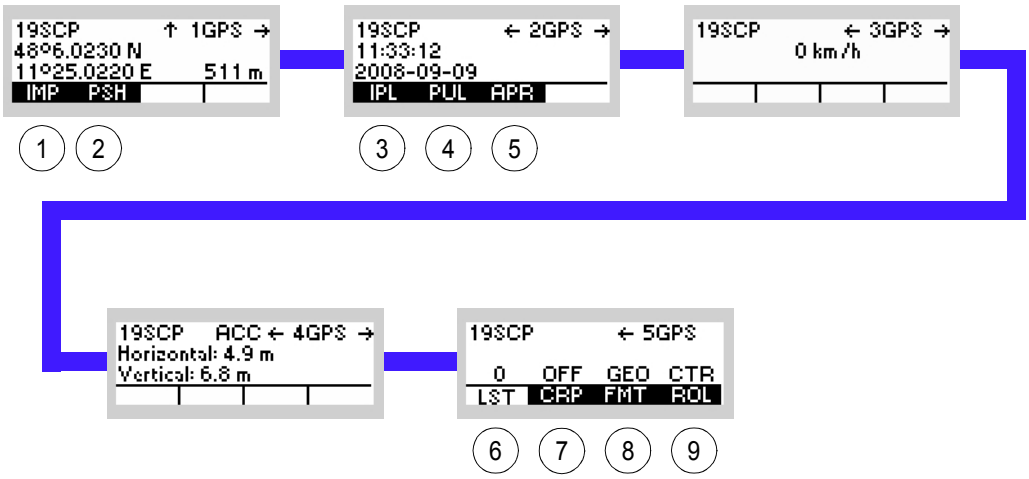
Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The own GPS position is displayed (if available). **NOTICE** **For further information see sect. 5.2.2.1 Display of the Own GPS Position.**
2	0 _*+ to 9 WXYZ	Press.	The display changes:
3		Press.	Press several times until the desired subordinate menu is activated (see Figure 5.2). The menu structure is explained separately in Figure 5.3. After a delay of approximately 10 seconds, the GPS operational page 1 is automatically reactivated.

Figure 5.2 Menu GPS (SCP, Submenus)



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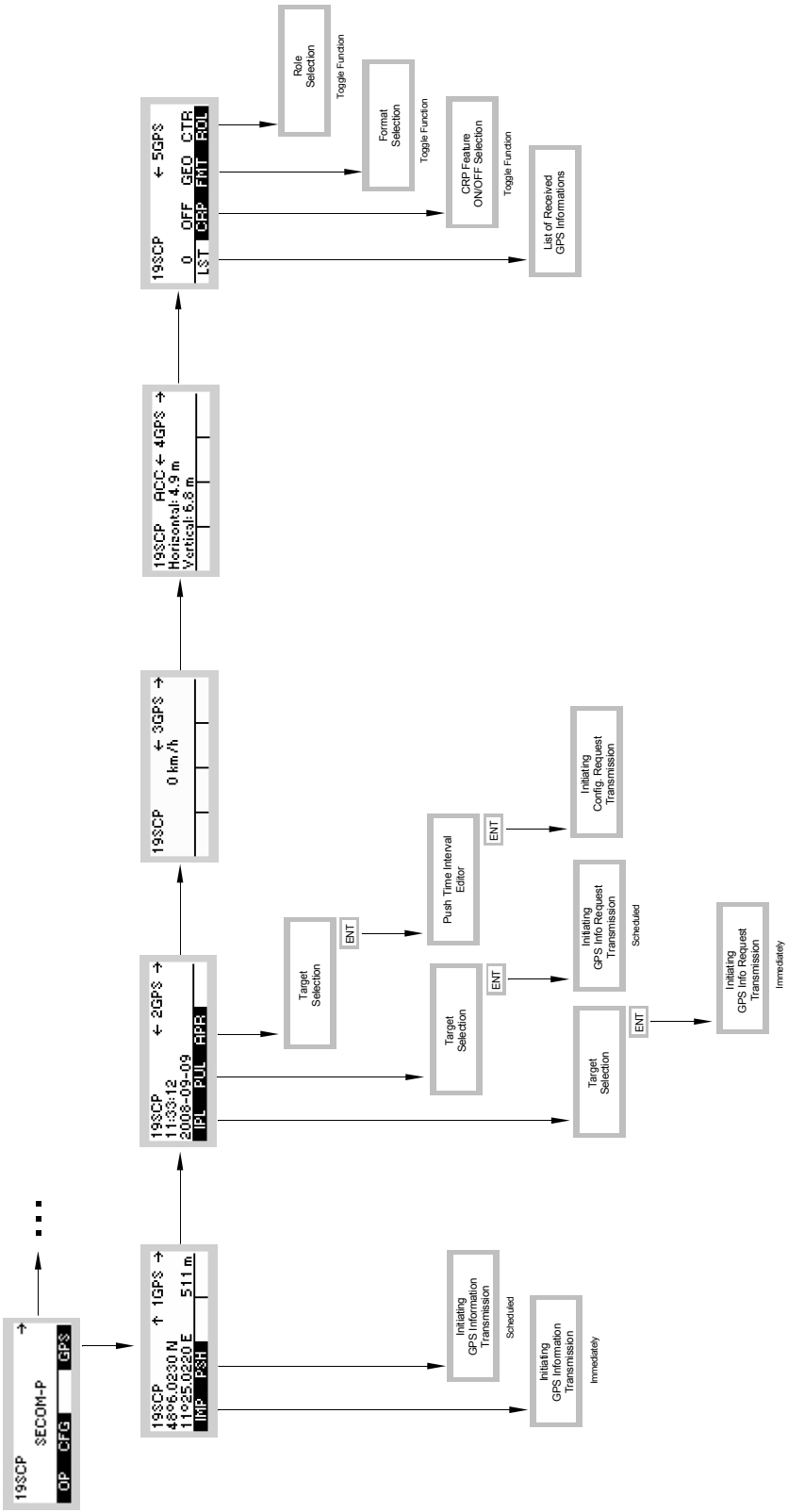
1 See sect. 5.2.2.3 Initiating a GPS Position Information Transmission (Push, Immediately)
2 See sect. 5.2.2.4 Initiating a GPS Position Information Transmission (Push, Scheduled)
3 See sect. 5.2.2.5 Initiating a GPS Information Request (Pull, Immediately, as Controller Feature)
4 See sect. 5.2.2.6 Initiating a GPS Information Request (Pull, Scheduled, as Controller Feature)
5 See sect. 5.2.2.7 Initiating an Auto Push Configuration Request Transmission (as Controller Feature)
6 See sect. 5.2.2.8 List of Received GPS Position Information
7 See sect. 5.2.2.9 Switching the Controller Reports Position as Controller Feature On or Off
8 See sect. 5.2.2.10 Selecting the Format of GPS Position Display
9 See sect. 5.2.2.11 Selecting the Role of a Participant

Figure 5.3 Menu GPS (SCP, Structure)



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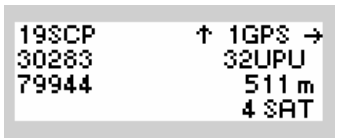
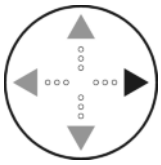
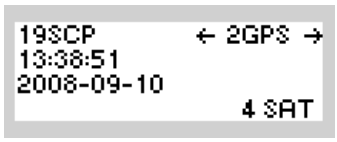
5.2.2.1 Display of the Own GPS Position

The own GPS (Global Positioning System) position can be displayed in three different formats:

- Geographical (GEO) positioning information (based on WGS84 ellipsoid),
- Universal Transverse Mercator (UTM) positioning information (based on WGS84 ellipsoid),
- Military Grid System (MGRS) positioning information (based on WGS84 ellipsoid).

The selection of the display format is controlled via softkey FMT (only with relevant software option).

Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The own GPS position is displayed in the selected format (GEO, UTM or MGRS). (GEO) (UTM) (MGRS)  see Figure 5.4
2		Press once.	The own GPS time and date are displayed.  see Figure 5.5

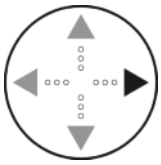
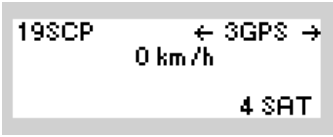
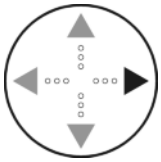
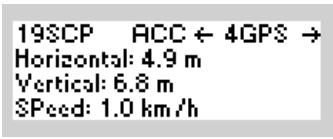
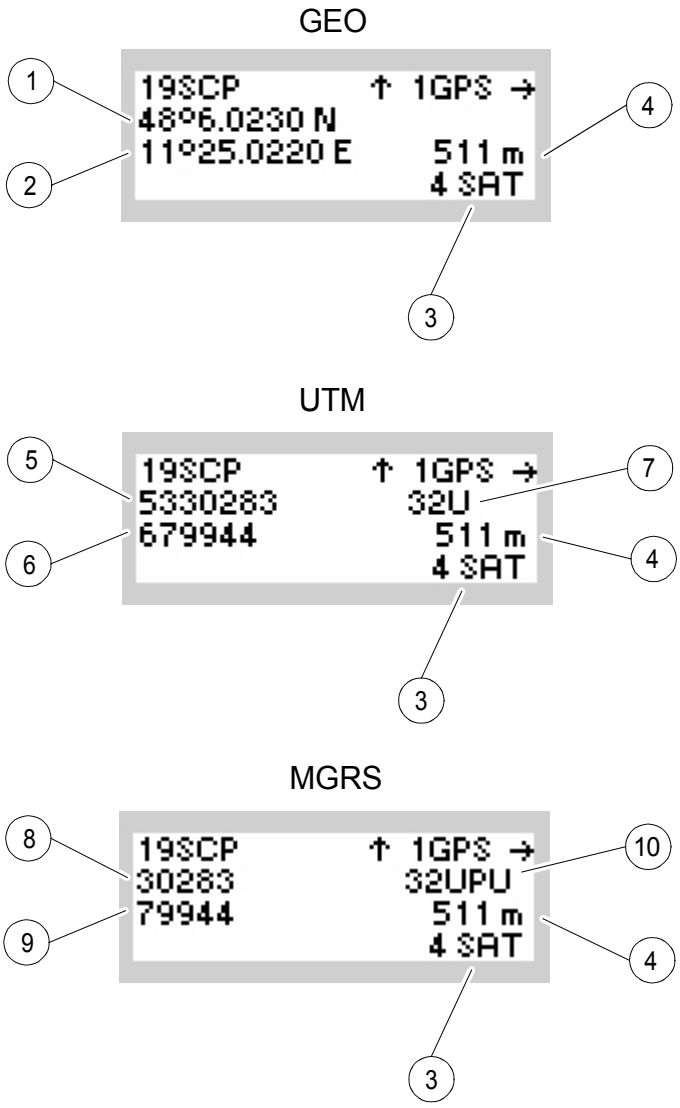
Step	Control	Action	Note
3		Press once.	The own velocity is displayed.  see Figure 5.6
4		Press once.	The accurancy is displayed.  see Figure 5.7

Figure 5.4 Menu GPS (Position)



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GEO Geographical (**GEO**) positioning information (based on WGS84 ellipsoid)
1 Latitude (LAT) - In degrees and milliminutes plus north / south indication
2 Longitude (LON) - In degrees and milliminutes plus east / west indication.
3 Current GPS (SAT) reception quality - Number of satellites received (1 to 7) or 'NO SAT' for 0 satellites
4 Altitude (ALT) - In meter from sea level
UTM Universal Transverse Mercator (**UTM**) positioning information (based on WGS84 ellipsoid)
5 Latitude (LAT) - In meter (northing)
6 Longitude (LON) - In meter (easting).
7 UTM zone indication
MGRS Military grid system (**MGRS**) positioning information (based on WGS84 ellipsoid)
8 Latitude (LAT) - In meter (northing)
9 Longitude (LON) - In meter (easting)
10 MGRS zone indication

Figure 5.5 Menu GPS (Time / Date)

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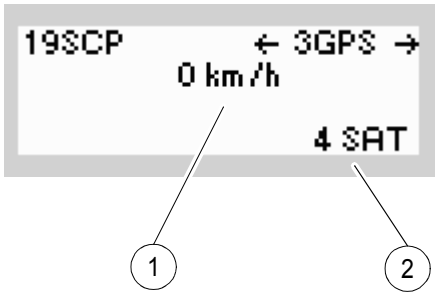
1 Time (TIM) - GPS time in HH-MM-SS
2 Date (DAT) - GPS date in CCYY-MM-DD
3 Current GPS (SAT) reception quality - Number of satellites received (1 to 7) or 'NO SAT' for 0 satellites

Figure 5.6 Menu GPS (Velocity)



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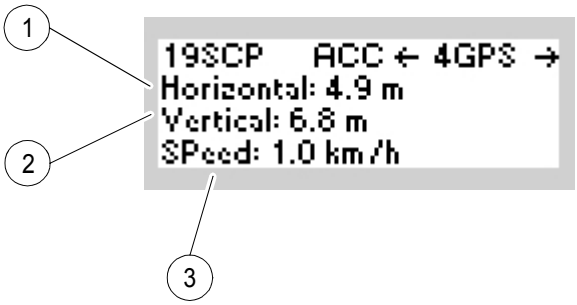
1 Current velocity (VEL) in forward direction - Velocity in km/h
2 Current GPS (SAT) reception quality - Number of satellites received (1 to 7) or 'NO SAT' for 0 satellites

Figure 5.7 Menu GPS (Accurancy)



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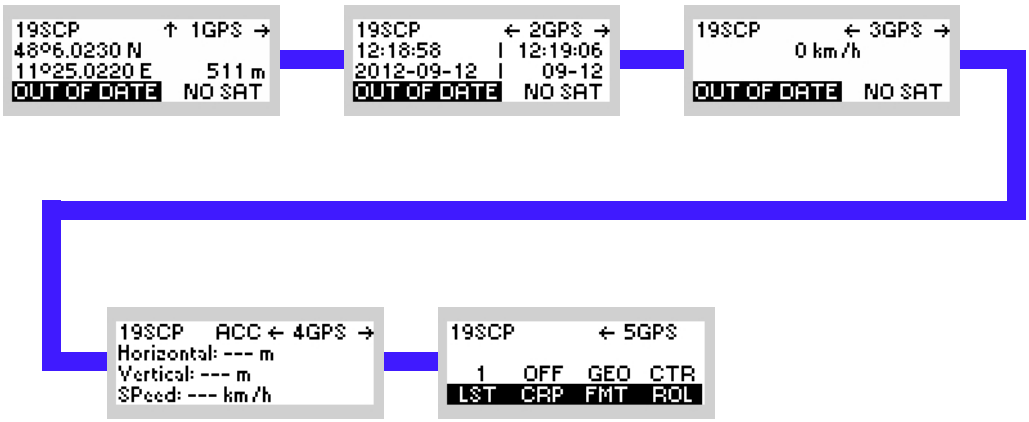
1 Horizontal accurancy estimate in m
2 Vertical aAccurancy estimate in m
3 Speed accurancy estimate in km/h

5.2.2.2 Invalid GPS Signal

If a GPS participant has currently no GPS satellite visibility, the last received position is displayed. In this case it will report empty GPS positioning information to other participants. If the radio never had a valid GPS position, the data items will displayed as empty (“---“).

Figure 5.8 Menu GPS (SCP, Invalid GPS Signal)



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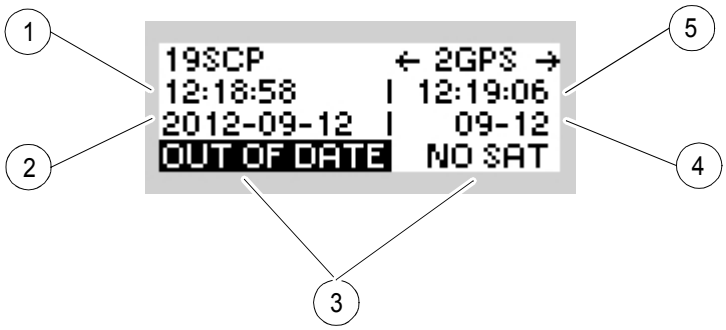
If the GPS time or date cannot be retrieved from the satellites, the calculated time and date from GPS module will be displayed instead. The calculated time is only displayed, if a valid GPS signal was received while radio runtime. Otherwise data items will displayed as empty (“---“)

Figure 5.9 Menu GPS (Time / Date, Invalid GPS Signal)



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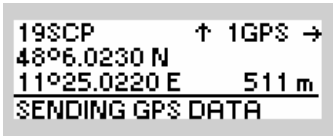
1 The last received GPS time in HH-MM-SS
2 The last received GPS date in CCYY-MM-DD
3 The displayed values are out of date. No satellites are available.
4 Calculated date from GPS module in MM-DD
5 Calculated time from GPS module in HH-MM-SS

5.2.2.3 Initiating a GPS Position Information Transmission (Push, Immediately)

By means of softkey IMP (Immediately Push) the operator can immediately transmit (push) its current GPS positioning information (see sect. 5.2.2.1 Display of the Own GPS Position) to other participants operating in the same network.

Starting point: Main page of e.g. SECOM-P menu

Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	2 ABC (IMP)	Press.	The display changes: 

If a GPS participant has currently only limited or no GPS satellite visibility, it will push empty GPS positioning information to the network. Also, immediate push actions can be executed even if the GPS time signal (required for scheduling) has never been received.

Immediate GPS data are transmitted unscheduled (see sect. 5.2.1.2 Types of GPS Transmission). Hence, there is some potential that any unscheduled transmission conflicts on-air with other (scheduled or unscheduled) GPS transmissions and therefore cannot be received by other GPS participants.

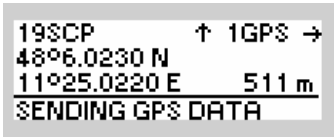
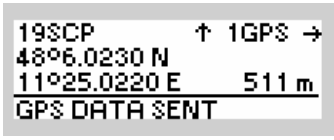
On the other hand, an immediate transmission is executed without any scheduling delay. Therefore immediate push transmissions should be used in situations when a delay in transmitting the GPS push data cannot be accepted or in case the GPS time signal (required for scheduling) has never been received before.

The reception of the immediately pushed GPS position information by other GPS participants is described in sect. 5.2.2.8 List of Received GPS Position Information.

5.2.2.4 Initiating a GPS Position Information Transmission (Push, Scheduled)

By means of softkey PSH (Push) the operator can transmit (push) its current GPS position to other participants using a scheduled transmission (see sect. 5.2.1.2 Types of GPS Transmission).

Starting point: Main page of e.g. SECOM-P menu

Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3	3 DEF (PSH)	Press.	The display changes:  

If a GPS participant has currently only limited or no GPS satellite visibility, it will push empty GPS positioning information to the network. However, standard push actions can be executed only after the GPS time signal (required for scheduling) has been received at least once. This is due to the fact that standard push actions are scheduled transmissions in order to avoid potential on-air collisions.

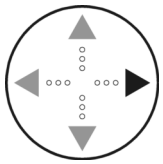
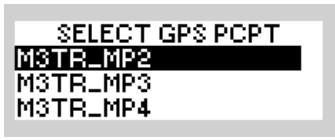
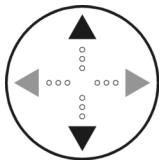
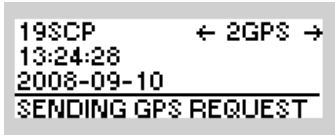
Thus, using the standard push mode is more reliable than the immediate push (see sect. 5.2.2.3 Initiating a GPS Position Information Transmission (Push, Immediately)). On the other hand, in case the GPS signal has never been received before, the operator must use an immediate push transmission (see sect. 5.2.2.3 Initiating a GPS Position Information Transmission (Push, Immediately)) in order to transmit an empty GPS position record (indicating the missing GPS reception to other participants).

The reception of the pushed GPS position information by other GPS participants is described in sect. 5.2.2.8 List of Received GPS Position Information.

5.2.2.5 Initiating a GPS Information Request (Pull, Immediately, as Controller Feature)

By means of softkey IPL (Immediately Pull) the operator of a controller radio can immediately request (pull) the GPS position from a single participant operating in the same network.

Starting point: Main page of e.g. SECOM-P menu

Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3		Press once.	The display changes:
4	2 ABC (IPL)	Press.	The display changes: 
5		Select targeted single participant (PTCP) from selection list.	
6	ENT	Press.	The display changes: 

Step	Control	Action	Note

Immediate GPS pull requests and responses are transmitted non-scheduled. Hence, there is some potential that any unscheduled transmissions will conflict on-air with another (scheduled or unscheduled) GPS transmission and hence cannot be received by other GPS participants.

In order to avoid collisions caused by multiple providers responding immediately, an immediate pull request can only be addressed to a single (P2P) participant. The selection process of the addressed participant is described in sect. 5.2.1.3 Addressing of GPS Transmissions.

On the other hand, immediate pull actions can be executed even if the GPS time signal (required for scheduling) has never been received before. Also, immediate pull actions are executed without any scheduling delay. Thus, the addressed participant will also respond immediately (if receiving the request).

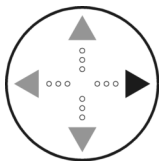
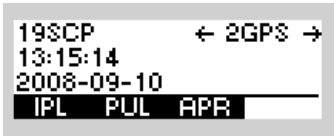
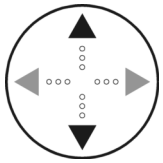
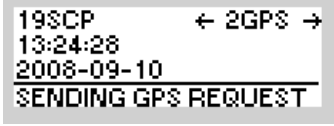
Thus, immediate pull actions should be used in situations when a delay in requesting the GPS data cannot be accepted or in case the GPS signal has never been received before (by the controller or by the addressed participant).

The reception of the immediate GPS pull response from the addressed provider is described in sect. 5.2.2.8 List of Received GPS Position Information.

5.2.2.6 Initiating a GPS Information Request (Pull, Scheduled, as Controller Feature)

By means of softkey PUL (Pull) the operator of a controller radio can request (pull) the GPS position from all or from a single participant using a scheduled transmission (see sect. 5.2.1.2 Types of GPS Transmission).

Starting point: Main page of e.g. SECOM-P menu

Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3		Press once.	The display changes: 
4	3 DEF (PUL)	Press.	The display changes:
5		Select all (BROAD-CAST) or a single participant (PTCP) from selection list.	
6	ENT	Press.	The display changes: 

Step	Control	Action	Note

Standard pull actions (be it request or response) can be executed only when the GPS time signal (required for scheduling) has been received at least once. This is due to the fact that standard pull transmissions are scheduled in order to avoid on-air collisions with other (scheduled) GPS transmissions. Thus, using the standard pull mode is more reliable than the immediate pull (see sect. 5.2.2.5 Initiating a GPS Information Request (Pull, Immediately, as Controller Feature)).

A standard pull request can be addressed to all participants (BROADCAST) or to a single participant. The selection process of the addressed participant(s) is described in sect. 5.2.1.3 Addressing of GPS Transmissions.

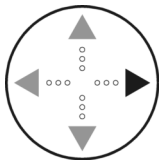
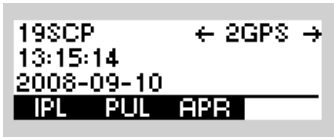
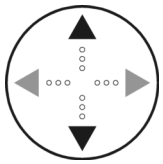
In case the GPS signal has never been received by an addressed participant, the participant will not respond to the standard pull request. The participant then appears to be “absent” to the controller, i.e. it does not appear in the list of received GPS positions (see sect. 5.2.2.8 List of Received GPS Position Information). In this case, the operator of the controller may use an immediate pull request (see sect. 5.2.2.5 Initiating a GPS Information Request (Pull, Immediately, as Controller Feature)) in order to pull a particular participant not responding. If an addressed GPS participant has currently only limited or no GPS satellite visibility, it will still respond by transmitting empty GPS positioning information using a scheduled transmission.

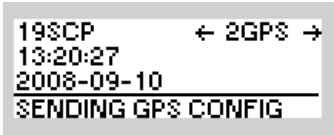
The reception of the GPS position received from the addressed GPS participants is described in sect. 5.2.2.8 List of Received GPS Position Information.

5.2.2.7 Initiating an Auto Push Configuration Request Transmission (as Controller Feature)

By means of softkey APR (Auto Push Request) the operator of a controller radio can send an Auto Push Configuration Request (APR) to all or to a single participant using a scheduled transmission (see sect. 5.2.1.2 Types of GPS Transmission).

Starting point: Main page of e.g. SECOM-P menu

Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The display changes:
2	0 _*+ to 9 WXYZ	Press any of these keys.	The display changes:
3		Press once.	The display changes: 
4	4 GHI (APR)	Press.	The display changes:
5		Select all (BROAD-CAST) or addressed single participant (PTCP) from selection list.	
6	ENT	Press.	The display changes:

Step	Control	Action	Note
7	0 _*+ to 9 WXYZ	Enter valid APT interval.	
8	ENT	Press.	The display changes: 

APR actions (be it request or response) can be executed only after the GPS time signal (required for scheduling) has been received at least once. This is due to the fact that APR transmissions are scheduled in order to avoid on-air collisions with other (scheduled) GPS transmissions.

An APR request can be addressed to all participants (BROADCAST) or to a single participant. The selection process of the addressed participant(s) is described in sect. 5.2.1.3 Addressing of GPS Transmissions.

The auto push time interval [in seconds] of the addressed participants is entered by using a numerical editor. A default interval of 60 seconds is pre-configured, but this can be adapted to operational requirements. Due to the scheduling constraints (see sect. 5.2.1.2 Types of GPS Transmission), the time interval can only be set an integer multiple of the scheduling round time. Thus, the value entered will be adjusted automatically to match an integer multiple of the scheduling round time. Selecting a time interval of zero disables a previously configured (via APR on-air command or R&S RNMS configuration) auto push time interval.

It is the responsibility of the controller's operator to ensure that an APR operation (being only of a temporary nature) is disabled (by sending for example an APR/APT=0 request to all radios) if the resumption of automatic reporting is not desired (when the radio is switched on next time).

Selected / addressed manpack and / or handheld providers and manpack controllers with CRP (Controller Report Position) enabled will start to periodically transmit their current GPS position (if available) using the configured time interval (assuming network and GPS synchronization is given).

In case the GPS signal has never been received by addressed participant(s), the participant will not respond to the APR command. If the participant(s) receives the GPS signal later, it joins the other participants already executing the auto push time operation.

The reception of the automatically pushed GPS position received from the addressed GPS participants is described in sect. 5.2.2.8 List of Received GPS Position Information.

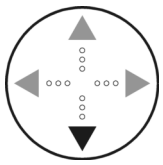
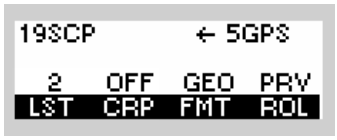
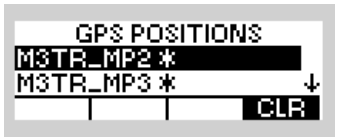
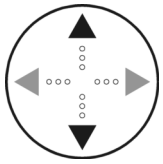
5.2.2.8 List of Received GPS Position Information

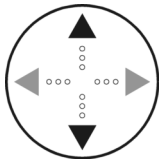
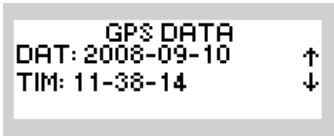
Selecting One of the Received GPS Position Information

By means of softkey LST (List) the operator can list and display GPS position information being received from other participants (due to push, pull or auto push actions).

A count greater than zero above the softkey LST on GPS operational page 4 indicates the number of GPS participants from which GPS positioning information has been received.

Starting point: Main page of e.g. SECOM-P menu

Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The display changes:
2		Press once.	The display changes: 
3	2 ABC (LST)	Press.	The display changes:  When pressing the LST softkey, the MMI (Man-Machine Interface) will display a list of RNMS (Radio Network Management System) configured radio names indicating the participant(s) from which GPS position information has been received. Entries which are older than a pre-configured time value (e.g. 10 minutes) will be marked with an asterisk (*) following the participant name. This global validity time-out (measured from the time of reception) can be configured by R&S RNMS3000.
4		Select the desired participant from the list.	

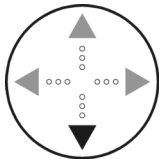
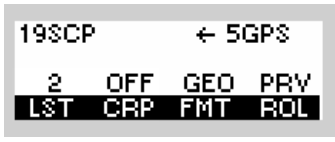
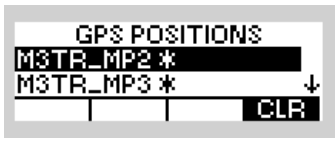
Step	Control	Action	Note
5	ENT	Press.	The display changes: By pressing ENT, the currently highlighted / selected GPS position entry is displayed as a scrollable viewer (the user can use the up and down arrow keys to scroll through the information; possible scrolling is indicated on the right by arrow symbols pointing up and / or down). The information displayed contains all transmitted GPS data items. Each line represents one data item in the selected format (see also sect. 5.2.2.1 Display of the Own GPS Position).
6		Scroll through GPS data items.	  As an addition, the distance (DST) between the received GPS position and the GPS position of the own radio (assuming local GPS reception is currently given) is calculated and displayed in meters and degrees (0° to 360°) related to geographical north.
7	CLR ESC	Press.	The display changes:

Clearing the List

By means of softkeys LST (List) and CLR (Clear) the operator can clear all received GPS positioning information and the count will be reset to zero.

If the preset page is changed or the manpack is shut down, all received GPS positioning information will be automatically cleared.

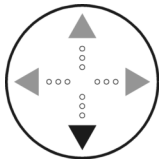
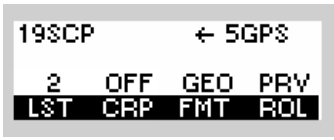
Starting point: Main page of e.g. SECOM-P menu

Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The display changes:
2		Press once.	The display changes: 
3	2 ABC (LST)	Press.	
4	5 JKL (CLR)	Press.	The display changes:
4	ENT		Entries are deleted, the count is reset to zero.

5.2.2.9 Switching the Controller Reports Position as Controller Feature On or Off

By means of softkey CRP (Controller Reports Position) the operator can enable / disable the controller feature CRP Controller Reports Position and permit a controller to also act as provider (see also sect. 5.2.1.1 Roles of Radios Supporting GPS Reporting).

Starting point: Main page of e.g. SECOM-P menu

Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The display changes:
2		Press once.	The display changes: 
3	3 DEF (CRP)	Press.	Repetitively pressing this key toggles the feature on and off. The new setting is now effective.

The influence of the currently selected CRP status is summarized in Table 5.2.

Table 5.2 Influence of the Currently Selected CRP Status

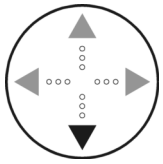
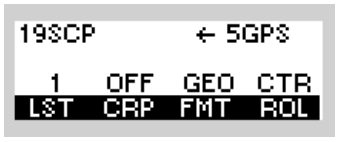
Expected action	CRP is off (disabled)	CRP is on (enabled)
Controller responds to immediate pull request being received from another controller.	No, controller disregards immediate pull requests.	Yes, controller responds immediately (even if GPS time signal has not been received yet).
Controller responds to standard pull request being received from another controller.	No, controller disregards standard pull requests.	Yes, controller responds using scheduled transmission (assuming the GPS time signal has been received at least once).
Controller responds to Auto Push Config Request (APR) being received from another controller.	No, controller disregards APR request.	Yes, controller starts to execute auto push operation using scheduled transmission (assuming the GPS time signal has been received at least once).
Controller starts to execute RNMS (Radio Network Management System) based auto push configuration.	No, controller disregards RNMS auto push configuration.	Yes, controller starts to execute auto push operation using scheduled transmission (assuming the GPS time signal has been received at least once).
Controller transmits its own GPS (Global Position System) positioning information when pulling or configuring other GPS participants.	No, controller does not transmit its own GPS position.	Yes, controller does transmit its own GPS position (if available).

The terms "at least once" and "never received" refer to the GPS satellite reception after the preset page supporting GPS reporting has been selected.

5.2.2.10 Selecting the Format of GPS Position Display

By means of softkey FMT (Format) the operator can select the format of the GPS position information display. This format applies to both, the displaying of own GPS positioning information (see sect. 5.2.2.1 Display of the Own GPS Position) and of received GPS positioning information (see sect. 5.2.2.8 List of Received GPS Position Information).

Starting point: Main page of e.g. SECOM-P menu

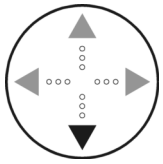
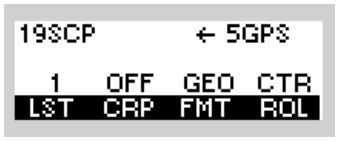
Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The display changes:
2		Press once.	The display changes: 
3	4 GHI (FMT)	Press.	Repetitively pressing this key changes the format of the GPS position information display. Possible settings: • GEO (Geographical) • UTM (Universal Transverse Mercator) • MGRS (Military Grid System) The new setting is now effective.

For more information concerning these formats, see sect. 5.2.2.1 Display of the Own GPS Position.

5.2.2.11 Selecting the Role of a Participant

By means of softkey ROL (Role) the operator can select the role of a participant as being a GPS provider (PRV see sect. 5.2.1.1 Roles of Radios Supporting GPS Reporting) or a GPS controller (CTR see sect. 5.2.1.1 Roles of Radios Supporting GPS Reporting).

Starting point: Main page of e.g. SECOM-P menu

Step	Control	Action	Note
1	5 JKL (GPS)	Press.	The display changes:
2		Press once.	The display changes: 
3	5 JKL (ROL)	Press.	Repetitively pressing this key changes the role of a participant. Possible settings: • PRV (Provider) • CTR (Controller) The new setting is now effective.

The influence of the currently selected role is summarized in Table 5.3.

Table 5.3 Influence of the Currently Selected Role

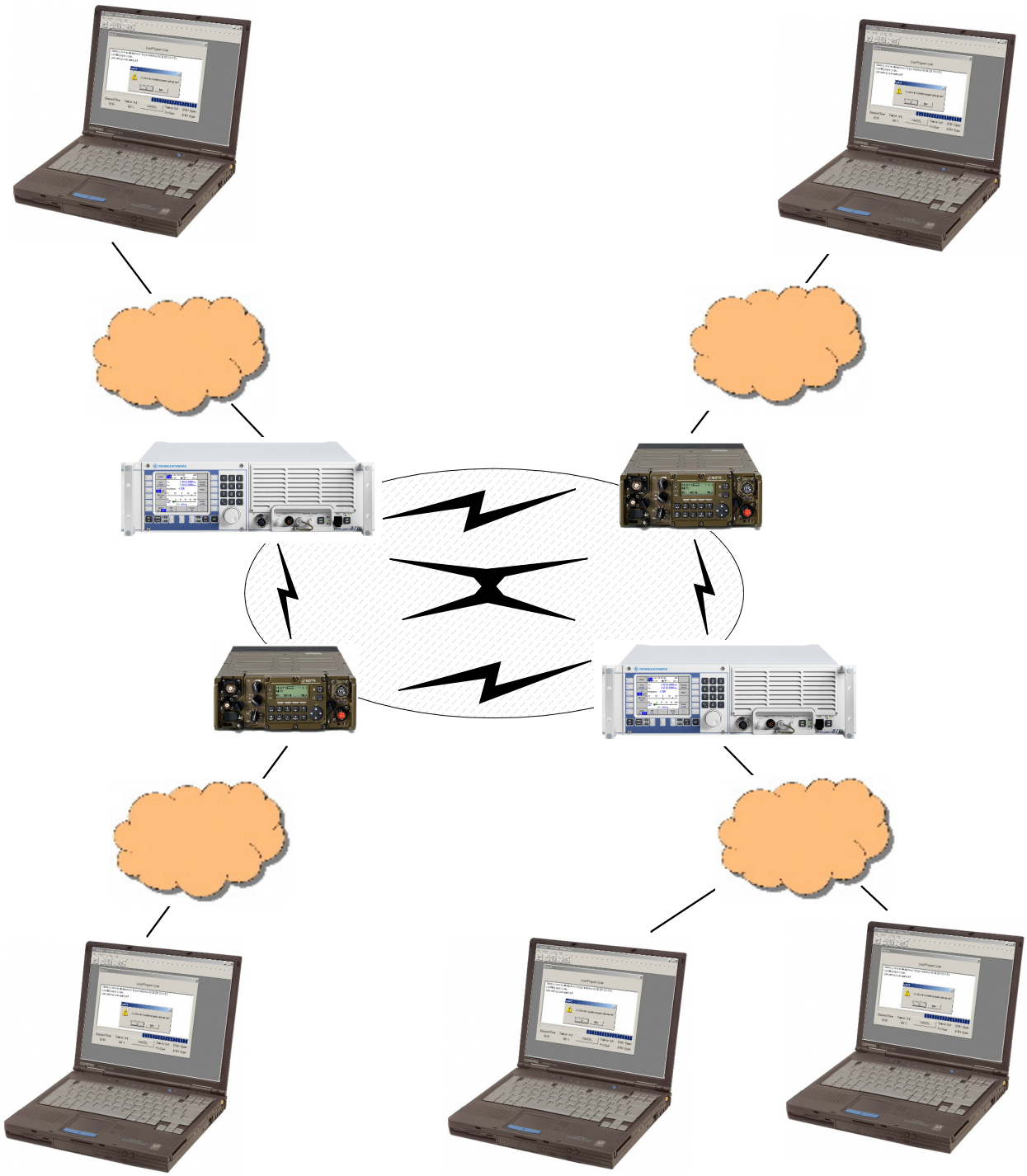
Features supported	ROL = PRV (provider)	ROL = CTR (controller)
Push own GPS data onto the network.	Yes	Yes
Pull GPS data from other GPS participants in the same network.	No	Yes
Send an Auto Push Configuration Request (APR) to other GPS participants operating in the same network.	No	Yes
Receive and list GPS data (due to push, pull or auto push actions) from other GPS participants operating in the same network.	Yes	Yes

5.3 IP over Air (IPoA)

5.3.1 Basics of IP over Air (IPoA)

The IPoA protocol provides radio-embedded Internet protocol (IP) functionality (open systems interconnection (OSI) layer 3), enabling a customer system for IP communication over the air by integrating radios into the network infrastructure (Figure 5.10).

Figure 5.10 Network Infrastructure



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From an IP layer point of view, the radios act as routers between the wired networks and the air network (e.g. SECOM-H).

The IPoA protocol is available with these waveforms:

	R&S M3TR	R&S M3SR Series 4100
SECOM-V	x	
SECOM-H	x	x
OFDM (Orthogonal Frequency Division Multiplex)	x	
ALE-3G / xDL (Low Data Rate Link Protocol (LDL), High Data Rate Link Protocol (HDL))	x	x

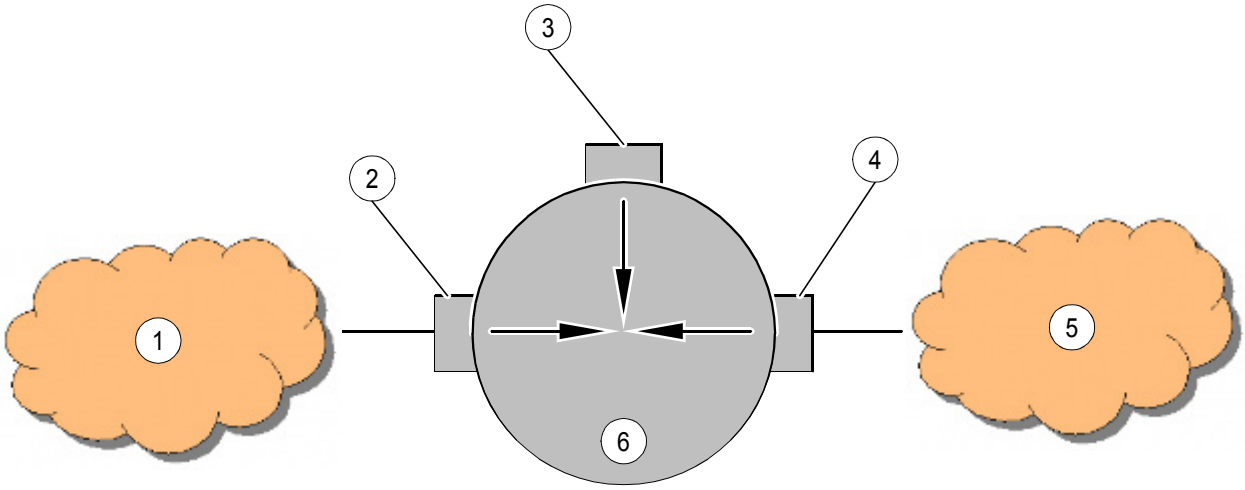
A radio-enhanced network provides complete IP transparency, meaning that any OSI layer 4 (and higher) protocol can be transported over IP. Of course, timing and error constraints imposed by the radio channel cannot be hidden from the higher OSI layers like TCP (Transmission Control Protocol) and under some circumstances can severely degrade end-to-end performance.

A radio channel will always provide lower data rates (down to 2.4 kbit/s), will have a higher delay or higher delay variations and will be more erroneous compared to a wired network. Therefore it is recommended to use UDP (User Datagram Protocol) as transport protocol. Please refer to ”Recommendations for the Transport Layer” on p. 5.50 for recommendations about the usage and/or configuration of upper layer protocols (OSI layers 4 to 7).

Since UDP is a connection-less protocol (no acknowledgments, no flow control), it is up to an upper layer protocol / application to provide a secured connection and to provide any sort of flow control. Without flow control, data rates exceeding the air network capacity may lead quickly to data loss. The radio offers only a limited amount of memory to queue incoming data, and there is no mechanism to inform an application when data is being dropped, no matter what reasons caused the packet loss.

For each network (Ethernet, air, Point-to-Point Protocol (PPP)) the radio provides an IP interface specifying the respective network settings (IP address, netmask, Figure 5.11).

Figure 5.11 Radio IP Interfaces



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1 IP/Ethernet Network
2 Ethernet IP Interface
3 PPP IP Interface
4 Air IP Interface
5 IP/Air Network
6 Router (Radio)

- The Ethernet IP interface specifies the interface to the wired network connecting Ethernet-based devices (computers, routers) with the radio.
- The air IP interface specifies the interface to the air network.
- The PPP IP interface defines the PPP settings that allow a computer to set up a point-to-point connection to the radio.

The above described IP interfaces allow the radio to route/forward IP packets between the different IP networks.

5.3.1.1 General Constraints

- All radios belonging to the same air network must have the same settings in the underlying waveform, i.e. SECOM-H settings like data rate, search pattern etc.
- The same applies to connection and operation mode, these settings must be identical on all radios belonging to the same network.
- Such radios must also belong to the same air IP network.
- IP addresses belonging to the same IP network, be it Ethernet, air or PPP, must be unique.
- Ethernet, air and PPP IP networks shall not overlap.
- Several settings are in the form of an IP address or netmask.
- If not stated otherwise, all parameter changes (concerning radio settings or IP settings described below) have immediate effect, i.e. no reboot of the radio is necessary.

5.3.1.2 Recommendations for the Transport Layer

As mentioned above, the radio channel has different characteristics when compared to an Ethernet network:

- Very slow data rate
- Very high round-trip-time (RTT)
- Very high delay variation
- High bit error rate

These characteristics can have serious effects on the upper layer protocols like TCP.

Drawbacks Using TCP-Based Applications over Radio Channels

The TCP protocol itself is designed to adapt to the characteristics of the transmission channel or error situations that might occur. Typically it is used in wired LAN (Local Area Network) environments built up with packet switching routers, dial-up connections, etc.

TCP measures the Round-Trip Time (RTT) that its packets need to be transmitted from the client to the server and back. Based on that RTT timing, it adapts its internal protocol timers, e.g. the retransmit timers. With the help of this mechanism it is possible to use TCP over a wide bandwidth range (very slow dial-up connections or high speed LANs).

The error case which occurs most often in packet-switched networks is congestion. This happens if more packets arrive at a router than the router can forward e.g. over a slow link. If the router discards some packets which could not be sent because of this, TCP will recognize the packet loss. As a result it will retransmit the unacknowledged packet(s) when the retransmission timer exceeds the preset time. At the same time it will reduce its local transmission rate to help the congestion situation to be resolved. The TCP's transmission window (the amount of yet unacknowledged data that is allowed to be sent) will be reduced abruptly and

the retransmission timer for that packet will be increased by a certain factor (TCP back-off). The transmission window will be opened very slowly after the reduction to avoid another congestion.

This behaviour can cause some negative effects if TCP/IP connections are transmitted via radio links. If packets are lost because of a brief jamming or an interrupted link (shadow effects) and (shortly) after that the link is error- free again, TCP will accidentally assume a congestion and will react with the mechanisms described above. Also, if the link is available again, no data will be sent because TCP is in back-off and/or has reduced its transmission window (Comment: How the transmission window is used and whether the data transmission is completely blocked by e.g. the only pending TCP packet which waits to be retransmitted depends strongly on the application protocol which is used over TCP/IP!).

The disadvantages using TCP/IP over erroneous/slow radio channels arise from these effects and it is recommended to use UDP as transport protocol.

All above mentioned drawbacks cause a massive performance degradation when multiple TCP connections are running over the air network. In the worst case, it is even possible that some TCP connections time out. IPoA provides a solution called FastLink in order to handle multiple TCP connections (or other IP protocol based connections) efficiently. Please refer to sect. 5.3.2 FastLink Mode (FLM) for information regarding FastLink.

Recommended Adjustments for TCP

If TCP is the only available means to be used as transport protocol, some settings on the host-side can positively influence the behaviour of TCP over the radio channel.

The following settings are recommended in order to enhance TCP performance:

- Enabling Selective Acknowledgments (SACK)

  If SACK is activated, only lost packets must be retransmitted, and not those which were sent afterwards.

- Enabling timestamps

  Adding a timestamp in the TCP options field helps to calculate the RTT more accurately which in turn results in precise timeouts and thus optimizes retransmission handling.

- Disable window scaling

  Make sure the window scaling option is disabled, some operating systems like Windows Vista have this option enabled per default.

- Non-delayed ACKs

  The TCP implementation of Microsoft Windows delays per default all ACKs by 200 ms in order to minimize overhead (possibility to acknowledge more than one packet at once if packets arrive within 200 ms). However, for radio links it is better to avoid an ACK delay in order to keep the RTT as low as possible.

- Maximum Transmission Unit (MTU) of 512 bytes

  A smaller MTU reduces the risk of packet corruption due to fluctuating radio channel quality and optimizes throughput for concurrent connections.

- Reduced receive window size

  A reduced receive window discourages the sender from sending huge packet bursts congesting the network. Recommended values are between 4 to 16 x MSS (Maximum Segment Size), typically 8 x MSS = 3766.

NOTICE

All hosts (endpoints terminating the transport protocol) involved need their settings to be adapted.

5.3.1.3 Special IP Services

The IPoA protocol provides support for several predefined IP services running on the radio, such as

- Text Message Service
- Alarm Service
- GPS Service and
- GPS Immediate Service.

Each of these services can be enabled / disabled in the mission configuration using R&S RNMS3000 (Radio Network Management System) and has a send priority and an IP mapping (protocol / port) assigned as listed in Table 5.4.

Table 5.4 Priority, IP Mapping (Protocol / Port) and ARQ

Service	Send priority order	Protocol	Port	Enabled	ARQ	FastLink assigned
FastLink Control	1st	UDP	35008	no	off	off
Text Message	4th	UDP	35002	no	off	off
Alarm Message	2nd	UDP	35000	no	off	off
GPS	5th	UDP	35004	no	off	off
GPS Immediate	3rd	UDP	35006	no	off	off
Transparent IP	6th	ANY	ANY	yes	off	off
User1	6th	TCP	ANY	yes	on	off
User2	7th	ANY	35010	no	off	on
User3	8th	UDP	35012	no	off	off
User4	8th	UDP	35014	no	off	off

The send priority order defines the priority among the services, i.e. alarm messages are always sent before all other services. IP data passed to the IPoA protocol for transmission is mapped to the services according to their IP mapping configuration, e.g. a UDP packet with

destination port 35002 is mapped to the Text Message Services and treated with its respective priority. Therefore, the above listed UDP ports cannot be used by customer-specific applications and pose a restriction to the complete IP transparency of IPoA as described in ”Basics of IP over Air (IPoA)” on p. 5.46 (of course the restriction only applies when the before-mentioned services are configured). IP data not mapping to any of the configured services (default IP data) is sent with lowest priority. This results in noticeable performance degradation (data rate/ delay) for default IP data, when many of the mentioned (higher priority) IP services are enabled.

IPoA provides additional user services (User2 to 4) that can be enabled and configured in R&S RNMS3000 to match the specific needs of a given network topology and customer applications. If your applications do not allow a data mapping based on protocol and port, IPoA provides the possibility to map the data according to the TOS (Type Of Service) byte in the IP header as an alternative. Please contact the Rohde & Schwarz Customer Support for further information.

Feedback Messages

In order to allow a flow control for user data sent over the radio network, the IPoA protocol generates ICMP (Internet Control Message Protocol) source quench messages when its send buffer reaches a specific use level (upper threshold). Also when a packet is dropped due to an exhausted send buffer, a source quench message is generated. As long as the use level does not fall below a 2nd specific use level (lower threshold), each obtained packet is answered with an ICMP source quench message destined to the originator. The ICMP source quench implementation complies with RFC792 (request for commands). The originator of the IP data shall use the source quench messages to implement a flow control mechanism that is to reduce its data rate upon reception of source quench messages, and eventually slowly increase the data rate later. Such a behaviour greatly reduces the risk of packet drop due to full send queues inside the IPoA protocol.

Table 5.5 provides an overview of the internally allocated buffer space available for transmission and the upper and lower thresholds for the source quench messages.

Table 5.5 Send Buffer and Thresholds

Waveform	Send buffer [Kbyte]	Upper threshold [%]	Lower threshold [%]
SECOM-V (only R&S M3TR)	315	70	50
SECOM-H	39.4	70	50
OFDM (only R&S M3TR)	630	70	50
ALE-3G / xDL	129	70	50

The send buffer size varies among the waveforms due to their maximum data rates supported, thus a fast waveform like OFDM (only R&S M3TR) possesses a larger send buffer when compared to a slow waveform like SECOM-H.

NOTICE

The available send buffer is clustered in data chunks of different sizes from 64 bytes to 1524 bytes. When sending mainly large (e.g. 1500 bytes) or mainly small (e.g. 64 bytes) data chunks, not all of the above mentioned send buffer may be available. If, for example, SECOM-V (only R&S M3TR) is the waveform used and only 1500 byte packets are sent, source quench will not become active at a use level of 70 % of 315 kB (220.5 Kbyte), but already when the 1500 byte clusters are used up to 70 %, which will be already at a use level of 155.6 Kbyte.

Automatic Repeat Request (ARQ)

ALE-3G / xDL and IPoA protocol for SECOM-V (only R&S M3TR), SECOM-H and OFDM (only R&S M3TR) uses different data link layer protocols for channel access. This different mechanism will be described in the following:

IPoA protocol ARQ

The data link layer (layer 2) of the IPoA protocol stack contains an ARQ (Automatic Repeat Request) algorithm. The type of the ARQ algorithm is "Selective Repeat". Per default all TCP/IP data, which is not mapped to any of the configured services are transmitted with ARQ protection. Other protocols like UDP and ICMP are not transmitted with ARQ protection. ARQ can be enabled or disabled for each service by means of R&S RNMS3000.

ARQ Functionality

Each IP data packet, which is sent to air by the transmitter, is acknowledged by the receiver (ACK packet without payload).

The transmitter retransmits packets which are not acknowledged in time. Due to this, packets that have not been acknowledged yet, remain in the transmission queue until an acknowledgment was received, the maximum retransmission count is reached or the maximum packet life time (TTL) is exceeded. In the case of maximum retransmission count or TTL, the packet is not retransmitted anymore and is dropped.

ARQ contains a flow control mechanism called "Sliding Window". This prevents a packet flooding of the receiver (if many packet losses occur).

The benefit of using ARQ with "Selective Repeat" in the data link layer is:

- Minimizing of data packet losses
- Selective Repeat: Only lost packets are retransmitted (in contrast to the ARQ algorithm "Go Back N").
- The handling of ARQ in the data link layer reduces the retransmissions of data packets in higher protocol layers (for example TCP) that have an own implementation of ARQ and increases the data transmission performance.

ALE-3G / xDL ARQ Functionality

Instead of the Carrier Sense Multiple Access/Collision Avoidance (CSMA/CA) mechanism of the IPoA protocol, the ALE-3G uses its own ALE algorithm to establish logical links between stations of an ALE-3G network. This automatic link establishment algorithm chooses the best communication channel to the destination based on channel quality analysis (LQA). After the establishment of a logical link between two stations, the initiator of the link has the first opportunity to transfer an IP packet with one of the xDL protocols over the channel to the destination. HDL (High Data Rate Link Protocol) and LDL (Low Data Rate Link Protocol) always guarantee the error-free transfer of the packet by using an ARQ mechanism.

Since the ALE-3G channel access differs from the IPoA protocol, the following features of the IPoA protocol are not needed or supported:

	Note
FastLink Mode (FLM)	Not needed. ALE-3G establishes logical links by itself.
IPoA Rebro	Not supported.
Message Service Alert messages	Not supported. xDL only supports Point-to-Point links.
IPoA operational mode	Not supported.
IPoA connection mode	Not supported.
Change of IP Air address	Not supported. ALE-3G uses a static look-up table for conversion of IP to ALE-3G address. This can only be changed via configuration.
Multicast Routing	Not supported. xDL only supports Point-to-Point links.

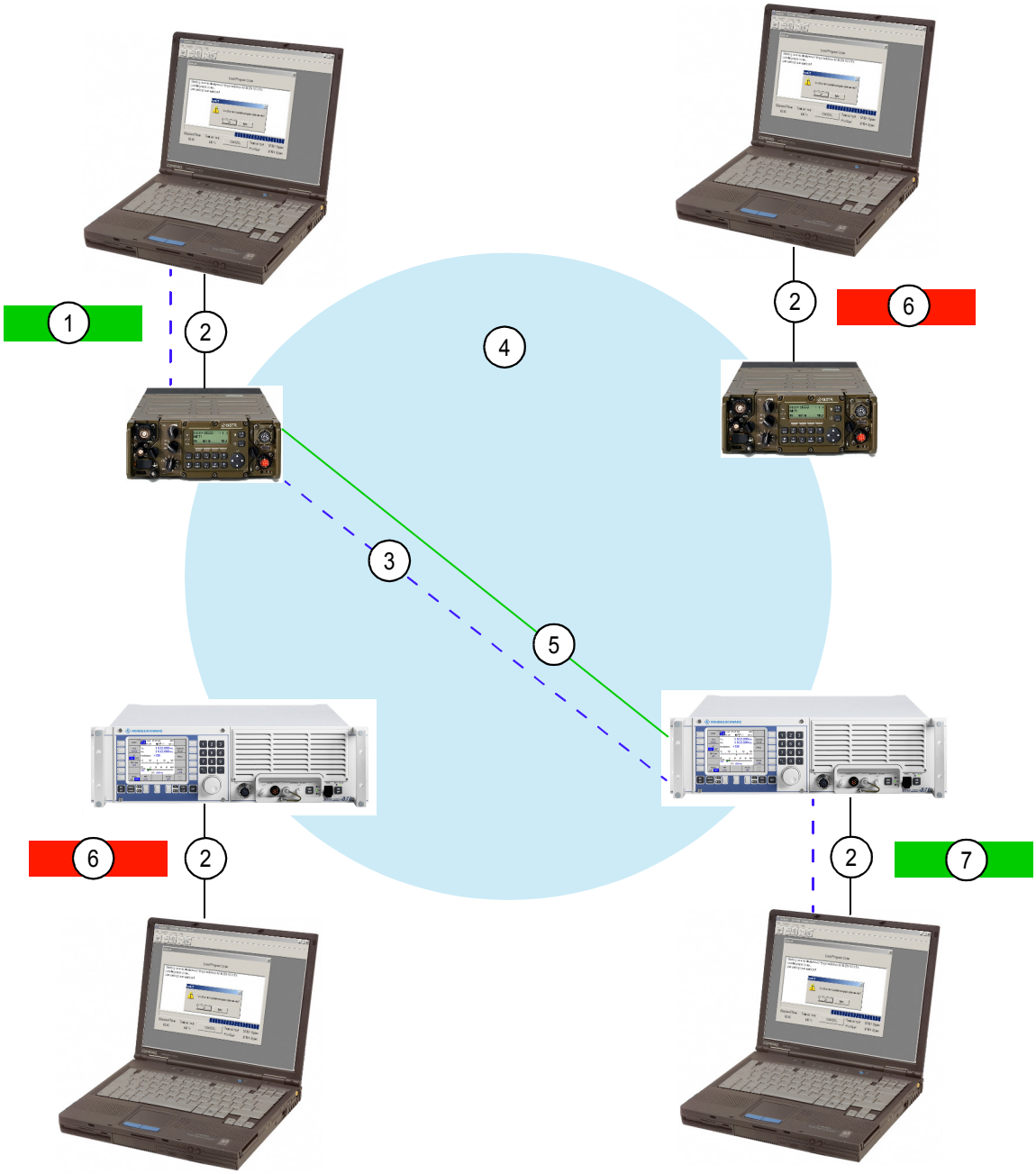
5.3.2 FastLink Mode (FLM)

The main purpose of the FastLink Mode (FLM) feature is to allow an application to establish exclusive point-to-point connections and thus to avoid concurrent connections on the radio network. IPoA itself provides appropriate mechanisms on the link layer to reduce the collision probability for concurrent connections, the efficiency will suffer with increasing amount of parallel connections.

Especially multiple long-lasting TCP (Transmission Control Protocol) connections will benefit from FLM, since the TCP protocol does not scale well with increasing amount of concurrent connections over a slow radio link (see sect. 5.3 IP over Air (IPoA)).

If the typical use case consists of many (e.g. more than 5) concurrent and long-lasting connections, FLM will greatly improve performance and reliability of such data transfers. Although the FLM feature uses some lower layer (link layer) services, there is no influence of these layers by FLM. FLM can be seen as a stand-alone state machine on application level that sits on top of the transport and link layer. It is the responsibility of the application to use FLM appropriately, e.g. to send only FLM assigned data when an FLM connection is established if exclusive channel access (only one connection at a time) shall be guaranteed network-wide.

Figure 5.12 FLM Connection



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1 CONNECTED (Tx)
2 Ethernet
3 Application data (e-mail)
4 SECOM-H net
5 Established FLM connection
6 BUSY
7 CONNECTED (RX)

If an application establishes an FLM connection, all other applications are not allowed to establish an FLM connection themselves, i.e. the FLM state of their gateway radio is "Busy" as shown in the above picture. After an FLM connection has been established successfully, the involved applications can exchange data like e-mail. The applications should do this as quick as possible, since other applications may be waiting for FLM access. The application that initiated the FLM connection should terminate the connection as soon as the data transfer is finished.

Data transferred over an FLM connection is mapped by IPoA to a specific service (as done with any other, non-FLM data). This service must have the FastLink flag configured (see sect. 5.3 IP over Air (IPoA)).

First, this is required by IPoA (IP over Air) since each service gets a priority assigned in which data is transmitted, thus also FLM data must be mapped to a specific priority. This allows IPoA to send non-FLM data in at higher priority (than FLM data) from any station even if an FLM connection is active.

→ FLM influences only data mapped to a service with enabled FastLink.

Second, if an FLM connection is active and data is mapped to a service with fastlink on (FLM assigned data), the data is tagged on the link layer. This allows all other radios in the network to detect an ongoing FLM data transfer even if the FLM connection establishment was missed due to a temporary out-of-range situation.

Third, all radios in a network survey an ongoing FLM connection with a timer. As long as FLM assigned data is transmitted over the radio network, the timer will be reset. If no FLM assigned data is seen on the radio network, the timer will elapse and cause the FLM connection to be terminated automatically (see ”FLM Relative Idle Timeout” on p. 5.63).

NOTICE

FLM does not force the user/an application to establish an FLM connection prior to transmission of FLM assigned data, i.e. there is no check whether an FLM connection is active at the time of sending FLM assigned data. It is up to the application to ensure that an FLM connection was established before sending FLM assigned data. However, if no FLM connection is active, the FLM controlled data is not tagged (on link layer) as such and other radios in the network will remain in the IDLE state and will allow other applications to establish an FLM connection.

5.3.2.1 FLM Control

An application can access the FLM functionality by means of remote commands. These commands allow the application to obtain the current state of FLM, initiate and terminate an FLM connection and get additional information about configuration and for efficient FLM use. The offered commands are as follows:

FLM Connect Request <destination IP>

Tries to establish an FLM connection to the provided destination. The current FLM state must be IDLE, otherwise the request is not accepted. The connect request may fail for several reasons:

- Destination is not reachable (no route, out of range).
- Another radio issued a connect request and won the competition for the unique FLM connection.

FLM Disconnect Request

Causes an established FLM connection to be terminated. Only the radio that established the FLM connection is allowed to issue a disconnect request.

FLM State

Returns the current state of the FLM module in the radio. The possible states are shown in Table 5.6:

Table 5.6 FLM States

Idle	No FLM connection active in the radio network.
Connecting	The radio tries to establish an FLM connection.
ConnectedTx	The radio that issued the connect request established an FLM connection successfully.
ConnectedRx	The radio that received a connect request established an FLM connection successfully.
Busy	An FLM connection is established, but the radio is not involved (neither the source nor the destination of the FLM connection).
Disconnecting	An application issued a disconnect request and the radio initiated termination of an active FLM connection.
Rebro-Connecting	Equal to connecting, but indicates that the connect request was forwarded to another radio network (rebroadcast). The application must expect a longer connection setup.
Rebro-Busy	Indicates that a remote network has already an active FLM connection.

It is strongly recommended to use the trap feature for this command since some state transitions may occur in a very quick sequence. A polling mechanism might miss some state transitions, especially care should be taken for the immediate state transition from 'Rebro-Busy' to 'Idle'.

Figure 5.13 shows the state transitions in a graphic representation.

Table 5.7 FLM Activities

ActiveTx	The radio that initiated an FLM connection.
ActiveRx	The remote radio involved in an FLM connection (peer of active Tx radio).
Passive	The radio is not involved in an active FLM connection.
Idle	No FLM activity in the radio network.

Figure 5.13 State Transitions (Graphic Representation)

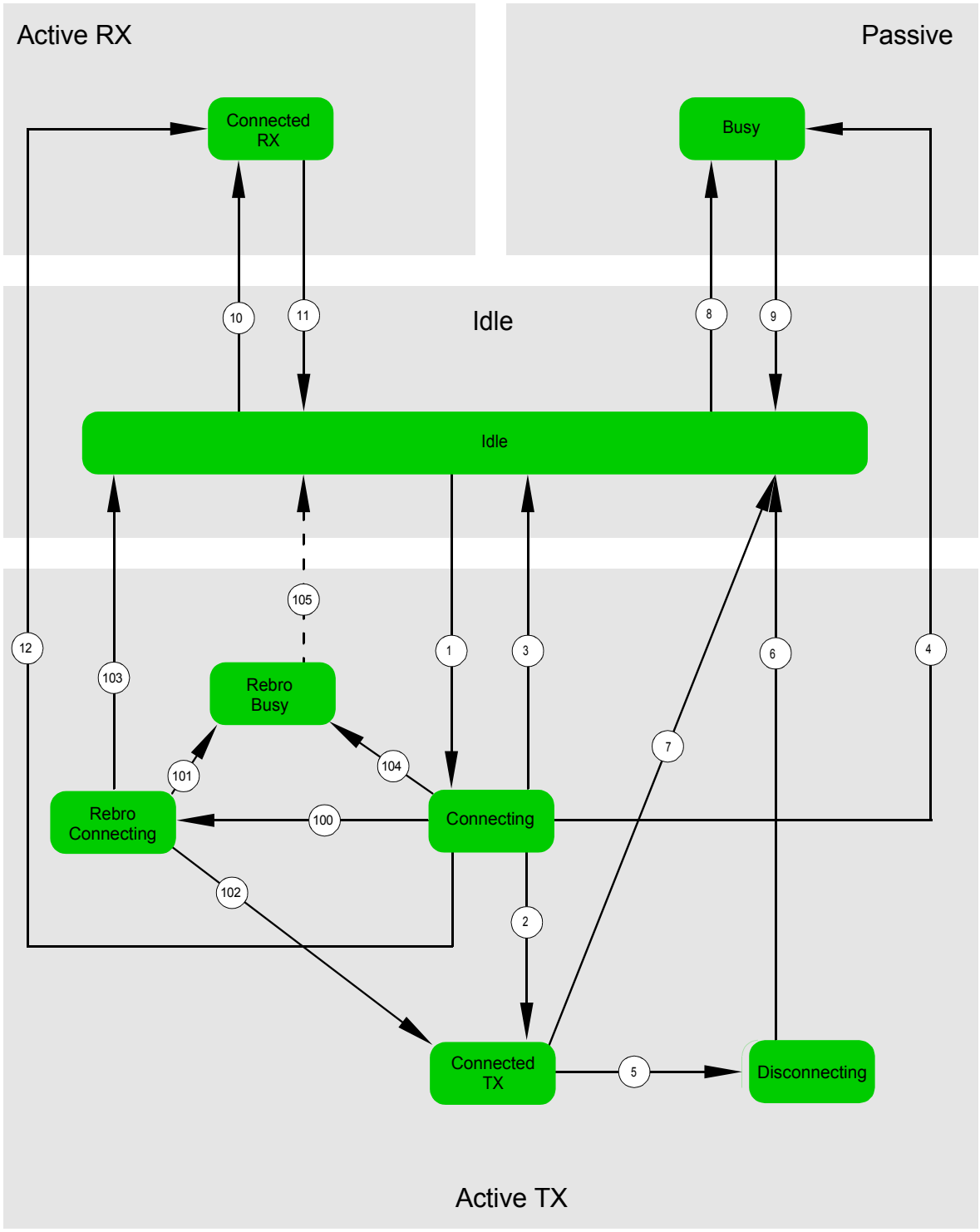

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Table 5.8 shows the state transitions and the events causing the state transition:

Table 5.8 State Transitions (Events)

No.	Old State	New State	Event
1	Idle	Connecting	Connection establishment pending.
2	Connecting	ConnectedTx	Connection established.
3	Connecting	Idle	Connection request failed, e.g. destination not reachable.
4	Connecting	Busy	Other station won competition for connection (other station tries to set up a connection to a 2nd other station).
5	ConnectedTx	Disconnecting	Connection termination initiated by user.
6	Disconnecting	Idle	Connection termination finished.
7	ConnectedTx	Idle	Idle timeout.
8	Idle	Busy	• External connection established. • External FastLink data transmission detected.
9	Busy	Idle	• External connection termination. • Idle timeout.
10	Idle	ConnectedRx	Connection established.
11	ConnectedRx	Idle	• Connection termination (initiated by active Tx station). • Idle timeout.
12	Connecting	ConnectedRx	Other station won competition for connection (other station tries to set up a connection to this radio).

Table 5.9 State Transitions (Rebroadcast)

No.	Old State	New State	Event
100	Connecting	Rebro-Connecting	Connection establishment over rebroadcast pending .
101	Rebro-Connecting	Rebro-Busy	A remote network in rebroadcast scenario is busy.
102	Rebro-Connecting	ConnectedTx	Connection over rebroadcast established.
103	Rebro-Connecting	Idle	Connection request failed, e.g. destination not reachable.
104	Connecting	Rebro-Busy	Remote network in rebroadcast scenario is busy. The Rebro-Busy state indicates that the connection request failed due to a busy remote network (and not due to a non-reachable station). This transition is followed immediately by the next transition (105).
105	Rebro-Busy	Idle	Remote network in rebroadcast scenario is busy.

FLM Re-Connect Delay

In case a connect request failed, the application must wait for the specified time (in seconds) before issuing another connect request. This is required in order to avoid/greatly reduce the risk of concurrent connect requests from several radios at the same time. It is recommended to use the trap feature for this command in order to get instantly updated about changes to this parameter.

FLM Message Size Threshold

Since FLM imposes some overhead (control messages), it does not make sense to use FLM for short data transfers. Only longer transfers will benefit from the enhanced efficiency provided by FLM. The returned value (in bytes) shall provide a reference for making the decision whether to use FLM or not for a data transfer of a specific length.

FLM Relative Idle Timeout

Returns a time in seconds that defines for how long an established FLM connection may remain unused until the FLM connection gets terminated automatically. An FLM connection is considered as unused if no FLM assigned data is transferred or received. Data transfer or reception of other data is not taken into account. It is recommended to use the trap feature for this command in order to get instantly updated about changes to this parameter.

FastLink over Rebroadcast

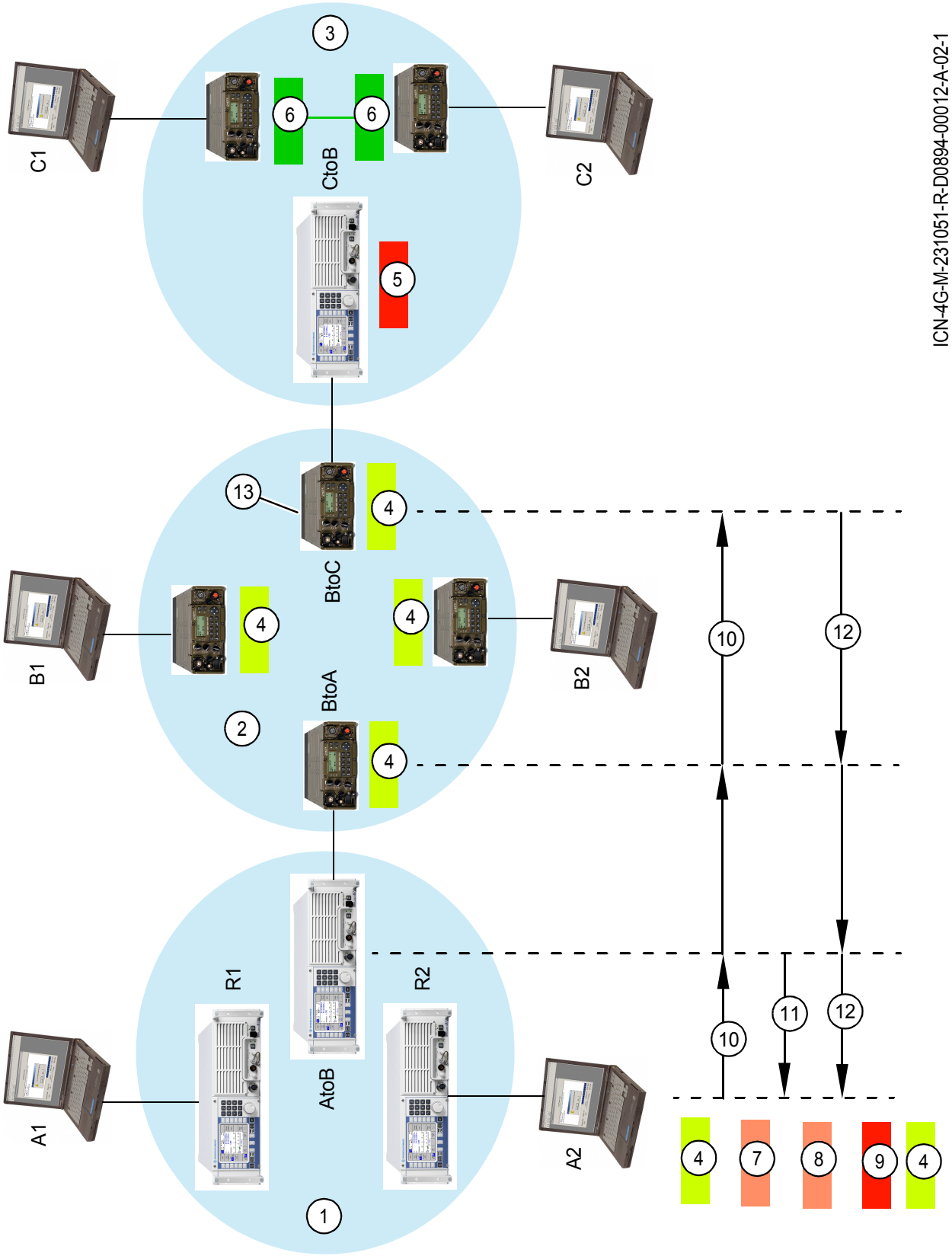
The FLM feature can be used transparently in case of rebroadcast, i.e. there is no major difference in the use of FLM between a single network and a rebroadcast network topology. Of course, the application will notice the difference in terms of longer FLM connection establishment and data transmission times.

Special FLM connection states notify the application that an FLM connection is used over Rebroadcast. The state transition from 'Connecting' to 'Rebro-Connecting' indicates FLM connection establishment over more than one network.

The state transition into 'Rebro Busy' is followed immediately by a transition to the state 'Idle' and indicates that a remote network (meaning not the local network in case of rebroadcast) already has an active FLM connection and thus the connect request was denied.

During FLM connection establishment over rebroadcast, the Relative Idle Timeout (RIT) value will be updated for each remote network traversed towards the final destination. The application should use a trap on the remote RIT command in order to get updated instantly about changes. Also the Re-Connect Delay (RCD) value may be updated in case of Rebroadcast und should be watched with a trap. The picture below shows an attempt of an FLM connection establishment in a network topology with three networks A, B and C where rebroadcast applies.

Figure 5.14 FastLink over Rebroadcast



1 Network A
2 Network B
3 Network C
4 IDLE
5 BUSY
6 CONNECTED
7 Connecting
8 Rebro-connecting
9 Rebro-busy
10 Connect request
11 Request pending
12 Rebro-busy
13 Remote Network C: State is busy

Network C has an active FLM connection.

Now, an application on PC A2 wants to establish an FLM connection to an application running on PC C2 and issues a 'Connect Request' (CR) command. The state changes from 'Idle' to 'Connecting'. The CR is answered by the Radio AtoB in Network A with a 'Request Pending'. When the 'Request Pending' arrives at radio R2, the state changes to 'Rebro-Connecting' and the 'Relative Idle Timeout' value gets updated. In the meanwhile the forwarded CR traverses Network B and arrives at the Rebroadcast Radio BtoC. This radio knows the current state in Network C and answers the CR with 'Rebro-Busy'. When this messages arrives at the initiating radio R2 in Network A, the state changes from 'Rebro-Connecting' to 'Rebro-Busy', followed immediately by a state change to 'Idle'.

5.3.2.2 Rebroadcast / Relay Mode

Service Setup

To set up a relay or rebroadcast station two radios must be connected "back-to-back" over their local Ethernet. The relay/rebroadcast radios have to be set to service IP_REBRO. All other participating radios must use the service VOICE_O_IPD (Voice Priority Over IP Data).

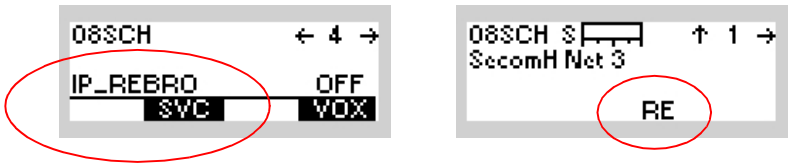
Only R&S M3TR: To remind a user that service IP_REBRO is selected (and the special IP address is valid), the pattern "RE" is shown on the MMI display.

NOTICE

Special ports: The rebroadcast/relay mode functionality uses two UDP ports. These ports must not be used by any other application. These are port 38642 for rebroadcast/ relay voice service and port 38643 for broadcast forwarding.

Figure 5.15 Configuration/Indication Service IP_REBRO on MMI

R&S M3TR



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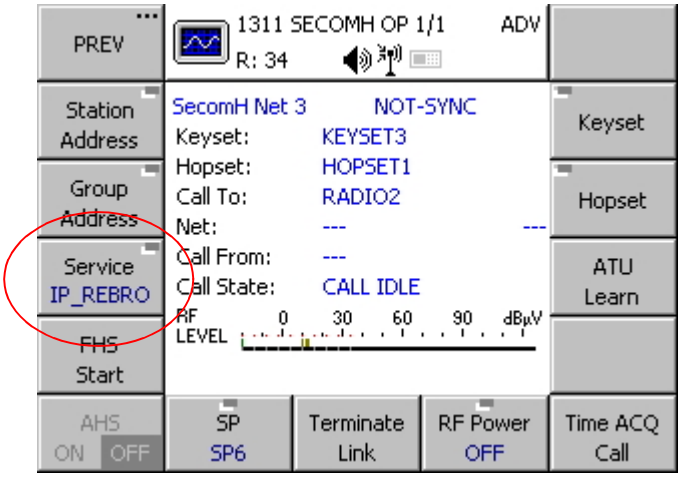

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Local IP Subnet - Relay/Rebroadcast IP Address

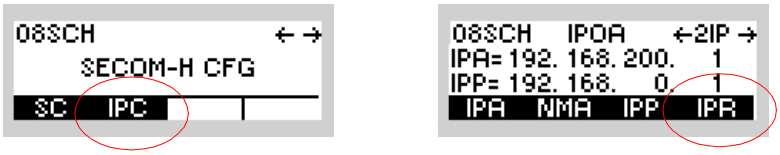
As mentioned above, both relay/rebroadcast radios are connected via their local Ethernet and therefore need an own IP subnet to communicate. The "standard" IP addresses of the radios' Ethernet interfaces would normally not fit that purpose. So only for relay/rebroadcast a further unique IP address for each relay/rebroadcast radio has to be configured, which is only valid for the time service IP_REBRO is selected. This can be done using the Routing Wizard of R&S RNMS3000, MMI or remote control (GB2PP).

NOTICE

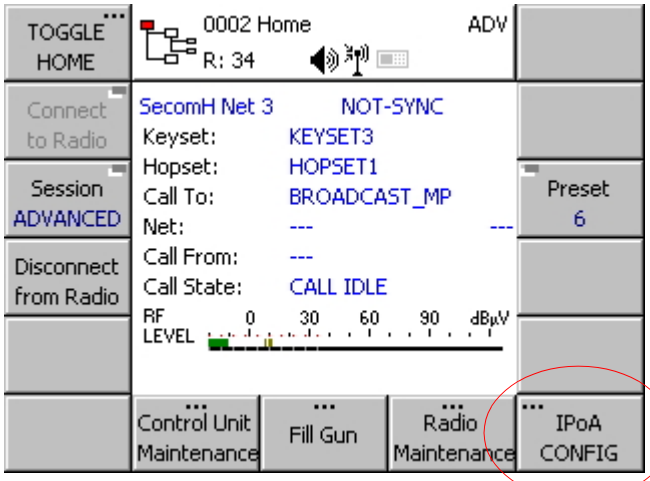
For all other services the standard Ethernet IP is valid. If using the remote control (GB2PP) access, the user must be aware that after switching to or from mode IP_REBRO the remote connection will be closed. The connection has to be established again, using the from now on valid IP address.

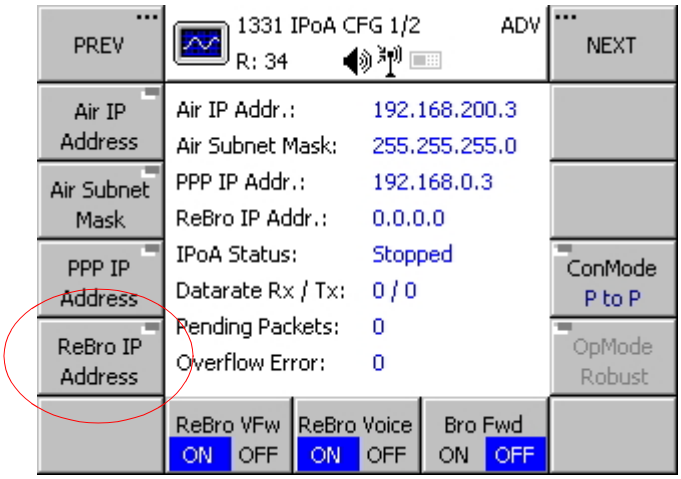
Figure 5.16 Configuration of IP Address for Relay/Rebroadcast Mode on MMI

R&S M3TR



R&S M3SR Series 4100





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Digital Voice Transfer

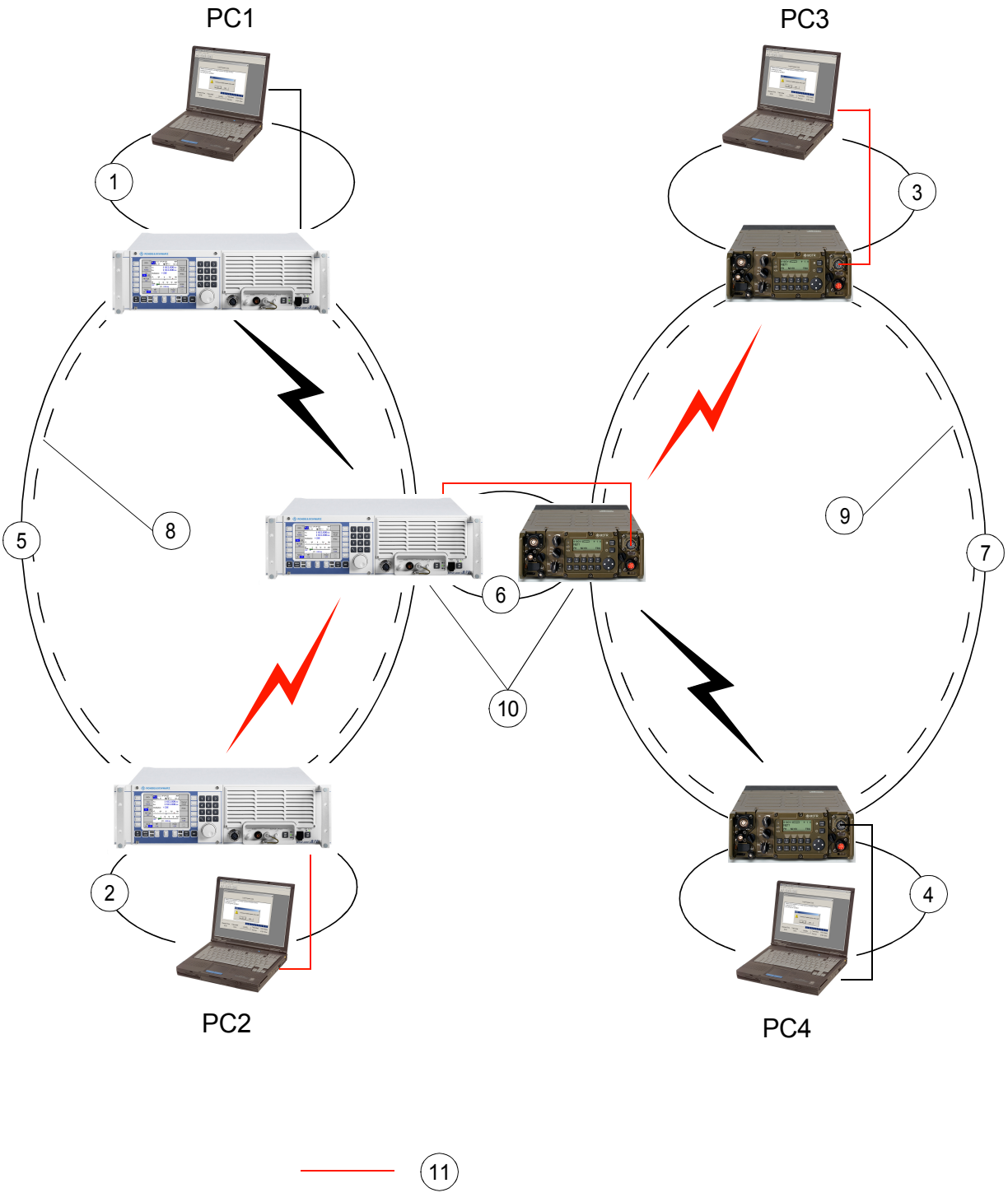
A relay/rebroadcast station transfers voice as digitally vocoded data stream. Both relay/rebroadcast radios have to use the same vocoder type and data rate to ensure that there is no loss of voice data and quality.

Further specific configurations and issues concerning the modes are discussed below.

Rebroadcast Mode

The Rebroadcast Mode is used to connect two IP subnets/waveform nets and transfer both voice and IP data or just IP data over it. The two radios need only a "back-to-back" connection over their local Ethernet. The subnets may use the same waveform on both sides or different waveforms. If voice has to be transferred over a Rebroadcast Station, both radios must use the same vocoder type and data rate (e.g. AMBE2k4 or MELP2k4).

Figure 5.17 Rebroadcast Scenario



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1 IP subnet (e.g. 10.0.1.0)
2 IP subnet (e.g. 10.0.2.0)
3 IP subnet (e.g. 10.0.3.0)
4 IP subnet (e.g. 10.0.4.0)
5 IP subnet 1 (e.g. 10.1.1.0)
6 IP subnet (e.g. 10.2.0.0)
7 IP subnet 2 (e.g. 10.1.2.0)
8 Waveform net 1 (e.g. SECOM-H)
9 Waveform net 2 (e.g. SECOM-H)
10 Rebroadcast station
11 Example for data/voice path

Propagation and Routing

The digitally vocoded voice data is propagated according to the configuration of the waveform net. To transfer digitally vocoded data from one rebroadcast radio to the other, the data is packed into IP packets and transferred as standard IP packets via Ethernet. The counterpart radio unpacks the IP packets containing the digitally vocoded voice and propagates it into its associated waveform net as digitally vocoded voice data again.

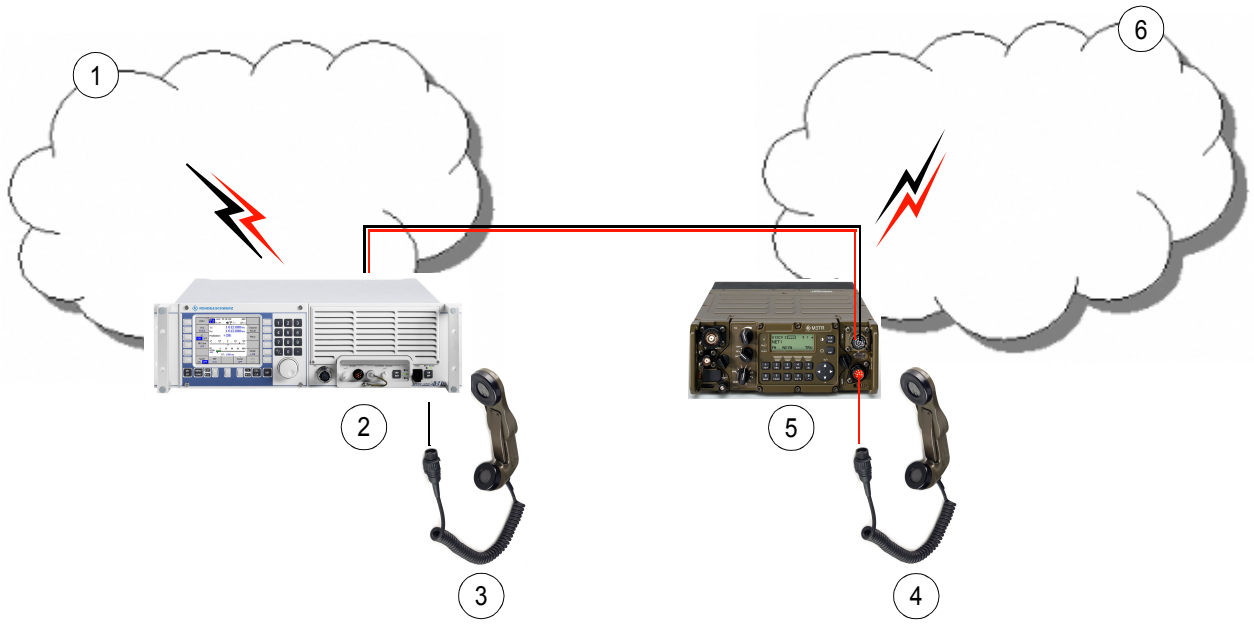
For transferring IP data from e.g. PC2 to PC3 a standard IP routing takes place. This means that all involved nodes and radios need to have appropriate routing tables. This routing information can be prepared automatically with the help of the Routing Wizard of R&S RNMS3000. Alternatively, the routing tables may be set manually by using the MMI or remote control.

NOTICE

If only IP data is transferred via a Rebroadcast Station, the data rates of the two associated waveform nets may differ. Though the radios have large data buffers for intermediate data storage, it may happen that data is lost when the second net is much slower than the first net or the second net is "busy" and a lot of traffic is sent via the Rebroadcast Station.

Local Voice Participation

Figure 5.18 Local Voice for Rebroadcast Mode



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1 Net 1
2 Rebro/relay radio 1
3 Handset 1
4 Handset 2
5 Rebro/relay radio 2
6 Net 2

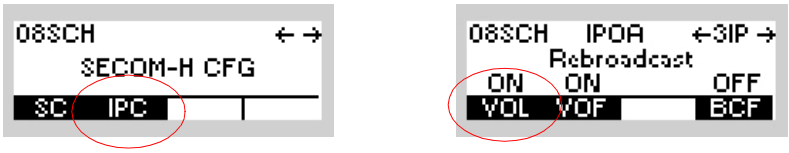
A user located at a rebroadcast station can speak and listen to the local waveform net by using an analog device, e.g., a handset. This functionality can be enabled/disabled by R&S RNMS3000 configuration, MMI or remote control (GB2PP). Disabling this functionality may be desired in order to prevent monitoring of the voice traffic, e.g. at an unguarded station. Local voice participation is only possible within the local waveform net the rebroadcast radio belongs to. It is not possible to speak/listen to the waveform net of the partner rebroadcast radio. E.g. handset 1 is not able to monitor voice traffic from Net 2 and vice versa.

NOTICE

Local voice activity has the highest priority - so if PTT is pushed locally, all other voice data to be forwarded by means of rebroadcast is dropped.

Figure 5.19 Local Voice Selection on MMI

R&S M3TR



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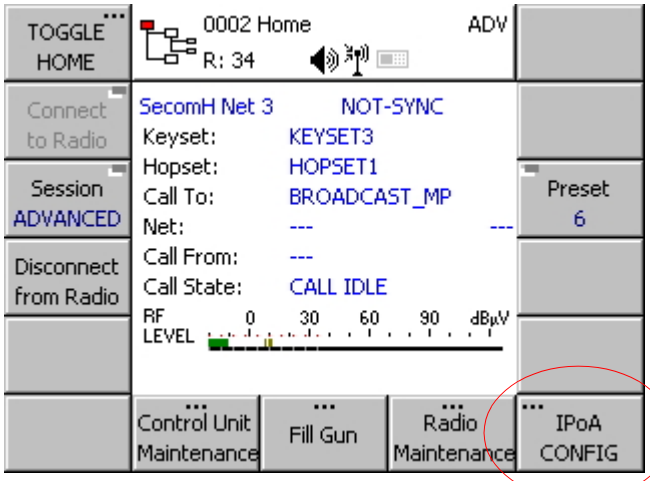

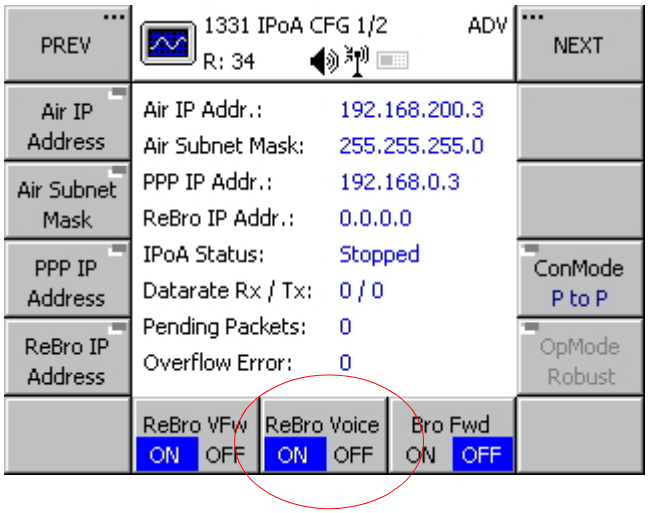

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Local Voice Forwarding

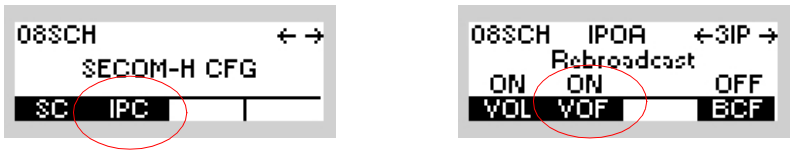
Due to the fact that voice is routed by means of the waveform settings and IP data should be used in combination with a broadcast configuration on the waveform layer, voice would be spread out over all nets which are connected to rebroadcast stations. To avoid this probably unwanted effect, there is the possibility to disable forwarding of any incoming voice data over the rebroadcast station. Nonetheless, it is possible to use the local handset or similar equipment to participate in voice traffic of the local waveform net. The feature can be enabled/disabled by R&S RNMS3000 configuration, MMI or remote control (GB2PP).

NOTICE

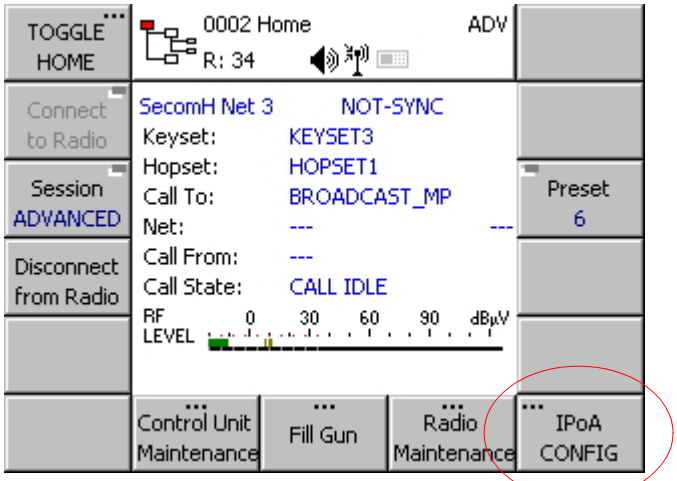
This functionality has to be set at the receiving-from-air radio. If disabled, all voice data will be dropped instantly after reception from air. With this feature a rebroadcast station may be configured to allow bidirectional, unidirectional or no voice forwarding at all.

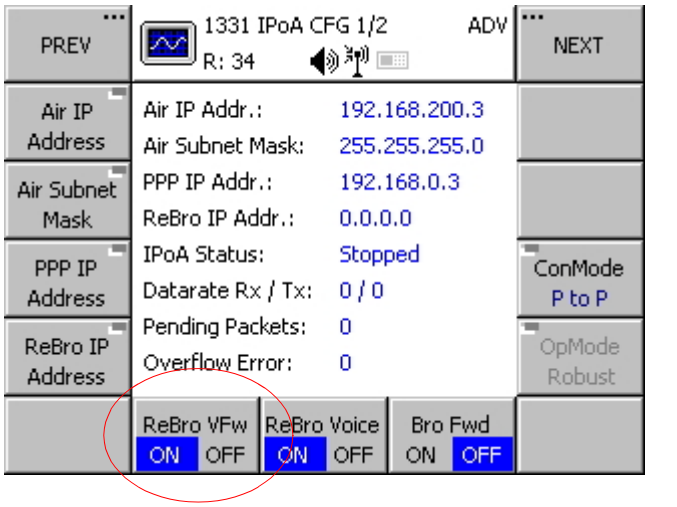
Figure 5.20 Voice Forwarding Selection on MMI

R&S M3TR



R&S M3SR Series 4100





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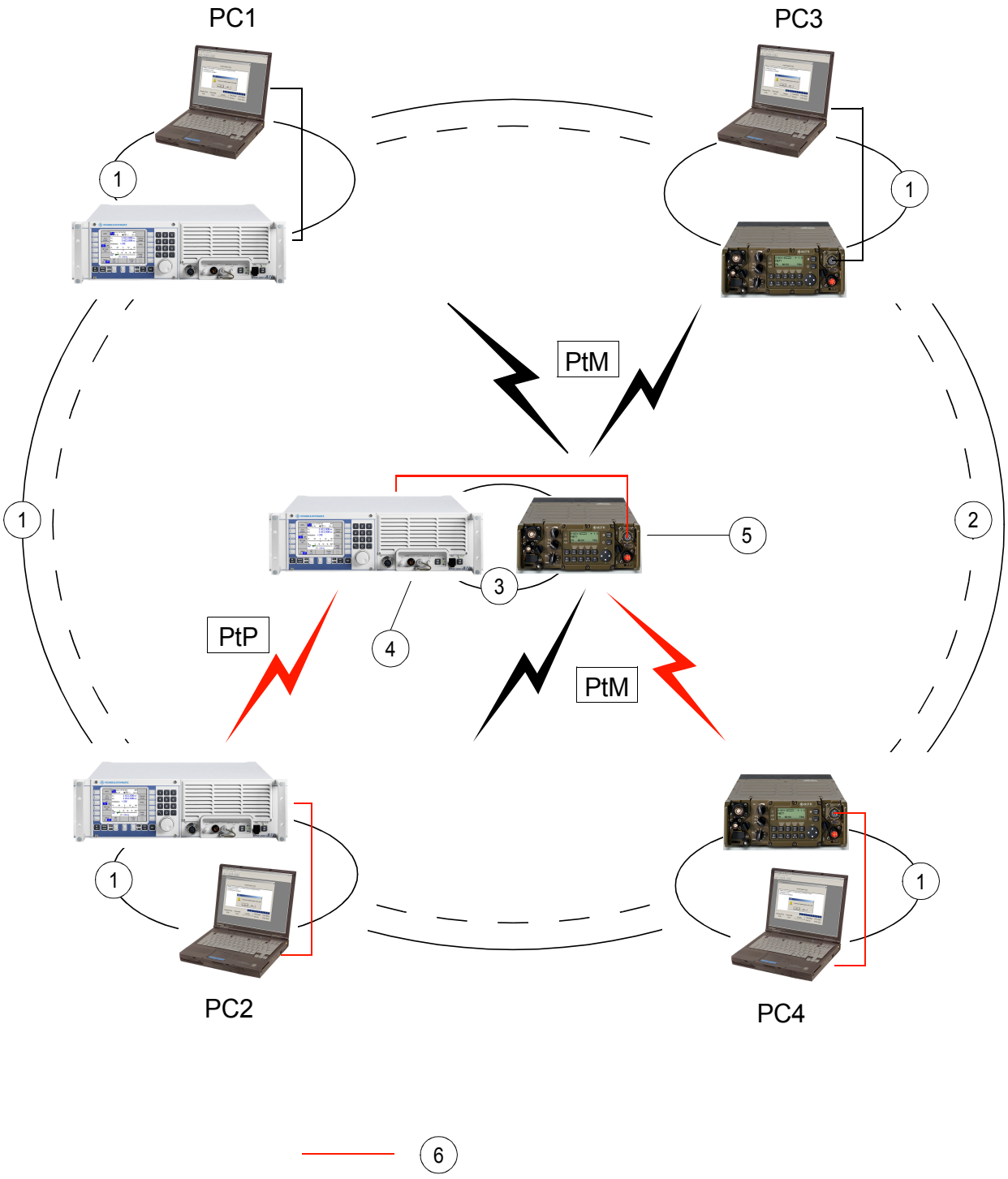
Relay Mode

The Relay Mode is mainly used to extend the operating range of radios within one IP subnet/ waveform net. A typical scenario could be if the radios are located around a hill, so that some radios cannot catch the radio signals from the others. The Relay Station, placed at the top of the hill, can be "seen" and reached by all radios around. A Relay Station consists of two radios which are connected "back-to-back" over their local Ethernet using a Rohde & Schwarz accessory cable (ord. no. R&S GK3022 6148.6595.02).

In order to realize a relay scenario it is also necessary to configure the waveform net accordingly.

Figure 5.21 Relay Scenario



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1 IP subnet (e.g. 10.1.1.0)
2 Waveform net (e.g. SECOM-H)
3 IP subnet (e.g. 10.2.0.0)
4 Rx radio
5 Tx radio
6 Example of data/voice path
PtP Point-to-Point
PtM Point-to-Multipoint

Propagation

In case of a relay station the relay radios take over different roles, according to the IP subnet and waveform configuration. Only one radio receives the data coming from the user radios (Rx radio). For that purpose every user radio has a waveform point-to-point connection to the Rx radio. The data is collected into IP packets and sent via local Ethernet to its partner radio. The second radio only transmits the data coming from the Rx radio using a waveform point-to-multipoint mode.

This configuration ensures a minimum impact on the particular radio channels, coming either from the user radios or the relay Tx radio.

IP Routing

Concerning IP traffic, the PCs and the radios need specific IP routes. As mentioned before, the two relay radios are also members of the same IP subnet as all other radios.

Configuration of PCs and user radios:

- The relay Rx radio must be set as gateway for all destinations.

Configuration of the relay radios:

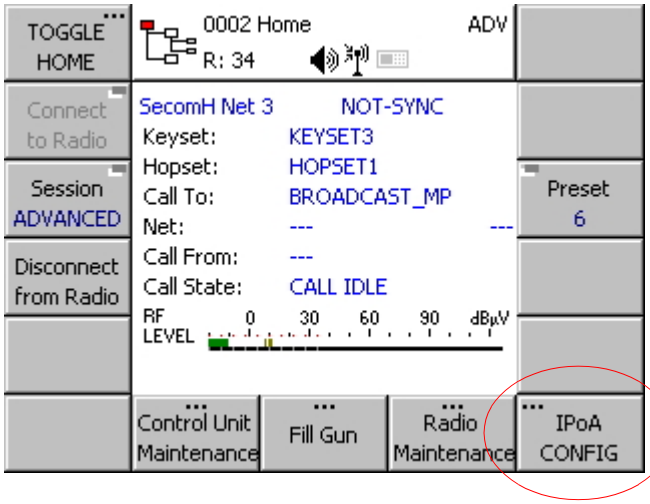
- The relay radios need particular routing tables, too. The Rx radio has only one routing table entry with default gateway Tx radio. The Tx radio needs routing table entries for all PCs behind the radios.

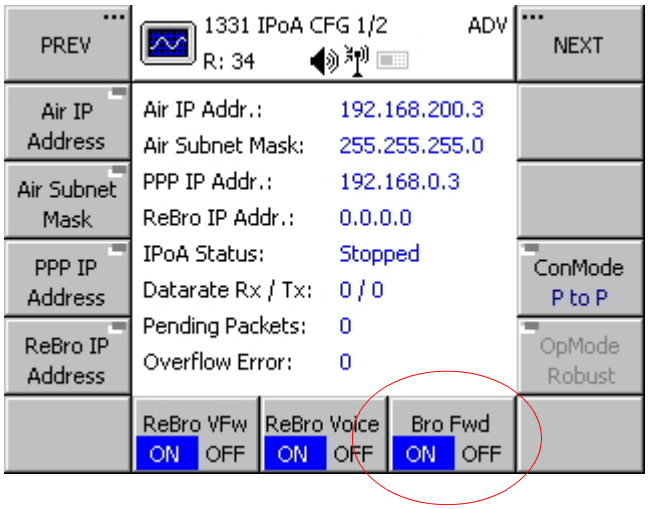
With the Routing Wizard of R&S RNMS3000 these routes can be set automatically for the user radios and also for the relay station's radios.

Figure 5.22 Relay IP Broadcast Selection on MMI

R&S M3TR

R&S M3SR Series 4100





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Relay IP Broadcast Forwarding

All radios in a relay scenario belong to the same subnet. Therefore, an IP broadcast of one radio (e.g. an alert message or a GPS tracking report) would be consumed by the relay Rx radio, but would not be propagated to all other radios. To provide also a forwarding of such broadcast messages to the other radios, a "Relay IP Broadcast Forwarding" can be enabled. The feature can be enabled/disabled by R&S RNMS3000 configuration, MMI or remote control (GB2PP).

NOTICE

This functionality is only intended for use in relay scenarios. Do not enable in case of a rebroadcast scenario (not conform to RFC 791 and RFC 2644).

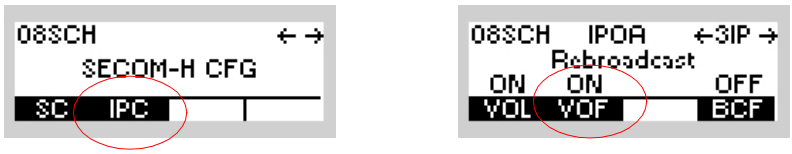
Local Voice Participation

A user located at a relay station can listen to the local waveform net by using an analog equipment at the Rx radio and speak at the Tx radio's handset. This functionality can be enabled/disabled by R&S RNMS3000 configuration, MMI or remote control (GB2PP).

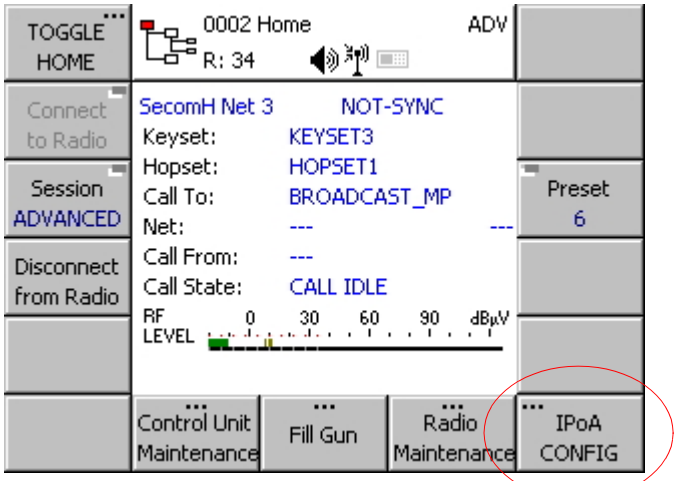
Disabling this functionality may be desired in order to prevent monitoring the voice traffic, e.g. at an unguarded station.

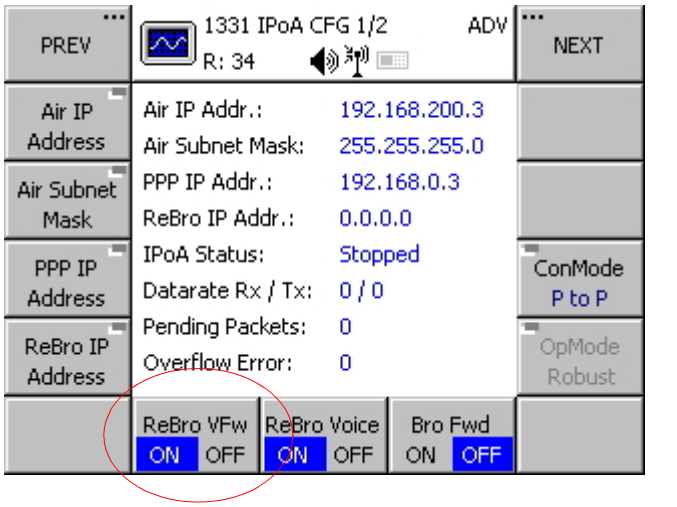
Figure 5.23 Local Voice Selection on MMI

R&S M3TR



R&S M3SR Series 4100





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Local Voice Forwarding

See ”Local Voice Forwarding” on p. 5.74

5.3.3 Settings in Menu IP OVER AIR (IP)

The menu IP is available for the following preset pages:

- SECOM-V
- SECOM-H
- OFDM

Each preset page main configuration menu page holds a softkey labelled "IPC". As an example, the "SECOM-V" main menu page is shown.

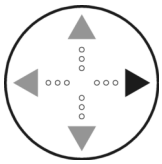
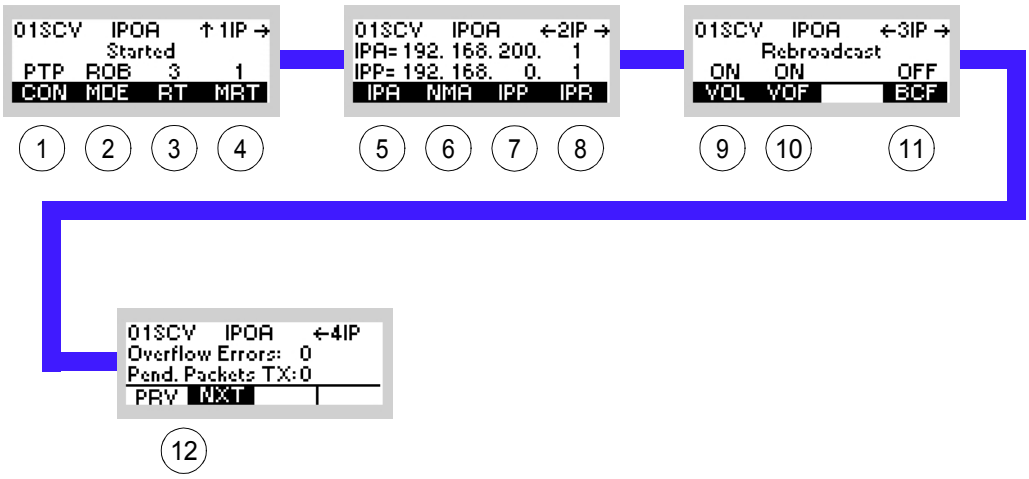
Step	Control	Action	Note
1	(IPC) 3 DEF	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired submenu is activated (see Figure 5.24). The complete menu structure is shown in Figure 5.25.

Figure 5.24 Menu IP (Submenus)



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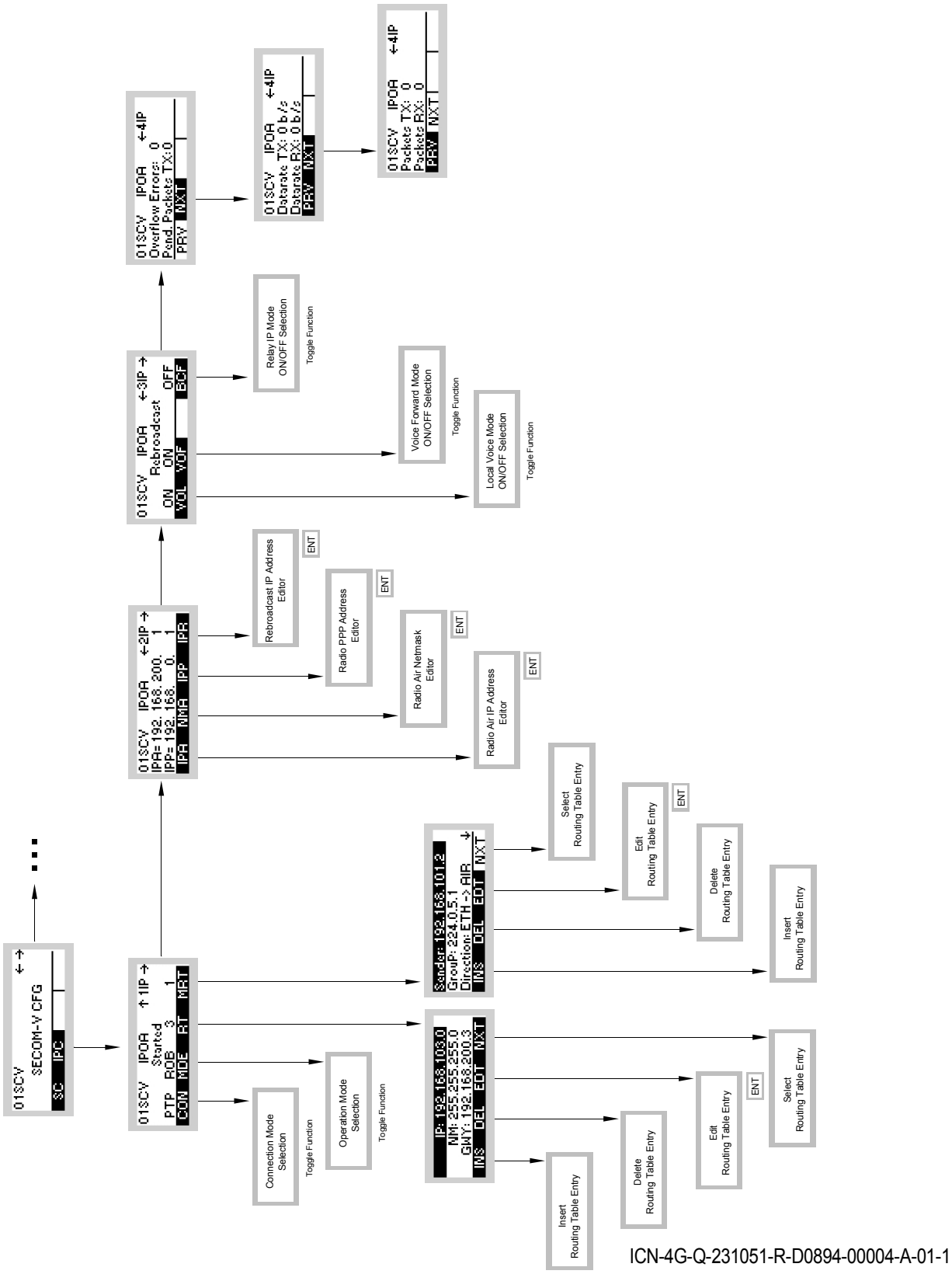
1 See sect. 5.3.3.1 Changing the Connection Mode
2 See sect. 5.3.3.2 Changing the Operation Mode
3 See sect. 5.3.3.3 Editing the Routing Table
4 See sect. 5.3.3.4 Editing the Multicast Routing Table
5 See sect. 5.3.3.5 Changing the Radio Air Interface IP Address
6 See sect. 5.3.3.6 Changing the Radio Air Interface Netmask
7 See sect. 5.3.3.7 Changing the PPP IP Interface Address
8 See sect. 5.3.3.8 Changing the Rebroadcast IP Address
9 See sect. 5.3.3.9 Switching the Local Voice Mode for Rebroadcast On or Off
10 See sect. 5.3.3.10 Switching the Voice Forward Mode for Rebroadcast On or Off
11 See sect. 5.3.3.11 Switching the Relay IP Mode for Broadcast On or Off
12 See sect. 5.3.3.12 Inquiring the Statistic Items of the Air Interface

NOTICE

- **IPoA is active for services IP_DATA and VOICE_O_IPD (Voice Priority Over IP Data).**
- **If service VOICE_O_IPD has been selected, it is no longer possible to change the data rate (DR) in SECOM-V configuration (it is greyed out in the menu). In this case the data rate set under Config - CFG - VOC is used.**

Figure 5.25 Menu IP (Structure)



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5.3.3.1 Changing the Connection Mode

The connection mode setting depends on the network topology the radio is used in. For single point-to-point connections, i.e. when only two radios form a network, the point-to-point connection mode (PTP) shall be used for best performance. Nevertheless, network connection mode (NET) can be used in a network consisting of only two radios. Due to a different access scheme on the air channel, a degraded performance must be taken into account compared to PTP mode.

In networks consisting of more than two radios, the NET mode must be selected. Proper functioning in PTP mode is highly improbable in such a network.

By means of softkey CON (Connection) the operator can change the connection mode.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	Open the configuration page of IPoA.
2	2 ABC (CON)	Press.	Repetitively pressing this key changes the connection mode. Possible values: • PTP (point-to-point) • NET (network)

5.3.3.2 Changing the Operation Mode

There are three operation modes that can be configured:

- Performance mode (PRF) – provides higher throughput at the expense of high reliability. The performance mode synchronizes the radios on the air network only if an idle phase preceded a transmission. A radio sending permanently (no idle phases) for more than six hours could get out-of-sync and cause collisions. In such a scenario it is recommended to use the ROB mode.
- Robust mode (ROB) – provides higher reliability at the expense of high throughput. This mode synchronizes the radios on the air network with each sending of data.
- RS-IRP mode (RS_IRP) – similar to the performance mode, but ensures compatibility with the RS-IRP protocol at the expense of high performance.

Restrictions:

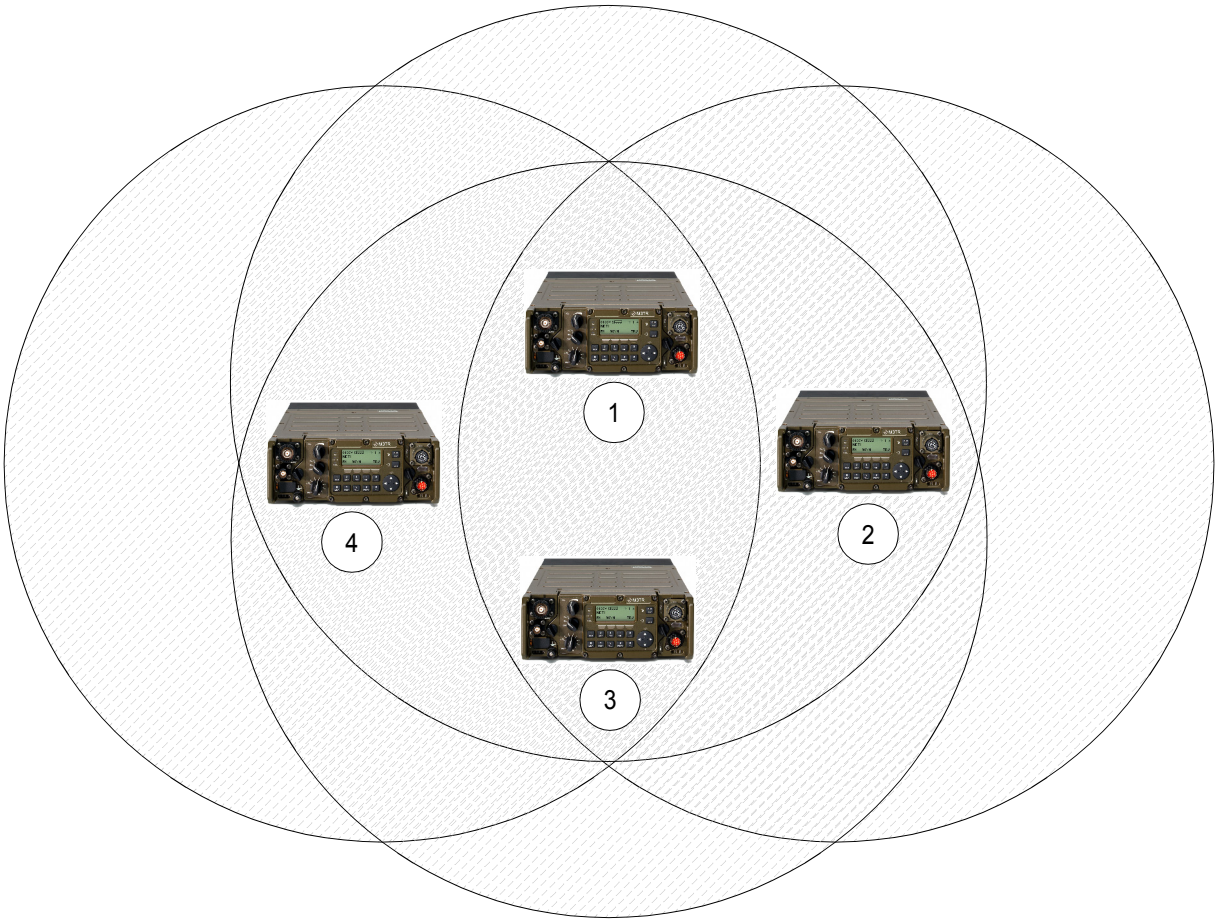
The RS_IRP mode cannot be selected/de-selected via MMI (man-machine interface), i.e. the RS_IRP mode must be defined in the mission configuration using the R&S RNMS3000.

The PRF operation mode is not available for the waveforms OFDM and SECOM-H.

The PRF mode shall not be used in multi-hop networks, i.e. when some radios need an intermediate radio to communicate with another one. As a consequence, the RS-IRP mode cannot be used either.

To guarantee a working multi-hop network, the ROB mode shall be used instead, and additionally the radio which is the time reference unit (TRU) in the network must be "visible" (radio communication possible) to all other radios belonging to the network. See sect. 4.7.3.10 Defining a Radio as a Time Reference Unit on how to configure a radio as TRU in a, e.g. SECOM-H network.

Figure 5.26 Multi-Hop Network Scenario



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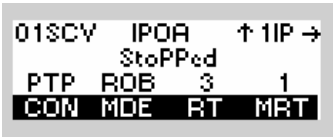
1 TRU
2 M3TR3
3 M3TR2
4 M3TR1

Figure 5.26 shows a valid multi-hop network scenario. The semi-transparent circles around each radio represent their coverage. Radio TRU is the time reference unit and visible to all other radios. Radio M3TR1 can use radio TRU and/or radio M3TR2 for the next hop to reach radio M3TR3.

By means of softkey MDE (Mode) the operator can change the operation mode.

Starting point: Main page of e.g. SECOM-V configuration menu

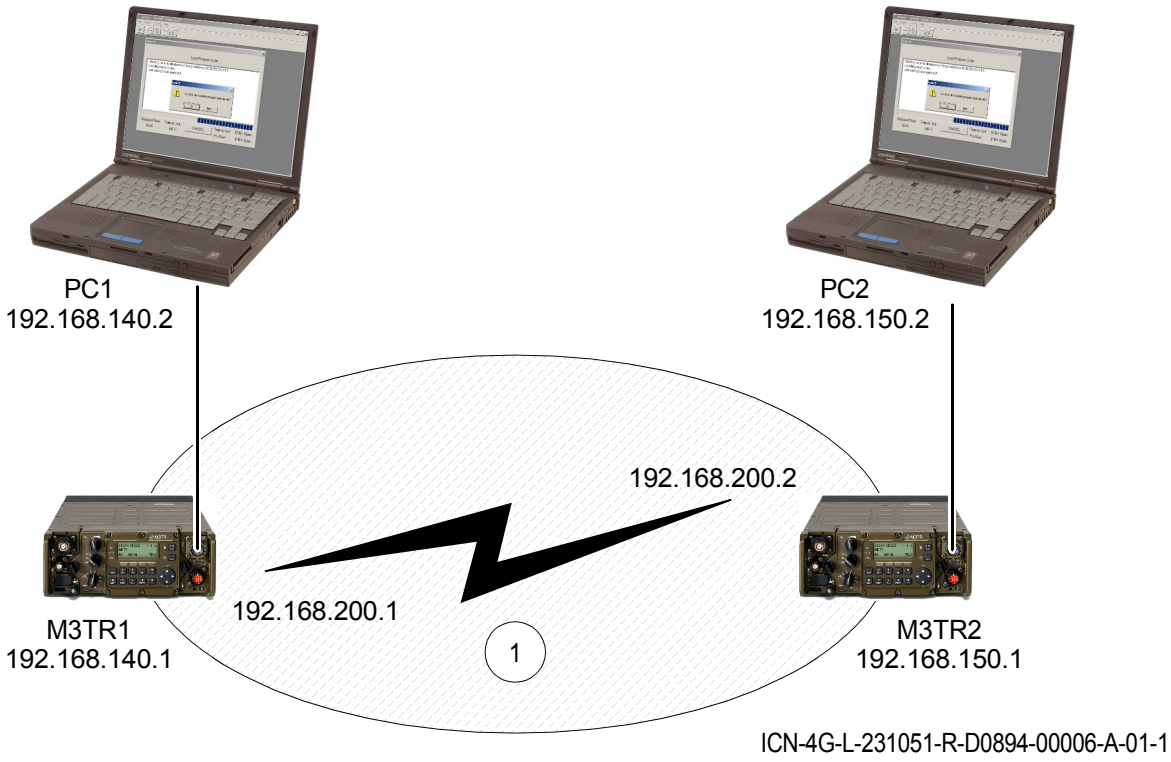
Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes: 
2	3 DEF (MDE)	Press.	Repetitively pressing this key changes the operation mode. Possible values: • PRF (performance) • ROB (robust) • IRP (RS_IRP compatible)

5.3.3.3 Editing the Routing Table

The entries in the routing table define where to forward incoming IP data to. Basically, a routing entry consists of a network (specified by IP address and netmask) and a gateway. When the destination IP address of an incoming packet matches the network of a routing entry, it is forwarded to the specified gateway. The radio chooses automatically the proper outgoing IP interface, i.e. if the gateway is in the range of the air IP network, the air IP interface is used as output IP interface.

Therefore, the IP address of the gateway must be reachable directly by the radio, thus should reside in the range of the Ethernet, air or PPP (Point-to-Point Protocol) IP Interface.

Figure 5.27 Example: PC1 and PC2 want to exchange IP data bi-directionally over the air network



1 e.g. SECOM-V Net 1

M3TR1	Air IP: 192.168.200.1		
Routing Table	IP Address	Netmask	Gateway
	192.168.150.2	255.255.255.0	192.168.200.2
M3TR2	Air IP: 192.168.200.2		
Routing Table	IP Address	Netmask	Gateway
	192.168.140.2	255.255.255.0	192.168.200.1

- Radio M3TR1 needs a route to forward packets destined to PC2 (192.168.150.2). The gateway for this route is Radio M3TR2 (192.168.200.2) which is reachable by radio M3TR1 over the air IP interface.
- Radio M3TR2 needs a route to forward packets destined to PC1 (192.168.140.2). The gateway for this route is Radio M3TR1 (192.168.200.1) which is reachable by radio M3TR2 over its air IP interface.
- There are no explicit routes necessary to route packets from one IP interface to another, e.g. radio M3TR2 can forward packets for PC2 automatically from the Air IP interface to the Ethernet IP interface.

NOTICE

The necessary routing configuration of PC1 and PC2 is omitted.

By means of softkey RT (Routing Table) the operator can edit a routing table.

The following functions are possible:

- Insert
- Delete
- Edit
- Select

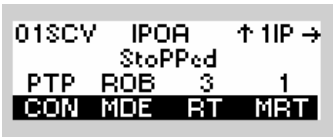
NOTICE

A maximum of 15 entries is allowed per preset page and a total maximum of 200 entries is allowed for the radio.

Inserting a Routing Table Entry

By means of softkey INS (Insert) the operator can insert a new entry.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes: 
2	4 GHI (RT)	Press.	The display changes:
3	2 ABC (INS)	Press.	The display changes:

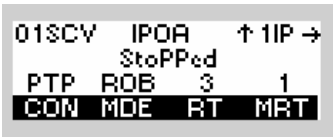
NOTICE

The new entry can be modified by means of softkey EDT.

Selecting a Routing Table Entry

By means of softkey NXT (Next) the operator can select an entry.

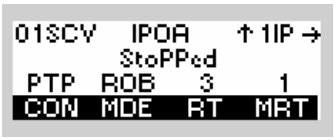
Starting point: Main page of e.g. SECOM-V configuration menu

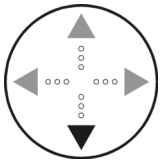
Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes: 
2	4 GHI (RT)	Press.	The display changes:
3	5 JKL (NXT)	Press several times until the desired entry is displayed.	**NOTICE** **A configured but not active route, e.g. due to a not matching air IP address, will be indicated in square brackets, e.g. [192.168.200.5].**

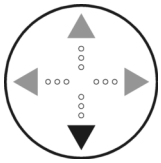
Editing a Routing Table Entry

By means of softkey EDT (Edit) the operator can edit an inserted entry.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes: 
2	4 GHI (RT)	Press.	The display changes:
3	5 JKL (NXT)	Press several times until the desired entry is displayed.	The display changes:
4	4 GHI (EDT)	Press.	The display changes:
		IP Address	
5	0 _*+ to 9 WXYZ	Enter the first octet of IP address.	
6	ENT	Press.	

Step	Control	Action	Note
7	0 _*+ to 9 WXYZ	Enter the second octet of IP address.	
8	ENT	Press.	
9	0 _*+ to 9 WXYZ	Enter the third octet of IP address.	
10	ENT	Press.	
11	0 _*+ to 9 WXYZ	Enter the fourth octet of IP address.	
12	ENT	Press.	The display changes:
13		Press once.	The display changes:
		Netmask	
14	4 GHI (EDT)	Press.	The display changes:
15	0 _*+ to 9 WXYZ	Enter the first octet of netmask.	
16	ENT	Press.	

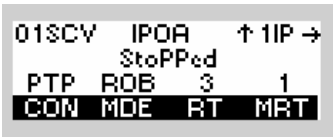
Step	Control	Action	Note
17	0 _*+ to 9 WXYZ	Enter the second octet of netmask.	
18	ENT	Press.	
19	0 _*+ to 9 WXYZ	Enter the third octet of netmask.	
20	ENT	Press.	
21	0 _*+ to 9 WXYZ	Enter the fourth octet of netmask.	
22	ENT	Press.	The display changes:
23		Press once.	The display changes:
		Gateway Address	
24	4 GHI (EDT)	Press.	The display changes:
25	0 _*+ to 9 WXYZ	Enter the first octet of gateway address.	
26	ENT	Press.	

Step	Control	Action	Note
27	0 _*+ to 9 WXYZ	Enter the second octet of gateway address.	
28	ENT	Press.	
29	0 _*+ to 9 WXYZ	Enter the third octet of gateway address.	
30	ENT	Press.	
31	0 _*+ to 9 WXYZ	Enter the fourth octet of gateway address.	
32	ENT	Press.	The display changes:

Deleting a Routing Table Entry

By means of softkey DEL (Delete) the operator can delete an entry.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	Open the configuration page of IPoA. 
2	4 GHI (RT)	Press.	Shows the first entry in the routing table.
3	5 JKL (NXT)	Press several times until the desired entry is displayed.	
4	3 DEF (DEL)	Press.	The previously visible entry is deleted and the next entry is displayed.

5.3.3.4 Editing the Multicast Routing Table

In a multicast-enabled environment, the radio can act as a multicast router in order to forward multicast IP (Internet Protocol) packets from the source towards the destination. The radio is not intended for sending or receiving multicast packets itself. The multicast (MC) routing table allows a static definition of the forwarding rules for multicast packets. Dynamic population of the table with the help of a multicast routing protocol like IGMP (Internet Group Management Protocol) is not supported.

The multicast routing table is completely independent of the unicast routing table.

Multicast IP packets are destined to a group of receivers (1 to n relationship), specified by the group IP address.

According to RFC 1112 (request for commands), the multicast group IP address has a range of 224.0.0.0 to 239.255.255.255.

RFC 3171 (Internet Assigned Numbers Authority (IANA) Guidelines for IPv4 Multicast Address Assignments) lists the current assignment practice of multicast group addresses. The block from 224.0.0.0 to 224.0.0.255 is reserved for multicast routing protocols. Like most router implementations, the R&S M3TR Tactical Radio does not route packets within this block. Therefore the possible configuration range is limited to 224.0.1.0 to 239.255.255.255.

It is advised to follow the guidelines of RFC 3171 and to use only the block 239.0.0.0 to 239.255.255.255, which is defined as administratively scoped block, i.e. for local usage.

A multicast routing table entry consists of the sender IP address, group IP address, routing direction and the time-to-live (TTL) threshold.

The sender IP address defines the source / sender of multicast packets that shall be routed. The group IP address defines the multicast group that wants to receive multicast data from the multicast sender.

The routing direction specifies the incoming and outgoing IP interface of a route, i.e. ETH (Ethernet) → AIR defines the Ethernet IP interface as incoming and the air IP interface as outgoing interface.

It is possible to configure more than one multicasting route with the same sender and group IP but different routing directions, creating a 1-to-n relationship between incoming and outgoing interfaces, e.g. to have configured direction AIR → ETH and AIR → PPP (Point-to-Point Protocol). In this case, multicast packets coming from the air IP interface will be forwarded to the Ethernet IP interface and to the PPP IP interface.

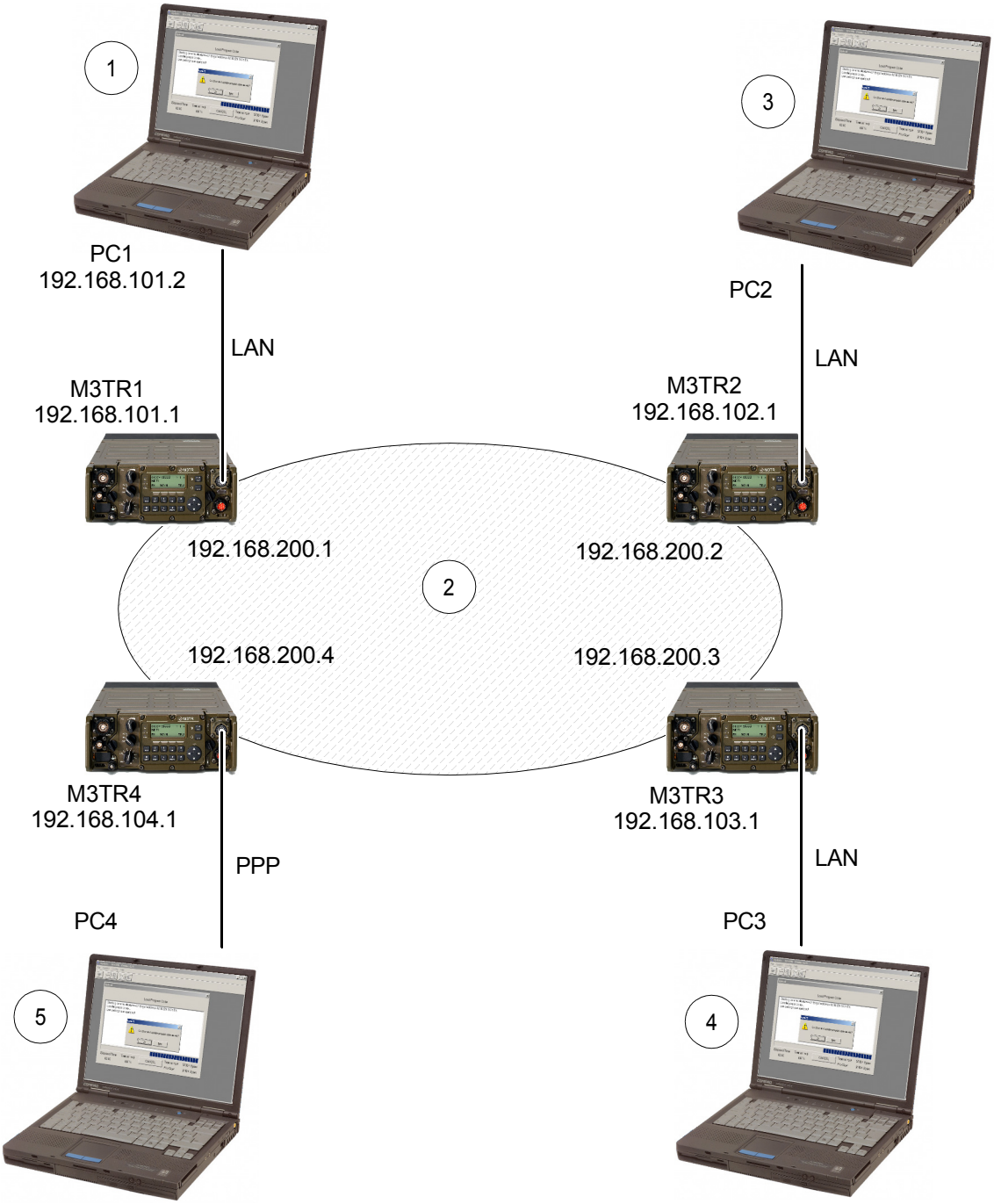
On the other side it makes no sense to configure two routes with the same sender and group IP, but opposite directions, like AIR → ETH and ETH → AIR.

The AIR -> AIR routing direction is used only in multi-hop scenarios.

When two radios are out of reach, an intermediate radio must forward incoming multicast packets (coming over the radio channel) to the radio channel, thus AIR → AIR. Directions involving the PPP interface are only active if PPP is enabled in the SRC setting of the IP port.

The TTL threshold defines the TTL value that incoming multicast packets must exceed in order to be routed. Packets with a TTL equal to or smaller than the configured threshold will be dropped.

Figure 5.28 Example: PC1 wants to transmit multicast (MC) data to PC2, PC3 and PC4



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1 MC Sender
Group IP: 224.0.5.1
2 e.g. SECOM-V Net
3 MC Receiver
Group IP: 224.0.5.1
4 MC Receiver
Group IP: 224.0.5.1
5 MC Receiver
Group IP: 224.0.5.1

M3TR1	Air IP: 192.168.200.1			
MC Routing Table	Sender IP	Group IP	Direction	TTL
	192.168.101.2	224.0.5.1	ETH → AIR	2
M3TR2	Air IP: 192.168.200.2			
MC Routing Table	Sender IP	Group IP	Direction	TTL
	192.168.101.2	224.0.5.1	AIR → ETH	1
M3TR3	Air IP: 192.168.200.3			
MC Routing Table	Sender IP	Group IP	Direction	TTL
	192.168.101.2	224.0.5.1	AIR → ETH	1
M3TR4	Air IP: 192.168.200.4			
MC Routing Table	Sender IP	Group IP	Direction	TTL
	192.168.101.2	224.0.5.1	AIR → PPP	1

- PC1 with IP 192.168.101.2 sends a multicast packet to the group 224.0.5.1. Radio M3TR1 receives the packet on the Eth IP interface. A lookup in the MC routing table finds an entry with matching sender and group IP address. According to the routing direction the packet is passed to the Air IP interface for transmission. The packet is transmitted over the Air network and is received by radios M3TR2 to 4 on its Air IP interfaces. Radio M3TR2 finds a matching entry in its multicast routing table (sender 192.168.101.2, group 224.0.5.1). The routing direction defines the Eth IP interface as outgoing interface and the packet is transmitted on the LAN (Local Area Network).
- According to its multicast routing table, Radio M3TR4 forwards the received packet to the PPP IP interface. PC4 receives the packet over the established PPP link.
- Usefulness of the TTL threshold:

  Each IP packet (and so multicast packets) contains a TTL field. The initial value set by the sender is decremented by each router (hop) the packet passes. If the packet's TTL reaches the value 1, the packet is not forwarded anymore by the router, i.e. the packet will be dropped.

The TTL threshold of a multicast routing table entry defines the minimum TTL that incoming packets must exceed in order to be forwarded.

In our example the initial value of the packet's TTL must be 3 in order to pass the first hop (M3TR1), since its matching multicast routing table entry has a configured TTL threshold of 2. This value ensures that the packet has a large enough TTL to pass the second hops (M3TR2, 3, 4) on the way to its destinations.

There is nothing wrong in leaving the default TTL threshold of 1 unchanged, especially when the entire network topology is unknown (like number of hops from source to destination).

A proper TTL threshold configuration can avoid an unnecessary forwarding of packets whose (too small) TTL will cause next hop routers to drop them.

NOTICE

The necessary configuration for PC 2 to 4 is omitted.

By means of softkey MRT (Multicast Routing Table) the operator can edit the multicast routing table.

The following functions are possible:

- Insert
- Delete
- Edit
- Select

NOTICE

A maximum of 15 entries is allowed per preset page and a total maximum of 100 entries is allowed for the radio.

Inserting a Multicast Routing Table Entry

By means of softkey INS (Insert) the operator can insert a new entry.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes:
2	5 JKL (MRT)	Press.	The display changes:
3	2 ABC (INS)	Press.	The display changes:
			NOTICE **The new entry can be modified by means of softkey EDT.**

Selecting a Multicast Routing Table Entry

By means of softkey NXT (Next) the operator can select an entry.

Starting point: Main page of e.g. SECOM-V configuration menu

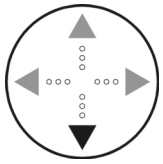
Step	Control	Action	Note
1	**3 DEF** (IPC)	Press.	The display changes:
2	**5 JKL** (MRT)	Press.	The display changes: **NOTICE** **A configured but not active multicast route will be indicated in square brackets, e.g. [192.168.100.5].**
3	**5 JKL** (NXT)	Press several times until the desired entry is displayed.	

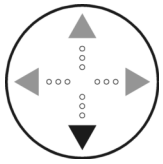
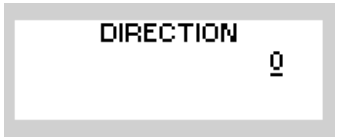
Editing a Multicast Routing Table Entry

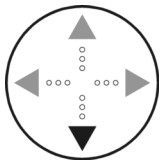
By means of softkey EDT (Edit) the operator can edit an inserted entry.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes:
2	5 JKL (MRT)	Press.	The display changes:
3	5 JKL (NXT)	Press several times until the desired entry is displayed.	The display changes:
4	4 GHI (EDT)	Press.	The display changes:
		Sender IP Address	
5	0 _*+ to 9 WXYZ	Enter the first octet of sender IP address.	
6	ENT	Press.	
7	0 _*+ to 9 WXYZ	Enter the second octet of sender IP address.	

Step	Control	Action	Note
8	ENT	Press.	
9	0 _*+ to 9 WXYZ	Enter the third octet of sender IP address.	
10	ENT	Press.	
11	0 _*+ to 9 WXYZ	Enter the fourth octet of sender IP address.	
12	ENT	Press.	The display changes:
13		Press once.	The display changes:
Group IP Address			
14	4 GHI (EDT)	Press.	The display changes:
15	0 _*+ to 9 WXYZ	Enter the first octet of group IP address.	
16	ENT	Press.	
17	0 _*+ to 9 WXYZ	Enter the second octet of group IP address.	

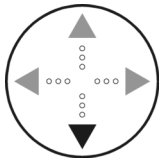
Step	Control	Action	Note
18	ENT	Press.	
19	0 _*+ to 9 WXYZ	Enter the third octet of group IP address.	
20	ENT	Press.	
21	0 _*+ to 9 WXYZ	Enter the fourth octet of group IP address.	
22	ENT	Press.	The display changes:
23		Press once.	The display changes:
		Routing Direction	
24	4 GHI	Press.	The display changes: 
25	0 _*+ to 9 WXYZ	Change the transport direction.	Possible Values: 0 = ETH → AIR (Ethernet to Air) 1 = AIR → ETH (Air to Ethernet) 2 = PPP → AIR (Point-to-Point Protocol to Air) 3 = AIR → PPP (Air to Point-to-Point protocol) 4 = AIR → AIR (Air to Air) **NOTICE** **Routing direction for multicast packets from input to output interface**
26	ENT	Press.	The display changes:

Step	Control	Action	Note
27		Press once.	The display changes:
	Time-to-Live Threshold		
28	4 GHI (EDT)	Press.	The display changes:
29	0 _ * + to 9 WXYZ	Change the threshold.	Range: 1 to 255 **NOTICE** **Only multicast packets with a TTL value greater than this threshold are routed to the next station.**
30	ENT	Press.	

Deleting a Multicast Routing Table Entry

By means of softkey DEL (Delete) the operator can delete an entry.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes:
2	5 JKL (MRT)	Press.	The display changes:
3		Press several times until the desired entry is displayed.	
4	3 DEF (DEL)	Press.	The previously visible entry is deleted and the next entry is displayed.

5.3.3.5 Changing the Radio Air Interface IP Address

The air IP (Internet Protocol) address specifies the IP address of the air IP interface. By this address the radio is addressed within the air IP network on IP layer level.

Combined with the air IP netmask, the air IP network is defined. The relation between IP address, netmask and network is explained in sect. 5.3 IP over Air (IPoA).

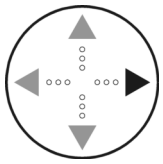
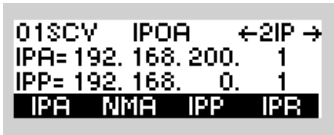
It is required that all radios forming an air network reside in the same air IP network in order to allow proper IP routing.

NOTICE

This parameter needs a restart in order to take effect.

By means of softkey IPA (Air IP Address) the operator can change the radio air IP address.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes:
2		Press once.	The display changes: 
3	2 ABC (IPA)	Press.	The display changes:
4	0 _*+ to 9 WXYZ	Enter the first octet of radio air IP address.	

Step	Control	Action	Note
5	ENT	Press.	The display changes:
6	0 _*+ to 9 WXYZ	Enter the second octet of radio air IP address.	
7	ENT	Press.	The display changes:
8	0 _*+ to 9 WXYZ	Enter the third octet of radio air IP address.	
9	ENT	Press.	The display changes:
10	0 _*+ to 9 WXYZ	Enter the fourth octet of radio air IP address.	
11	ENT	Press.	

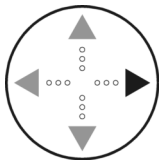
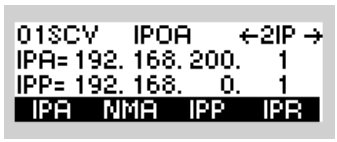
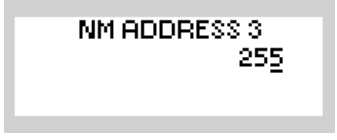
5.3.3.6 Changing the Radio Air Interface Netmask

Due to internal limitations of the air network, the air IP netmask is restricted to the range of

- 255.255.128.0 to 255.255.255.255 in the network modes ROB (robust) and PRF (performance) and
- 255.255.255.128 to 255.255.255.255 in RS-IRP mode.

By means of softkey NMA (Air Netmask) the operator can change the radio air netmask.

Starting point: Main page of e.g. SECOM-V configuration menu

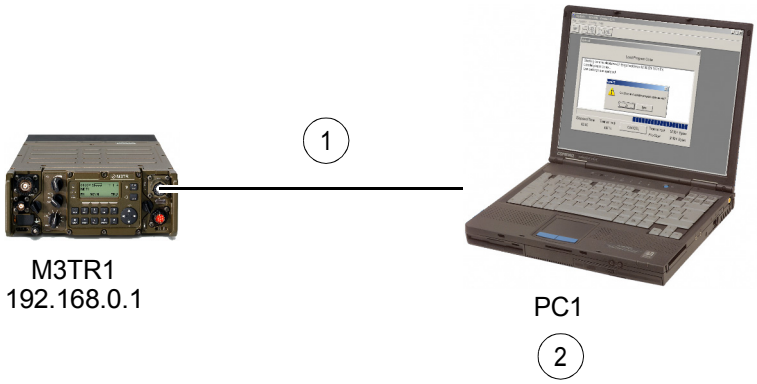
Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes:
2		Press once.	The display changes: 
3	3 DEF (NMA)	Press.	The display changes:
4	0 _*+ to 9 WXYZ	Enter the first octet of radio air netmask.	
5	ENT	Press.	The display changes: 
6	0 _*+ to 9 WXYZ	Enter the second octet of radio air netmask.	

Step	Control	Action	Note
7	ENT	Press.	The display changes:
8	0 _*+ to 9 WXYZ	Enter the third octet of radio air netmask.	
9	ENT	Press.	The display changes:
10	0 _*+ to 9 WXYZ	Enter the fourth octet of radio air netmask.	
11	ENT	Press.	

5.3.3.7 Changing the PPP IP Interface Address

Apart from the Ethernet and air IP interface, the R&S M3TR Tactical Radio offers a third IP (Internet Protocol) interface, the PPP IP interface (Point-to-Point Protocol). It allows a serial connection from a computer to the radio by means of the point-to-point protocol. The PPP IP interface has a fixed network mask of 255.255.255.0, but its IP address can be configured here. A computer establishing a PPP connection receives its IP address from the radio, which is always "PPP IP address of Radio" + 1:

Figure 5.29 PPP Connection



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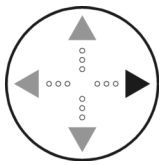
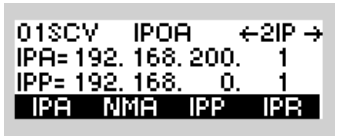
1 PPP connection
2 IP assigned by R&S M3TR

The radio must have PPP enabled in its IP port configuration, and the following settings apply for the remote endpoint:

- The baud rate must be set to the same value as configured in the radio. Possible settings are: 2400 bit/s, 9600 bit/s, 19200 bit/s and 115200 bit/s.
- No hardware flow control
- IP header compression may be enabled
- Supported authentication protocols are PAP (Password Authentication Protocol) and CHAP (Challenge Handshake Authentication Protocol)
- Username / password: vxPPPClient / vxPPPClient

By means of softkey IPP (IP Point-to-Point) the operator can change the point-to-point IP address. It is recommended to restart the radio and the PPP session again if already started after changing the IP address.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes:
2		Press once.	The display changes: 
3	4 GHI (IPP)	Press.	The display changes:
4	0 _*+ to 9 WXYZ	Enter the first octet of PPP IP address.	
5	ENT	Press.	The display changes:
6	0 _*+ to 9 WXYZ	Enter the second octet of PPP IP address.	
7	ENT	Press.	The display changes:
8	0 _*+ to 9 WXYZ	Enter the third octet of PPP IP address.	

Step	Control	Action	Note
9	ENT	Press.	The display changes:
10	0 _*+ to 9 WXYZ	Enter the fourth octet of PPP IP address.	
11	ENT	Press.	

Remote Control via PPP

For starting a remote control session via PPP (Point-to-Point Protocol) the radio must be connected via serial cable to a remote station (i.e. PC). To establish the PPP session the above mentioned settings have to be adjusted on the remote station and finally the PPP connection has to be started.

An additional routing entry (host route) needs to be set on the remote station to reach the remote control server:

- Dest IP: IP of local Ethernet interface (main IP interface of the radio)
- Netmask: 255.255.255.255 (→ host route)
- Gateway IP: remote connection IP of PPP session (provided by radio) = “PPP IP address of Radio+1”

On a PC this could be the following command line:

route add 192.168.100.2 mask 255.255.255.255 192.168.0.2

with

radio’s local Ethernet IP = 192.168.100.2 and PC’s local PPP address = 192.168.0.2

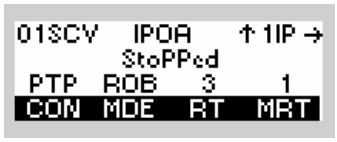
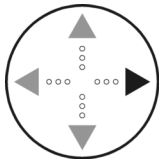
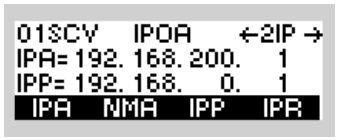
Additionally, a gateway address must be configured, even if there is no gateway. The gateway address, which is by default 0.0.0.0, has to be changed to any unicast address within the IP subnet of the radio’s Ethernet interface, except .0 and .255 and the radio IP address itself.

Then remote control can be started by addressing the IP of the radio’s local Ethernet interface.

5.3.3.8 Changing the Rebroadcast IP Address

By means of softkey IPP (IP Rebroadcast) the operator can change the rebroadcast IP address.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes: 
2		Press once.	The display changes: 
3	5 JKL (IPR)	Press.	The display changes:
4	0 _*+ to 9 WXYZ	Enter the first octet of rebroadcast IP address.	
5	ENT	Press.	The display changes:
6	0 _*+ to 9 WXYZ	Enter the second octet of rebroadcast IP address.	
7	ENT	Press.	The display changes:

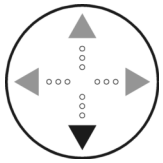
Step	Control	Action	Note
8	0 _ * + to 9 WXYZ	Enter the third octet of re-broadcast IP address.	
9	ENT	Press.	The display changes:
10	0 _ * + to 9 WXYZ	Enter the fourth octet of re-broadcast IP address.	
11	ENT	Press.	

For further details see sect. 5.3.2.2 Rebroadcast / Relay Mode.

5.3.3.9 Switching the Local Voice Mode for Rebroadcast On or Off

By means of softkey VOL (Voice Local) the operator can switch the local voice mode for rebroadcast on or off.

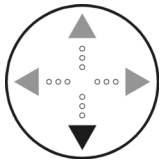
Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes:
2		Press twice.	The display changes:
3	2 ABC (VOL)	Press.	Repetitively pressing this key toggles the local voice mode for rebroadcast on and off. The new setting is now effective. For further details see sect. 5.3.2.2 Rebroadcast / Relay Mode.

5.3.3.10 Switching the Voice Forward Mode for Rebroadcast On or Off

By means of softkey VOF (Voice Forward) the operator can switch the voice foreard mode for rebroadcast on or off.

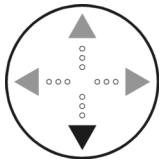
Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes:
2		Press twice.	The display changes:
3	3 DEF (VOF)	Press.	Repetitively pressing this key toggles the voice foreard mode for rebroadcast on and off. The new setting is now effective. For further details see sect. 5.3.2.2 Rebroadcast / Relay Mode.

5.3.3.11 Switching the Relay IP Mode for Broadcast On or Off

By means of softkey BCF (Broadcast Forward) the operator can switch the relay IP mode for broadcast on and off.

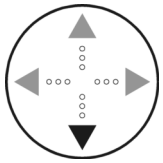
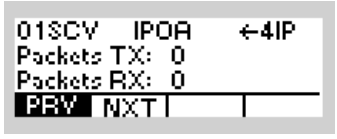
Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes:
2		Press twice.	The display changes:
3	5 JKL (BCF)	Press.	Repetitively pressing this key toggles the relay IP mode for broadcast on and off. The new setting is now effective. For further details see sect. 5.3.2.2 Rebroadcast / Relay Mode.

5.3.3.12 Inquiring the Statistic Items of the Air Interface

By means of softkeys PRV (Previous) and NXT (Next) the operator can inquire the statistic items.

Starting point: Main page of e.g. SECOM-V configuration menu

Step	Control	Action	Note
1	3 DEF (IPC)	Press.	The display changes:
2		Press once.	The display changes: Overflow Errors: Number of packets which could not be transmitted due to lack of outbound buffers. Pending Packets Tx: Number of packets in outbound queues.
3	3 DEF (NXT)	Press.	The display changes: Datarate Tx: Datarate Rx:
4	3 DEF (NXT)	Press.	The display changes:  Packets Tx: Number of transmitted packets. Packets Rx: Number of received packets.

5.4 Message Service

5.4.1 Basics of Message Service

The Message Service functionality is used for the exchange of short data messages (SDM) between radios in the same network.

Message Service is available with these waveforms in combination with waveform services IP-Data and Voice-over-IP Data:

	R&S M3TR	R&S M3SR Series 4100
SECOM-V	x	
SECOM-H	x	x
OFDM (Orthogonal Frequency Division Multiplex)	x	

Received messages can be accessed via the man-machine interface (MMI) and remote control interfaces. An external PC-based application may be used for accessing / displaying or further processing of stored messages.

5.4.1.1 Storage Strategy

Incoming alert and SDM messages are stored persistently on the radio. The receive buffer depends on the currently selected Preset Page. The radio can support individual receive buffers for up to ten IPoA Preset Pages. If the receive buffer is full, any new incoming message will subsequently replace the receive buffer's oldest message. The oldest message will be deleted in the process.

5.4.1.2 Message Size

An SDM message with standard encoding may hold up to 200 characters.

5.4.1.3 Prerequisites

In order to transmit and receive messages over Message Service, the following requirements must be met:

- A Message Service type (alert messages and/or SDM messages) must be activated via R&S RNMS3000 and
- IP_DATA or VOICE_O_IPD must be selected as active Service Group and
- the radio needs to be synchronous with its waveform specific network and
- a valid IPoA net must be configured in R&S RNMS3000 (regarding IPoA addresses, IPoA operation mode, routing tables plus an appropriate waveform data rate).

5.4.1.4 IP-Based Interface for External Applications

The Message Service provides an IP-based interface for external applications to receive and transmit messages.

5.4.1.5 Message Addressing

The predefined alert messages are broadcast to all stations in the network.

It is possible to send SDM messages

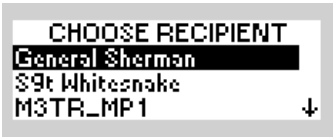
- to a single message recipient within the current radio network (unicast addressing).
- to every radio within the current network (broadcast addressing).

5.4.1.6 Participant Selection List (R&S M3TR only)

The alert messages can only be broadcast. Due to this, the description below is related to SDM messages. The selection list for the addressable participants supports the selection of

- a single GPS participant (point-to-point)
- all GPS participants (broadcast).

After a command softkey is pressed, the user is presented with a selection list of R&S RNMS3000 configured radios participating in GPS reporting:



The list contains

- an entry for broadcast and
- the RGA (Radio Global Address) names of all configured participants except for the own radio and
- predefined nicknames.

5.4.1.7 Indication of a New SDM in the Waveform-Specific Operational Menu (R&S M3TR only)

On arrival of a new SDM message, a NEW SDM message will be indicated in the main window of the operational menu. This message is only visible in idle state. The indication is maintained until all messages in the received SDM messages list have been read.

5.4.2 Settings in Menu Message Service (M)

Starting point:

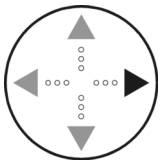
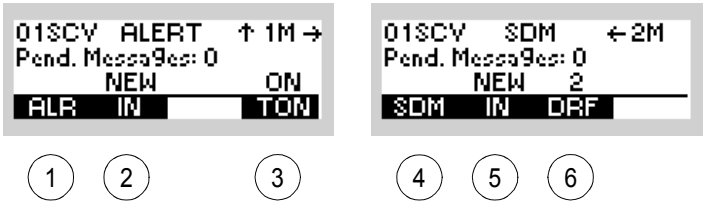
Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes, e.g.:
2		Press.	Press several times until the desired submenu is activated (see Figure 5.30). The complete menu structure is shown in Figure 5.31.

Figure 5.30 Menu M (Submenus)



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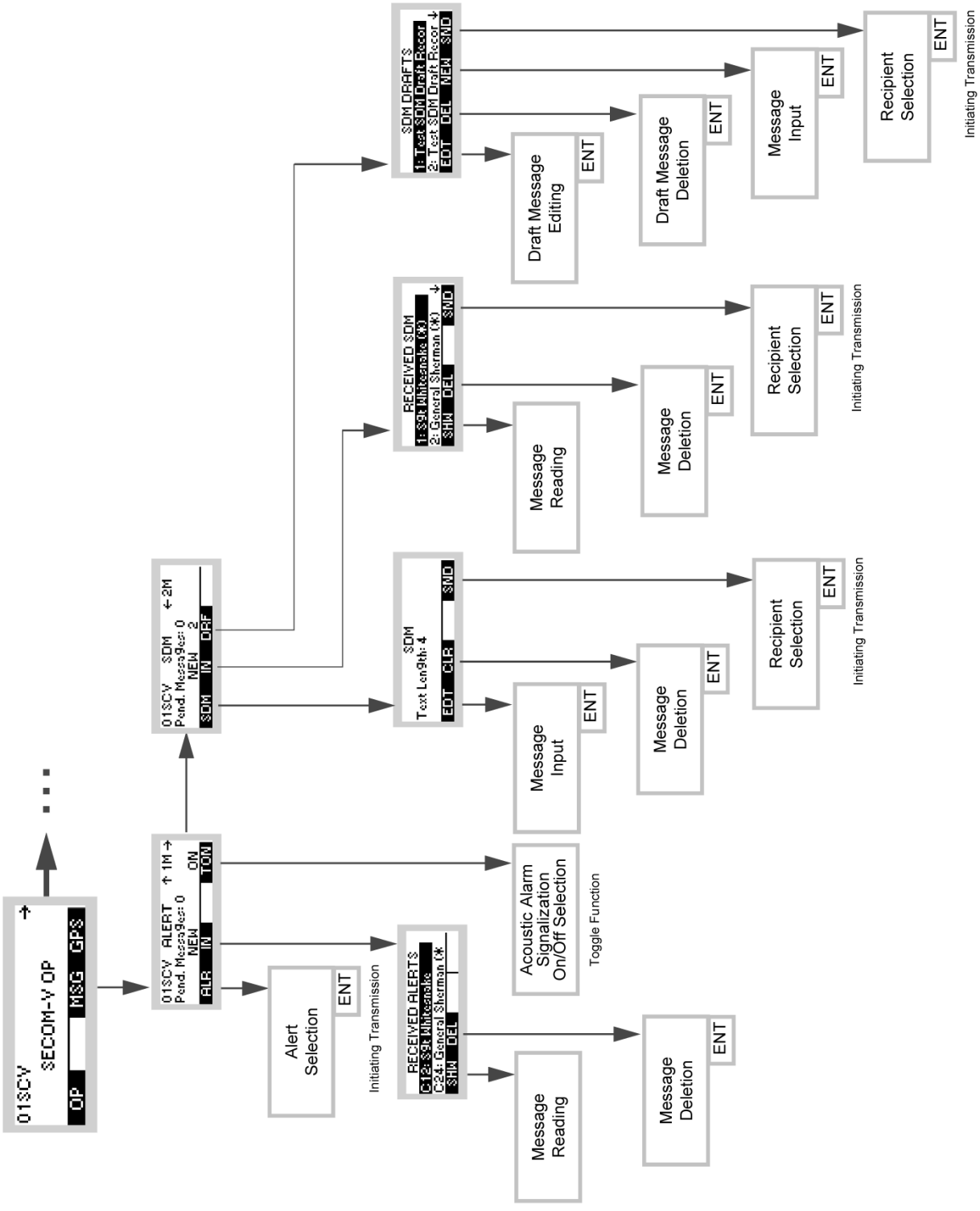
1 See sect. 5.4.2.1 Initiating an Alert Message
2 See sect. 5.4.2.2 Received Alert Messages
3 See sect. 5.4.2.3 Changing the Acoustic Alert Message Signalization State
4 See sect. 5.4.2.4 Initiating an SDM Message
5 See sect. 5.4.2.5 Received SDM Messages
6 See sect. 5.4.2.6 Initiating an SDM Message from the Draft Folder

Figure 5.31 Menu M (Structure)



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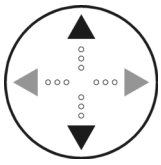
5.4.2.1 Initiating an Alert Message

The predefined alerts are broadcast in urgent situations to all stations in the network (exception: sender of alert), while no transmission is in progress.

By means of softkey ALR (Alert) the operator can initiate an alert message.

Starting point: Main page of e.g. SECOM-V menu

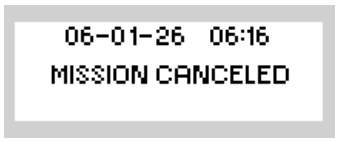
Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes: The Field “Pend. Messages” indicates the number of alert messages waiting to be sent.
2	2 ABC (ALR)	Press.	The display changes: Alert message structure: **## : alert message content** ## = max. 2 digit alert code number The asterisk (*) indicates that the message is unread.
3		Press several times until the desired alert message is selected.	
4	ENT	Press.	The selected alert message is now being sent.

5.4.2.2 Received Alert Messages

Full Screen Display of Received Alert Message via MMI

Incoming alert messages are immediately displayed in full-screen mode on the radio-internal MMI. A prerequisite for this functionality is that the radio is not in remote login state.

Example of an alert:



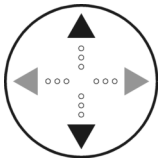
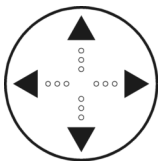
If an alert message is received before the previous alert message was left by the operator, the incoming message will be stored in the background and displayed as soon as the previous message is left.

Selecting One of the Received Alert Messages

By means of softkeys IN and SHW (Show) the operator can select the alert message to be displayed.

Starting point: Main page of e.g. SECOM-V menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes: "**NEW**" indicates that a new message has come in. Otherwise, the number of messages in the inbox appears in the same position.
2	3 DEF (IN)	Press.	The display changes:

Step	Control	Action	Note
			Record structure: **C ## : sender (*)** C ## = C and 2-digit alert code number Sender can be • a nickname assigned to an IP address, • a radio name, or • an IP address. The asterisk (*) indicates that the message is unread.
3		Press several times until the desired received alert message is selected.	
4	2 ABC (SHW)	Press.	The display changes:
5		Press to scroll within the message content.	

NOTICE

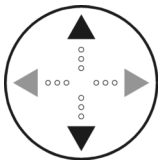
Message Service can buffer up to 10 incoming alert messages in a list if an inbox has been assigned to the related preset page. The newest message is shown at the first position. The sorting depends on the time of arrival. The selected SMS entry is displayed in inverse characters.

As long as any incoming message is still to be read, 'NEW' is indicated on the MMI. When all incoming messages have been read, the number of pending messages in the list is indicated on the MMI.

Deleting One of the Received Alert Messages

By means of softkeys IN and DEL (Delete), the operator can select the message to be deleted.

Starting point: Main page of e.g. SECOM-V menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes:
2	3 DEF (IN)	Press.	The display changes:
3		Press several times until the desired received SDM is selected.	
4	3 DEF (DEL)	Press.	The display changes:
5	ENT	Press.	The selected message is now deleted.

NOTICE

Alert messages are stored in a list. After scrolling through the list view and selecting the message to be deleted, the operator is presented with a confirmation dialog to actually delete the selected message. Pressing ENT confirms the deletion, ESC cancels the deletion. Either choice returns the user to the alert message list view. Incoming messages are stored and displayed on a last-in-first-out (newest message is displayed first) basis. If a message is deleted, the message count is decremented and the next message moves up in the list. If the deletion is cancelled, the message order remains.

5.4.2.3 Changing the Acoustic Alert Message Signalization State

The operator is notified about the receipt of an alert message via an acoustic signalization tone. The signalization tone can be switched on or off via R&S RNMS3000 and the radio internal MMI / REMOTE interface.

By means of softkey TON (Tone) the operator can change the state of alert message signalization.

Starting point: Main page of e.g. SECOM-V menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes:
2	5 JKL (TON)	Press.	Repetitively pressing this key toggles between alert message signalization on and off.

NOTICE

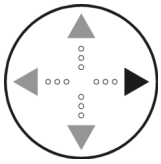
In case the OFDM waveform is activated, the softkey TON is disabled and the alert message signalization is switched off, because the acoustic signalization tone functionality does not work with OFDM waveforms.

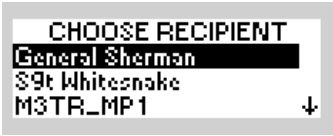
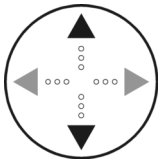
5.4.2.4 Initiating an SDM Message

By means of softkeys SDM and EDT (Edit) the operator can create an SDM message or edit an already created SDM message.

By means of softkeys SDM and SND (Send), the operator can send an SDM message.

Starting point: Main page of e.g. SECOM-V menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes:
2		Press once.	The display changes: The field “Pend. Messages” indicates the number of SDM messages waiting to be sent.
3	2 ABC (SDM)	Press.	The display changes: SDM length information indicates whether an SDM has already been prepared and how many characters were input.
4	2 ABC (EDT)	Press.	The display changes:
5	0 _ * + to 9 WXYZ	Enter the message.	

Step	Control	Action	Note
6	ENT	Press.	The entered SDM message will be buffered and is now ready to be sent. The display changes:
7	5 JKL (SND)	Press.	The display changes:  Recipient can be • a nickname assigned to an IP address, • a radio name, or • an IP address.
8		Press several times until the desired recipient is selected.	
9	ENT	Press.	The SDM message is now being sent.

NOTICE

The CLR (Clear) softkey clears all entries. After pressing CLR , the operator is presented with a confirmation dialog to actually delete the previously entered SDM message. Pressing ENT confirms the deletion, ESC cancels the deletion. On deletion, the character counter will be set to 0.

NOTICE

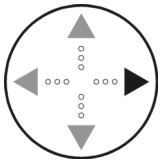
While editing, the CLR/ESC button can be used to clear single characters, but if kept pressed for a longer period, it acts as an escape and quits the message editing menu.

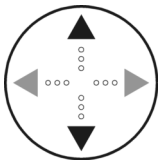
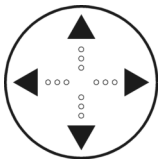
5.4.2.5 Received SDM Messages

Selecting One of the Received SDM Messages

By means of softkeys IN (Inbox) and SHW (Show) the operator can select the message to be displayed.

Starting point: Main page of e.g. SECOM-V menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes:
2		Press once.	The display changes: 'NEW' indicates that a new message has come in. Otherwise, the number of messages in the SDM inbox appears in the same position.
3	3 DEF (IN)	Press.	The display changes: **Order of message: sender** Sender can be • a nickname assigned to an IP address, • a radio name, or • an IP address. The asterisk (*) indicates that the message is unread.

Step	Control	Action	Note
4		Press several times until the desired received SDM is selected.	
5	2 ABC (SHW)	Press.	The display changes:
6		Press to scroll within the message content.	

NOTICE

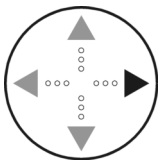
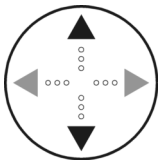
Message Service can buffer up to 10 incoming alert messages in a list if an inbox has been assigned to the related preset page. The newest message is shown at the first position. The sorting depends on the time of arrival. The selected SMS entry is displayed in inverse characters.

As long as any incoming message is still to be read, 'NEW' is indicated on the MMI. When all incoming messages have been read, the number of pending messages in the list is indicated on the MMI.

Deleting One of the Received SDM Messages

By means of softkeys IN and DEL (Delete), the operator can select the message to be deleted.

Starting point: Main page of e.g. SECOM-V menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes:
2		Press once.	The display changes:
3	3 DEF (IN)	Press.	The display changes:
4		Press several times until the desired received SDM is selected.	
5	3 DEF (DEL)	Press.	The display changes:
6	ENT	Press.	The selected message is now deleted.

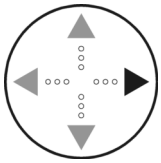
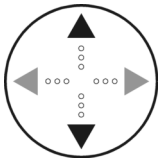
NOTICE

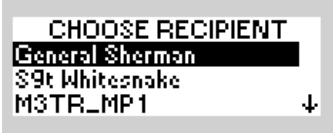
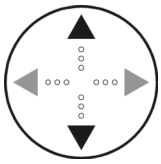
SDM messages are stored in a list. After scrolling through the list view and selecting the message to be deleted, the operator is presented with a confirmation dialog to actually delete the selected SDM. Pressing ENT confirms the deletion, ESC cancels the deletion. Either choice returns the user to the SDM list view. Incoming messages are stored and displayed on a last-in-first-out (newest message is displayed first) basis. If a message is deleted, the message count is decremented and the next message moves up in the list. If the deletion is cancelled, the message order remains.

5.4.2.6 Initiating an SDM Message from the Draft Folder

By means of softkeys DRF (Draft) and SND (Send), the operator can send a predefined SDM message.

Starting point: Main page of e.g. SECOM-V menu

Step	Control	Action	Note
1	4 GHI (MSG)	Press.	The display changes:
2		Press once.	The display changes: The field 'Pend. Messages' indicates the number of SDM messages waiting to be sent.
3	4 GHI (DRF)	Press.	The display changes: Record structure: **## : truncated message** ##: the index of draft 'Msg content' is shown as truncated ASCII message.
4		Press several times until the desired SDM draft is selected.	

Step	Control	Action	Note
5	5 JKL (SND)	Press.	The display changes:  Recipient can be • a nickname assigned to an IP address, • a radio name, or • an IP address.
6		Press several times until the desired recipient is selected.	
7	ENT	Press.	The selected SDM draft message is now being sent.

NOTICE

The EDT (Edit) softkey opens the SDM message editor window to work on a predefined SDM.

The NEW softkey opens the SDM message editor window to create a new SDM draft.

The DEL (Delete) softkey deletes the selected SDM draft. After pressing DEL, the operator is presented with a confirmation dialog to actually delete the SDM draft. Pressing ENT confirms the deletion, ESC cancels the deletion. The SDM drafts are stored and displayed on a last-in-first-out (newest message is displayed first) basis. If a draft is deleted, the draft count is decremented and the next draft moves up in the list. If the deletion is cancelled, the message order remains.

Message service can buffer up to 20 SDM drafts in a list. This list can be accessed on a preset page for which an inbox has been assigned.

5.5 Voice over IP (VoIP)

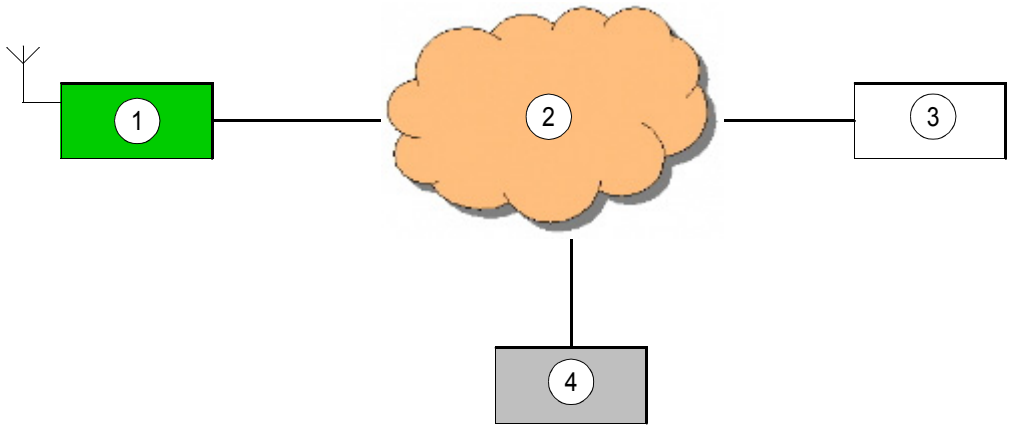
5.5.1 Basics of Voice over IP (VoIP)

The VoIP service functionality enables a radio to perform voice communication with an external VoIP user over an IP network. The external VoIP user is an IP-capable device such as a VoIP telephone or the R&S GB4000V.

Remote operation is a typical use case of the VoIP service, where besides the voice over IP, the remote control of the radio is also performed via IP.

The Figure 5.32 shows an IP-based remote operation application.

Figure 5.32 IP-Based Remote Operation Application



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1 Radio
2 IP network
3 Remote controller
4 VoIP user

The VoIP service can be used for a voice communication between an external VoIP user and a radio network. For this purpose, one radio in the radio network acts as VoIP gateway. The VoIP gateway radio is connected via Ethernet to an IP network and handles calls originated from or coming towards the radio network. Any radio in the network can act in the role of VoIP gateway. This role is configured via R&S RNMS3000.

NOTICE

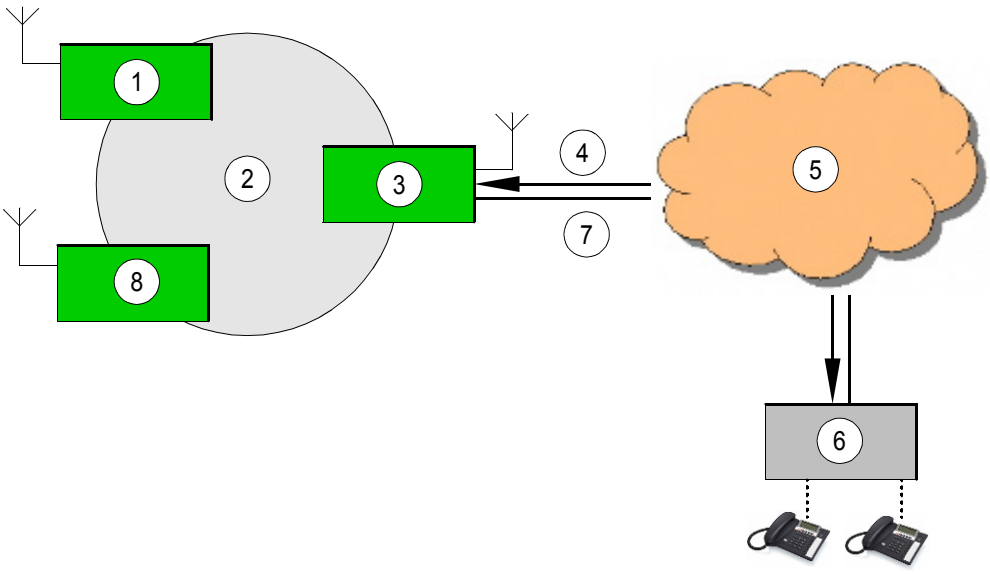
For ALE-3G, the phone service has some limitations regarding call signalling (see ”Call Initiation” on p. 5.154).

5.5.1.1 Configuration Scenarios

Connecting a Single Radio Cell with a VoIP Network

Figure 5.33 illustrates the architecture of a single radio cell connected to a VoIP network using a Gateway Radio (GWR) to connect with the IP network.

Figure 5.33 Connecting a Radio Network to a VoIP Network



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1. CNR station name BRAVO
2. IPoA network (SECOM-V or ALE-3G)
3. GWR station name ALPHA
   IP-host name "gwr_alpha"
4. Inbound dials
   RGA_BROADCAST@gwr_alpha
   BRAVO@gwr_alpha
5. VoIP network
6. VoIP-PBX "v-server"
7. Outbound dials
   0015192345656@v-server
8. CNR station CHRIS

The radios “ALPHA”, “BRAVO” and “CHRIS” are connected with ALE-3G or SECOM-V. ALPHA is configured as a GWR and connected to the VoIP private branch exchange (VoIP-PBX) “v-server” using ETHERNET. The PBX must support the IETF RFC 3261 SIP-standard and the RFC 3550 realtime transport protocol standard.

It is not a mandatory requirement to connect the GWR to a PBX – it is also possible to connect just one phone peer to peer to the GWR. A PBX has the advantage to offer voice prompts to unform caller or callee about a radio call and how to proceed with PTT on the phone. This makes the system more useer friendly. Additionally a PBX can be used as a gateway into a public network or could be used to transfer calls to other radio-cells. Combinations of two GWR over ETHERNET could be used to connect two radio-nets over VoIP.

The communication between GWR and the other radios of the group is implemented using a proprietary protocol, therefore the SIP settings in the CNR’s must not be configured. Only the GWR implements the SIP-gateway to the PBX.

Inbound Calls
Inbound calls into the radio network allow the connection to one of the other radios of the group or to the whole group using a broadcast target URI.

If the external caller wish to be connected to a particular radio e.g. “BRAVO” the PBX sends sip-invites e.g. to BRAVO@gwr_alpha (the hostname of GWR “ALPHA”). The voice stream from the PBX in direction to “BRAVO” can be received only on this particular radio. The reception of the voice stream at “CHRIS” is not possible. If the caller wish to broadcast his message to all members of a radio cell the PBX sends the SIP-invite to RGA_BROADCAST@gwr_alpha. The GWR will be set in broadcast mode and the voice-stream from the caller can be received on all radios of the cell.

There is always only one voice session at the time possible, the GWR will reject further additional calls.

Outbound Calls
The system behaviour in case of outbound calls rely strongly on the configuration of the radios. In case of broadcast mode all radios of a cell are able to listen to the voice stream from the particular radio to the PBX.

In difference to the first case nobody else can listen to the voice stream towards the GWR, if the operator of the radio has chosen a point to point station connection to the GWR-radio.

There is no outgoing call towards the SIP-network possible if the operator chooses a point to point connection to another radio than the GWR.

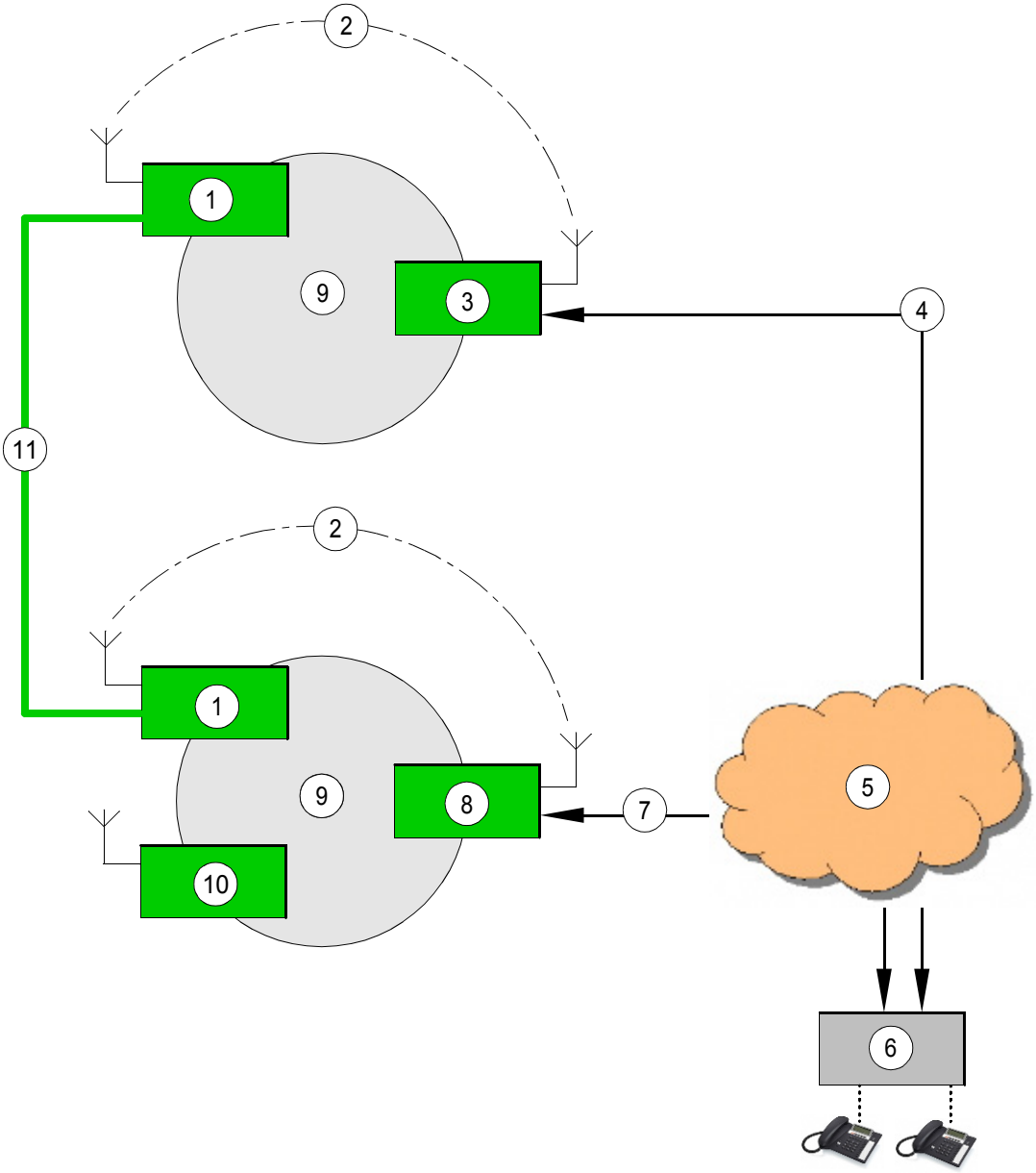
CNR Removal into another Radio Cell
There are scenarios where many GWR radios installed along a line (e.g. border control). The radios of the group are installed on vehicles moving between different locations and changing from one radio cell to the next one.

The operator needs to change to another preset page to connect to the GWR of the new radio cell. The preparation of those scenarios is possible using the RNMS Mission Planner software.

The radio registers itself at the GWR after the preset page has been changed. The GWR sends a SIP-registration for this CNR to the PBX . This allows the PBX to route calls to this CNR using the correct and current GWR address.

This scenario requires that SIP-clients must register with the SIP-PBX.

Figure 5.34 CNR - Change of the Radio Cell



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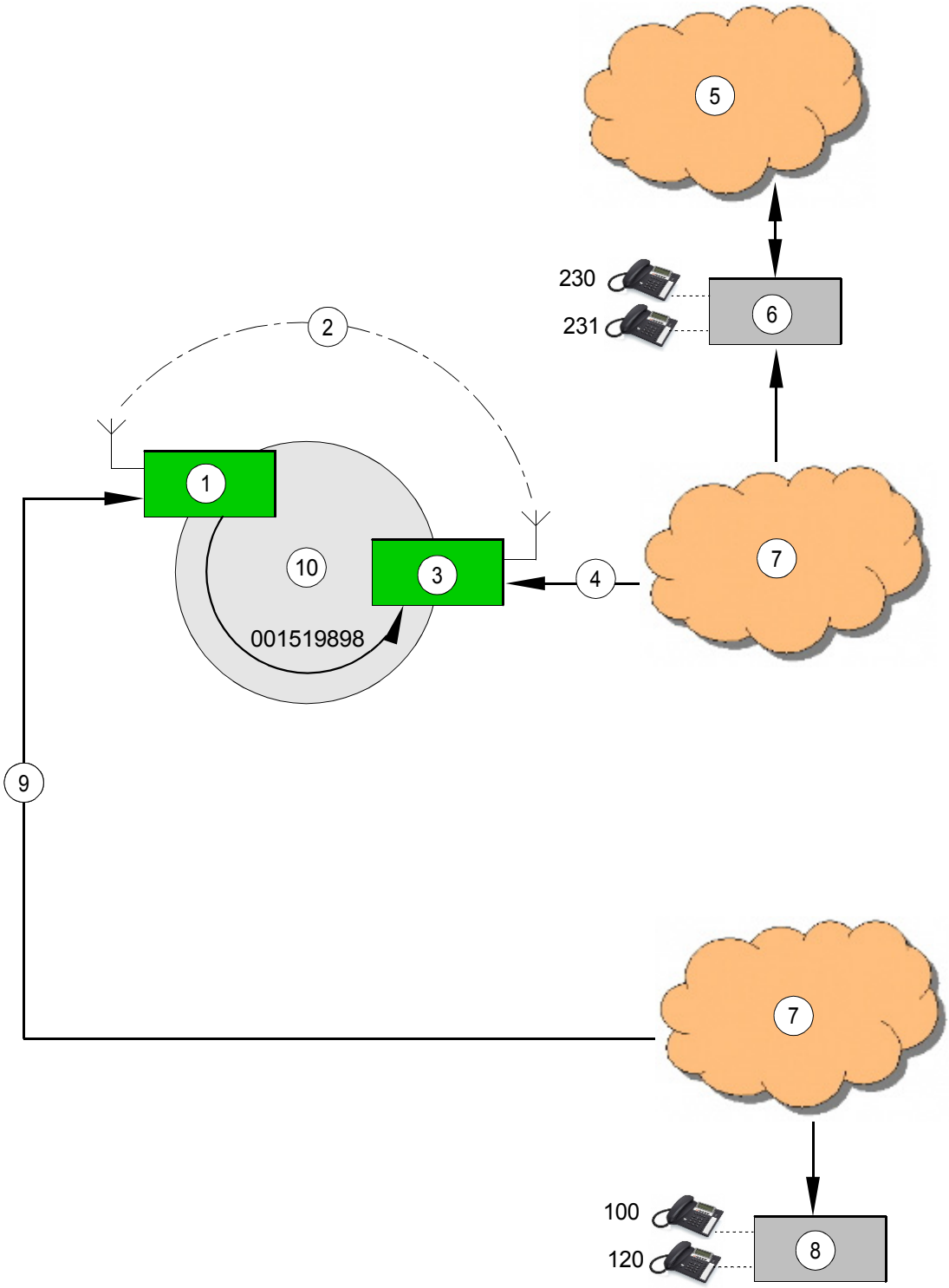
1 Group member 1 (CHRIS)
2 Proprietary protocol (IP over air)
3 GWR station name BETHA
IP-host name "gwr_betha"
4 Inbound dial
CHRIS@gwr_betha
5 VoIP network
6 SIP-PBX
7 Inbound dial
CHRIS@gwr_alpha
8 GWR station name ALPHA
IP-host name "gwr_alpha"
9 IPoA network (SECOM-V or ALE-3G)
10 Group member 2 (BRAVO)
11 Group member moves with a vehicle into the next network cell and connect himself manually to the new GWR.

The IP address of the hosting GWR changes and a REGISTER has to be send to the SIP-PBX

SIP Domain Connect Over Air
Figure 5.35 show the configuration:

Figure 5.35 SIP Domain Connect Over Air



ICN-4G-Q-231054-R-D0894-00012-A-01-1

1 Group member 1 (CHRIS)
2 Proprietary protocol (IP over air)
3 GWR station name ALPHA
IP-host name "gwr_alpha"
4 Inbound dial
100@gwr_alpha
5 Public telephone network (PSTN)
6 SIP-PBX 2 with PSTN connection
7 VoIP network
8 SIP-PBX 1, e.g. on a vessel
9 Inbound dial
10 GWR station name BETHA
IP-host name "gwr_betha"
11 IPoA network (SECOM-V or ALE-3G)
12 Group member 1 (BRAVO)

The configuration can be used e.g. to connect a local VoIP network on a vessel with a local VoIP network on land with a PBX connected to the Public Switched Network (PSTN). This would allow calls from extensions of the vessel to private extensions at the head quarter on land or destinations in the public telephone network and vice versa. The only limitation is that there is only one call at the time possible.

Both GWR's must be in one air – network and have to be connected pier to pier over IPoA. This means that on GWR 'BETHA" the following parameters of GWR "ALPHA" have to be configured:

- VoIP service "on"
- Signaling mode "Gateway"
- SIP settings
- BOA (broadcast on air) Gateway address of the remote radio

The same has to be done on "ALPHA" using the values of "BETHA".

There must be a prefix in the dialplan of PBX 1 configured which routes calls to the GWR gw_beta. GW_beta forwards the request to gw_alpha using the proprietary protocol. GW_alpha sends an SIP-invite to the PBX which decides based on dial prefixes if the call has to be forwarded to the PSTN or if one of the local extensions have to be called.

Calls from land to sea are going the same way, the only difference is here, that there are only extensions available (no routing to other networks).

Scenario “Remote Phone Handle”
This configuration can be used to connect a single radio of a cell to a VoIP network to participate at the conversation inside the radio cell using the VoIP connection.

There is no broadcast or directed connection establishment to particular other radios possible, it is just an “over IP extension” of the handle.

- SIP-mode on the radio must be “on”
- Signalling mode “off”
- SIP settings have to be provided

The invite from the VoIP network sends URI’s with a user “LOCAL” e.g. “INVITE LOCAL@192.168.1.100”, or emty user part 192.168.1.100.

5.5.1.2 General Constraints

- All radios belonging to the same radio network must have the same settings in the underlying waveform (ALE-3G, SECOM-V), data rates, Voice-over-IP Data, etc.
- Since this service requires the IPoA service to be enabled, all the constraints defined to the IPoA service must be met.
- VoIP gateway radio is able to handle one SIP (Session Initiation Protocol) call session at a time.
- Service configuration, as the definition of the VoIP gateway radio and the activation of the phone service should be performed via R&S RNMS3000.
- PBX or VoIP phone must not offer more than one CODEC. The preferred CODEC is G.711 A-law.

5.5.1.3 Call Session

Real-time Transport Protocol (RTP) is used to transport packets over the IP network. The RTP packets are encoded with G.711 A-law. Session Initiation Protocol (SIP) is used to initiate, modify and terminate the RTP call session and makes use of the Session Description Protocol (SDP) for defining session parameters.

Only one call session at a time is supported by the VoIP gateway radio. If an external VoIP user requests a second call session, it will get a busy signal. If a radio requests a call while another is already being established, the second request will be ignored.

Voice Stream Conversion between Radio and VoIP Network

Once a SIP-call session has been established, the VoIP gateway radio is responsible for the conversion between voice stream (radio network side) and RTP stream (IP network side) as well as for the transcoding. On IP network side, voice is sent in RTP packets encoded with G.711. On the radio network side, voice communication occurs using the respective waveform and vocoder adopted in this radio network.

After the VoIP gateway radio has transcoded the incoming message from the IP network, it is then able to send the voice stream to all radios in this radio network. Three mechanisms are supported for the activation of the VoIP gateway transmission:

- PTT bit in the RTP header extension

  PTT bit indication in the RTP header extension is supported as defined by EUROCAE 137-1. Only if the PTT bit in the RTP header extension is set, will VoIP gateway radio transmission be activated, i.e., voice stream will be broadcast to the radios in the radio network.

- Use of phone keys

  The use of phone keys indicating the activation and the deactivation of the VoIP gateway radio transmission is also supported, for e.g., phone keys '1' and '2'. These keys can be configured via R&S RNMS3000 and it is also possible to have the same phone key for activation and deactivation. The transmission of the DTMF tones is done as RTP-event according to RFC2833.

- VOX

  VOX functionality at the VoIP gateway radio is as well supported for the activation of the VoIP gateway radio transmission.

Voice Communication inside the Radio Network during a Session

During an active VoIP connection the external VoIP user having a session with the VoIP gateway radio is able to listen to any communication taking place inside the radio network, which is also addressed to the VoIP gateway radio.

Only R&S M3TR: For the configuration of the Squelch Line see 'Switching the Squelch Line On or Off'.

5.5.1.4 Phone Service

Phone book

Each radio in the radio network has a phone book, with preconfigured phone entries. Up to 20 phone book entries can be defined, each consisting of a name, a number and an address. Phone book entries are selectable from the MMI (Man-Machine Interface) and by remote command (GB2PP). Only the name of the phone book entry is displayed on the MMI.

NOTICE

Only R&S M3TR: The phone book is also used for a speed dial in the phone patch mode for fixed frequency (see 'Basics of Phone Patch Mode'). In this case, the dialled numbers are converted into DTMF (Dual Tone Multi Frequency) tones locally and sent over the air. For the VoIP Service, the dialled number is sent over the air to the VoIP gateway radio, which adapts this message into a SIP invite request.

Call Initiation

An operator at any radio in the radio network is able to initiate a call. A phone book entry can be chosen remotely (GB2PP) or from the MMI. It is also possible to dial the SIP phone number of the desired called party from the MMI. This request is sent to the VoIP gateway radio, which tries to initiate a call session with the desired called party through SIP.

When an external VoIP user wants to call the radio network, it calls the VoIP gateway radio. To address a particula radio in the radio nework, the Name of the Radio (RGA, ALE-3G) in the network is called. The VoIP gateway radio is able to accept an incoming call automatically after a period of time defined by means of the automatic call accept delay parameter configured for the VoIP gateway radio via the R&S RNMS3000 (the default value is 10 s).

However, in case the automatic response is not desired, this parameter should be set to 65535 s to deactivate it. This ensures that the incoming call can only be answered by an operator of a radio in the radio network.

For SECOM-V, if the radio network is called, the VoIP gateway radio broadcasts a signalling message announcing the incoming call to the endpoint radios. Operators are able to accept this call before the timeout defined by the automatic call accept delay. Calls can be accepted on any radio. Since ALE-3G uses the standard xDL for IPoA services, which does not support broadcast, only the remote radio can accept an incoming call (either automatically or manually).

Call Termination

Any radio operator in the radio network is able to terminate incoming or outgoing calls to or from his radio if the phone service is enabled. The call session can also be terminated by the external VoIP user.

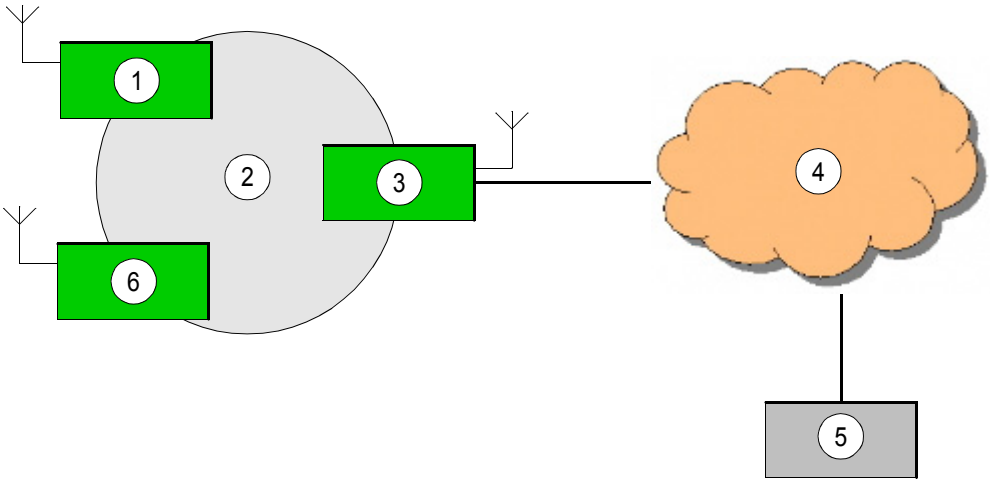
NOTICE

The limitation of the phone service for ALE-3G affects only the broadcast of signalling messages from the VoIP gateway to the endpoint radios. Therefore the announcement of an incoming call to the endpoint radios in broadcast mode is not supported. The initiation and termination of a call from an endpoint radio is, nevertheless, not affected by this limitation.

5.5.1.5 Scenario: Call Session between a Radio Network and a VoIP Telephone

This scenario describes a VoIP communication over an IP network between a radio network and a VoIP telephone.

Figure 5.36 Connection between a Radio Network and a VoIP Telephone



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1 Radio 1
2 Radio Network
3 VoIP Gateway Radio
4 IP Network
5 VoIP Telephone
6 Radio 2

With the phone service enabled, if the operator of radio 1 wants to call a VoIP telephone connected to an IP network, the operator can select the phone book entry corresponding to the desired called party or dial its number from the MMI. This is will be sent over the air to the VoIP gateway radio, which will translate it into a SIP signalling message. The gateway radio invites the VoIP telephone for a call session over the IP network.

If the telephone wants to call the radio network, it will call the VoIP gateway radio. The incoming call can either be answered by the VoIP gateway radio (automatically or manually) or by an operator at an endpoint radio, depending on the waveform used inside the radio network and on the definition of the automatic call accept delay parameter via R&S RNMS3000 (see ”Call Initiation” on p. 5.154). In case of a broadcast call all radios can accept or deny the incoming call.

The call setup procedure starts with the exchange of SIP signalling between the VoIP gateway radio and the VoIP telephone, and the exchange of proprietary signalling between the VoIP gateway radio and the radios if the phone service is enabled. Once the call session is established, the VoIP telephone is able to communicate with the radio network. Any radio which was addressed by this call is able to communicate with the VoIP telephone. Moreover, the VoIP telephone will listen to any communication occurring inside the radio network which is addressed to the VoIP gateway radio.

If the phone service is enabled, local acoustic signals are played at the radio operators side, as well as messages are displayed on the MMI. Messages will be sent to announce an incoming call, to inform when the call session has been established, when the called party is ringing or when the call session has ended.

5.5.2 Settings in Menu PHN (SECOM-V OP, Operation)

NOTICE

For Fixed Frequency (FF), the softkey PHN refers to the service phone patch mode (see sect. 3.3 Phone Patch Mode). These services have similar functionalities as the CAL, PHB and DSC softkeys. However, the phone patch mode is intended to allow a radio to set up a link with a telephone connected to a PABX (Private Automatic Branch Exchange) and the calling procedure is performed using DTMF (Dual-Tone Multi Frequency) tones transmitted over the air.

The Phone service provided by the VoIP service can be found in the menu SIPPHONE, which can be accessed by pressing the PHN softkey in any of the following preset pages:

- SECOM-V
- ALE-3G

Step	Control	Action	Note
1	3 DEF (PHN)	Press.	The display changes, e.g.: The complete menu structure is shown in Figure 5.37.

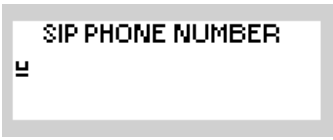
Figure 5.37 Menu PHN (SCV SIP Phone, Submenu)

1 See sect. 5.5.2.1 Entering the Phone Number for a Manual Dial
2 See sect. 5.5.2.2 Selecting the Phone Number for a Speed Dial (Using the Phone Book)
3 See sect. 5.5.2.3 Accepting an Incoming Call
4 See sect. 5.5.2.4 Terminating an Active Call Session

5.5.2.1 Entering the Phone Number for a Manual Dial

After pressing the CAL softkey the SIP phone number of the desired destination can be entered. It may consist of alphanumeric characters.

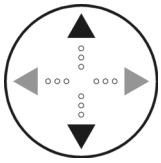
Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	3 DEF (PHN)	Press.	The display changes:
2	2 ABC (CAL)	Press.	The display changes: 
3	0 _*+ to 9 WXYZ	Enter a SIP phone number.	The dialled number can be a phone number or a SIP URI.
4	ENT	Press.	The display changes:
			When the call is accepted by the called party, the current call status will be displayed:

5.5.2.2 Selecting the Phone Number for a Speed Dial (Using the Phone Book)

By means of softkey PHB (Phonebook) the operator can select a phone number for speed dial.

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	3 DEF (PHN)	Press.	The display changes:
2	3 DEF (PHB)	Press.	The display changes: Phone book entries are displayed.
3		Select a phone book entry.	
5	ENT	Press.	The display changes: When the call is accepted by the called party, the current call status will be displayed:

5.5.2.3 Accepting an Incoming Call

By means of softkey ACC (Accept) the operator can accept an incoming call.

The acceptance of an incoming call can be performed by the VoIP gateway radio or, in case phone service is enabled and SECOM-V is used, by any operator at an endpoint radio inside the radio network (see sect. 5.5 Voice over IP (VoIP)).

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	(PHN) 3 DEF	Press.	The display changes: The message “INCOMING CALL” displayed in the MMI alerts the operator that the radio network is receiving a call.
2	(ACC) 4 GHI	Press.	The display changes:

If the phone service is not enabled or in case of ALE-3G, the call announcement and call status will be displayed only on the MMI of the VoIP gateway radio.

5.5.2.4 Terminating an Active Call Session

By means of softkey DSC (Disconnect) the operator can terminate an active call session.

Starting point: Main page of SECOM-V OP menu

Step	Control	Action	Note
1	3 DEF (PHN)	Press.	The display changes: The message “CALL ACTIVE” displayed in the MMI alerts the operator that the radio network currently has an active call.
2	5 JKL (DSC)	Press.	The display changes:

6 Malfunctions

6.1 Visual Inspection

CAUTION

If a connector shows any discoloration caused by heat, its mating connector is also defective and must also be replaced.

Check the following:

1. Check the external wiring between the radio with or without the control unit and the external equipment.
2. Check if all connectors are plugged in firmly.
3. Check the power supply cable and the RF coaxial cables at the rear for mechanical damage.

If necessary, replace cables by new ones one by one until the defective connection has been found.

Obvious damage of minor importance can be corrected at once, assuming that the appropriate equipment is available. In case of severe damage, the tactical radio must be sent to the nearest repair facility.

6.2 Troubleshooting utilizing BIT

The tactical radio is equipped with a Built-In Test Equipment (BITE), performing various self-tests of different depths. There are 4 different kinds of built-in tests implemented in the tactical radio:

- Power-on Built-In Test (PBIT)
- Continuous Built-In Test (CBIT)
- Initiated Built-In Test (IBIT)
- Extended Built-In Test (EBIT)

The Power-on Built-In Test (PBIT) starts immediately and automatically when the radio is powered up, a Continuous Built-in Test continuously monitors essential parameters during operation, and the Initiated Built-In Test is started by the operator, generating error messages for failure diagnosis. The Extended Built-in Test (EBIT) requires special external test equipment.

In addition, the built-in test also covers external devices (e.g. accessories) such as power amplifiers.

The BIT results are made available to the operator in different ways:

- By indication on the display
- By means of an LED on the front panel, which indicates FAULT status of the tactical radio.

6.2.1 PBIT

After power-on, the **Power-On Built-In Test (PBIT)** is started automatically. PBIT is performed in less than 1 second. It allows a short analysis of main functions like receive and transmit mode with acceptable test depth and test time. This keeps the delay from power-on to the first possible user action on the radio reasonably short. The detection of installed modules and options as well as their versions is considered a part of PBIT. Not all functions can be tested within the one second needed for PBIT. If the user needs to know more details about the status of the tactical radio, the next step may be to initiate the IBIT.

6.2.2 CBIT

The **Continuous Built-In Test (CBIT)** is the least profound test, but it is running continuously in the background. It is not influencing normal operation of the equipment and will not change any settings of the radio while in progress. In practice, the CBIT is running with an update rate of about one update per second as long as the radio is fully powered on. In power saving modes, some tests will not be performed.

6.2.3 IBIT

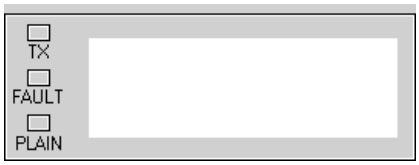
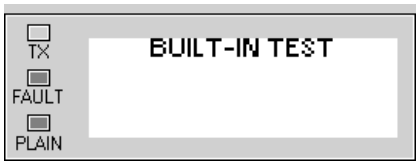
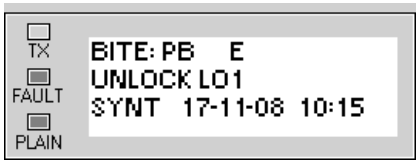
The **Initiated Built-in Test (IBIT)** is the most profound of the built-in tests, running without any additional equipment like special loop cables etc. IBIT should be completed within five seconds.

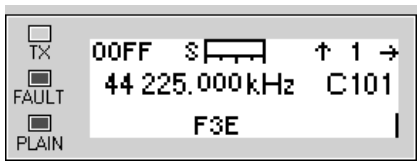
6.2.4 EBIT

The **Extended Built-In Test (EBIT)** is the deepest possible test outside the tactical radio production facilities. It is not a pure built-in test, it needs special internal hardware and software means as well as external equipment like a PC, a boundary-scan controller, coaxial cables to close loops etc.

6.2.5 Automatic Power-On Built-In Test (PBIT)

Switch the tactical radio on by turning the mode switch clockwise to either RX or RX/TX. PBIT is started automatically. However, results will only be available after you have entered the login password.

Step	Control	Action	Note
1		Set the mode switch to position Rx or RX/TX.	The display changes: Display test  The display changes: Built-in test in progress  Login procedure The display changes: Example: 

Step	Control	Action	Note
2	CLR ESC	Press.	The display changes:  Irrespective of the result the tactical radio returns to the preset operating mode.

- If PBIT has detected a failure in the tactical radio, the next step would be to perform an IBIT (Initiated Built-In Test), which permits more detailed failure analysis. See sect. 6.2.6 Settings in Menu OP (BITE, Operation).

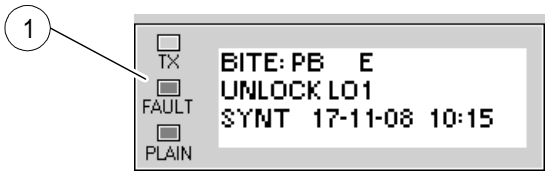
  Failures are visualized on the display of the tactical radio. In addition to such a message the red FAULT LED may light up. In this case the tactical radio is not in proper working order and must be transferred to a service depot.

For operation of the tactical radio two failure classes are defined, associated with the following types of messages:

- Warnings:
  - Operation may go on even if warning messages are displayed.
  - The radio should be checked as soon as possible.
  - All active warnings are logged in the failure archive, if possible.
- Errors (Fatal Errors):
  - The radio is no longer in proper working order.
  - Send the radio to the next repair facility.
  - As soon as an error is detected, the LED FAULT lights up: Figure 6.1.
  - Error messages remain resident until the fault is eliminated and will be logged in the failure archive: Figure 6.2.

When PBIT is completed, a status message is displayed on the front panel. If in addition the red FAULT LED lights up, an ERROR (E) has been detected. The tactical radio is not operative and must be transferred to a service depot.

Figure 6.1 LED FAULT



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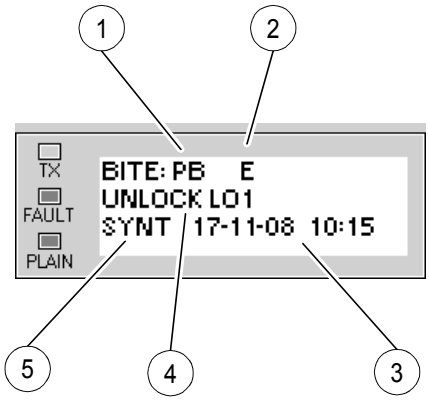
1 Status LED FAULT

Figure 6.2 Error Message after Power-On Built-In Test



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1 Type of self-test:
   - - = No Test
   - CB = Continuous Built-In Test CBIT
   - PB = Power-On Built-In Test PBIT
   - IB = Initiated Built-In Test IBIT
   - EB = Extended Built-In Test IBIT
2 Failure level:
   - - = No Error
   - E = Error
   - FE = Fatal Error
   - W = Warning
3 Date and time of failure occurrence
4 Failure description: UNLOCK LO1
5 Failure location:
   - --- = No Device
   - ATU = Antenna Tuning Unit
   - DSP1 = Digital Signal Processor
   - EATU = External Antenna Tuning Unit (e.g. R&S FK3150)
   - EPA = External Power Amplifier (e.g. R&S VU3050)
   - E2PA = External Power Amplifier 2 (e.g. R&S VK3150)
   - E3PA = External Power Amplifier 3 (e.g. R&S VT3050)
   - EPS = External Power Supply
   - EPS/PA = External Power Supply / Power Amplifier
   - FE = Frontend
   - FE/PA = Frontend / Power Amplifier
   - FE/VPA = Frontend / VHF/UHF Power Amplifier
   - FE/RC = Frontend / Radio Controller
   - FP = Front Panel
   - PA = Power Amplifier
   - VPA = VHF/UHF Power Amplifier
   - SEL = Preselector
   - PS = Power Supply
   - RC = Radio Controller
   - RC/FP = Radio Controller / Front Panel
   - RC/PS = Radio Controller / Power Supply
   - SECU = Security Key
   - SYNT = Synthesizer

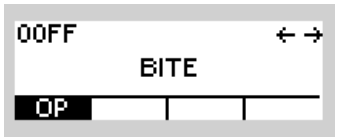
6.2.6 Settings in Menu OP (BITE, Operation)

NOTICE

If CBIT message RF OVERCURR FAILURE EATU (warning) appears, try to tune again or start ATU learn function. Additionally, check connection between external ATU and antenna.

If this warning persists, antenna impedance is unfavourable; avoid continuous transmission (> 10 minutes) at the frequencies involving full output power.

Starting point:



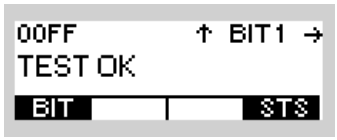
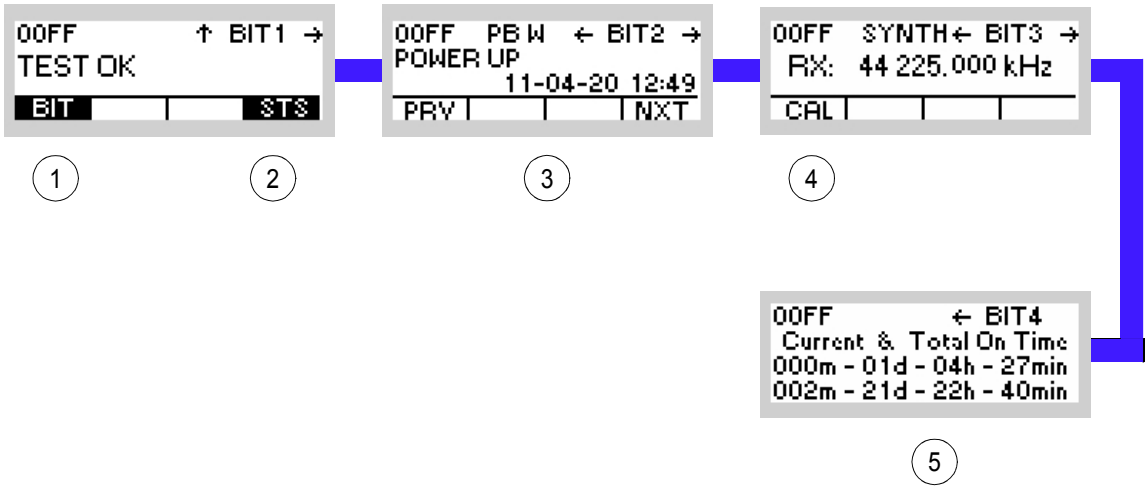
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes, e.g.:  Press several times until the desired subordinate menu is activated (see Figure 6.3). The menu structure is explained separately by Figure 6.4.

Figure 6.3 Menu OP (BITE, Submenus)



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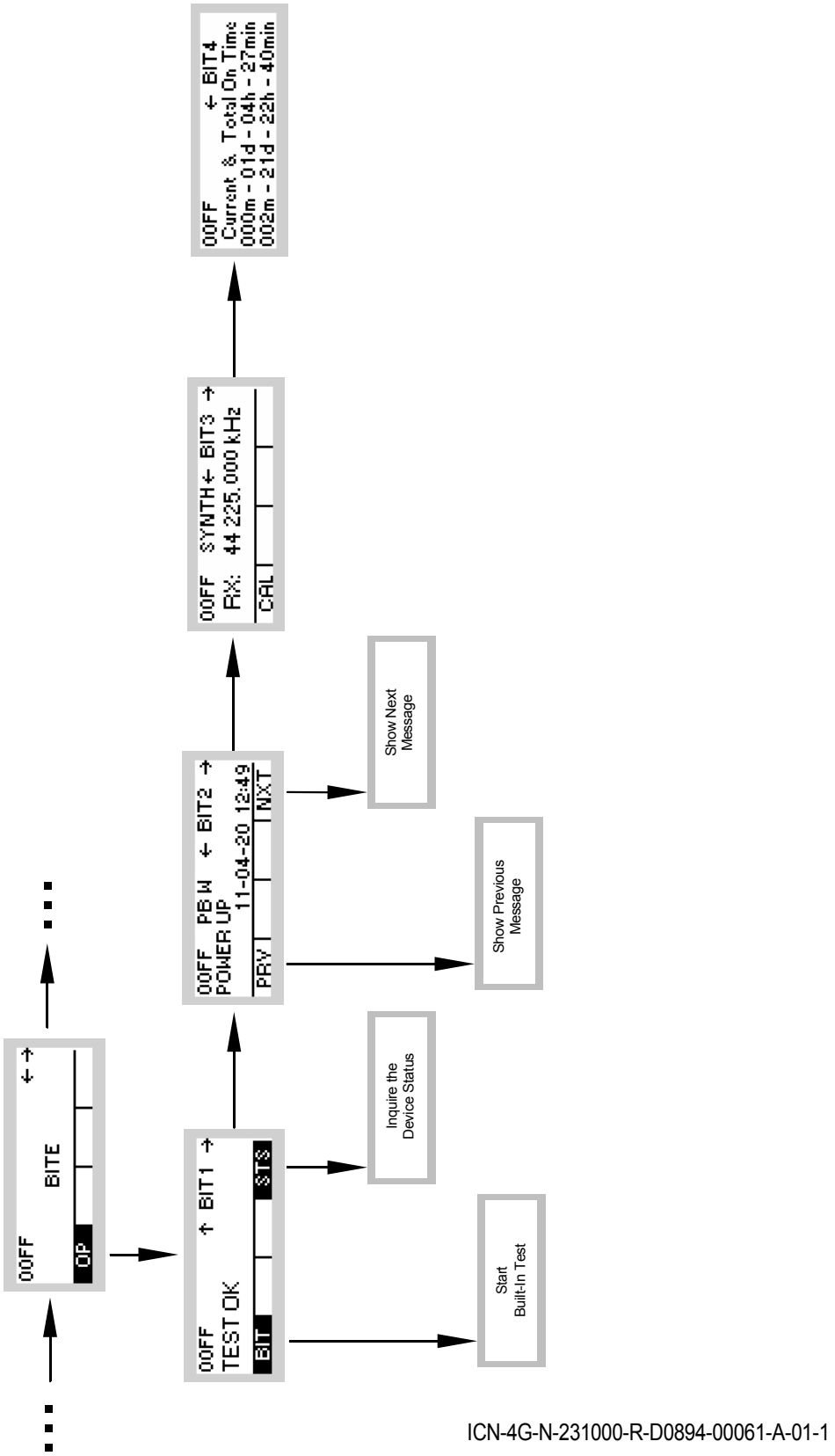
1 See sect. 6.2.6.1 Starting IBIT (Initiated Built-In Test)
2 See sect. 6.2.6.2 Inquiring the Device Status
3 See sect. 6.2.6.3 Inquiring Error Messages
4 See sect. 7.5 Calibration
5 See sect. 6.2.6.4 Inquiring the Elapsed Time Meter Status

Figure 6.4 Menu OP (BITE, Structure)



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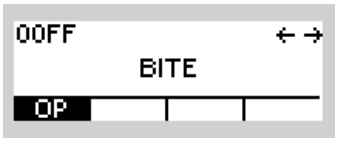
6.2.6.1 Starting IBIT (Initiated Built-In Test)

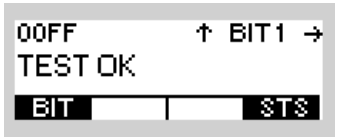
By means of softkey BIT (Built-In Test) a self-test of the tactical radio can be started.

NOTICE

The IBIT (Initiated Built-In Test) should be started only from Preset Page 0.

Starting point: Main page of BITE menu



Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2	2 ABC (BIT)	Press.	The display changes: Built-In Test is in progress. The display changes: IBIT OK

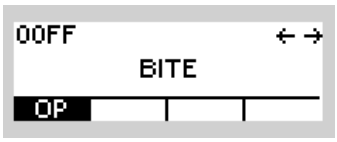
- The display shows only one failure.

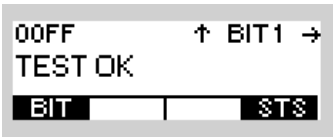
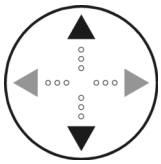
  If IBIT has detected more failures, they can be inquired. See sect. 6.2.6.3 Inquiring Error Messages.

6.2.6.2 Inquiring the Device Status

By means of softkey STS (Status) a status inquiry of the modules installed in the tactical radio can be started.

Starting point: Main page of BITE menu

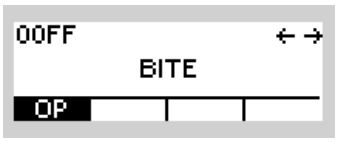


Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2	5 JKL (STS)	Press.	The display changes:
3		Press several times until the relevant device designator is displayed.	Possible devices: • ATU = Antenna Tuning Unit • DSP1 = Digital Signal Processor • EATU = External Antenna Tuning Unit (e.g. R&S FK3150) • EPA = External Power Amplifier (e.g. R&S VU3050) • E2PA = External Power Amplifier 2 (e.g. R&S VK3150) • E3PA = External Power Amplifier 3 (e.g. R&S VT3050) • EPS = External Power Supply • EPS/PA = External Power Supply / Power Amplifier • FE = Frontend • FE/PA = Frontend / Power Amplifier • FE/VPA = Frontend / VHF/UHF Power Amplifier • FE/RC = Frontend / Radio Controller • FP = Front Panel • PA = Power Amplifier • VPA = VHF/UHF Power Amplifier • SEL = Preselector • PS = Power Supply • RC = Radio Controller • RC/FP = Radio Controller / Front Panel • RC/PS = Radio Controller / Power Supply • SECU = Security Key • SYNT = Synthesizer

6.2.6.3 Inquiring Error Messages

By means of softkeys NXT (NEXT) and PRV (PREVIOUS) available error messages can be viewed in succession.

Starting point: Main page of BITE menu



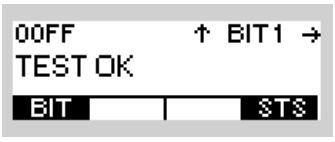
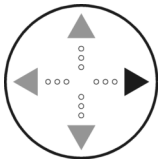
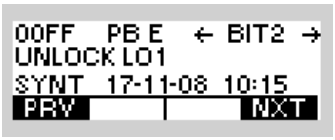
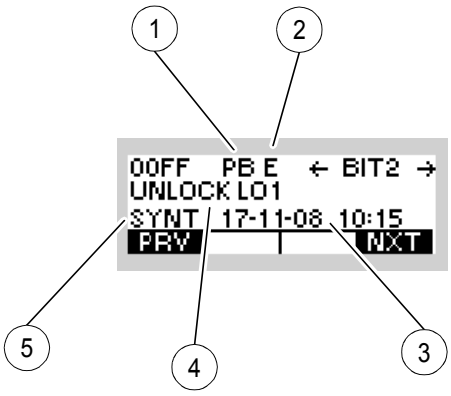
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	The display changes: 
3	2 ABC (PREV) or 5 JKL (NXT)	Press several times until the desired message is displayed.	**NOTICE** **For further information see Figure 6.5.**

Figure 6.5 Error Message



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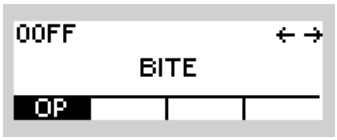
1 Type of self-test:
   - - = No Test
   - CB = Continuous Built-In Test CBIT
   - PB = Power-On Built-In Test PBIT
   - IB = Initiated Built-In Test IBIT
   - EB = Extended Built-In Test IBIT
2. Failure level:
   - - = No Error
   - E = Error
   - FE = Fatal Error
   - W = Warning
3. Date and time of failure occurrence
4. Failure description: UNLOCK LO1
5. Failure location:
   - --- = No Device
   - ATU = Antenna Tuning Unit
   - DSP1 = Digital Signal Processor
   - EATU = External Antenna Tuning Unit (e.g. R&S FK3150)
   - EPA = External Power Amplifier (e.g. R&S VU3050)
   - E2PA = External Power Amplifier 2 (e.g. R&S VK3150)
   - E3PA = External Power Amplifier 3 (e.g. R&S VT3050)
   - EPS = External Power Supply
   - EPS/PA = External Power Supply / Power Amplifier
   - FE = Frontend
   - FE/PA = Frontend / Power Amplifier
   - FE/VPA = Frontend / VHF/UHF Power Amplifier
   - FE/RC = Frontend / Radio Controller
   - FP = Front Panel
   - PA = Power Amplifier
   - VPA = VHF/UHF Power Amplifier
   - SEL = Preselector
   - PS = Power Supply
   - RC = Radio Controller
   - RC/FP = Radio Controller / Front Panel
   - RC/PS = Radio Controller / Power Supply
   - SECU = Security Key
   - SYNT = Synthesizer

6.2.6.4 Inquiring the Elapsed Time Meter Status

Starting point: Main page of BITE menu



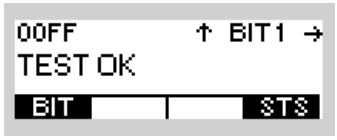
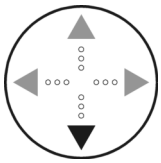
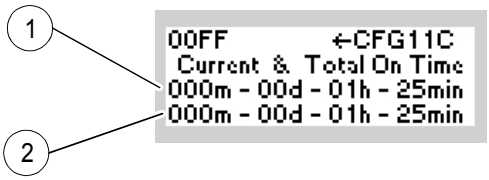
Step	Control	Action	Note
1	2 ABC (OP)	Press.	The display changes: 
2		Press once.	See Figure 6.6.

Figure 6.6 Elapsed Time Meter



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1 Operating time since last switching-on
2 Accumulated operating time since production

The layout is as follows: Months – Days – Hours – Minutes.

One month is considered to have 30 days.

7 Maintenance

7.1 Scheduled Maintenance

As a device for field use the tactical radio needs to be cleaned at regular intervals, depending on the conditions (i.e. climate) and frequency of use.

NOTICE

Only qualified personal may carry out following maintenance work.

Replacement of the backup battery (part of the module Radio Controller RC) and calibration of the reference oscillator (part of the module Radio Frequency Unit RFU) should be performed once every five years. For instructions see relevant Service Manuals.

7.2 Maintenance of the Tactical Radio

⚠ WARNING

Be absolutely sure to disconnect the tactical radio from power before proceeding!

To do so set the mode switch to position OFF.

7.2.1 Checking the Connections

In tactical use external devices may be connected at X1 (ANT), X2 (GPS), X4 (AUDIO) and X5 (DATA), see Figure 7.1.

To rule out any failures (poor contacting), the cable connections towards these system components must be impeccable.

Therefore in rough conditions these connections need to be examined every day. Special attention must be given to the firm seating of connectors.

The battery needs to be checked in the same way (see sect. 2.2 Installation).

7.2.2 Cleaning the Front Panel

For cleaning any dirt off the front panel, it must be removed. For this proceed as follows:

1. Turn the two mounting screws manually to the left by 90 degrees Figure 7.2. This unlocks the front panel.
2. Carefully pull the front panel off towards the front. The connection at X7 will come undone.

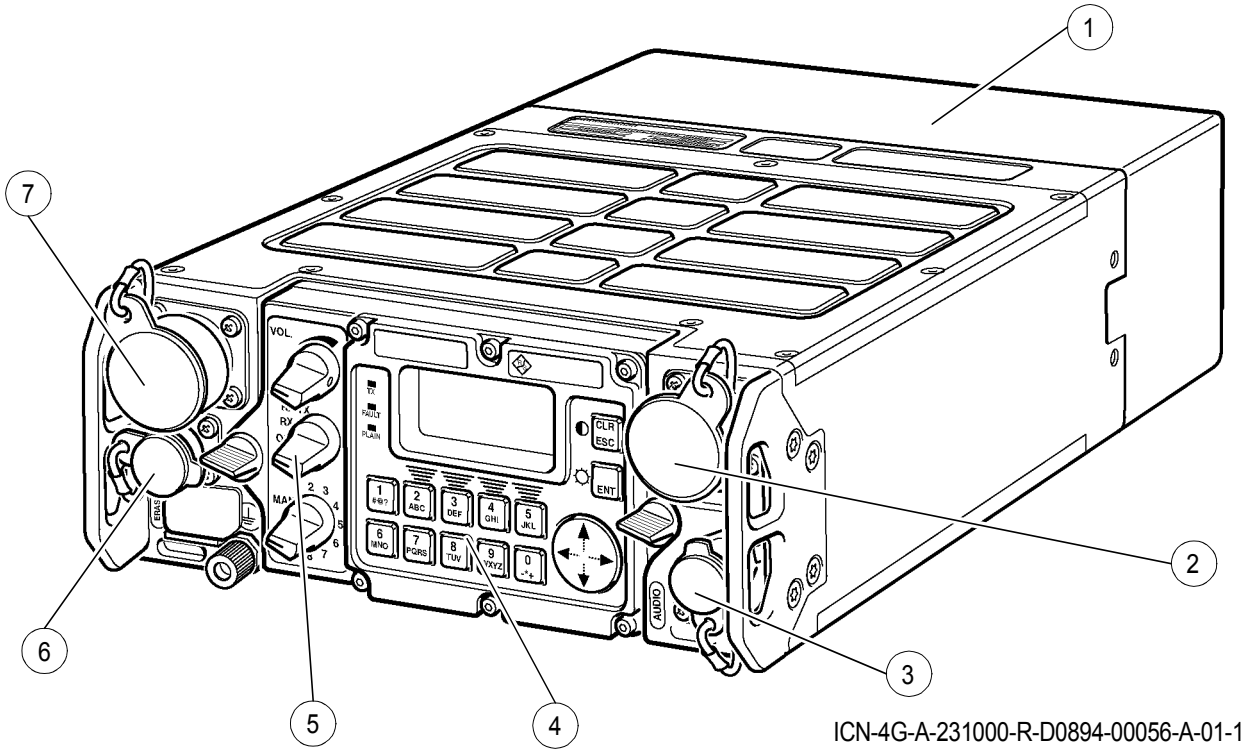
Once cleaning is completed, re-assemble the tactical radio in the reverse order of disassembly.

NOTICE

Do not use compressed air for cleaning the front panel since socket X7 cannot be covered!

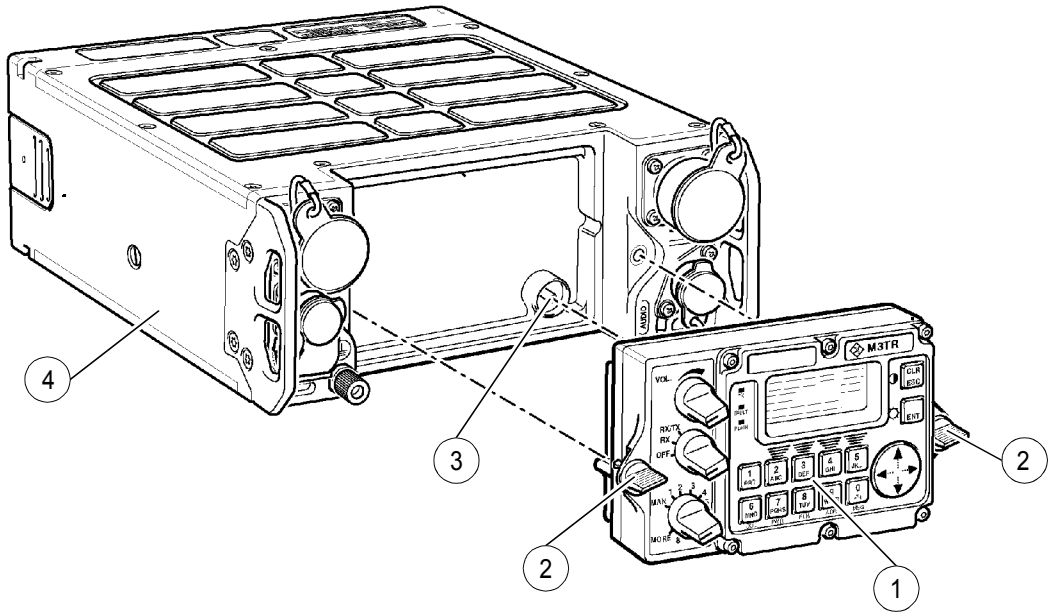
When powering the tactical radio on again, a self-test (PBIT) will be started. This checks if the front panel has been attached correctly. In addition to that an IBIT (Initiated Built-In Test) may be carried out (see sect. 6.2.6 Settings in Menu OP (BITE, Operation)).

Figure 7.1 Tactical Radio with Battery



1 Battery
2 Socket X5 (DATA) with protective cap
3 Socket X4 (AUDIO) with protective cap
4 Front Panel
5 Mode Switch
6 Socket X2 (GPS) with protective cap
7 Socket X1 (ANT) with protective cap

Figure 7.2 Tactical Radio with Front Panel Removed



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1 Front panel
2 Mounting screws
3 Socket X7
4 Tactical radio

7.2.3 Maintenance of Battery Pack R&S IB3001

CAUTION

Dispose of defective and non-usable Batteries R&S IB3001 in accordance with the relevant national regulations for special waste disposal.

Batteries R&S IB3001 are rechargeable.

The Li-ion Battery R&S IB3001 is rechargeable. For recharging put discharged batteries into the Battery Charger R&S IC3000 or R&S IC3001. The battery charger will switch off automatically once charging is terminated.

Before mounting the battery, check both the battery connector and the battery socket of the tactical radio for contaminated contacts. If contamination is found, clean by using either compressed air or a brush, see sect. 7.3 Taking Care, Cleaning.

7.2.4 Maintenance of Battery Pack R&S IB3002

CAUTION

Dispose of used up Batteries R&S IB3002 in accordance with the relevant national regulations for special waste disposal.

Before mounting the battery, check both the battery connector and the battery socket of the tactical radio for contaminated contacts.

If contamination is found, clean by using either compressed air or a brush, see sect. 7.3 Taking Care, Cleaning.

7.3 Taking Care, Cleaning

7.3.1 Taking Care

Such measures involve cleaning and touching up slight blemishes in the varnish coat of the unit. The materials in the List of Materials Table 7.1 are required:

Table 7.1 List of Materials

Item	Description
1	Soft brush
2	Duster
3	Household window and glass detergent
4	Paint, RAL 6014, yellow olive

7.3.2 Cleaning

⚠ WARNING

Wear goggles when working with compressed air in order to avoid any injuries to the eyes.

⚠ CAUTION

Direct compressed air first towards ground until no more condensed water is contained in the air jet.

Keep a minimum distance of 20 cm between compressed air and unit.

Do not use solvents (thinners etc.), petroleum ether or alcohol of any sorts for cleaning.

Such substances will irreversibly damage the varnish coat!

1. First of all clean surfaces of the unit with compressed air.
2. Continue cleaning with a soft brush or a duster.
3. Clean heavily contaminated surfaces, especially grease stains, with a soft, lint-free cloth moistened with glass and window detergent.

7.4 Paintwork

7.4.1 Retouching the Paint Work

Touch up the paint work of the unit as follows:

1. Remove any loose paint particles from the area of repair.
2. Clean area to be retouched with a soft, lint-free cloth soaked in suds.
3. Wait for the suds to dry out.
4. Retouch with paint carefully and allow plenty of time to dry out.
5. Once the first coat is completely dry, apply a second coat and again allow it to dry. The repair is thus completed.

7.4.2 Treatment of Pigmentation Variances in the Varnish Coat

Pigmentation variances, which may be found in the varnish coat of the housing, are mere blemishes caused by humidity accumulation after packaging. Such pigmentation variances are in no way affecting the properties of the varnish coat or the functional order of the tactical radio.

The pigmentation variances are reversible and can be removed by tempering.

7.5 Calibration

To maintain the specification of the tactical radio, the oscillator (part of the module Radio Frequency Unit RFU) needs to be calibrated. The time interval for calibration of the reference oscillator is once every five years (together with battery exchange, to be performed by qualified personnel only).

The procedure should be performed at room temperature to ensure correct calibration.

For calibration any possible RX frequency of the radio may be used. Rohde & Schwarz recommends to perform the calibration with a frequency from 10 MHz to 100 MHz. The output power of the frequency standard must in the range of -10 dBm to 0 dBm.

To calibrate the oscillator, the test equipment in the test equipment list (Table 7.2) is required.

NOTICE

Equivalent test equipment may be used.

Special tools are not required.

Table 7.2 List of Test Equipment

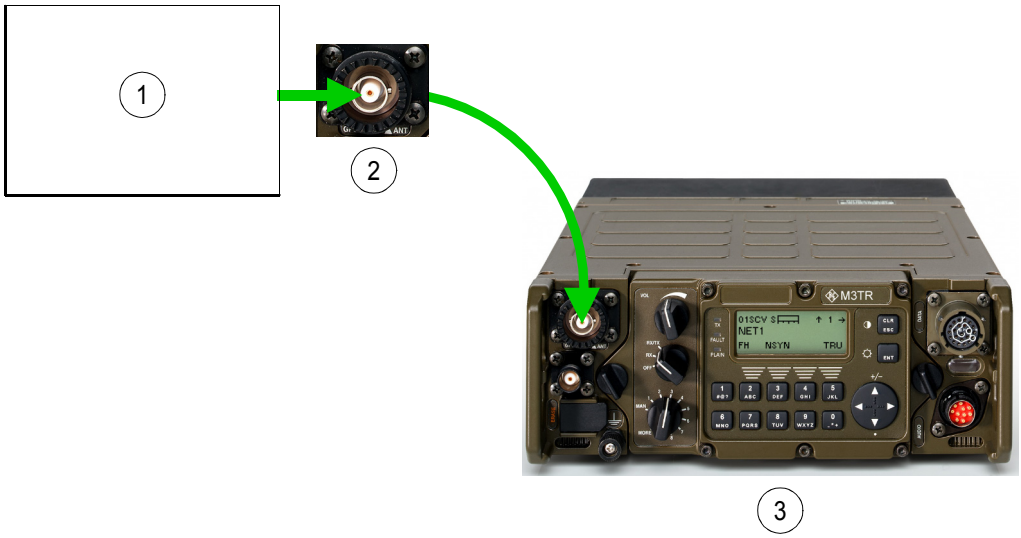
Item	Test equipment, required data	Equipment recommended by Rohde & Schwarz	Ordering code
1	10 MHz frequency standard $\Delta f \leq 0.01$ ppm / -10 dBm to 0 dBm	conventional workshop model	
2	Tactical Radio Operating Documentation		

NOTICE

When using a docking station or an R&S MR 3000H, set the RF input/output port manually to FRONT 50 OHMS!

Do not switch off the radio or disconnect the antenna while calibration is in progress (the process takes 1 to 2 minutes).

Figure 7.3 Test Setup



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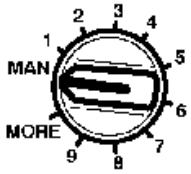
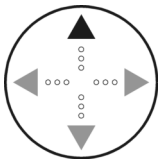
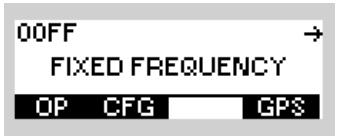
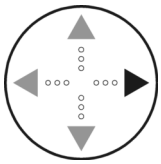
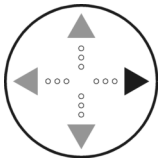
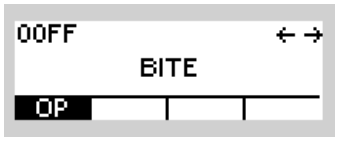
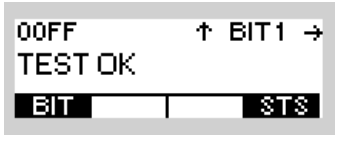
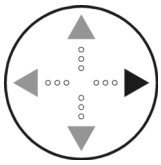
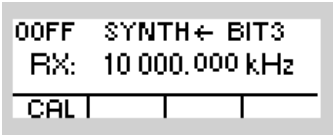
1 Frequency standard
2 Connector X1
3 Tactical radio

To calibrate the oscillator proceed as follows:

Step	Control	Action	Note
1		Switch on.	Switch on all test equipment and wait for the clock to stabilize.
2		Connect.	Connect the frequency standard to the antenna connector X1 (see Figure 7.3).
3		Turn the mode switch to RX.	

Step	Control	Action	Note
4		Turn the preset page selector to MAN.	The display changes:
5	2 ABC	Press.	The display changes: Set the RX frequency to the output frequency of the frequency standard (for example 10 MHz, see sect. 3.2.2.1 Changing the Frequency).
6		Press once.	The display changes: 
7		Press once.	The display changes: For access to the calibration function it is necessary to enter the code for User Level 2 (see sect. 3.5 Login.
8		Press once.	The display changes: 
9	2 ABC (OP)	Press.	The display changes: 

Step	Control	Action	Note
10		Press twice.	The display changes: 
11	2 ABC (CAL)	Press.	
12		Switch off	After the message “FINISHED OK” switch off the tactical radio and disconnect the test setup.

The following error messages may appear during the calibration:

EXT REF LOW LEVEL (external reference low level)

The output power of the frequency standard is too low. Increase the output power or use another frequency standard.

EXT REF WRONG FREQ (external reference wrong frequency)

Calibration with the applied reference frequency failed. Check if the RX frequency set on the radio matches the reference frequency of the frequency standard.

If the frequency set on the radio and the reference frequency are identical (the frequency standard meets the required specifications), the radio hardware may be defective. Please contact the service.

TUNE RANGE FAILURE

Tuning failed because the possible tuning range was exceeded.

If the frequency set on the radio and the reference frequency are identical (the frequency standard meets the required specifications), the radio hardware may be defective. Please contact the service.

FLASH FAILURE

The determined calibration values could not be stored in the FLASH memory. Repeat the calibration procedure. If the error persists, the radio hardware is defective, please contact the service.

8 Technical Information

8.1 Technical Data

See data sheets (sect. 9 Drawings)

8.2 External Interfaces

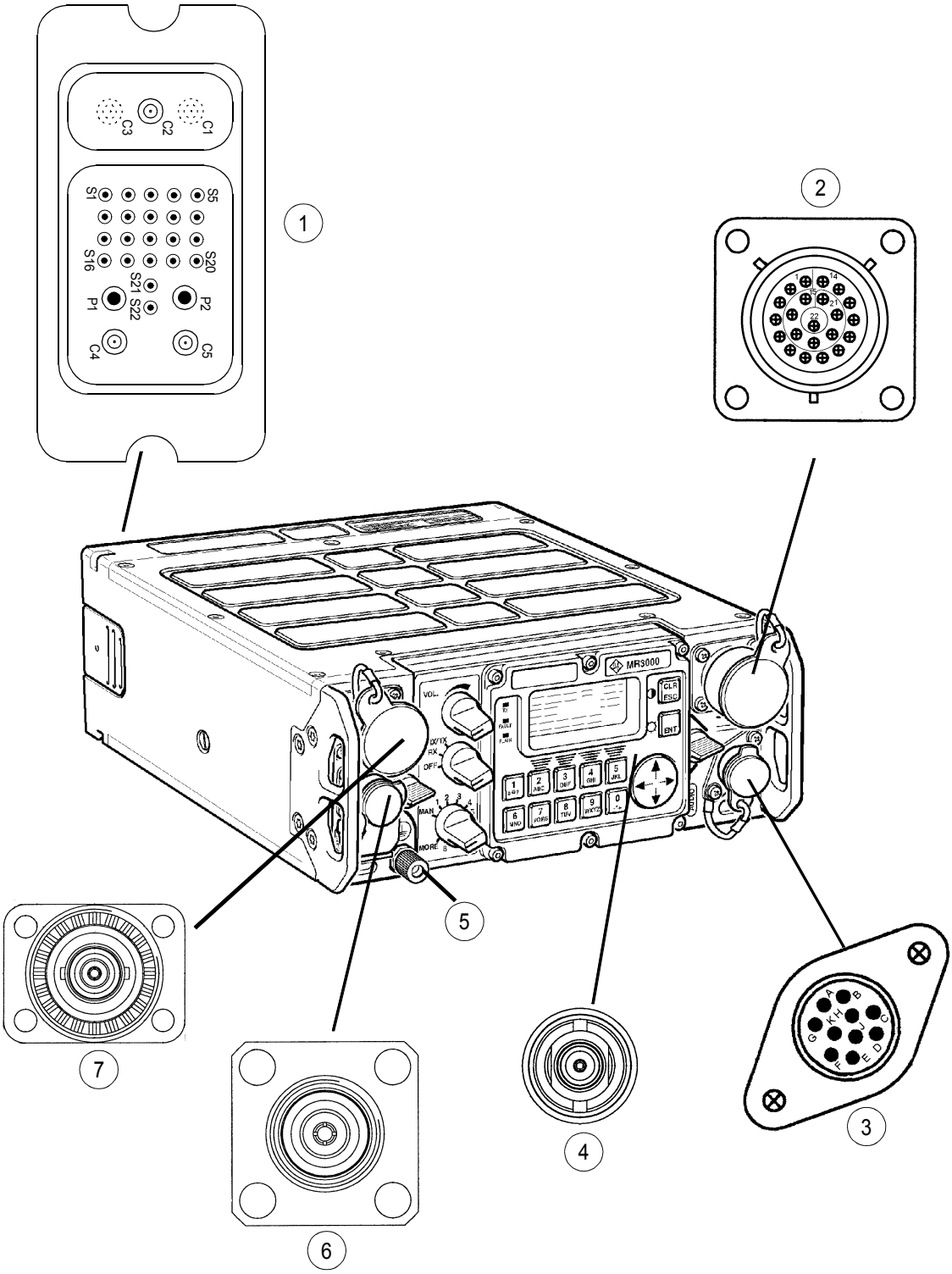
See interface descriptions (sect. 9 Drawings)

For connectors see Figure 8.1.

NOTICE

Mating connectors are contained in Mating Connector Set R&S GK3004 (ident. no. 6098.3253.02).

Figure 8.1 External Interfaces of Tactical Radio



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1 Socket X6 (Rear connector)
2 Socket X5 (DATA) with protective cap
3 Socket X4 (AUDIO) with protective cap
4 Socket X7 (Located behind Front Panel)
5 Socket X3 (Ground)
6 Socket X2 (GPS) with protective cap
7 Socket X1 (ANT) with protective cap

8.3 Remote Control

Detailed information is provided in the

- GB2 PP M3TR/SERIE 4100D (order no.: 6118.8725.90 SB),

available on demand from Rohde & Schwarz.

8.4 Handling, Storage and Transportation Instructions of Battery Pack R&S IB3001

8.4.1 Handling

- The battery has been designed for a specific application. Do not use it for any other application.
- Do not connect batteries in series or parallel. Irreversible damage can be done.
- Observe correct polarities during installation and charging.
- Use a specific charger designed for use of Li-Ion batteries. Otherwise irreparable damage to the battery electronics could occure.
- Do not heat above 70 °C. The batteries contain thermal fuses which could activate and make batteries inoperable.
- The battery is designed with an electronic device to protect against overdischarge, overcharge and short-circuiting between the terminals.
  - If you cannot discharge the battery, it may be overdischarged. Charge the battery for 0.5 hour and check again.
  - If you cannot charge the battery, it may be overcharged. Discharge the battery and check again.
  - If the battery has been short-circuited, charge it to reset the electronics.
  - If the battery still does not work, contact the Rohde & Schwarz customer support center.
- Do not apply pressure that will deform the batteries.
- Batteries should not be exposed to heat or flames.
- Batteries should not be disassembled or modified.
- Batteries should not be exposed to direct sunlight for extended periods of time.
- Do not short-circuit the battery.
- Do not allow metallic objects to come into contact with the terminals.
- Do not immerse in water (although the batteries are watertight).
- Do not drop the battery or subject it to repetitive shock.
- Do not solder directly to the battery.

8.4.2 Storage

- In order to avoid short circuits, handle batteries carefully. Always ensure that the leads and terminals are insulated.
- Prior to use, keep the battery in supplied packaging, at a temperature preferably not exceeding 30 °C.
- Initial state of charge of batteries before storage should be between 15 % and 50 % of capacity and is defined by taking into account:
  - the maximum consumption of electronic devices
  - the self-discharge of the cells (the higher the state of charge, the higher the rate of the self-discharge)
  - a minimum of 5 % of state of charge is required at the end of storage to avoid any 'overdischarge'.
- If after storage the battery voltage is low or even 0 V, the battery protection circuit has probably gone into 'sleep mode'. In such a case, reset the battery with an approved charger.
- Please recharge the battery every six months.

8.4.3 Transportation

⚠ CAUTION

Transport Restriction - CLASS 9

For further information see the product transport certificate issued by the Manufacturer.

8.4.4 End of Life

- After numerous cycles, it is normal to observe a decrease in the battery capacity.
- Do not try to open or disassemble the battery.
- Do not dispose of in fire.

8.5 Handling, Storage and Transportation Instructions of Battery Pack R&S IB3002

8.5.1 Handling

- Batteries should not be recharged.
- Batteries should not be exposed to heat or flames.
- Batteries should not be disassembled or modified.
- Batteries should not be exposed to direct sunlight for extended periods of time.
- Do not short-circuit the battery.
- Do not allow metallic objects to come into contact with the terminals.
- Do not immerse in water (although the batteries are watertight).
- Do not drop the battery or subject it to repetitive shock.
- Do not solder directly to the battery.

8.5.2 Storage

Store this battery in a cool, dry place, between 0 and +20 °C to maximize its performance.

8.5.3 Transportation

CAUTION

Transport Restriction - CLASS 9

For further information see the product transport certificate issued by the Manufacturer.

9 Drawings

Order Form

Interface Descriptions

- 6118.3000.01 SB
- 6118.3500.01 SB

Data Sheet

- PD 5213.9228.22

Global Menu Structure