Programs After Market Services (PAMS)

Technical Documentation

SERVICE MANUAL

[NMP Part No. 0275422]

NSW-5 SERIES CELLULAR PHONES

NOKIA

NSW–5 ISSUE 1 10/2000

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue1	**10/2000**	OJuntune	

NSW-5
SERIES CELLULAR PHONES
SERVICE MANUAL

CONTENTS:

IMPORTANT

This document is intended for use by qualified service personnel only.

Company Policy

Our policy is of continuous development; details of all technical modifications will be included with service bulletins.

While every endeavour has been made to ensure the accuracy of this document, some errors may exist. If any errors are found by the reader, NOKIA MOBILE PHONES Ltd should be notified in writing.

Please state:

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Latest Amendment Number (if applicable)

Page(s) and/or Figure(s) in error

Please send to:

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PAMS Technical Documentation
PO Box 86
24101 SALO
Finland

Warnings and Cautions

Please refer to the phone's user guide for instructions relating to operation, care and maintenance including important safety information. Note also the following:

Warnings:

1. CARE MUST BE TAKEN ON INSTALLATION IN VEHICLES FITTED WITH ELECTRONIC ENGINE MANAGEMENT SYSTEMS AND ANTI–SKID BRAKING SYSTEMS. UNDER CERTAIN FAULT CONDITIONS, EMITTED RF ENERGY CAN AFFECT THEIR OPERATION. IF NECESSARY, CONSULT THE VEHICLE DEALER/MANUFACTURER TO DETERMINE THE IMMUNITY OF VEHICLE ELECTRONIC SYSTEMS TO RF ENERGY.
2. THE HANDPORTABLE TELEPHONE MUST NOT BE OPERATED IN AREAS LIKELY TO CONTAIN POTENTIALLY EXPLOSIVE ATMOSPHERES EG PETROL STATIONS (SERVICE STATIONS), BLASTING AREAS ETC.
3. OPERATION OF ANY RADIO TRANSMITTING EQUIPMENT, INCLUDING CELLULAR TELEPHONES, MAY INTERFERE WITH THE FUNCTIONALITY OF INADEQUATELY PROTECTED MEDICAL DEVICES. CONSULT A PHYSICIAN OR THE MANUFACTURER OF THE MEDICAL DEVICE IF YOU HAVE ANY QUESTIONS. OTHER ELECTRONIC EQUIPMENT MAY ALSO BE SUBJECT TO INTERFERENCE.
4. CLASS 1 LASER PRODUCT. See IEC60825–1 specification: 825–1; 5: Labelling, 5.1: General, 5.2: Class 1

Cautions:

1. Servicing and alignment must be undertaken by qualified personnel only.
2. Ensure all work is carried out at an anti–static workstation and that an anti–static wrist strap is worn.
3. Ensure solder, wire, or foreign matter does not enter the telephone as damage may result.
4. Use only approved components as specified in the parts list.
5. Ensure all components, modules screws and insulators are correctly re–fitted after servicing and alignment. Ensure all cables and wires are repositioned correctly.
6. All PC's used with NMP Service Software for this produce must be bios and operating system "Year 2000 Compliant".

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PAMS Technical Documentation
NSW-5 Series Transceivers

General Information

AMENDMENT RECORD SHEET

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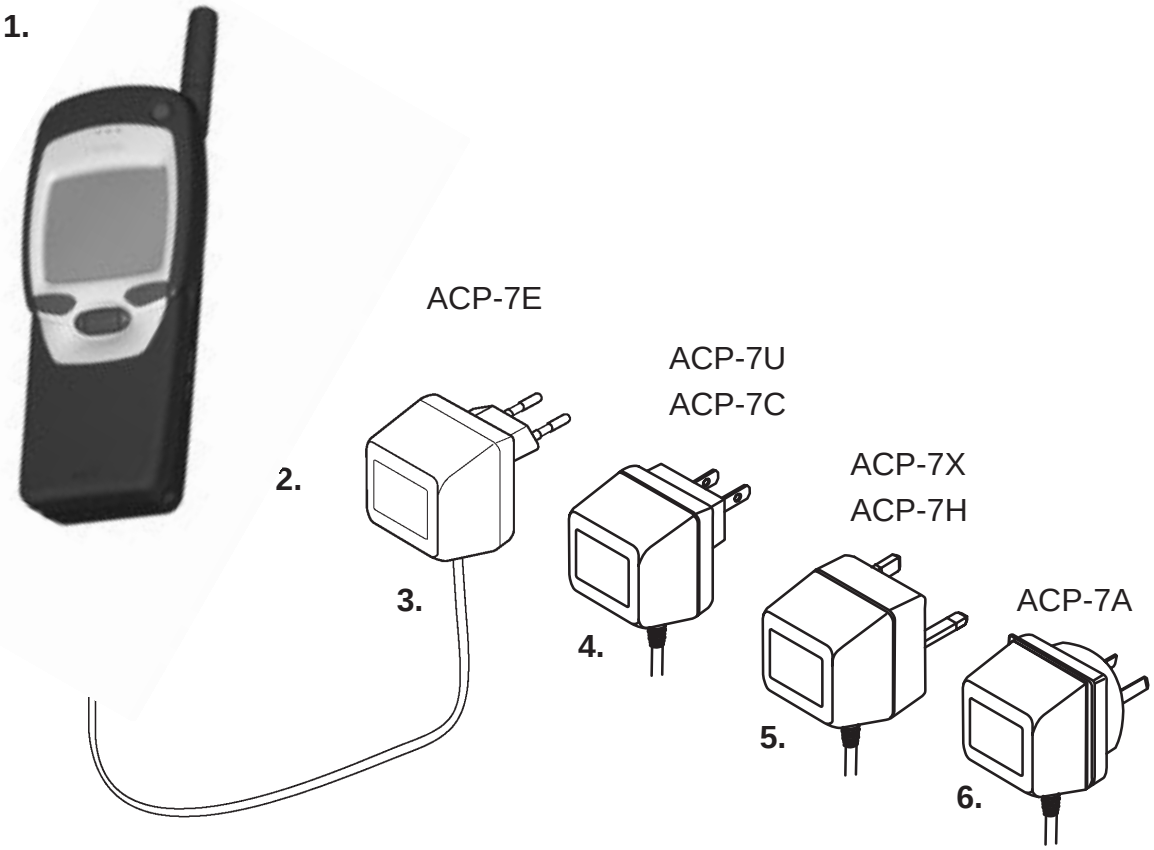
Issue 1	**10/2000**	OJuntune	

CONTENTS

Product Selection

Handportables

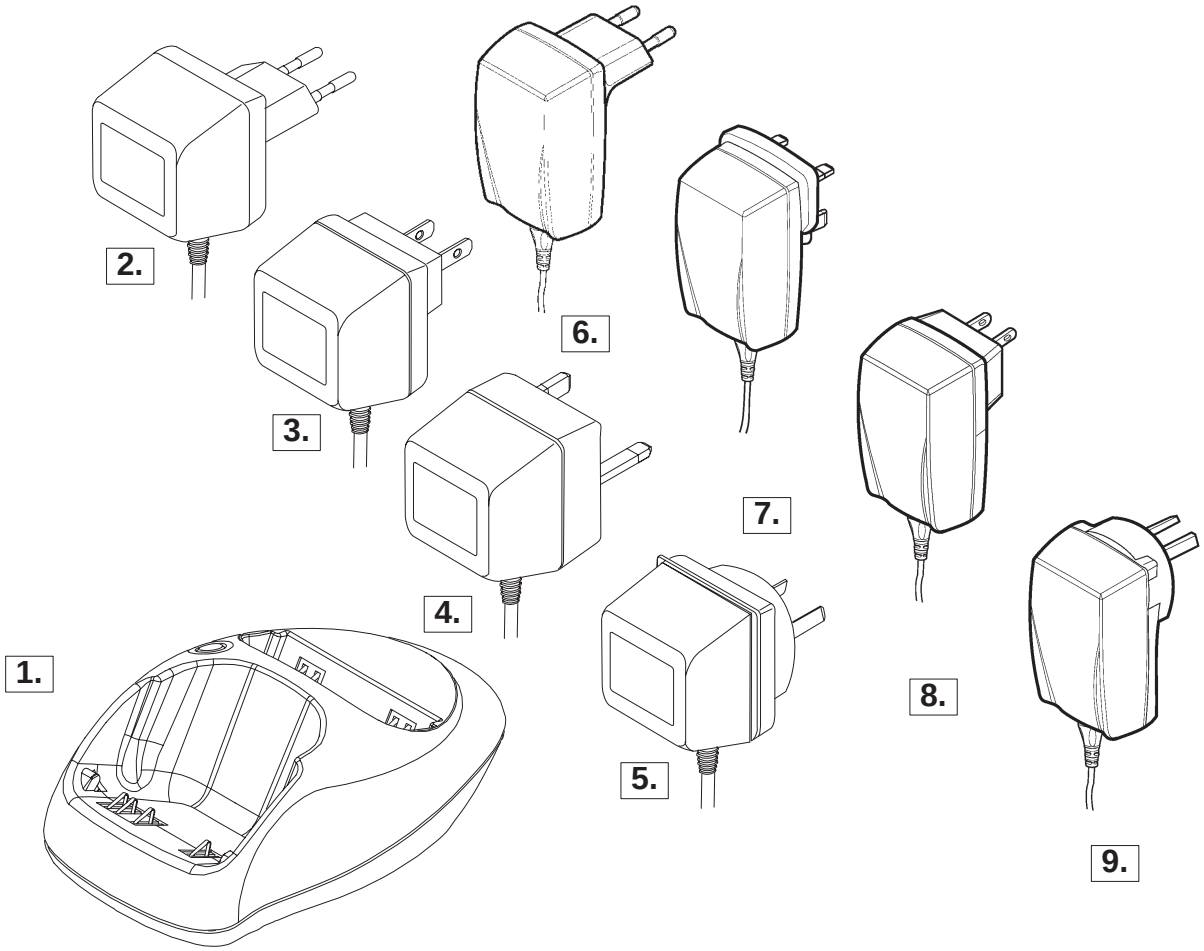
The NSW-5 is a dualband/dualmode radio transceiver unit for the US TDMA 800/1900MHz networks.



Item	Name:	Type code:	Material code:
1.	Transceiver	(See variant Appendices)	
2.	Standard battery (Li-Ion 900 mAh)	BLS-2S	0670300
3.	AC Travel Charger (Euro plug) 207-253 Vac	ACP-7E	0675144
4.	AC Travel Charger (US plug) 198-242 Vac	ACP-7U	0675143
5.	AC Travel Charger (UK plug) 207-253 Vac	ACP-7X	0675145
	AC Travel Charger (UK plug) 180-220 Vac	ACP-7H	0675146
6.	AC Travel Charger (Australia) 216-264 Vac	ACP-7A	0675148

Desktop Option

The desktop option allows the user to charge the handportable and spare battery from mains.



Item	Name:	Type code:	Material code:
1.	Desktop stand	DCH-9	0700049
2.	AC Travel Charger (Euro plug) 207-253 Vac	ACP-7E	0675144
3.	AC Travel Charger (US plug) 108-132 Vac	ACP-7U	0675143
	AC Travel Charger (US plug) 198-242 Vac	ACP-7C	0675158
4.	AC Travel Charger (UK plug) 207-253 Vac	ACP-7X	0675145
	AC Travel Charger (UK plug) 180-220 Vac	ACP-7H	0675146
5.	AC Travel Charger (Australia) 216-264 Vac	ACP-7A	0675148
6.	Performance Travel Charger Euro plug 90-264 Vac	ACP-8E	0675195
	Performance Travel Charger Korea plug 90-264 Vac	ACP-8K	0675199
7.	Performance Travel Charger UK plug 90-264 Vac	ACP-8X	0675197
8.	Performance Travel Charger US plug 90-264 Vac	ACP-8U	0675196
	Performance Travel Charger China plug 90-264 Vac	ACP-8C	0675211
9.	Performance Travel Charger Australia plug 90-264 Vac	ACP-8A	0675214

Product and Module List

Unit/type:	Type des.	Code:
Transceiver	**NSW-5**	
Slim Battery 900 mAh Li-Ion	**BLS-2S**	0670300
Extended Battery 900 mAh Li-Ion	**BLS-2N**	0670306
Standard Battery 900 mAh NiMH	**BMS-2S**	0670314
Vibrator Battery 900 mAh NiMH	**BMS-2V**	0670315

Chargers, Unit/type:	Type des.	Code:
AC Travel Charger (US) 108-132 Vac	**ACP-7U**	0675143
AC Travel Charger (EUR) 207-253 Vac	**ACP-7E**	0675144
AC Travel Charger (UK) 207-253 Vac	**ACP-7X**	0675145
AC Travel Charger (UK) 180-220 Vac	**ACP-7H**	0675146
AC Travel Charger (AUS) 216-264 Vac	**ACP-7A**	0675148
AC Travel Charger (CHI) 198-242 Vac	**ACP-7C**	0675158
AC Travel Charger (ARG) 216-264 Vac	**ACP-7AR**	0675244
Performance Travel Charger (EUR) 90-264 Vac	**ACP-8E**	0675195
Performance Travel Charger (US) 90-264 Vac	**ACP-8U**	0675196
Performance Travel Charger (ARG) 90-264 Vac	**ACP-8AR**	0675248
Cigarette Lighter Charger	**LCH-8**	0675231
Cigarette Lighter Charger	**LCH-9**	0675120

Car Accessories, Unit/type:	Type des.	Code:
Basic Car Holder	**MBC-1**	0700060
Complete Car Kit	**CARK-91US**	0080263
Complete Car Kit with handset	**CARK-91H**	0080287

Other Accessories, Unit/type:	Type des.	Code:
Headset with remote control	**HDC-9P**	0694063
Desktop Stand with two slots	**DCH-9**	0700049
Belt Clip	**BCH-12U**	0720161
RS-232 Cable	**DLR-3P**	0730183
Loopset	**LPS-1**	0630146

Technical Specifications

General Specifications of Transceiver NSW-5

The NSW-5 is a dualband/dualmode radio transceiver unit fror the US TDMA 800/1900MHz networks. The transceiver is fully based on 3V technology.

The transceiver comprises the System/RF/keypad module (UT5U), the LCD module and assembly parts.

The User interface consists of number, talk, soft and power keys in the keymat. Instead of the normal up/down arrow keys, there is a Roller Key with a selector switch. The display is a full graphic 96x65 pixel LCD.

The transceiver also comprises a Sliding cover over the keys. The Sliding cover comprises a microphone.

The Antenna is of a fixed meander type. An external antenna connection is provided by a top shoulder RF connector on the back.

The transceiver supports IR data transmission through the IR window on the top of the phone.

Mechanical Characteristics

Unit	Dimensions (W x H x D) (mm)	Weight (g) Typ.	Volume (ccm)	Notes
Transceiver	53 x 125 x 22	95	90	
Transceiver with BLS-2S 900mAh Li-Ion battery	53 x 125 x 25	140	125	
BLS-2S battery pack 900mAh	45 x 103 x 10	45	35	Li-Ion prismatic
BLS-2N battery pack 900mAh	45 x 103 x 10	50	41	Li-Ion prismatic
BMS-2S battery pack 900mAh	45 x 103 x 12	72	46	NiMH 3x5/3AAA
BMS-2V battery pack 900mAh	45 x 103 x 14	76	52	NiMH 3x5/3AAA with Vibra

Temperature range

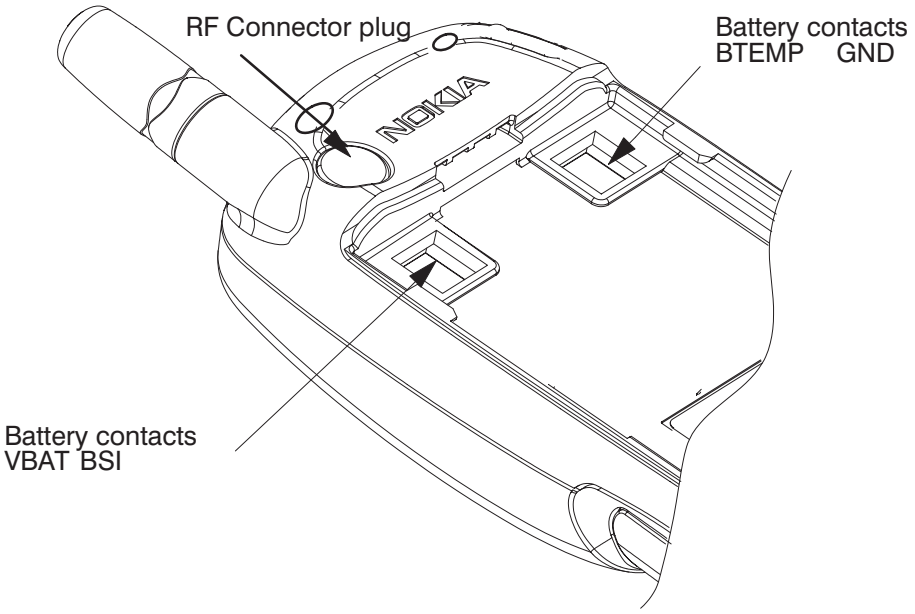
Performance	Temp range	Comments
Ambient	-30 ... +60 ° C	Specification fulfilled, IS-55, Class B, IS-137
Internal	-30 ... +85 ° C	Limited by MCU SW
Battery, internal	-30 ... +45 ° C	Charging limit

RF Connector

The RF-connector is needed to utilize the external antenna with Car Cradle. The RF-connector is located on the back side of the transceiver on the top section. See the illustration in the next chapter.

Con-tact	Line Symbol	Parameter	Mini-mum	Typical / Nomi-nal	Maxi-mum	Unit / Notes
1	EXT_ANT	Impedance		50ohm		External antenna connec-tor, 0 V DC
2	GND					

Battery Contacts



Pin	Line Symbol	Parameter	Mini-mum	Typical / Nomi-nal	Maxi-mum	Unit / Notes
1	VBAT	Battery voltage	3.0	3.6	5.0	V/ Maximum voltage in idle mode with charger connected
2	BSI	Input voltage				Battery size indication
3	BTEMP	Input voltage Input voltage Output voltage PWM output signal frequency	0 2.1 1.9 20	 22	1.4 3 2.8 25	V/ Battery temperature indica-tion V/ Phone power up (pulse) V/ Battery power up (pulse) kHz/ PWM to VIBRA BAT-TERY
4	GND		0		0	V

PAMS Technical Documentation
NSW-5 Series Transceivers

System Module UT5U

Issue 1 10/00

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Issue1	**10/00**	OJuntune	

CONTENTS

Schematic Diagrams:

Page No

Vocabulary

CS	= Cellular System
DCT	= Digital Core Technology
HW	= Hardware (drivers)
PC	= Personal Computer
RAM	= Random Access Memory
ROM	= Read Only Memory
SPEC	= Specification
SW	= Software
TDMA	= Time Division Multiple Access
LCD	= Liquid Crystal Display
FSTN	= Film Compensated Super Twist Nematic
COG	= Chip On Glass
ASIC	= Application Specific Integrated Circuit
DSP	= Digital Signal Processor
DTMF	= Dual Tone Multi–Frequency
DTX	= Discontinuous Transmission
EEPROM	= Electrically Erasable Programmable Read–Only Memory
EFR	= Enhanced Full Rate codec
EM	= Energy Management
IF	= Interface, Intermediate Frequency
IR	= Infrared
IrDa	= Infrared Data
RISC	= Reduced Instruction Set Controller
SCM	= Short Code Memory
SMS	= Short Message Services
MO	= Mobile Originated
MT	= Mobile Terminated
SW	= Software
UI	= User Interface
PWB	= Printed Wiring Board
Engine	= Radio Module

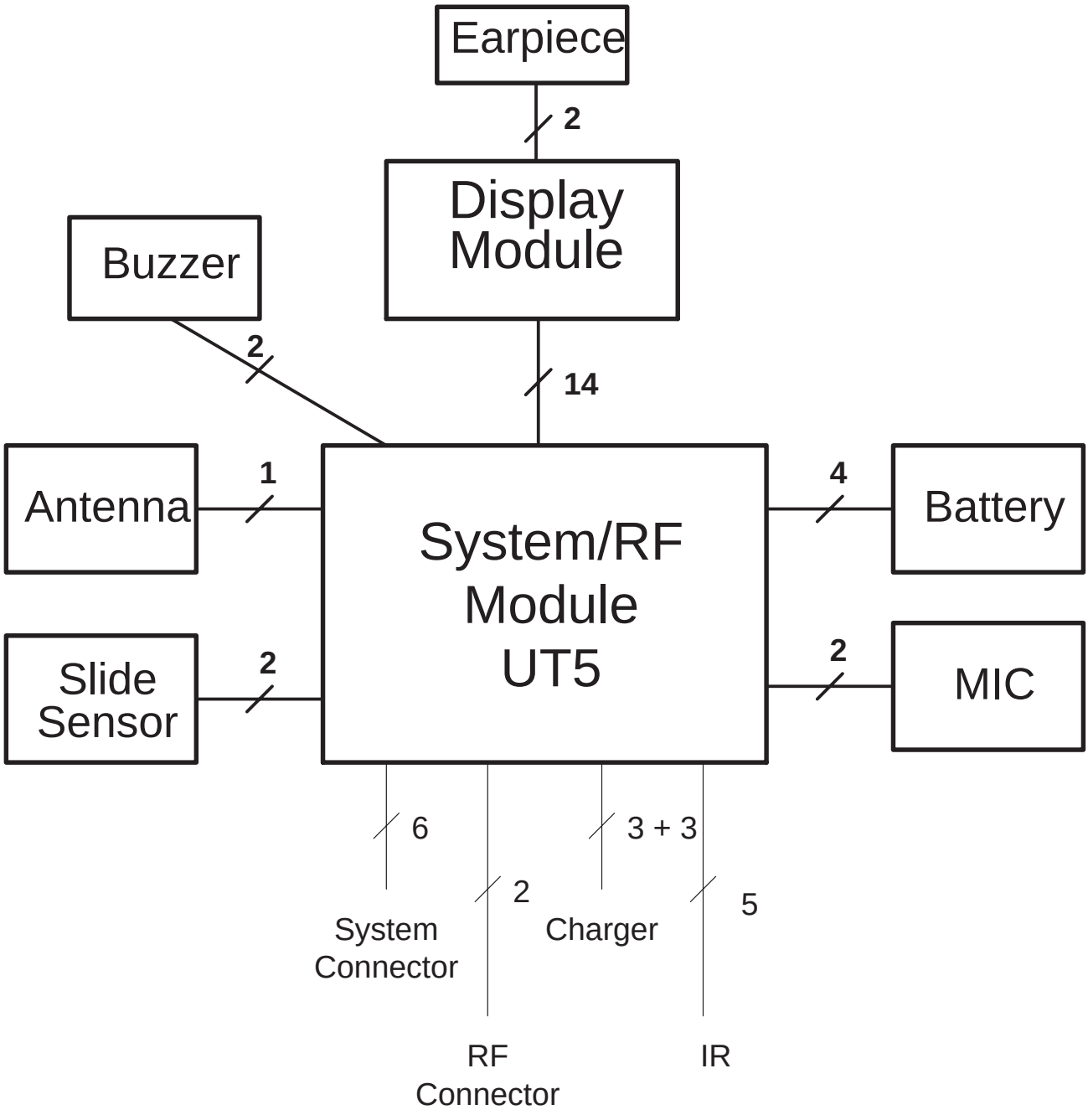
Transceiver NSW–5

Introduction

The NSW–5 is a dualband/dualmode radio transceiver unit fror the US TDMA 800/1900MHz networks. The transceiver is fully based on 3V technology.

The transceiver consists System/RF/keypad module (UT5), sub assembled LCD module and assembly parts.

Interconnection Diagram



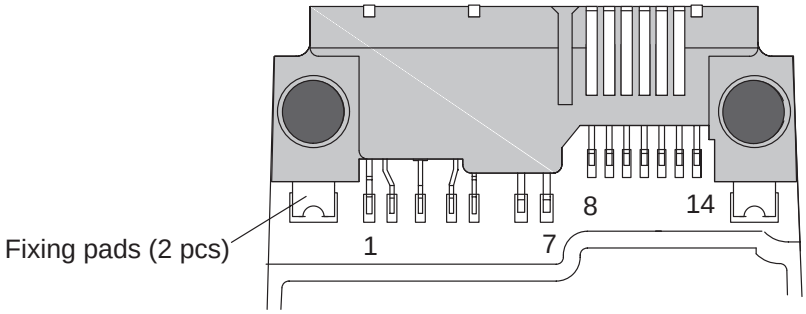
System Connector

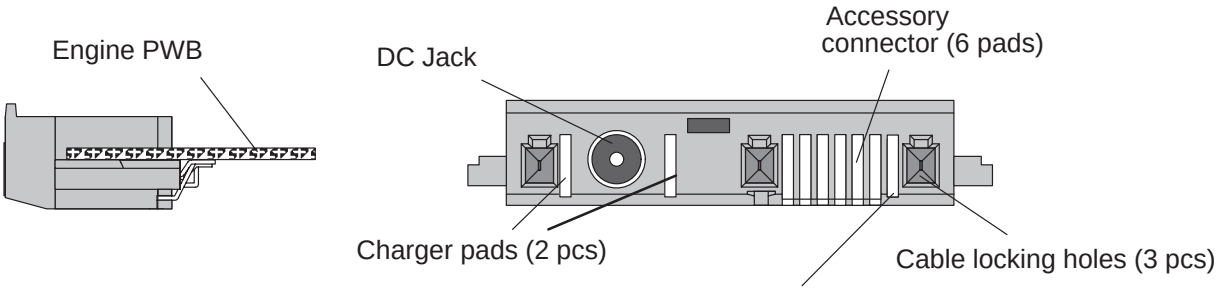
The System connector provides

– 9 contact pads
  2 for charging (Charge Voltage and Charging Control (PWM))
  6 for accessory interface
  common GND
– 3–pole round DC–jack for charging
– Cavity and 2 contact springs for Slide Sensor Switch

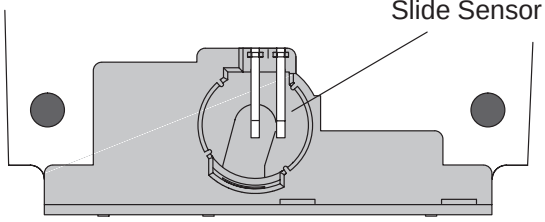
The System Connector diagrams are below:

B side view





A side view



The System connector pin and signal listing is in the next table:

Contact pin	Line Symbol	Parameter	Minimum	Typical / Nominal	Maximum	Unit / Notes
1	VIN	Charger input voltage		6.0		V/ Unloaded ACP-8 Charger
				650		mA/ Supply current
	VIN	Charger input current	7.24	7.6	7.95	V/ Unloaded ACP–7 Charger
			320	370	420	mA/ Supply current

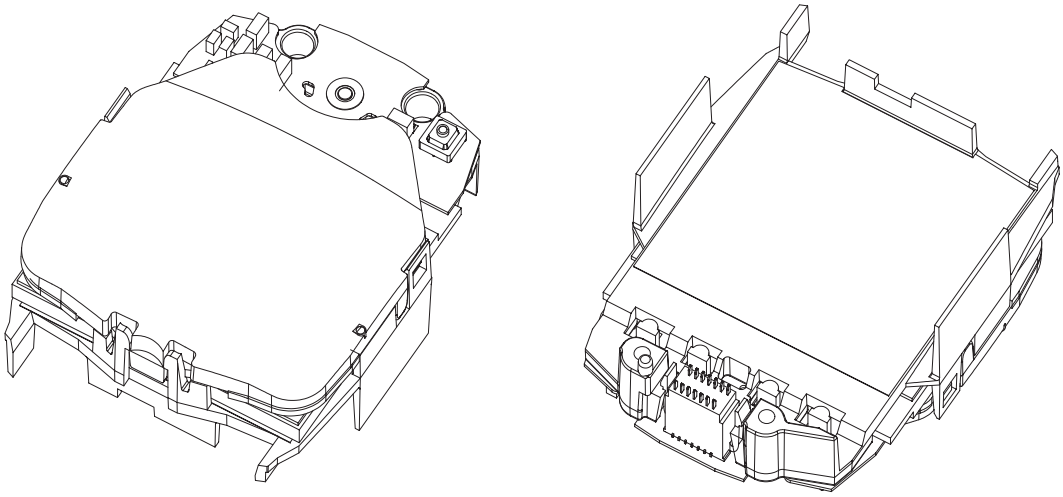
Contact pin	Line Symbol	Parameter	Minimum	Typical / Nominal	Maximum	Unit / Notes
CHARGER JACK (2)	L_GND	Charger ground input	0	0	0	V/ Supply ground
CHARGER JACK (3)	VIN	Charger input voltage	7.1	8.4	9.3	V/ Unloaded ACP-8 Charger
			720	800	850	mA/ Supply current
		Charger input current	7.24	7.6	7.95	V/ Unloaded ACP–7 Charger
			320	370	420	mA/ Supply current
CHARGER JACK (4)	CHRG CTRL	Output high voltage	2.0		2.8	V/ Charger control (PWM) high
		PWM frequency		32		Hz /PWM frequency for charger
5	CHRG CTRL	Output high voltage	2.0		2.8	V/ Charger control (PWM) high
		PWM frequency		32		Hz /PWM frequency for charger
Slide switch (6)	SLIDE	SLIDE OPEN/ CLOSE	2.7	2.8	2.85	V/ Contact in microphone cavity.
Slide switch (7)	L_GND	SLIDE SWITCH GND	0	0	0	V/ Contact in microphone cavity.
8	XMIC	Input signal voltage		60	1 Vpp	mVrms
9	SGND	Signal ground	0		0	mVrms
10	XEAR	Output signal voltage		80	1 Vpp	mVrms
11	MBUS	I/O low voltage	0		0.8	V/Serial bidirectional control bus. Baud rate 9600 Bit/s
		I/O high voltage	2.0		2.8	
12	FBUS_ RX	Input low voltage	0		0.8	V/ Fbus receive.
		Input high voltage	2.0		2.8	V/ Serial Data, Baud rate 9.6k–230.4kBit/s
13	FBUS_ TX	Output low voltage	0		0.8	V/ Fbus transmit.
		Output high voltage	2.0		2.8	V/ Serial Data, Baud rate 9.6k–230.4kBit/s
14	L_GND	Common ground input	0	0	0	V/ Supply ground

User Interface (UI)

Radio module provides the connections for keymat, roller key, mic, buzzer and display module. Slide sensor switch is placed in bottom connector. Microphone lines in slide are connected to the PWB via contacts on A–cover. Speaker is connected to display module.

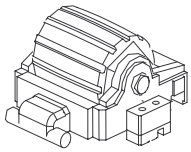
Display

Display assembly (figure below) consists of LCD, flexfoil with power key and pads for speaker and LEDs for back light, PWB connector, Plastic lens with ESD shield and light guide parts which also hold the assembly parts together.



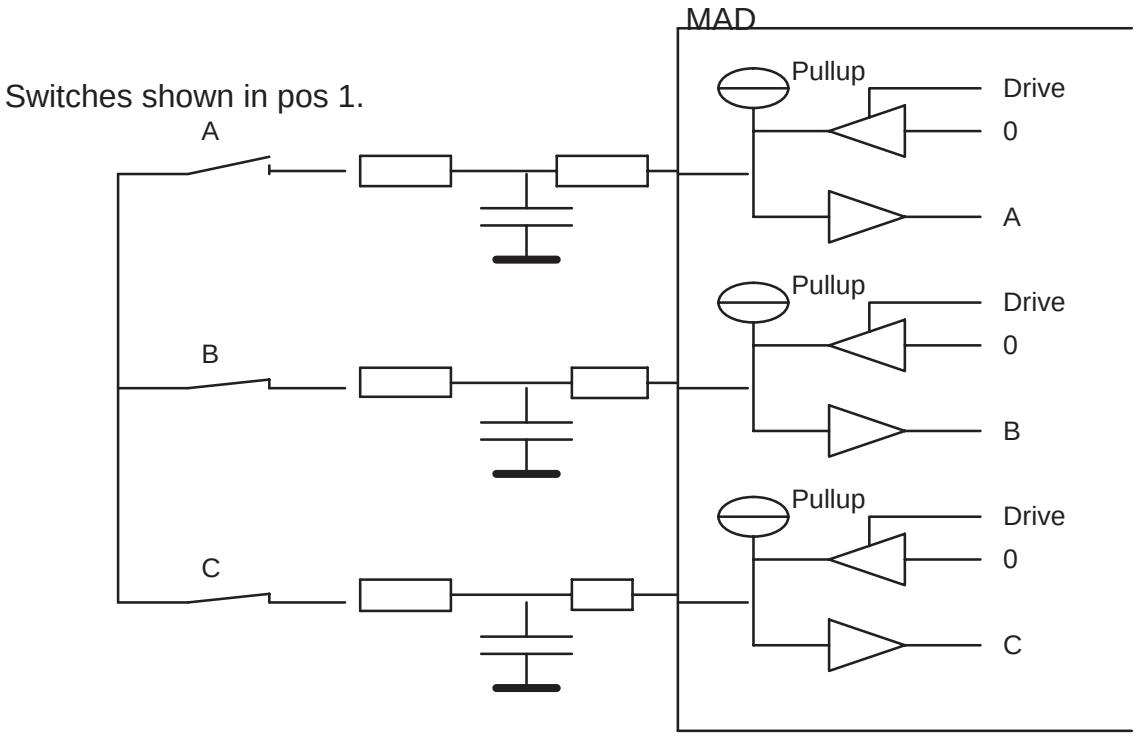
Roller key

The roller is a state type encoder. It has 3 states, the contact arrangement is shown in the following table, ”x” marks a closed contact.



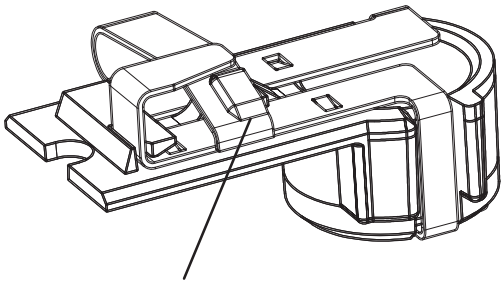
Position	Contact A	Contact B	Contact C
1		x	x
2	x		x
3	x	x	

The roller key schematic diagram is below.



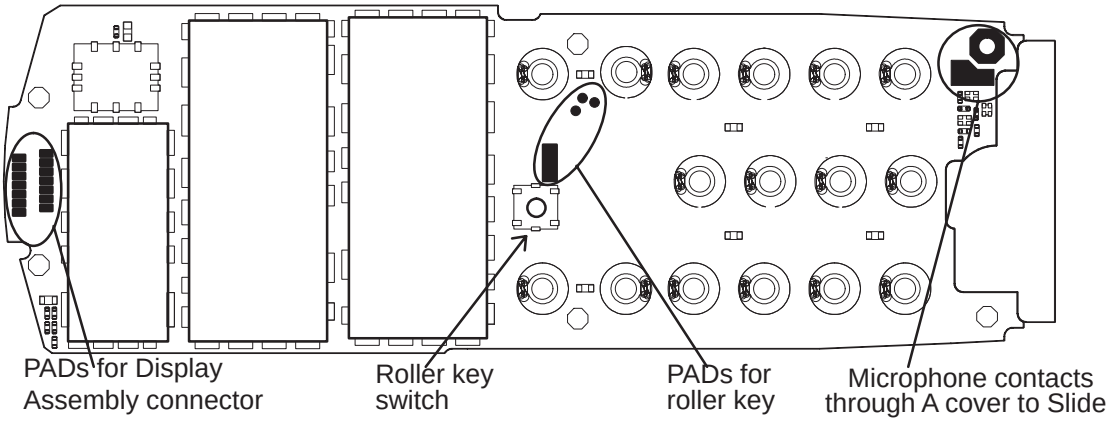
Slide sensor switch

A custom connector for sensing if the Slide is open or closed. Connector guides in to the Microphone Cavity in the System Connector.



The hook in slide cover will hit here. When the slide is closed, there is no electrical contact between the springs.

UI contacts on the Engine module



Submodules

List of Submodules

Name of submodule	Function
CTRLU	Control Unit for the phone, comprising MAD ASIC (MCU, DSP, System Logic) and Memories
PWRU	Power supply, comprising CCONT and CHAPS
AUDIO–RF_IF	Audio coding and RF–BB interface, COBBA
INF	Infrared transceiver
UI	User interface; UISWITCH, keyboard LEDs, and UI pad areas

These blocks are only functional blocks and therefore have no type nor material codes. For block diagram, see the baseband schematics on the syst–level.

Operation Modes

The transceiver has five different operation modes:

– Power off
– Idle
– Active
– Charge
– Local

In the Power off mode only the circuits needed for power up are supplied.

In the Idle mode circuits are powered down and only sleep clock is running.

In the Active mode all the circuits are supplied with power altough some parts might be in the idle state part of the time.

The Charge mode is effective in parallel with previous modes. The charge mode itself consists of two different states, i.e. the charge and the maintenance charge mode.

The Local mode is used for testing and alignment.

Active Operation

The phone has the following Active Operation modes:

– Analog mode, on 800 MHz band
  – Analog Control Channel ACCH
  – Analog Voice Channel AVCH
– Digital mode, on 800 MHz band
  – Digital Control Channel DCCH
  – Digital Traffic Channel DTCH
– Digital mode, on 1900 MHz band
  – Digital Control Channel DCCH
  – Digital Traffic Channel DTCH
– Out Of Range –mode OOR

If the phone cannot find signal from the base station on any control channel (analog or digital) it goes into OOR mode for power saving.

Analog Control Channel mode (ACCH)

On analog control channel the phone receives continuous signalling messages on Forward Control Channel (FOCC) from base station, being most of the time in IDLE mode. Only the receiver part is on. Occasionally phone re–scans control channels in order to find the stronger or other-

wise preferred control channel. Also registration (TX on) happens occasionally, where phone sends its information on Reverse Control Channel (RECC) to base station and the phone's location is updated in the switching office.

If a call is initiated, either by the user or base station, the phone moves to analog voice channel or digital traffic channel mode depending on the orders by the base station.

Analog Voice Channel Mode (AVCH)

The phone receives and transmits analog audio signal. All circuitry is powered up except digital rx–parts. In this mode DSP does all the audio processing, and in the Hands Free (HF) mode it also performs echo–cancellation and the HF algorithm. COBBA makes AD–conversion for MIC signal, and DA–conversion for EAR signal.

With audio signal also SAT (Supervisory Audio Tone) is being received from the base station. The SAT signal can be 5970 Hz, 6000Hz or 6030 Hz, the frequency being defined by the base station. DSP's DPLL phase lock loops to SAT, detects if the SAT frequency is the expected one and examines the signal quality. DSP reports SAT quality figures to MCU regularly. The received SAT signal is transponded (transmitted back) to base station.

Base station can send signalling messages on Forward Voice Channel (FVC) to the phone, by replacing the audio with a burst of Wide Band Data (WBD). Typically these are handoff or power level messages. System Logic RX–modem is used for receiving the signalling message burst, after which it gives interrupt to MCU for reading the data. During the burst audio path must be muted; MCU gives message to DSP about this. MCU can acknowledge the messages on Reverse Voice Channel (RVC), where DSP sends the WBD to transmitter RF.

Digital Control Channel Mode (DCCH)

On digital control channel (DCCH) the DSP receives the paging information from the Paging channels. DSP sends messages to MCU for processing them.

Phone uses sleep mode between received time slots. Then DSP sets the sleep clock timer and MCU, DSP and RF including VCXO are powered down. Only sleep clock and necessary timers are running.

From DCCH phone may be ordered to analog control channel or to analog or digital traffic channel.

Digital Traffic Channel Mode (DTCH)

On digital voice channel the DSP processes speech signal in 20 ms time slots. DSP performs the speech and channel functions in time shared fashion and sleeps whenever possible. Rx and tx are powered on and off

according to the slot timing. MCU is waken up mainly by DSP, when there is signalling information for the Cellular Software.

In Digital Data Channel Mode audio processing is not needed and the audio circuitry can be shut down. Otherwise the mode is similar to Digital Voice Channel Mode.

Out of Range Mode (OOR)

If the phone cannot find signal from the base station on any control channel (analog or digital) it can go into OOR mode for power saving.

All RF circuits are powered off and baseband circuits are put into low power mode, VCXO is stopped and only sleep clock is running in MAD and CCONT. After the programmable timer in MAD has elapsed the phone turns receiver on and tries to receive signalling data from base station. If it succeeds, the phone goes to standby mode on analog or digital control channel. If the connection can not be established the phone will return to out of range mode, until the timer elapses again.

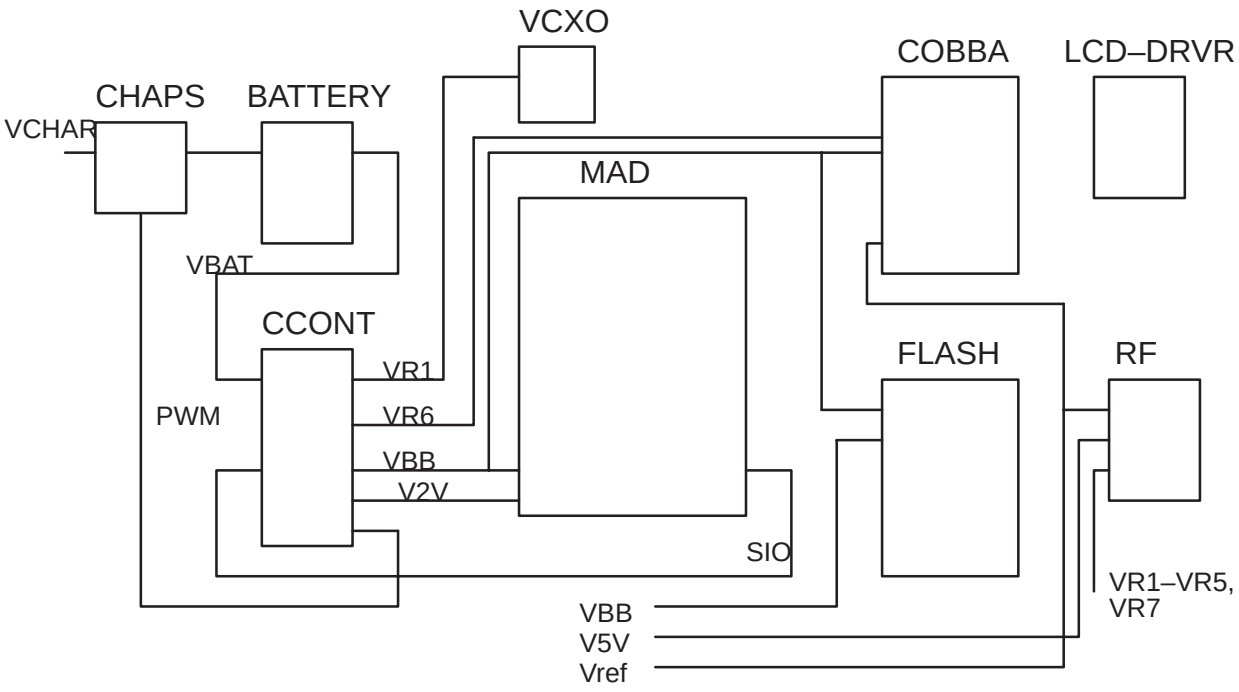
Power Distribution

In normal operation the baseband is powered from the phone‘s battery. An external charger recharges the battery. The charger can be either a standard charger that can deliver around 350 mA or so called performance charger, which can deliver supply current up to 850 mA.

The baseband contains components that control power distribution to whole phone excluding those parts that use continuous battery supply. The battery feeds power directly to following parts of the system: CCONT, power amplifier, and UI (buzzer, display, keyboard lights, IR and vibra). Figure below shows a block diagram of the power distribution.

The power management circuit CHAPS provides protection agains overvoltages, charger failures and pirate chargers etc. that would otherwise cause damage to the phone.

Block Diagram of power distribution



Technical Summary of power distribution

Battery voltage VBAT is connected to CCONT which regulates the supply voltages VBB, VR1–VR7, VSIM and V5V. CCONT enables automatically VR1, VBB, V2V, VR6 and Vref in power–up.

VBB is used as baseband power supply for all digital parts. It is constantly on when the phone is powered up. VSIM is used as programming voltage for the Flash memory when SW is writing a backup of EEPROM data during power–down with the power key.

V5V is used for RF parts only. It can be switched off by the RFCEN signal.

VR1 is used for the VCXO supply, and VR6 is used in COBBA for analog parts. RFCEN signal to CCONT controls both VR1 and VR6 regulators; they can be switched off in sleep modes, and during standby. During sleep VR6 output pin is connected to VBB regulator inside CCONT.

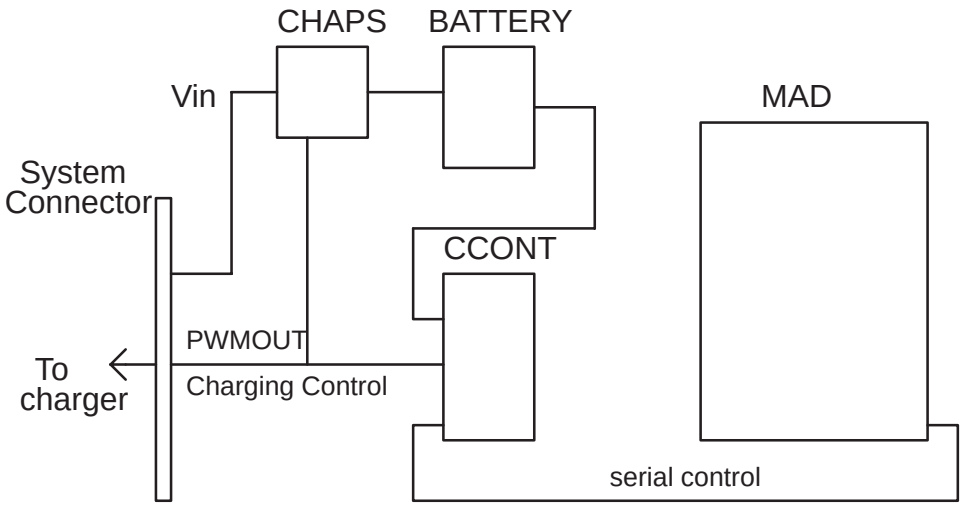
CCONT regulators are controlled either through SIO from MAD or timing sensitive regulators are controlled directly to their control pins. These two control methods form a logical OR–function, i.e. the regulator is enabled when either of the controls is active. Most of the regulators can be controlled individually.

CHAPS connects the charger voltage (VCHAR) to battery. MCU of MAD controls the charging through CCONT. MAD sets the parameters to PWM–generator in CCONT and PWM–output controls the charging voltage in charger.

When the battery voltage is below 3.0V, CHAPS controls independently the charging current.

Charging Control

Charging is controlled by MCU SW, which writes control data to CCONT via serial bus. CCONT output pin PWMOUT (Pulse Width Modulation) can be used to control both the charger and the CHAPS circuit inside phone. Charging control diagram below.



Two–wire charging

With 2–wire charging the charger provides constant output current, and the charging is controlled by PWMOUT signal from CCONT to CHAPS.

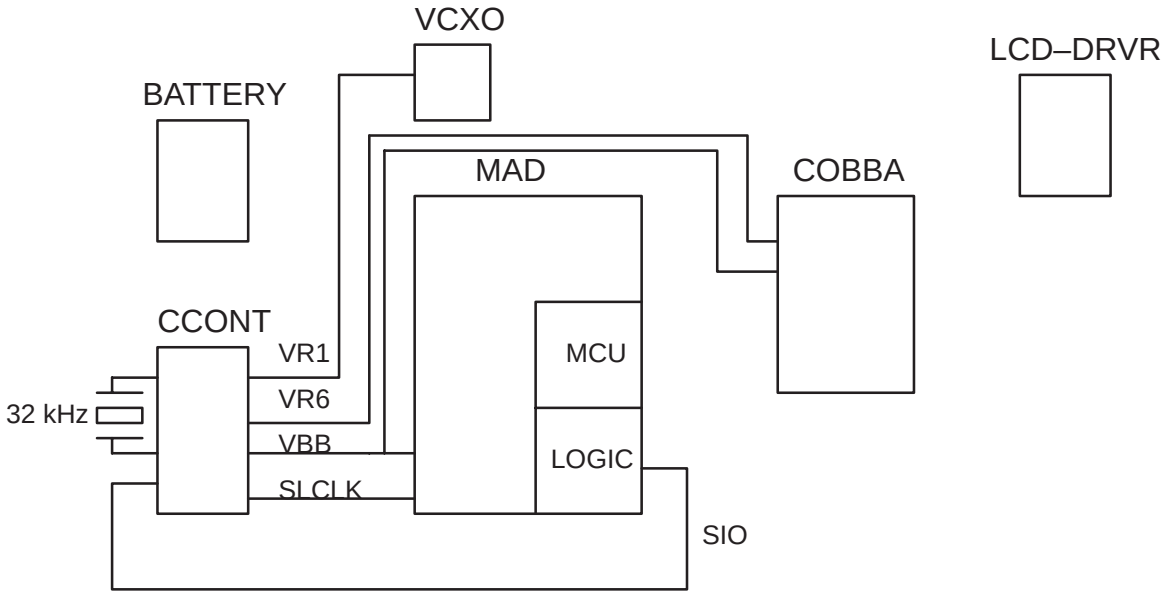
The PWMOUT signal frequency set is 1 Hz, and the charging switch in CHAPS is pulsed on and off at this frequency. The final charged energy to battery is controlled by adjusting the PWMOUT signal pulse width.

Both the PWMOUT frequency is selected and the pulse width controlled by the MCU which writes these values to CCONT.

Three–wire charging

With 3–wire charging the charger provides adjustable output current, and the charging is controlled by the PWMOUT signal from CCONT to charger, with the bottom connector signal. The PWMOUT signal frequency set is 32 Hz, and the charger output voltage is controlled by adjusting the PWMOUT signal pulse width. The charger switch in CHAPS is constantly on in this case.

Watchdog



Both MAD and CCONT include a watchdog, and both use the 32 kHz sleep clock. The watchdog in thw MAD is the primary one, called SW–watchdog. MCU has to update it regularly. If it is not updated, logic inside MAD gives reset to MAD. After the reset the MCU can read an internal status bit to see the reason for reset, whether it was from the MAD or CCONT. The SW–watchdog delay can be set between 0 and 63 seconds at 250 millisecond steps; and after power–up the default value is the max. time.

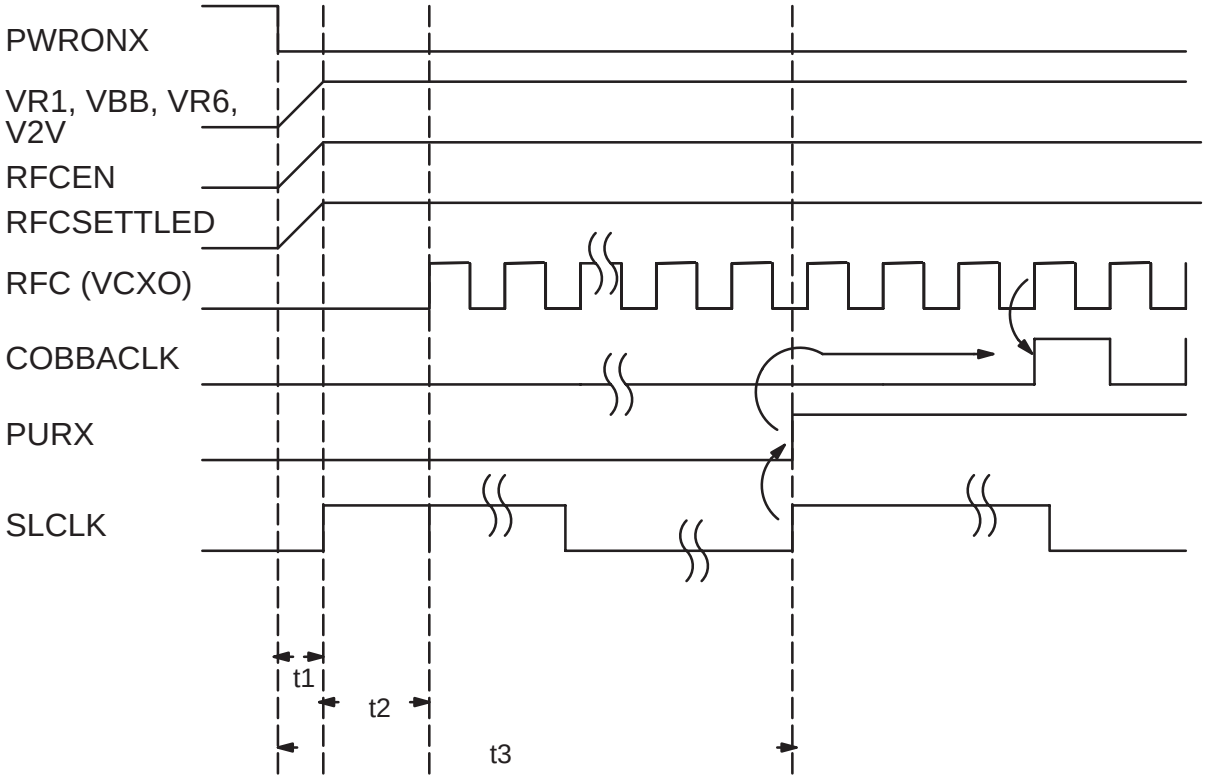
MAD must reset CCONT watchdog regularly. CCONT watchdog time can be set through SIO between 0 and 63 seconds at 1 second steps. After power–up the default value is 32 seconds. If watchdog elapses, CCONT will cut off all supply voltages.

After total cut–off the phone can be re–started through any normal power–up procedure.

Power up

When the battery is connected to phone, the 32.768 kHz crystal oscillator of the CCONT is not started until the power–button is pressed. The regulators are not started. After the crystal has started, the phone is ready to be powered up by any of the following ways.

Power up when power–button is pushed



t1	< 1 ms
t2	1 – 6 ms, VCXO settled
t3	62 ms, PURX delay generated by CCONT

After the PWR–key has been pushed, the CCONT gives PURX reset to MAD and the COBBA, and turns on VR1, VBB, V2V and VR6 regulators (if the battery voltage has exceeded 3.0 V). VR1 supplies VCXO, VBB supplies MAD and digital parts of COBBA, and VR6 supplies analog parts of COBBA. After the initial delay t2 the VCXO starts to give proper RFC to COBBA that further divides it to the COBBACLK for MAD. COBBA will output the COBBACLK only after the PURX reset has been removed. After delay t3 the CCONT releases PURX and MAD can take control of the operation of the phone.

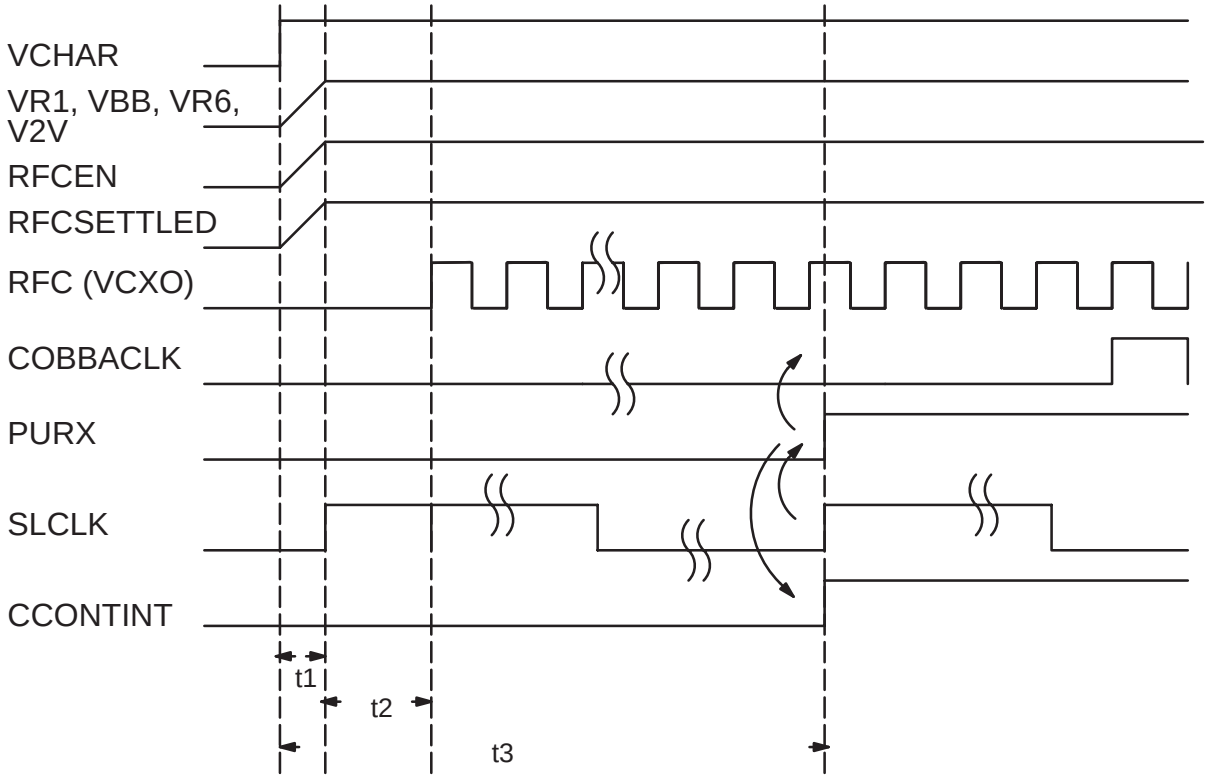
After that MCU–SW in MAD detects that the PWR–key is still pushed and shows the user that the phone is powering up by starting the LCD and

turning on the lights. MCU–SW must start also the RF receiver parts at this point.

V5V–regulator (for RF) default value is off in power–up, and can be controlled on via serial bus when needed.

Power up when charger connected

Normal battery voltage

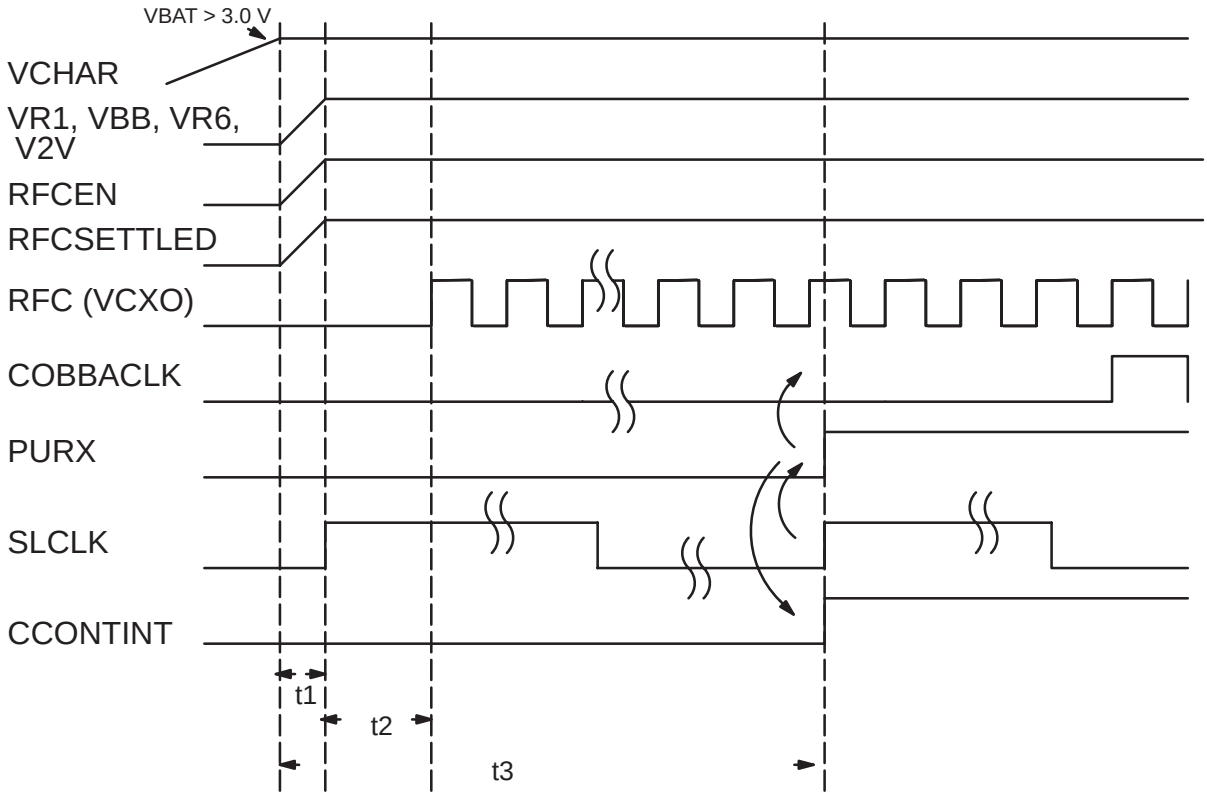


The power up procedure is similar to process described in the previous chapter with the exception that the rising edge of VCHAR triggers the power up in CCONT.

Also CCONT sets output CCONTINT. MAD detects the interrupt, and after that reads CCONT status register to find out the reason for the interrupt (charger in this case). The phone will remain in the ”acting dead” state, which means that the user interface is not activated unless the power button is pressed. Only the charging activity is indicated on the display.

CCONTINT is generated both in the case the charger is connected, and in the case the charger is disconnected.

Empty battery



Before battery voltage voltage rises over 3.0 V CHAPS gives an initial charge (with limited current) to the battery. After battery voltage reaches that voltage limit the power up procedure is as described in the previous chapters.

Anyway, if the standard charger is connected and power–up requested from the power button, the current consumption is kept in the minimum in the beginning because the charger output current is rather low and the battery voltage is on the minimum limit. Thus, the phone receiver parts and the user interface lights are not powered up immediately, but after a short delay.

IBI (Intelligent Battery Interface)

Phone can be powered up by external device (accessory or similar) by providing a start pulse to the battery signal BTEMP; this is detected by CCONT. After that the power–up procedure is similar to pushing power–button.

Mixed trigger to power up

It is possible that PWR–key is pushed during charger initiated power–up procedure or charger is connected during PWR–key initiated power up procedure. In this kind of circumstances the power–up procedure (from the HW point of view) continues as nothing had happened.

When the Baseband HW is working normally and SW is running, SW detects that both conditions are fulfilled and then acts accordingly.

Power Down

Controlled Power Down

Power down pushing PWR–key

MAD (MCU SW) detects that PWR–key is pressed long enough. After that the lights and LCD are turned off. MCU stops all the activities it was doing (e.g. ends a call), sends power off command to CCONT (i.e. gives a short watchdog time) and goes to idle–task. After the delay CCONT cuts all the supply voltages from the phone.

Note that the phone does not go to power off (from HW point of view) when the charger is connected and PWR–key is pushed. It is shown to user that the phone is in power off, but in fact the phone is just acting being powered off (”acting dead”).

Power down when battery voltage is discharged too low

During normal discharge the phone indicates the user that the battery will drain after some time. If not recharged, SW detects that battery voltage is too low and shuts the phone off through a normal power down procedure.

Anyway, if the SW fails to power down the phone, the CCONT will make a reset and power down the phone if the battery voltage drops below 2.6 – 2.9 V.

Power down with fault in the transmitter

If MAD receives fault indication, from the line TXF, that the transmitter is on although it should not be, the control SW will power down the phone.

Uncontrolled Power Down

Power down when watchdog expires

If the SW fails to update the watchdog, the watchdog will eventually expire and CCONT cuts all the supply voltages from the phone.

Power down with Battery disconnected

When battery is disconnected, immediate and totally uncontrolled power–down happens. Therefore a power off procedure in this case can not be described. One possible risk is that if the MCU is writing something to Flash exactly at the same moment, the memory contents may be corrupted.

Battery disconnected when charger is connected

From hardware point of view the phone could otherwise continue functioning normally, but if the charger voltage is higher than the maximum allowed battery voltage, this can damage the RF parts. Therefore, there must be hardware protection against this in CHAPS.

If the user presses the PWR–key, the phone can wake up to detect that the battery is not present (no BTYPE and /or BTEMP). After that the phone either turns itself off or goes to low current mode (can be decided by MCU SW).

This state does not harm the phone. The phone can not be used only from the charger without the battery.

Circuit Description of Submodules

CTRLU

CTRLU comprises MAD ASIC (MCU, DSP, System Logic) and Memories. The soldering connections of the IC are unaccessible for probing, only test points can be used. Therefore no pin list is published.

The environment consists of two memory circuits (FLASH,SRAM), a 22–bit address bus and a 16–bit data bus. Besides there are ROM1SELX, ROM2SELX and RAMSELX signals for chip selection.

MCU main features

– System control

– Cellular Software (CS)

Cellular Software takes care of communication with switching office, as well call build–up, maintenance and termination.

– Communication control

M2BUS is used to communicate to external devices. This interface is also used for service and maintenance purposes.

– User Interface (UI)

PWR–key, keyboard, LCD, backlight, mic, ear and alert (buzzer, vibra, led) control.

Serial interface from MAD to LCD (common for CCONT).

– Authentication

Authentication is used to prevent fraud usage of cellular phones.

– RF monitoring

RF temperature monitoring by VCXOTEMP, ADC in CCONT.
Received signal strength monitoring by RSSI, ADC in CCONT.
False transmission detection by TXF signal, digital IO–pin.

– Power up/down and Watchdog control

When power key is pressed, initial reset (PURX) has happened and default regulators have powered up in CCONT, MCU and DSP take care of the rest of power up procedures (LCD, COBBA, RF).
MCU must regularly reset Watchdog counter in CCONT, otherwise the power will be switched off.

– accessory monitoring

Accessory detection by EAD (XMIC/HEADSETINT), AD–converter in CCONT.
Connection (FBUS) for data transfer.

– battery and charging monitoring

MCU reads the battery type (BTYPE), temperature (BTEMP) and voltage (VBAT) values by AD–converter in CCONT, and phone's operation is allowed only if the values are reasonable. Charging current is controlled by writing suitable values to PWM control in CCONT.

MCU reads also charger voltage (VCHAR) and charging current values (IBAT).

– production/after sales tests and tuning

Flash and EEPROM loading, baseband tests, RF tuning

– Control of CCONT via serial bus

MCU writes controls (regulators on/off, Watchdog reset, charge PWM control) and reads AD–conversion values.
For AD–conversions MCU gives the clock for CCONT (bus clock), because the only clock in CCONT is sleep clock, which has too low frequency.

DSP main features

The DSP (Digital Signal Processor) is in charge of the channel and speech coding according to the IS–136 specification. The block consists of a DSP and internal ROM and RAM memory. The input clock is 9.72 MHz, and DSP has an own internal PLL–multiplier. Main interfaces are to MCU, and via System Logic to COBBA and RF.

– Analog transmit

Audio signal in analog mode is fed to the COBBA codec, where it is routed, amplified and converted by internal A/D converter into bitstream (the sample rate is in digital mode 8.0 kHz and in analog mode 8.1 kHz). The digitized speech is processed by the DSP audio modules into 48.6 kHz audio. This audio is FM modulated into I/Q samples at 97.2 kHz. The samples are sent via System Logic transmit buffer to the COBBA TXI/Q D/A converters. This I/Q modulated analog signal goes then to RF unit I/Q inputs. DSP must also perform echo cancelling in HF mode.

– Analog receive

In analog receive the signal is demodulated by DEMO (block in COBBA) and the sample rate is 48.6 kHz. The samples are directed trough System Logic to DSP. DSP performs audio processing and finally transfers the digital audio (8.1 kHz sample rate) back to COBBA, where they are D/A converted. Resulting audio signal is routed and amplified to the earpiece or external loudspeaker.

– Digital transmit

In digital transmit mode DSP processes speech data in 20 ms slots. It performs speech encoding (EFR), CRC generation, convolutional coding and interleaving. Finally it sends the symbols to the System Logic modulator. The modulator performs the $\pi/4$ DQPSK modulation. System Logic

controls the transmit timing and at specified intervals sends the I/Q samples at 97.2 kHz to COBBA for TXI/Q D/A converters.

– Digital receive

In digital receive mode the second IF is 450 kHz, which is sampled at 194,4 kHz in COBBA, aliased to 61,2 kHz and then downconverted and demodulated in DSP. The timing is controlled by System Logic. DSP performs bit detection with equalizer and then convolutional decoding and CRC checking. After this the (speech) bits are passed for speech decoding (EFR). The decoded bits are converted to analog signal in COBBA, then routed and fed to the earpiece.

– Analog modem functions

On the analog voice channel, DSP performs the signalling functions: SAT receiving and transponding. Transmit function: ST and wide band data.

– Control and general functions

In all modes DSP controls the RF. Controlling is done physically through System Logic, where all necessary timing functions are implemented, and control I/O lines are provided for e.g. synthesizer loading, power control etc.

In all transmit modes DSP takes care of the transmitted power control (TXC) and frequency control (AFC). Also DTMF tone generation is made in DSP.

All clocks and timing are generated from the RFC clock. In sleep mode only the 32 kHz clock is used.

System Logic main features

– MCU related clocking, timing and interrupts (CTIM)
– DSP related clocking, timing and interrupts (CTID)
– DSP general IO–port
–reset and interrupts to MCU and DSP
– interface between MCU and DSP (API)
– MCU interface to System Logic (MCUif)
– MCU controlled PWMs, general IO–port and USART for MBUS (PUP)
– Receive Modem (Rxmodem)
– Interface to Keyboard, CCONT and LCD Drivers (UIF)
– Interface to MCU memories, address lines and chip select decoding (BUSC)
– DSP interface to System Logic (DSPif)
– serial accessory interface (AccIf, DSP–UART)
– Modulation, transmit filter and serial interface to COBBA (MFI)
– Serial interface for RF synthesizer control (SCU)

Memories

FLASH
– size 2048k * 16 bit

contains the main program code for the MCU, and is able to emulate EEPROM.

SRAM

– size 256k * 16 bit

AUDIO–RF

Audio interface and baseband–RF interface converters are integrated into the COBBA circuit.

COBBA main features

The codec includes microphone and earpiece amplifier and all the necessary switches for routing. There are two different possibilities for routing; internal and external devices. There are also all the AD– and DA– converters for the RF interface.

A slow speed DA–converter provides automatic frequency control (AFC). In addition, there is a DA–converters for transmitter power control (TXC).

COBBA also passes the RFC (19.44 MHz) to MAD as COBBACLK (9.72 MHz).

COBBA is connected to MAD via two serial busses:

– RXTXSIO, for interfacing the RF–DACs and DEMO; and also for audio codec and general control. Signals used: COBBACLK (9.72 MHz, from COBBA), COBBACSX, COBBASD (bi–directional data) and COBBADAX (data ready flag for rx–samples).

– Codec SIO, for interfacing the audio ADCs / DACs (PCM–samples). Signals: PCMDCLK (data clock 1.08 MHz / 1.215 MHz), PCMSCLK (frame sync 8.0 kHz / 8.1 kHz), PCMTxdata and PCMRxdata.

A vibra alerting device is used for giving silent signal to the user of an incoming call. The device is controlled with a VibraPWM output signal from MAD. The vibra alert can be adjusted either by changing the pulse width or by changing the pulse frequency.

PWRU

CCONT Main Features

CCONT generates regulated supply voltages for baseband and RF. There are seven 2.8 V linear regulators for RF, one 2.8 V regulator for baseband, one special switched output (VR1_SW), one programmable 2 V output (V2V), one 3/5 V output, one 5 V output, and one 1.5 V +/– 1.5 % reference voltage for RF and COBBA.

Other functions include:

– power up/down procedures and reset logic

– charging control (PWM), charger detection
– watchdog
– sleep clock (32 kHz) and control
– 8–channel AD–converter.

CHAPS Main Features

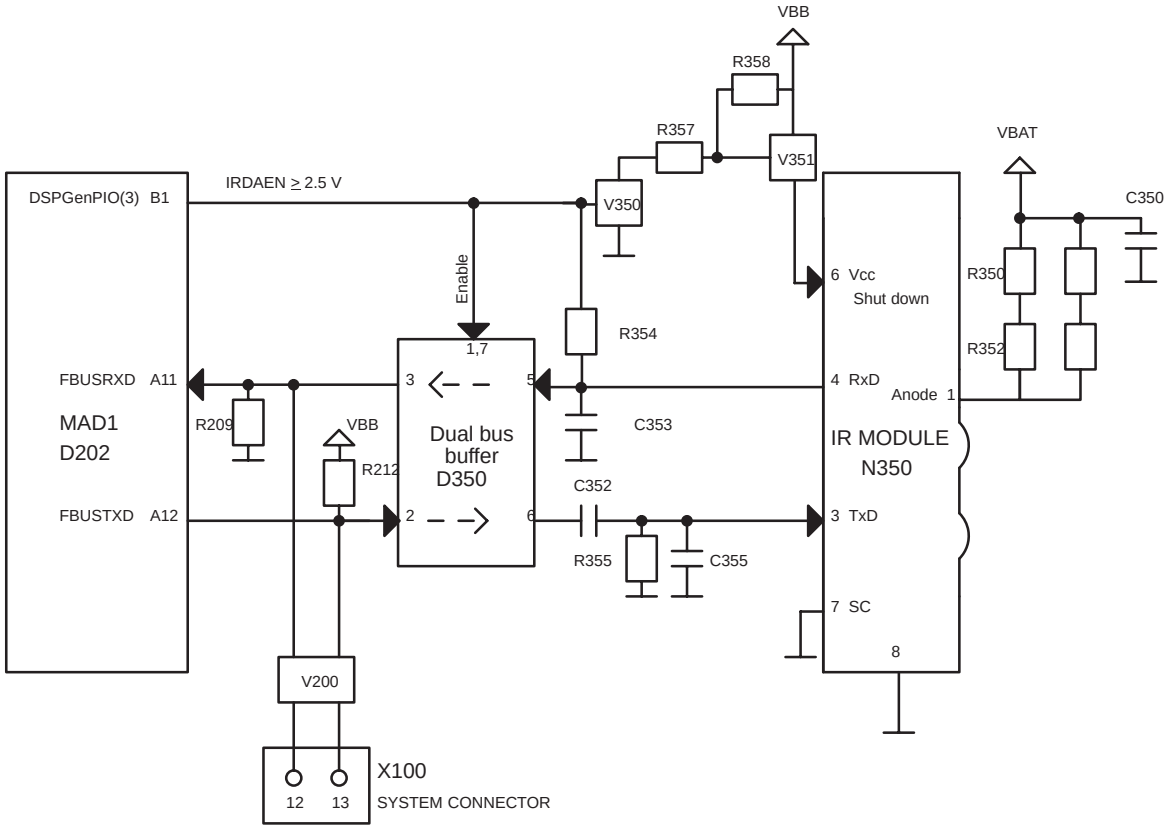
CHAPS comprises the hardware for charging the battery and protecting the phone from over–voltage in charger connector.

The main function are

– transient, over–voltage and reverse charger voltage protection
– limited start–up charge current for a totally empty battery
– voltage limit when battery removed
– with SW protection against too high charging current

INF

An infrared transceiver module is implemented as an alternative to a cable between the phone and a PC. See the figure below:



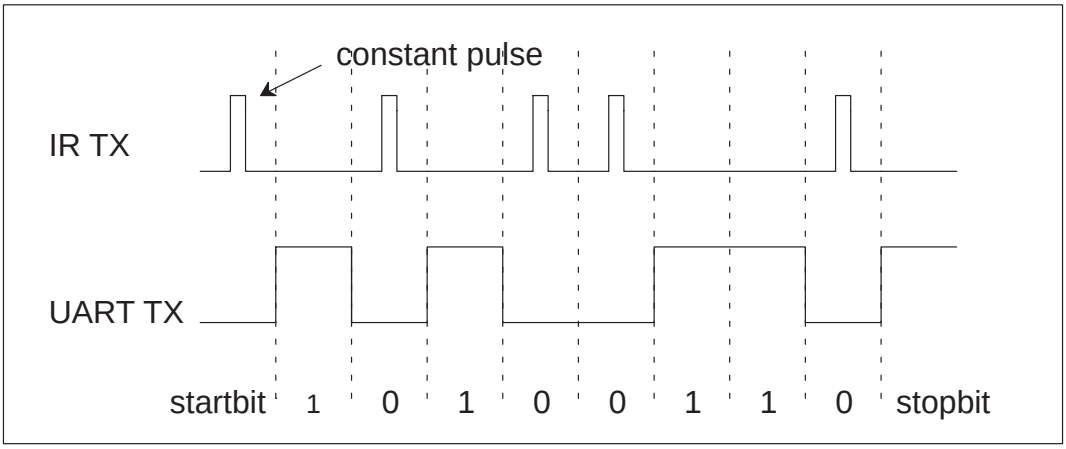
The infrared transceiver module is a stand alone component capable of infrared transmitting and receiving by transforming signals transmitted in

infrared light from and to electrical data pulses running in the two wire asyncronous databus. IR databus is the same as used for FBUS data transferring. Thus FBUS Tx and Rx lines must be turned to IR mode. The IR mode can be selected from user interface.

The module is activated with the IRDAEN signal by MAD, which supplies power to the IR module (N350) and enables supply current for IR leds. The IR datalines are connected to MAD accessory interface AccIf via FBUS. The RX and TX lines are separated from FBUS by 3–state buffer (D350), when the IR–module is switched off. The AccIf performs pulse encoding and shaping for transmitted data and detection and decoding for received data pulses.

The data is transferred over IR link using serial FBUS data at speeds 9.6, 19.2, 38.4, 56.6 or 115.2 kbits/s, which leads to maximum troughput of 92.160 kbits/s. The used IR module complies with the IrDA SIR specification (Infra Red Data Association).

Following figure gives an example of IR transmission pulses. In IR transmission a light pulse correspondes to 0–bit and a ”dark pulse” correspondes to 1–bit.



The FBUS cannot be used for external accessory communication, when the infrared mode is selected. Infrared communication reserves the FBUS completely.

User Interface

The Display Module is connected to engine board via X300. It contains LCD and LCD LEDs, power switch, and speaker pads.

TM23A (N300), a.k.a. UISWITCH, is an integrated switch IC for UI purposes. It includes control switch for buzzer and vibra, LED (display & keyboard) control and two current sinks for LEDs.

UISWITCH main features

- two adjustable constant current sinks for keyboard and LCD LEDs
- LED ON/OFF control
- buzzer ON/OFF control
- FET switch for buzzer current
- vibra ON/OFFcontrol (no internal vibrator in NSW–5)
- FET switch for vibra current
- thermal shutdown
- power down function for optimum current consumption
- package TSSOP20 because of low height requirement

RF Module

Technical Summary

The RF module converts the signal received by the antenna to a baseband signal and vice versa.

It consists of a conventional superheterodyne receiver and a transmitter for each band and also two frequency synthesizers for the required mixing.

The RF module includes one integrated circuit, the EROTUS a BiCMOS ASIC.

The dual–band RF–module is capable for seamless operation between 800 MHz and 1900 MHz bands. In practise this means capability to cross–band hand–offs and maho–measurements.

The EROTUS includes:

– Limiter amplifier for the analog receiver
– An AGC amplifier for the digital receiver
– A receiver mixer for the 450kHz down conversion
– PLLs for the 1GHz UHF and VHF synthesizers
– IQ–modulators for the transmitter
– A power control circuit for the transmitter and the AGC amplifier

The power amplifiers (PAs) are GaAs HBT MMICs. They comprise two 800 MHz and three 1900 MHz amplifier stages with input and interstage matching.

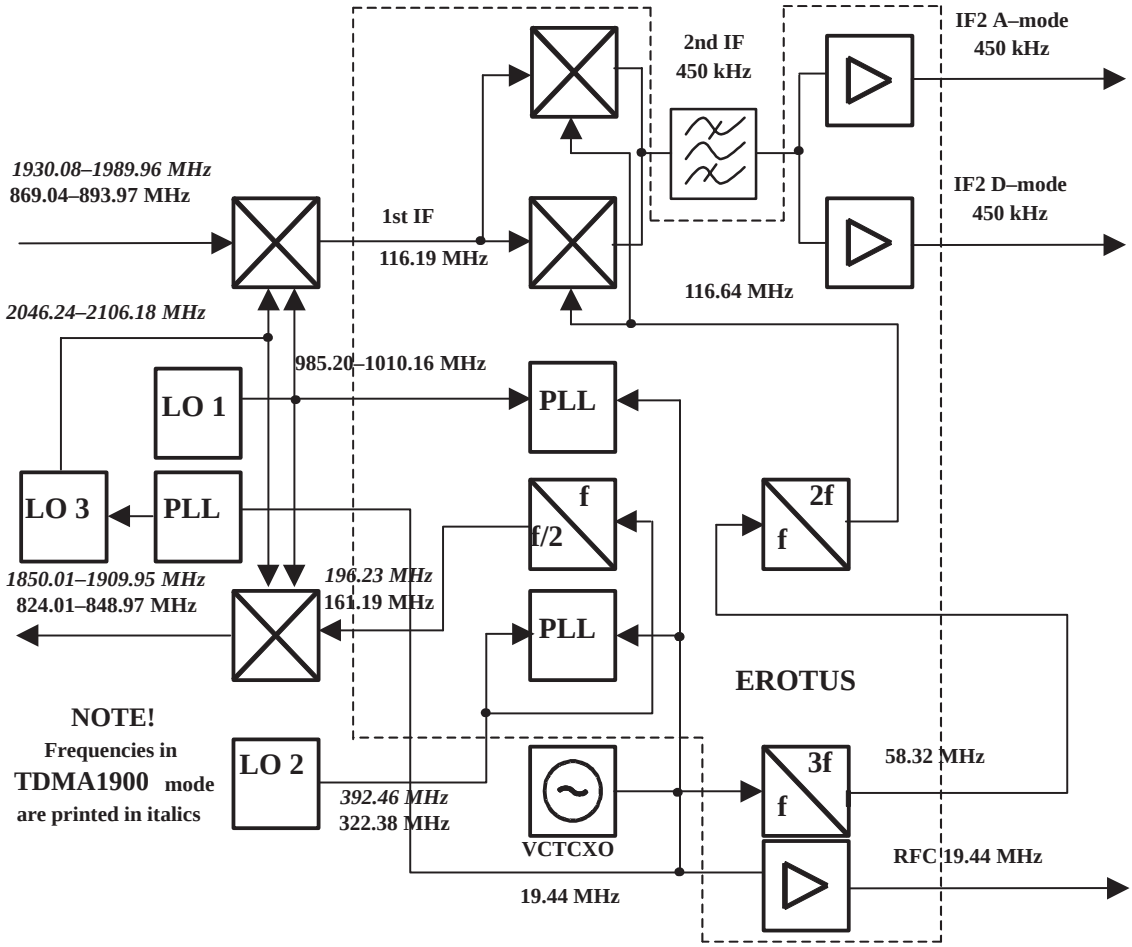
The LNA MMICs include:

– A LNA for each band with a step AGC
– Down converters for the receiver
– A prescaler for the LO buffer

On the next page is a graphical presentation of the used Frequency Plan.

RF Frequency Plan

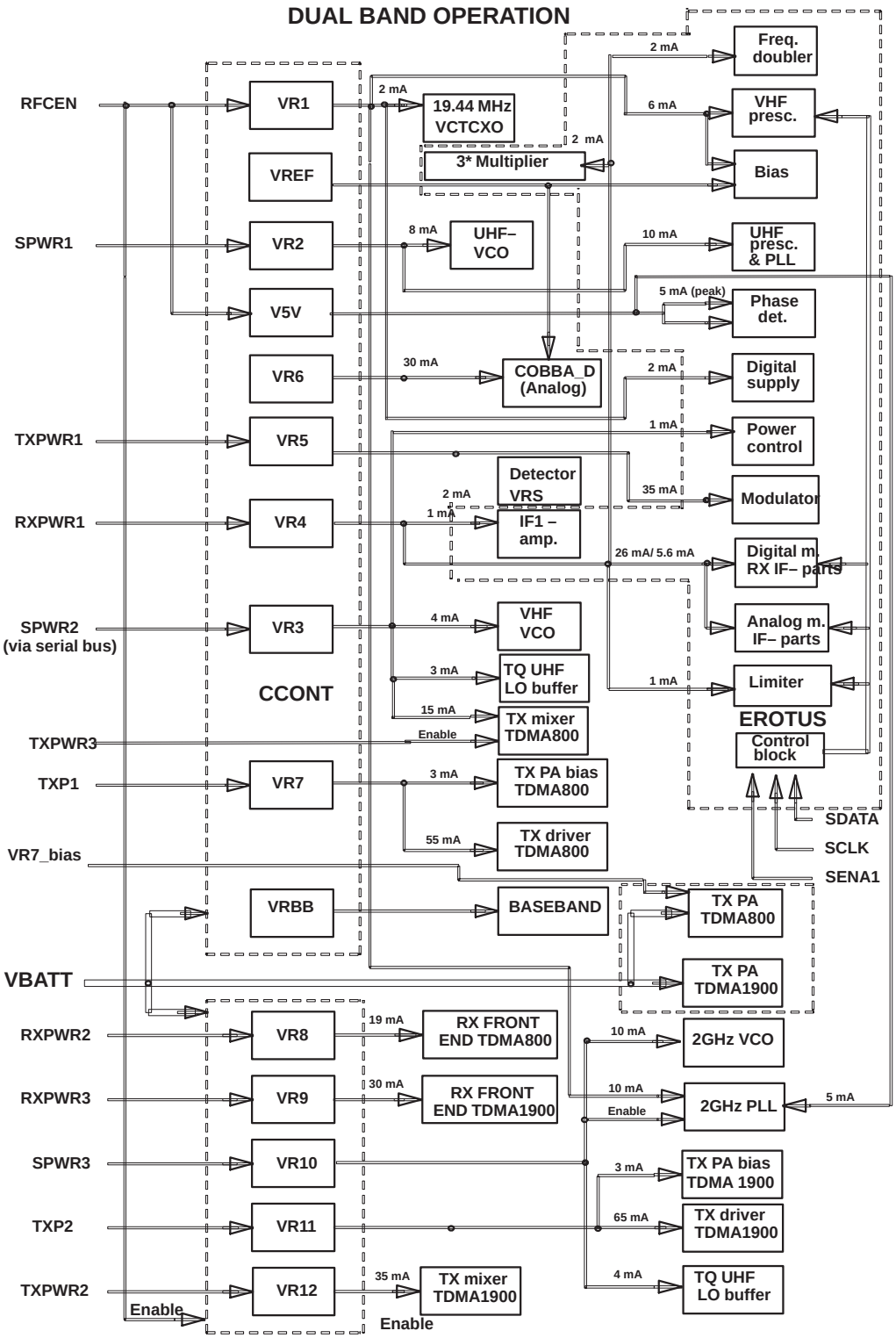
Intermediate frequencies of the RX are the same in all operation modes. RX/TX LO and TX IF modulator frequencies are different in TDMA800 and TDMA1900 operation modes. See figure below for details.



DC Characteristics

Power Distribution Diagram

There are two options for power distribution. 1st option is a dual band phone, which is presented in fig. 2. Current consumptions in the diagrams are only suggestive.



Current consumption in different operation modes can be seen in the table next page.

	800 MHz Ext. Standby [mA]	800 MHz Analog Control Channel [mA]	800 MHz Analog Traffic Channel [mA]	800 MHz Digital Control Channel [mA]	800 MHz Digital Traffic Channel [mA]	1900 MHz Digital Control Channel [mA]	1900 MHz Digital Traffic Channel [mA]
VR1	9.0 / 0.0	9.0	9.0	9.0 / 0.0	9.0	19.0 / 0.0	19.0
VR2	16.0 / 0.0	16.0	16.0	16.0 / 0.0	16.0	0.0	0.0
VR3	0.0	0.0	23.0	0.0	13.0	0.0	8.0
VR4	11.6 / 0.0	11.6	11.6	32 / 0.0	12.8*	32 / 0.0	12.8*
VR5	0.0	0.0	37.0	0.0	13.0 **	0.0	13.0 **
VR6	2.0 / 0.1	2.0	32.0 ***	2.0 / 0.1	32.0 ***	2.0 / 0.1	32.0 ***
VR7	0.0	0.0	58.0	0.0	19.2 ’	0.0	0.0
VR8	19.0 / 0.0	19.0	19.0	19.0 / 0.0	7.6 ”	0.0	0.0
VR9	0.0	0.0	0.0	0.0	0.0	30.0 / 0.0	12.0 ”’
VR10	0.0	0.0	0.0	0.0	0.0	10.0 / 0.0	10.0
VR11	0.0	0.0	0.0	0.0	0.0	0.0	22.5^
VR12	0.0	0.0	0.0	0.0	0.0	0.0	12.9^^
V5V	5.0 / 0.0	5.0	5.0	5.0 / 0.0	5.0	5.0 / 0.0	5.0
Total	62.6 / 0.1	62.6	210.6	83.0 / 0.1	127.6	98.0 / 0.1	147.2

NOTES:
* Mean value (ON/OFF=8/20ms), peak current 32.0 mA
** Mean value (ON/OFF=7/20ms), peak current 37.0 mA
*** Cobba_D mean current consumption estimated to be 30 mA
’ Mean value (ON/OFF=6.6/20ms), peak current 180.0 mA
” Mean value (ON/OFF=8/20ms), peak current 10.0 mA
”’ Mean value (ON/OFF=8/20ms), peak current 15.0 mA when AGC2=1
^ Mean value (ON/OFF=6.6/20ms), peak current 68.0 mA
^^ Mean value (ON/OFF=6.6/20ms), peak current 39.0 mA

Regulators

Most of the RF voltage regulation functions are located in the regulator IC CCONT. It has 8 separate regulators with power on/off controls (see fig 2). Regulator VR6 is used only for the COBBA_D IC and the rest of the regulators VR1–VR7 are reserved for the RF blocks. VR7_bias controls the 800MHz PA bias to boost better efficiency in analog mode and at power levels 6 to 10 in digital mode. V5V voltage is used for the PLL charge pump supply. In dual band phone there is a need for 5 additional regulators, which are integrated in Penta regulator IC.

Receiver

DAMPS800 RX

The receiver is a double conversion receiver. Most of the RX functions are integrated in two ICs, namely receiver front end and EROTUS. Receiver front end contains a LNA and the 1st mixer. Analog and digital IF–parts are integrated in the EROTUS.

The received RF signal from the antenna is fed through a duplex filter to the receiver unit. The signal is amplified by a low noise preamplifier. In digital mode the gain of the amplifier is controlled by the AGC2 control line. The nominal gain of 15 – 20 dB is reduced in the strong signal condition about 14 – 19 dB (in digital mode). After the preamplifier the signal is filtered with a SAW RF filter. The filter rejects spurious signals coming from the antenna and spurious emissions coming from the mixer and IF parts.

The filtered RF–signal is downconverted by an active mixer. The frequency of the first IF is 116.19 MHz. The first local signal is generated in the UHF synthesizer. The IF signal is fed through a SAW IF–filter. The filter rejects intermodulating signals and the second IF image signal. The filtered 1st IF is fed to the receiver section of the integrated RF circuit EROTUS, which has separate IF paths for analog and digital modes of operation.

In digital mode the IF1 signal is amplified by an AGC amplifier, which has a gain control range of 57 dB. The gain is controlled by an analog signal with AGC1–line. The amplified IF signal is down converted to a second IF in the mixer of EROTUS. The second local signal is the 6th overtone of the 19.44 MHz VCTCXO. LO frequency multiplier is implemented in two stages. First multiplication by 3 is done with a EROTUS multiplier with an external trap and the second multiplication by 2 is done in the integrated doubler in EROTUS.

The second IF frequency is 450 kHz. The second IF is filtered by two ceramic filters. The filter rejects signals on the adjacent channels. The filtered second IF is fed back to EROTUS, where it is amplified and fed balanced out to COBBA_D via IF2D lines.

In analog mode the filtered and amplified IF1 signal is fed to a mixer. This mixer has been optimized for low current consumption. After this the mixer down converted signal is fed through the same IF2 filter as in digital mode and finally it is amplified in the limiter amplifier. The limited IF2 signal is fed via balanced IF2A lines to COBBA_D, which has a digital FM–detector. The limiter amplifier produces also a RSSI voltage for analog mode field strength indication.

TDMA 1900 RX

On 1900 MHz band the receiver operates only in digital mode. There is a separate front end for this band. IF–parts are common for both bands. Operation of the receiver is similar to digital mode operation on 800 MHz band.

Frequency Synthesizers

The stable frequency reference for the synthesizers and base band circuits is a voltage controlled temperature compensated crystal oscillator VCTCXO. Frequency of the oscillator is 19.44 MHz. It is controlled by an

AFC voltage, which is generated in the base band circuits. In digital mode operation, the receiver is locked to base station frequency by AFC. Next to detector diode, there is a sensor for temperature measurement. Voltage RFTEMP from this sensor is fed to baseband for A/D conversion. This information of the RF PA–block temperature is used as input for compensation algorithms.

The ON/OFF switching of the VCTCXO is controlled by the sleep clock in the baseband via RFCEN. Other parts of the synthesizer section are 1 GHz VCO, 2 GHz VCO, VHF VCO, PLL for 2 GHz VCO and PLL sections of the EROTUS IC.

DAMPS 800 operation

1GHz UHF synthesizer generates the down conversion injection for the receiver and the up conversion injection for the transmitter. UHF frequency is 985.20 ... 1010.16 MHz, depending on the channel which is used. 1GHz UHF VCO is a module. The PLL circuit is dual PLL, common for both UHF and VHF synthesizers. These PLLs are included in the EROTUS IC.

LO signal for the 2nd RX mixer is multiplied from the VCTCXO frequency as described above.

VHF synthesizer is running only on digital or analog traffic channel. 322.38 MHz signal (divided by 2 in EROTUS) is used as a LO signal in the I/Q modulator of the transmitter chain.

TDMA 1900 operation

2 GHz VCO with external PLL circuit generates 2046.24 ... 2106.18 MHz injection signals for 1st RX mixer and TX upconverter.

VHF synthesizer is running only on digital traffic channel. Operating frequency 392.46 MHz is fed to EROTUS modulator, where it is divided by 2 and used as modulator LO signal.

Transmitter

DAMPS800 TX

The TX intermediate frequency is modulated by an I/Q modulator contained in the transmitter section of EROTUS IC. The TX I and TXQ signals are generated in the COBBA_D interface circuit and they are fed differentially to the modulator.

Intermediate frequency level at the modulator output is controlled by power control.

The output signal from EROTUS modulator is filtered to reduce harmonics and RX–band noise. The final TX signal is achieved by mixing the UHF VCO signal and the modulated TX intermediate signal in an active

mixer. After the mixing TX signal is amplified by a driver stage. From driver stage the signal is fed trough the TX filter to PA MMIC.

The PA amplifies the TX signal by 28–32 dB. Amplified TX signal is filtered in the duplex filter. Then signal is fed to the antenna, where the maximum output level is typically 480 mW.

The power control loop controls the gain of the EROTUS gain control stage. The power detector consists of a directional coupler and a diode rectifier. The output voltage of the detector is compared to TXC voltage in EROTUS. The power control signal (TXC), comes from the RF interface circuit, COBBA_D. TXP signal sets driver power down to ensure off–burst level requirements.

False transmission indication is used to protect transmitter against false transmission caused by component failure. Protection circuit is in EROTUS. The level for TXF is set by internal resistor values in EROTUS.

TDMA1900 TX

See 800 MHz digital mode transmitter.

DAMPS800/TDMA1900 operation

Supply voltages in different modes of operation

	800 MHz Ext. Stadby	800 MHz Analog Control Channel	800 MHz Analog Traffic Channel	800 MHz Digital Control Channel	800 MHz Digital Traffic Channel	1900 MHz Digital Control Channel	1900 MHz Digital Traffic Channel
VR1	ON/OFF	ON	ON	ON/OFF	ON	ON/OFF	ON
VR2	ON/OFF	ON	ON	ON/OFF	ON	ON/OFF*	ON/OFF*
VR3	OFF	OFF	ON	OFF	ON	OFF	OFF
VR4	ON/OFF	ON	ON	ON/OFF	ON/OFF	ON/OFF	ON/OFF
VR5	OFF	OFF	ON	OFF	ON/OFF	OFF	ON/OFF
VR7	OFF	OFF	ON	OFF	ON/OFF	OFF	OFF
VR8	ON/OFF	ON	ON	ON/OFF	ON/OFF	OFF	OFF
VR9	OFF	OFF	OFF	OFF	OFF	ON/OFF	ON/OFF
VR10	OFF	OFF	OFF	ON/OFF*	ON/OFF*	ON	ON
VR11	OFF	OFF	OFF	OFF	OFF	OFF	ON/OFF
VR12	OFF	OFF	OFF	OFF	OFF	OFF	ON/OFF
V5V	ON/OFF	ON	ON	ON/OFF	ON	ON/OFF	ON
NOTE: *ON during interband MAHO							

Software Compensations

Power Levels (TXC) vs. Temperature

Because of wide temperature range, it is neccessary to compensate the effect of temperature on the output power. To monitor this environment

change, temperature measurement is done by using NTC resistor. A Factor table is used for temperature compensation. The table values are defined without factory measurements. Temperature is measured and right compensation value is added to TXC–value. Requirement for compensation update is for every 1 minutes or after every 5°C of temperature change. This means that the PL2 output power is reduced linearily 0.5dB when temperature inside the phone rises from +55°C to+80°C.

Power Levels (TXC) vs. Channel

Duplexer frequency response ripple is compensated by software. Power levels are calibrated on four channels in production. Values for channels between these tuned channels are calculated using linear interpolation.

Power levels vs. Battery Voltage

To extend battery duration in digital mode, the output power is decreased linearily from level 2 to –0.5 dB when battery voltage drops below 3.3V.

TX Power Up/Down Ramps

Transmitter output power up/down ramps are controlled by SW. A special ramp tables are used for that. Requirement is for nine different ramps in digital mode for both operating bands. Separate ramps are used in power up and power down ramps.

Modulator Output Level

Maximum Pout level values:

–20dBm for power levels 2...5
–24dBm for power level 6
–28dBm for power level 7
–20dBm for power levels 8...10

Digital Mode RSSI

Digital mode RSSI vs. input signal is calibrated in production, but RSSI vs. RSSI vs. channel are compensated by software.

RF Block Specifications

Receiver

DAMPS 800MHz RX Front End

Receiver front end is integrated in the IC. It has a RF low noise amplifier with a gain step and an active mixer. RX interstage filter is a SAW filter.

Parameter	Min	Typ/ Nom	Max	Unit
Gain, (LNA + filter + mixer)	19	21	24	dB
Gain, LNA gain disabled		4		dB
Gain step	14	17		dB
Supply Voltage	2.7	2.8	2.9	V
Supply Current (LNA + Mixer)		17	22	mA

TDMA 1900MHz RX Front End

Receiver front end is integrated in the IC. It has RF amplifier with a gain step and an active mixer. RX interstage filter is a dielectric filter.

Parameter	Min	Typ/ Nom	Max	Unit
Gain, (LNA + filter + mixer)	19	21	23	dB
Gain, LNA gain disabled		4		dB
Gain step	14	17		dB
Supply Voltage	2.7	2.8	2.9	V
Supply Current (LNA + Mixer)		28	33	mA

1st IF Amplifier

The 1st IF filter is a SAW filter. The function of the filter is to provide attenuation for the intermodulating signals

Analog IF parts

Analog mode IF–parts are included in EROTUS. Functional blocks: IF1 amplifier, a 2x–multiplier for LO signal, a mixer and a limiter amplifier with RSSI. Specifications for analog mode IF–parts are in table 5. IF2 filter is a double 450 kHz ceramic filter.

Parameter	Min	Typ/ Nom	Max	Unit
Supply voltage	2.7	2.8	2.9	V
IF1 amp + mixer current cons.		6.5	8	mA (+0.6 mA in d–mode)
6x freq. multipl. current cons.		1.8	2	mA
Limiter + RSSI current cons.		1.4	2.5	mA
Power up time			3.5	ms
RF input impedance single end	3.5	4//tbd	5	kohm//pF
RF input frequency range		116.19		MHz
Noise figure, IF1 amp + mixer			8	dB, RF = 116 MHz

Parameter	Min	Typ/ Nom	Max	Unit
Conversion gain @ Rl=1.5kohm	25		33	dB
Conversion gain variation			TBD	dB, temp -30...+85°C
3rd order input intercept point	20			mV_{rms}
Mixer output frequency range		450		kHz
Mixer out to limiter in isolation	70			dB, @ 450 kHz
Limiter input frequency		450		kHz
Limiter input limiting range	30			uV_{rms}
Limiter output voltage		0.3		V_{pp}
Limiter output resistive load	10			kΩ
Limiter output capacitive load			5	pF
RSSI dynamic range	65	70		dB
RSSI starting level @ LIMIN1	30		60	uVrms
RSSI voltage slope	5	10		mV/dB
RSSI voltage range	0.1		1.5	V
RSSI output capacitive load			50	pF
RSSI output resistive load	500			kΩ
Freq. multiplier input frequency		19.44		MHz
Input signal spurious levels	–10			dBc, (19.44 MHz spurs)
Input signal level	600		1000	mV_{pp}

Digital IF parts

The digital IF–parts of EROTUS comprise AGC Amplifer with 57 dB control range, a mixer and a buffer amplifier for the last IF.

Parameter	Min	Typ/ Nom	Max	Unit
Supply voltage	2.7	2.8	2.9	V
Current consumption		25.2	34.5	mA
RF input frequency range		116.19		MHz
Local frequency (6x19.44 MHz)		116.64		MHz
IF frequency		450		kHz
Max voltage gain, AGC + mixer	47			dB
Min voltage gain, AGC + mixer			–10	dB
Noise figure @ max gain			8	dB
Control voltage for min gain		0.7		V
Control voltage for max gain		1.4	1.45	V
AGC gain control slope	TBD	90	TBD	dB/V

Parameter	Min	Typ/ Nom	Max	Unit
Mixer output 1dB compr. point	0.8			V_{pp}
Gain of the last IF buffer	34	36	38	dB, single ended
Max IF2–buffer output level		1.4		V_{pp}
IF2–buffer output impedance			300	ohm, single ended

Transmitter

RF Characteristics of the transmitter:

Item	DAMPS	TDMA1900
TX frequency range	824.01...848.97 MHz	1850.01...1909.95 MHz
Type	Upconversion	
Intermediate frequency	161.19 MHz	196.23 MHz
Nominal power on highest power level	0.48W (≈26.8 dBm)	0.355W (≈25.5 dBm)
Power control range	65 dB	
Maximum rms error vector	12.5 %	

Synthesizers

Output levels

Parameter	Min	Typ/ Nom	Max	Unit
2G UHF synthesizer to Lo buffer				
level	–7			dBm
resistive load		tbd		Ω
parallel capacitance		tbd		pF
1G UHF synthesizer to TX mixer				
level	–2			dBm
impedance		tbd		Ω
VHF synthesizer to EROTUS				
level	100			mV_{pp}
resistive load	1k			Ω
parallel capacitance		tbd		pF
VCTCXO 19.44 MHz				
level	600			mV_{pp}
resistive load	1k			Ω
parallel capacitance			20	pF

Parameter	Min	Typ/ Nom	Max	Unit
VCTCXO 19.44 MHz to BB				
level	200			mV_{pp}
resistive load		10k		Ω
parallel capacitance		tbd		pF
VCTCXO				
3 * fo level	50		100	mV_{pp}
fo and 2xfo level	–25			dBc
harmonic supression	–25			dBc
resistive load		5k		Ω
parallel capacitance		tbd		pF

RF/BB interface signals

CCONT (baseband) control signals are included in table below. *These control signals are printed in italics.*

Signal name	From/ *Control*	To	Parameter	Min	Typ	Max	Unit	Function
VBAT	battery	RF 2V8 regul.	Voltage	3.1	3.6	5.3	V	Supply voltage for discrete 2V8 regulators in dual band phone
			Voltage during TX	3.0	3.6	5.0	V	
			Current			1200	mA	
VREF	CCONT	Erotus	Voltage	1.485	1.50	1.522	V	EROTUS reference voltage
			Current			10	uA	
VR1	CCONT / *RFCEN*	Erotus, VCTCXO, 2GHz PLL	Voltage	2.7	2.8	2.9	V	Supply for VCTCXO, and Erotus VHF prescaler, VCO and bias, 2 GHz PLL
			Current, tdma 800	3.0	7	9	mA	
			Current, tdma1900	3.0	17	19	mA	
VR2	CCONT / *SPWR1*	Erotus, UHF VCO1	Voltage	2.7	2.8	2.9	V	Supply voltage for tdma 800 UHF VCO and prescaler
			Current, tdma800	14	16	20	mA	
			Current, tdma1900		off		mA	
VR3	CCONT / *SPWR2 (via serial bus)*	VHF–VCO, LO–buff, TX mixer	Voltage	2.7	2.8	2.9	V	Supply for VHF VCO, LO buffer, tdma800 TX mixer and TXF
			Current, tdma800	20	24	30	mA	
			Current, tdma1900	4	9	12	mA	
VR4	CCONT / *RXPWR 1*	Erotus, VCTCXO IF1–amp	Voltage	2.7	2.8	2.9	V	Supply for Erotus IF–parts, IF1–amp., VCTCXO multiplier
			Current, anal.RX	10	12	15	mA	
			Current, digi.RX	30	32	34	mA	
VR5	CCONT / *TXPWR 1*	Erotus, TX pwr control	Voltage	2.7	2.8	2.9	V	Supply for Erotus modulator, TX pwr control
			Current, TX–mode	33	37	41	mA	
VR7	CCONT *TXP1*	TX PA	Voltage	2.7	2.88	2.95	V	TX PA bias and TX driver regulator enable
			Current, tdma800		55	60	mA	

Signal name	From/ *Control*	To	Parameter	Min	Typ	Max	Unit	Function
VR7_bias	CCONT / *VMODE*	RF 800MhZ PA bias control for analog mode	Logic high ”1”	tbd			V	800MHz PA bias voltage is increased to improve analog mode efficiency
V5V	CCONT / *RFCEN*	EROTUS	Voltage	4.8	5.0	5.2	V	Erotus and discrete synthesizer phase det
			Current		3.0	5.0	mA	
RFTEMP	RF	CCONT	Voltage	0		1.5	V	RF temperature sensor (47 k NTC to GND)
AFC	Cobba_D	VCTCXO	Voltage Min	0.05	1.2	2.25	V	Automatic frequency control signal for VCTCXO. When DAC is switched OFF AFC output is in high–Z mode
			Resolution		11		bits	
			Load resistance (dynamic)		10		kΩ	
			Load resistance (DC)		110		kΩ	
AGC1	Cobba_D	EROTUS	Voltage Min	0.7		1.40	V	Digital mode receiver gain control. DSP
			Load resistance	10			kΩ	
			Load capacitance			10	pF	
			Resolution		10		bits	
			Timing inaccuracy			8	us	
AGC2	MAD (CTID AGC2, genpio)	RX LNA	Logic high ”1”	2.0			V	LNA gain switch. Polarity: 0=reduced 1=normal DSP
			Logic low ”0”			0.5	V	
			Sink/source curr.		10	100	uA	
			Load capacitance			10	pF	
			Timing inaccuracy			8	us	
IF2AP/ IF2AN	EROTUS	Cobba_D	IF2 frequency		450		kHz	Differential IF2–signal from limiter to DEMO detector in Cobba_D
			Output level,		0.2		V_{pp}	
			Load resistance	10			kΩ	
			Load capacitance			5	pF	

Signal name	From/ *Control*	To	Parameter	Min	Typ	Max	Unit	Function
IF2DP/ IF2DN	ERO-TUS	Cobba_D	IF2 frequency		450		kHz	Differential IF2–signal to RX A/D–converter, PGA = 0 dB
			Output level		170	1400	mVpp	
			Source imp.			300	Ω	
RFC	VCTCXO	Cobba_D (via ERO-TUS	Frequency		19.44		MHz	High stability clock signal for the logic circuits
			Signal amplitude	0.2		1.0	Vpp	
			Load resistance	10			kΩ	
			Load capacitance			5	pF	
RFCEN	MAD (CTID, *RFCEN*)	CCONT, Cobba_D, RF block 2V8 regulator	Logic high ”1”	2.0			V	Supply voltage VR1 ON, RFC enable, RF block 2V8 regulator (PENTA) enable
			Logic low ”0”			0.5	V	Supply voltage VR1 OFF, RFC disable, RF block 2V8 regulator (PENTA) disable
			Current			100	uA	MCU, DSP
			timing inaccuracy			50	us	
RSSI	ERO-TUS	CCONT	Voltage	0.1		1.5	V	Analog mode field strength indicator voltage Digital mode
			Load resistance	0.5			MΩ	
			Load capacitance			50	pF	
RXPWR2	MAD (CTID, *DSP* FTC) MUX	RF block 2V8 regulator	Logic high ”1”	2.0			V	Supply voltage VR8 ON
			Logic low ”0”			0.5	V	Supply voltage VR8 OFF
			Current			100	uA	DSP
			timing inaccuracy			30	us	
RXPWR3	MAD (CTID, *DSP* FTC) MUX	RF block 2V8 regulator	Logic high ”1”	2.0			V	Supply voltage VR9 ON
			Logic low ”0”			0.5	V	Supply voltage VR9 OFF
			Current			100	uA	DSP
			timing inaccuracy			30	us	

Signal name	From/ *Control*	To	Parameter	Min	Typ	Max	Unit	Function
SCLK	MAD (SCU, *SCLK*)	EROTUS, UHF PLL tdma1900	Logic high ”1”	2			V	Synthesizer and control clock
			Logic low ”0”			0.8	V	
			Load resistance	50			kΩ	
			Load capacitance			20	pF	
			Data rate freq.		1.62		MHz	
SDATA	MAD (SCU, *SDATA*)	EROTUS, UHF PLL tdma1900	Logic high ”1”	2.0			V	Synthesizer and control data
			Logic low ”0”			0.8	V	
			Load resistance	50			kΩ	
			Load capacitance			20	pF	
			Timing accuracy			20	us	
SENA1	MAD (SCU, *SENA1*)	EROTUS	Logic high ”1”	2.0			V	Synthesizer and Erotus control enable
			Logic low ”0”			0.8	V	
			Load resistance	50			kΩ	
			Load capacitance			20	pF	
SENA2	MAD (SCU, *SENA2*)	UHF PLL tdma1900	Logic high ”1”	2.0			V	TDMA1900 UHF synthesizer enable
			Logic low ”0”			0.8	V	
			Load resistance	50			kΩ	
			Load capacitance			20	pF	
SPWR3	Cob-ba_D	RF 2v8 regul.	Logic high ”1”	2.0			V	Supply voltage VR10 ON
			Logic low ”0”			0.5	V	Supply voltage VR10 OFF
			Current			100	uA	DSP
			timing inaccuracy			200	us	
TXA	MAD (MFI, *TXA*)	EROTUS	Logic high ”1”	2.0			V	Power control loop mode during tx burst
			Logic low ”0”			0.5	V	Power control loop mode during ramp up/down
			Load resistance	10			kΩ	DSP
			Load capacitance			20	pF	
			Timing inaccuracy			10	us	
TXC	Cob-ba_D	EROTUS	Voltage Min value Max value	0.12 2.27	0.15 2.30	0.18 2.33	V	Makes transmitter power ramps and sets transmitter power level
			Load resistance	10			kΩ	
			Load capacitance			10	pF	
			Number of bits		10			
TXF	ERO-TUS	MAD	Logic high ”1”	2.0		3.0	V	False transmission indicator, function controlled via Erotus register
			Logic low ”0”	0		0.5	V	
			Load capacitance			10	pF	

Signal name	From/ *Control*	To	Parameter	Min	Typ	Max	Unit	Function
TXIP/ TXIN	Cob-ba_D	EROTUS	Differential voltage swing		0.62	0.82	V_{pp}	Differential in–phase TX baseband signal for the RF modulator.
			Common mode v. (digital mode)		0.8		V	
			Load resistance (differential)	10			MΩ	
TXQP/ TXQN	Cob-ba_D	EROTUS	Differential voltage swing		0.62	0.82	V_{pp}	Differential quadrature phase TX baseband signal for the RF modulator.
			Common mode v. (digital mode)		0.8		V	
			Load resistance (differential)	10			MΩ	
TXLX1	MAD (CTID, *TXLX*)	RF tdma800	Logic high ”1”	2.1			V	High power level mode for power detector
			Logic low ”0”	0		0.6	V	Low power level mode for power detector
			Sink/source curr.			8.0	mA	Timing tied to TXPWR1
			Load capacitance			10	pF	
			Timing inaccuracy			8	us	DSP
TXLX2	MAD *(TXLX2, DSPGen-Pio(6))*	RF tdma1900	Logic high ”1”	2.1			V	High power level mode for power detector
			Logic low ”0”	0		0.6	V	Low power level mode for power detector
			Sink/source curr.			8.0	mA	Timing tied to TXPWR1
			Load capacitance			10	pF	
			Timing inaccuracy			8	us	DSP
TXP2	MAD (MFI, *TXP*)	Penta reg, TX driver, TX PA, in tdma1900 mode	Logic high ”1”	2.0			V	Supply voltage VR11 ON
			Logic low ”0”			0.5	V	Supply voltage VR11 OFF
			Current			100	uA	
			Load capacitance			10	pF	
			Timing inaccuracy			10	us	DSP

Signal name	From/ *Control*	To	Parameter	Min	Typ	Max	Unit	Function
TXPWR1	MAD (CTID, *TXPWR 1*)	CCONT, EROTUS	Logic high ”1”	2.0			V	Supply voltage VR5 ON, TX power control enable
			Logic low ”0”			0.5	V	Supply voltage VR5 OFF, TX power control disable
			Current			50	uA	
			Timing inaccuracy			8	us	DSP
TXPWR2	MAD (CTID, *BENA*)	RF 2v8 regul.	Logic high ”1”	2.0			V	Supply voltage VR12 ON
			Logic low ”0”			0.5	V	Supply voltage VR12 OFF
			Current			50	uA	
			Timing inaccuracy			8	us	DSP
TXPWR3	MAD (gen-pio5)	RF 800MHz tx mixer enable	Logic high ”1”	2.0			V	Mixer enabled
			Logic low ”0”			0.5	V	Mixer disabled
			Current			2	mA	
			Timing inaccuracy			8	us	DSP

Parts Lists

Engine Module UT5U (0201142)

(EDMS V 13.1)

ITEM	CODE	DESCRIPTION	VALUE	TYPE
R100	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R101	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R150	1620019	Res network 0w06 2x10k j		0404
R152	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R153	1419007	Chip resistor	0.22	0.5W 1210
R154	1430826	Chip resistor	680 k	5 % 0.063 W 0402
R155	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R156	1430710	Chip resistor	22	5 % 0.063 W 0402
R159	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R161	1620025	Res network 0w06 2x100k j		0404
R163	1620019	Res network 0w06 2x10k j	0404	0404
R164	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R165	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R166	1825005	Chip varistor vwm14v vc30v	0805	0805
R167	1430325	Chip resistor	2.2 M	5 % 0.063 W 0603
R169	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R200	1620025	Res network 0w06 2x100k j	0404	0404
R201	1620025	Res network 0w06 2x100k j	0404	0404
R205	1620031	Res network 0w06 2x1k0 j	0404	0404
R208	1430744	Chip resistor	470	5 % 0.063 W 0402
R209	1430812	Chip resistor	220 k	5 % 0.063 W 0402
R210	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R211	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R212	1430796	Chip resistor	47 k	5 % 0.063 W 0402
R250	1430812	Chip resistor	220 k	5 % 0.063 W 0402
R251	1620103	Res network 0w06 2x22r j	0404	0404
R252	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R256	1620025	Res network 0w06 2x100k j	0404	0404
R258	1430718	Chip resistor	47	5 % 0.063 W 0402
R259	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R260	1620023	Res network 0w06 2x47k j	0404	0404
R261	1430742	Chip resistor	390	5 % 0.063 W 0402
R264	1430718	Chip resistor	47	5 % 0.063 W 0402
R265	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R266	1620105	Res network 0w06 2x2k2 j	0404	0404
R268	1430812	Chip resistor	220 k	5 % 0.063 W 0402
R270	1430812	Chip resistor	220 k	5 % 0.063 W 0402
R273	1430826	Chip resistor	680 k	5 % 0.063 W 0402
R274	1430830	Chip resistor	1.0 M	5 % 0.063 W 0402
R275	1620031	Res network 0w06 2x1k0 j	0404	0404
R307	1430732	Chip resistor	180	5 % 0.063 W 0402

R308	1430732	Chip resistor	180	5 % 0.063 W 0402
R309	1620101	Res network 0w06 2x470r j	0404	0404
R311	1430732	Chip resistor	180	5 % 0.063 W 0402
R312	1430744	Chip resistor	470	5 % 0.063 W 0402
R313	1620019	Res network 0w06 2x10k j	0404	0404
R314	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R315	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R316	1620031	Res network 0w06 2x1k0 j	0404	0404
R317	1620031	Res network 0w06 2x1k0 j	0404	0404
R318	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R320	1620031	Res network 0w06 2x1k0 j	0404	0404
R322	1620031	Res network 0w06 2x1k0 j	0404	0404
R350	1620117	Res network 0w06 2x5r6 j	0404	0404
R352	1620117	Res network 0w06 2x5r6 j	0404	0404
R354	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R355	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R357	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R358	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R702	1430700	Chip resistor	10	5 % 0.063 W 0402
R709	1430788	Chip resistor	22 k	5 % 0.063 W 0402
R721	1430718	Chip resistor	47	5 % 0.063 W 0402
R725	1430710	Chip resistor	22	5 % 0.063 W 0402
R744	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R751	1430790	Chip resistor	27 k	5 % 0.063 W 0402
R752	1430744	Chip resistor	470	5 % 0.063 W 0402
R756	1430790	Chip resistor	27 k	5 % 0.063 W 0402
R758	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R760	1620047	Res network 0w03 4x4k7 j	0804	0804
R761	1430830	Chip resistor	1.0 M	5 % 0.063 W 0402
R762	1430851	Chip resistor	15 k	2 % 0.063 W 0402
R763	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R764	1430744	Chip resistor	470	5 % 0.063 W 0402
R765	1430744	Chip resistor	470	5 % 0.063 W 0402
R767	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R768	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R770	1430700	Chip resistor	10	5 % 0.063 W 0402
R771	1430700	Chip resistor	10	5 % 0.063 W 0402
R774	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R775	1430804	Chip resistor	100 k	5 % 0.063 W 0402
R779	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R781	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R782	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R788	1430744	Chip resistor	470	5 % 0.063 W 0402
R789	1430744	Chip resistor	470	5 % 0.063 W 0402
R795	1430726	Chip resistor	100	5 % 0.063 W 0402
R796	1430700	Chip resistor	10	5 % 0.063 W 0402
R798	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R822	1430700	Chip resistor	10	5 % 0.063 W 0402

R830	1430792	Chip resistor	33 k	5 % 0.063 W 0402
R831	1430726	Chip resistor	100	5 % 0.063 W 0402
R832	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R833	1430726	Chip resistor	100	5 % 0.063 W 0402
R850	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R851	1430700	Chip resistor	10	5 % 0.063 W 0402
R860	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R861	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R862	1430726	Chip resistor	100	5 % 0.063 W 0402
R863	1430718	Chip resistor	47	5 % 0.063 W 0402
R864	1430700	Chip resistor	10	5 % 0.063 W 0402
R865	1430700	Chip resistor	10	5 % 0.063 W 0402
R880	1430700	Chip resistor	10	5 % 0.063 W 0402
R881	1430700	Chip resistor	10	5 % 0.063 W 0402
R883	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R884	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R886	1430772	Chip resistor	5.6 k	5 % 0.063 W 0402
R893	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R901	1430718	Chip resistor	47	5 % 0.063 W 0402
R903	1430762	Chip resistor	2.2 k	5 % 0.063 W 0402
R904	1430758	Chip resistor	1.5 k	5 % 0.063 W 0402
R905	1430740	Chip resistor	330	5 % 0.063 W 0402
R911	1430726	Chip resistor	100	5 % 0.063 W 0402
R912	1430718	Chip resistor	47	5 % 0.063 W 0402
R928	1430732	Chip resistor	180	5 % 0.063 W 0402
R929	1430700	Chip resistor	10	5 % 0.063 W 0402
R933	1430718	Chip resistor	47	5 % 0.063 W 0402
R934	1620101	Res network 0w06 2x470r j	0404	0404
R936	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R937	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R938	1430778	Chip resistor	10 k	5 % 0.063 W 0402
R939	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R940	1800659	NTC resistor	47 k	10 % 0.12 W 0805
R941	1430718	Chip resistor	47	5 % 0.063 W 0402
R942	1430764	Chip resistor	3.3 k	5 % 0.063 W 0402
R943	1430744	Chip resistor	470	5 % 0.063 W 0402
R944	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R945	1430754	Chip resistor	1.0 k	5 % 0.063 W 0402
R960	1430770	Chip resistor	4.7 k	5 % 0.063 W 0402
R980	1430740	Chip resistor	330	5 % 0.063 W 0402
R984	1430730	Chip resistor	150	5 % 0.063 W 0402
C100	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C101	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C151	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C153	2320586	Ceramic cap.	1.2 n	5 % 50 V 0402
C154	2320544	Ceramic cap.	22 p	5 % 50 V 0402
C155	2320530	Ceramic cap.	5.6 p	0.25 % 50 V 0402
C156	2320508	Ceramic cap.	1.0 p	0.25 % 50 V 0402

C157	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C158	2320481	Ceramic cap.	5R 1 u	10 % 0603
C159	2320481	Ceramic cap.	5R 1 u	10 % 0603
C160	2320481	Ceramic cap.	5R 1 u	10 % 0603
C161	2320481	Ceramic cap.	5R 1 u	10 % 0603
C162	2320481	Ceramic cap.	5R 1 u	10 % 0603
C163	2320481	Ceramic cap.	5R 1 u	10 % 0603
C164	2320481	Ceramic cap.	5R 1 u	10 % 0603
C166	2320481	Ceramic cap.	5R 1 u	10 % 0603
C169	2320481	Ceramic cap.	5R 1 u	10 % 0603
C170	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C171	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C172	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C173	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C174	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C175	2310793	Ceramic cap.	2.2 u	10 % 10 V 0805
C176	2320481	Ceramic cap.	5R 1 u	10 % 0603
C177	2611727	Tantalum cap.	15 u	20 % 10 V
3.2x1.6x1.6				
C179	2308792	Ceramic cap.	33 n	10 % 50 V 0805
C180	2320481	Ceramic cap.	5R 1 u	10 % 0603
C181	2320783	Ceramic cap.	33 n	10 % 10 V 0402
C182	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C183	2611727	Tantalum cap.	15 u	20 % 10 V
3.2x1.6x1.6				
C185	2611727	Tantalum cap.	15 u	20 % 10 V
3.2x1.6x1.6				
C187	2320481	Ceramic cap.	5R 1 u	10 % 0603
C188	2610003	Tantalum cap.	10 u	20 % 10 V
3.2x1.6x1.6				
C200	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C201	2320481	Ceramic cap.	5R 1 u	10 % 0603
C202	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C203	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C207	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C210	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C214	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C216	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C217	2320481	Ceramic cap.	5R 1 u	10 % 0603
C218	2320481	Ceramic cap.	5R 1 u	10 % 0603
C219	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C220	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C221	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C225	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C250	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C251	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C252	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C256	2320783	Ceramic cap.	33 n	10 % 10 V 0402

C257	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C258	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C259	2310793	Ceramic cap.	2.2 u	10 % 10 V 0805
C260	2310793	Ceramic cap.	2.2 u	10 % 10 V 0805
C261	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C262	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C263	2320783	Ceramic cap.	33 n	10 % 10 V 0402
C264	2320783	Ceramic cap.	33 n	10 % 10 V 0402
C265	2320783	Ceramic cap.	33 n	10 % 10 V 0402
C266	2320783	Ceramic cap.	33 n	10 % 10 V 0402
C267	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C270	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C271	2320783	Ceramic cap.	33 n	10 % 10 V 0402
C272	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C273	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C274	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C275	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C276	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C277	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C278	2320783	Ceramic cap.	33 n	10 % 10 V 0402
C279	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C280	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C283	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C285	2320783	Ceramic cap.	33 n	10 % 10 V 0402
C286	2320481	Ceramic cap.	5R 1 u	10 % 0603
C300	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C301	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C302	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C304	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C305	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C306	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C307	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C350	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C352	2320805	Ceramic cap.	100 n	10 % 10 V 0402
C353	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C355	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C357	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C702	2320526	Ceramic cap.	3.9 p	0.25 % 50 V 0402
C703	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C705	2320592	Ceramic cap.	2.2 n	5 % 50 V 0402
C706	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C707	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402
C708	2320524	Ceramic cap.	3.3 p	0.25 % 50 V 0402
C709	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C710	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C713	2320633	Ceramic cap.	220 p	5 % 25 V 0402
C715	2320604	Ceramic cap.	18 p	5 % 50 V 0402
C716	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402

C717	2320540	Ceramic cap.	15 p	5 % 50 V 0402
C719	2320760	Ceramic cap.	4.7 n	10 % 25 V 0402
C720	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C721	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C725	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C726	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C729	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C733	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C734	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C735	2320524	Ceramic cap.	3.3 p	0.25 % 50 V 0402
C736	2320524	Ceramic cap.	3.3 p	0.25 % 50 V 0402
C739	2320520	Ceramic cap.	2.2 p	0.25 % 50 V 0402
C742	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C743	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C744	2320514	Ceramic cap.	1.2 p	0.25 % 50 V 0402
C745	2320617	Ceramic cap.	30 p	2 % 50 V 0402
C746	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C748	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C749	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C750	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C751	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C755	2320728	Ceramic cap.	220 p	10 % 50 V 0402
C756	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C757	2320576	Ceramic cap.	470 p	5 % 50 V 0402
C758	2320576	Ceramic cap.	470 p	5 % 50 V 0402
C759	2320131	Ceramic cap.	33 n	10 % 16 V 0603
C760	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C761	2320760	Ceramic cap.	4.7 n	10 % 25 V 0402
C762	2320760	Ceramic cap.	4.7 n	10 % 25 V 0402
C763	2320760	Ceramic cap.	4.7 n	10 % 25 V 0402
C764	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C765	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C766	2320592	Ceramic cap.	2.2 n	5 % 50 V 0402
C767	2320760	Ceramic cap.	4.7 n	10 % 25 V 0402
C768	2320760	Ceramic cap.	4.7 n	10 % 25 V 0402
C769	2320760	Ceramic cap.	4.7 n	10 % 25 V 0402
C770	2320760	Ceramic cap.	4.7 n	10 % 25 V 0402
C772	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C773	2320760	Ceramic cap.	4.7 n	10 % 25 V 0402
C779	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C780	2320586	Ceramic cap.	1.2 n	5 % 50 V 0402
C781	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C782	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C783	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C784	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C785	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C786	2320576	Ceramic cap.	470 p	5 % 50 V 0402
C787	2320576	Ceramic cap.	470 p	5 % 50 V 0402

C788	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C789	2320592	Ceramic cap.	2.2 n	5 % 50 V 0402
C790	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C791	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C792	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C793	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C794	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C795	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C796	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C797	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C798	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C821	2320524	Ceramic cap.	3.3 p	0.25 % 50 V 0402
C822	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C824	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C825	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C830	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C831	2310248	Ceramic cap.	4.7 n	5 % 50 V 1206
C833	2320564	Ceramic cap.	150 p	5 % 50 V 0402
C834	2320564	Ceramic cap.	150 p	5 % 50 V 0402
C850	2320779	Ceramic cap.	100 n	10 % 16 V 0603
C851	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C855	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C860	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C861	2420017	Ceramic cap.	18 n	5 % 16 V 1206
C864	2320564	Ceramic cap.	150 p	5 % 50 V 0402
C865	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C866	2320564	Ceramic cap.	150 p	5 % 50 V 0402
C867	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C868	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C881	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C882	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C883	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C885	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C886	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C887	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C891	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C898	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C901	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C903	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C907	2320602	Ceramic cap.	4.7 p	0.25 % 50 V 0402
C908	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C909	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C910	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C913	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C914	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C916	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C918	2312401	Ceramic cap.	1.0 u	10 % 10 V 0805
C921	2320546	Ceramic cap.	27 p	5 % 50 V 0402

C923	2320941	Ceramic cap.		10 V 0402
C924	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C925	2320524	Ceramic cap.	3.3 p	0.25 % 50 V 0402
C927	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C928	2320524	Ceramic cap.	3.3 p	0.25 % 50 V 0402
C931	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C932	2320501	Ceramic cap.		50 V 0402
C934	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C937	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C938	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C939	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C941	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C943	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C949	2320522	Ceramic cap.	2.7 p	0.25 % 50 V 0402
C954	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C955	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C961	2320536	Ceramic cap.	10 p	5 % 50 V 0402
C962	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C963	2320778	Ceramic cap.	10 n	10 % 16 V 0402
C965	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C966	2320744	Ceramic cap.	1.0 n	10 % 50 V 0402
C968	2320921	Ceramic cap.	3.9 p	5 % 16 V 0402
C969	2320552	Ceramic cap.	47 p	5 % 50 V 0402
C970	2320530	Ceramic cap.	5.6 p	0.25 % 50 V 0402
C972	2320131	Ceramic cap.	33 n	10 % 16 V 0603
C981	2320530	Ceramic cap.	5.6 p	0.25 % 50 V 0402
C982	2320560	Ceramic cap.	100 p	5 % 50 V 0402
C984	2320540	Ceramic cap.	15 p	5 % 50 V 0402
C992	2320546	Ceramic cap.	27 p	5 % 50 V 0402
C999	2320903	Ceramic cap.	2.7 p	5 % 16 V 0402
L150	3203735	Ferrite bead 30r/100mhz	0805	0805
L701	3643007	Chip coil	18 n	5 % Q=30/250 MHz
0805				
L702	3645063	Chip coil	270 n	5 % Q=48/250 MHz
0805				
L703	3640045	Chip coil	10.Q n	5 % Q=55/750 MHz
0805				
L705	3641622	Chip coil	220 n	5 % Q=30/100 MHz
0805				
L721	3641521	Chip coil	6. Q n	5 % Q=50/250 MHz
0805				
L723	3645147	Chip coil	100 n	5 % Q=12/100 MHz
0603				
L724	3608407	Chip coil	470 n	5 % 1206
L740	3645231	Chip coil	39.Q n	5 % Q=40/250 MHz
0603				
L741	3641620	Chip coil	180 n	5 % Q=35/100 MHz
0805				

L745	3645145	Chip coil	39.Q n	5 % Q=12/100 MHz
0603				
L747	3645145	Chip coil	39.Q n	5 % Q=12/100 MHz
0603				
L750	3641421	Chip coil	100 u	5 % Q=15/0.796M
1008				
L761	3645029	Chip coil	1. Q u	10 % Q=45/10 MHz
0805				
L762	3641626	Chip coil	220 n	2 % Q=50/250 MHz
0805				
L868	3641421	Chip coil	100 u	5 % Q=15/0.796M
1008				
L901	3645147	Chip coil	100 n	5 % Q=12/100 MHz
0603				
L902	3645145	Chip coil	39.Q n	5 % Q=12/100 MHz
0603				
L904	3645145	Chip coil	39.Q n	5 % Q=12/100 MHz
0603				
L905	3645147	Chip coil	100 n	5 % Q=12/100 MHz
0603				
L906	3643001	Chip coil	10 n	5 % Q=30/250 MHz
0805				
L911	3640081	Dir.coupler 836.5+–12.5mhz	1206	1206
L930	3645129	Chip coil	18.Q n	5 % Q=8/100M 0603
L931	3645145	Chip coil	39.Q n	5 % Q=12/100 MHz
0603				
L940	3645129	Chip coil	18.Q n	5 % Q=8/100M 0603
L941	3645117	Chip coil	5.–0 n	Q=8/100M 0603
L951	3643011	Chip coil	22 n	5 % Q=40/250 MHz
0805				
L960	3645155	Chip coil	2.–0 n	Q=32/800M 0603
L961	3645145	Chip coil	39.Q n	5 % Q=12/100 MHz
0603				
L962	3645145	Chip coil	39.Q n	5 % Q=12/100 MHz
0603				
L964	3643001	Chip coil	10 n	5 % Q=30/250 MHz
0805				
L965	3646001	Chip coil	3.–0 n	Q=7/100M 0402
L966	4551003	Dir.coupler 1880+–30mhz 1		4DB
L975	3645147	Chip coil	100 n	5 % Q=12/100 MHz
0603				
L977	3641572	Chip coil	22.Q n	5 % Q=45/250 MHz
0805				
L978	3645155	Chip coil	2.–0 n	Q=32/800M 0603
L980	3645145	Chip coil	39.Q n	5 % Q=12/100 MHz
0603				
B150	4510243	Crystal	32.768 k	+–20PPM 12.5PF
G820	4350185	Vco 985.2–1010.2mhz 2.8v		tdma

G850	4510249	VCTCXO 19.44 M +–2.5PPM 2.8V		TDMA
G860	4350187	Vco 2046.2–2106.2mhz 2.8v		TDMA
F150	5119019	SM, fuse f 1.5a 32v		0603
Z100	3640085	Filt 470nf 16v 0r03 2a		0805
Z250	3640035	Filt z>450r/100m 0r7max 0.2a		0603
Z251	3640035	Filt z>450r/100m 0r7max 0.2a		0603
Z252	3640035	Filt z>450r/100m 0r7max 0.2a		0603
Z701	4511125	Saw filter 881.5+–12.5 M/4DB		3X3
Z726	4511113	Saw filter 1960+–30 M/5DB		3X3
Z741	4511011	Saw filter 116.19+–0.015 M		9.3X5
Z750	4550085	Cer.filt 450+–11.5khz/8db		6.7x5.7
Z751	4550081	Cer.filt 450+–11.5khz/8db		6.7x5.7
Z900	4511031	Saw filter 161.2/196.2 M		5X5
Z901	4511123	Saw filter 836.5+–12.5 M		/3.8DB 3X3
Z910	4512091	Dupl 824–849/869–894mhz		9.5x7.5
Z950	4511023	Saw filter 1880+–30 M		/4.2DB 3X3
Z960	4512103	Dupl 1850–1910/1930–1990mhz		17x8
Z970	4550065	Dipl 824–894/1850–1990mhz		3.2x1.6
Z975	4511023	Saw filter 1880+–30 M		/4.2DB 3X3
Z988	3640085	Filt 470nf 16v 0r03 2a		0805
V150	4210205	Transistor		SOT23
V151	4110067	Schottky diode	MBR0520L	20 V 0.5 A SOD123
V200	4113611	Emifilt/tvs emif01–10005w5		SOT353
V201	4113611	Emifilt/tvs emif01–10005w5		SOT353
V250	4210119	Transistor	BC849CW	npn 30 V 0.1 A SOT323
V251	4211621	MosFet		SOT363
V252	4113611	Emifilt/tvs emif01–10005w5		SOT353
V253	4113671	Tvs quad 6v1 esda6v1w5		SOT323–5
V254	4210052	Transistor	DTC114EE	npn RB V EM3
V255	4211641	MosFet		SOT363
V256	4211641	MosFet		SOT363
V300	4110601	Diode	FAST	SOD323
V302	4860005	Led	Green	0603
V303	4860005	Led	Green	0603
V304	4860005	Led	Green	0603
V305	4860005	Led	Green	0603
V306	4860005	Led	Green	0603
V307	4860005	Led	Green	0603
V350	4210052	Transistor	DTC114EE	npn RB V EM3
V351	4210102	Transistor	BC858W	pnp 30 V 100 mA 200MWSOT323
V723	4110911	Cap. diode	MA2SV01	1/3 V SOD523
V901	4210043	Transistor	DTC143ZE	npn RB V EM3
V902	4210043	Transistor	DTC143ZE	npn RB V EM3
V929	4110055	Sch. diode x 2	BAT17–07	4 V SOT143
V930	4110055	Sch. diode x 2	BAT17–07	4 V SOT143
V932	4112469	Pindix2 bar64–07 200v 0.1a		SOT143

D100	4340761	IC, MCU	MC33464N	SOT23–5
D200	4340601	IC, SRAM		CSP48
D201	4340597	IC, flash mem.		UBGA48
D202	4370619	Mad1 v20 rom7 f731575 c07		UBGA144
D203	4340845	1xinverter 1.8v–5.5v(7sz04)		sc70–5
D350	4340369	IC, dual bus buffer sso	TC7W126FU	SSOP8
N150	4370719	Ccont 2m wfd163mg64t/8		lfbga8x8
N151	4370621	Chaps v2.0 u423v20g36t		lbga6x6
N250	4370603	Cobba_d b06 twl91302ggv		UBGA64
N300	4370433	Uiswitch sttm23av20t		TSSOP20
N350	4860031	Tfdu4100 irda tx/rx>2.7v 115kbits		115KBITS
N701	4370063	Sc3918 tdma rec 869–894mhz		QSOP16
N702	4340247	IC, regulator	MC33765	2.8 V TSSOP16
N721	4370065	Sc3919 tdma rec 1930–1990		QSOP16
N750	4370183	Erotus wfd170ct64t		tqfp64
N770	4340233	Mrfic0916 rf amp 2500mhz		SOT143
N880	4340237	IC, PLL	UMA1021M	SSOP20
N900	4340171	IC, upconv 1.9ghz 3v so	uPC8106T	SO6S
N902	4340577	IC, RF amp.	21DB/900MHZ	SMM6
N903	4370311	Rf9103p1 pw amp		824–849 mhz
N951	4340577	IC, RF amp.	21DB/900MHZ	SMM6
N960	4370313	Rf9111p1 pw amp 1850–1910mhz		
N980	4340381	Mrfic1813 upconvgaas 1.9g		TSSOP16
S318	5409077	SM, push button sw spst 15v 20ma		
X100	5469061	SM, system conn 6af+3dc+mic+jack		
X104	5469069	SM, batt conn 2pol spr p3.5		100V2A
X105	5469069	SM, batt conn 2pol spr p3.5		100V2A
X991	5429007	SM, coax conn	m sw	50r 0.4–2ghz
A801	9517029	Shield assembly		dmc01832
A802	9517030	Shield assy		dmc01833
A803	9517029	Shield assembly		dmc01832
	9380753	Bar code label 27x6.5		dmd03311
	9854264	PCB UT5 40.5X118.5X1.1 M8 4/PA		

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PAMS Technical Documentation
NSW-5 Series Transceivers

Product Variants

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue 1	**10/00**	OJuntune	

CONTENTS

Page No

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Variants of NSW–5

Foreword

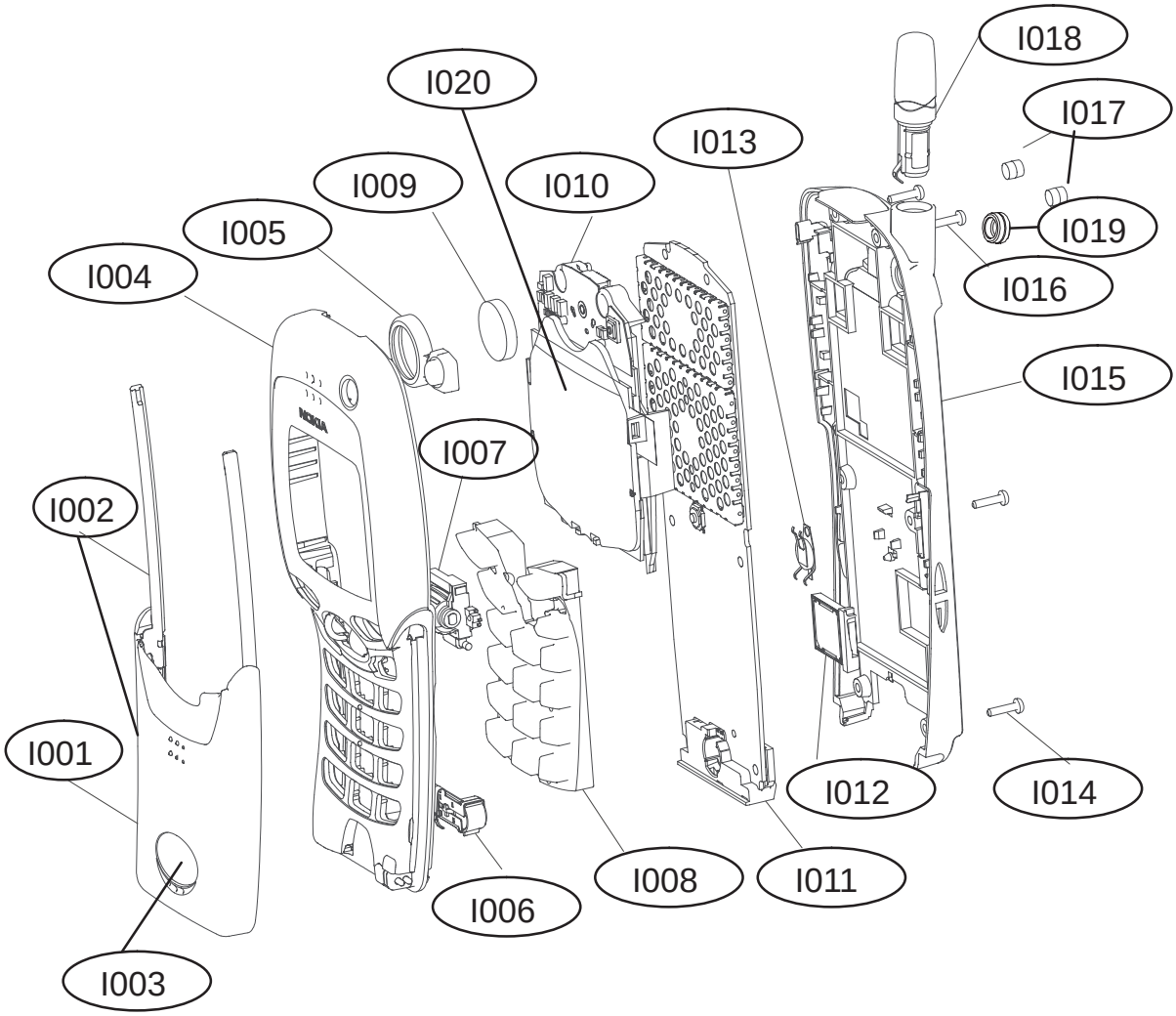
This section of the service manual (Appendix) contains specific details for the NSW-5 handportable telephone.

NOTE: The Service Manual is intended for use by qualified service personnel only.

Modules

Name of module	Type des.	Material code	Material code
Basic transceiver	NSW–5	0501659	
–System/RF module	UT5U	0201142	
– Software module (Basic SW)			0240823
– Mechanics assembly parts	MNSW5	0261711	

Exploded View of Transceiver NSW–5



Assembly Parts of NSW-5NX

ITEM	Q'TY	CODE	DESCRIPTION	VALUE, TYPE
I001		9497058	Slide cover assembly	
I002		9497009	Slide assembly	DMC01314
I003		(varia)	Logo label	
I004		9451486	A–cover assembly	DMC01461
I005		9790342	Power Keymat/Speaker gasket	DMC01487
I006		5200017	Slide sensor switch	DMC01259
I007		5200013	Roller key assembly	10v 1ma
I008		9794014	Keymat module	DMC01847
I009		5140067	Speaker + spring	103+–3DB
I010		9480401	Display assembly	DMC01299
I010		0201142	Radio module	UT5U
I012		5140123	Buzzer with gasket	100dB
I013		4700089	RTC battery polyacene	2.3 mAh 3.3V
I014	4	6290073	Screw M1.8x8 T6 remf. blk	dmd03671
I015		9456335	B–cover assembly	DMC01835
I016	2	6290079	Screw M1.8x11 T6	dmd04746
I017		9460299	Elastic plug	DMD04645
I018		0660198	Antenna fxd	824–894/1850–1990mhz
I019		9451139	Dust Cap	DMD02859
I020		9456920	Window assembly	

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PAMS Technical Documentation
NSW-5 Series Transceivers

Service Software Instructions

Issue 1 10/00

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue 1	**10/00**	OJuntune	

CONTENTS

Service Software

General

To run the After Sales SW, a parallel port software protection device (PKD-1) has to be connected. TDF-4 box must connected to PC for flashing purposes. The user can use PC-locals functions in modules for testing NSW-5 mobile stations (MS). The test functions send test messages from PC to MS and receive results and show them in the PC display. The messages can be sent via M2BUS or FBUS.

Note: if this software is to be run on laptops, the power saving feature MUST be switched off.

Hardware requirements for Windows 3.1x

The recommended minimum hardware standard to run Service Software is any computer which is 386 33 MHz or greater with at least 4 MB of memory and VGA type display (640 x 480). This assumes that only the WinTesla with After Sales Support Modules is active, i.e. other Windows packages are not running in the background.

Hardware requirements for Windows 95

The recommended minimum hardware standard to run Service Software is any computer which has Pentium processor, memory 8 MB and meets HW requirements recommended by Microsoft.

Software Environment of the Support Modules

The Service Software user interface is intended for the following environments: Microsoft Windows 3.1x (enhanced mode) and Windows 95environment running in enhanced mode. Support for Microsoft NT may be added, if required. Detailed information about Windows and application usage can be found from the Microsoft Windows Version 3.1 Users Guide chapter one (Windows Basics) and chapter two (Application Basics).

As an ordinary Windows application, the main idea in the user interface is that selections are made with menus, push buttons and shortcut keys. Selections can be done by using keyboard and/or mouse. There is always a status bar displayed at the bottom of the main window which contains information about current actions.

Required Servicing Equipment

- Computer: At least IBM 80386 or compatible with one unused serial port (COM1 or COM2) *), one parallel port (LPT1), hard disk recommended
- Operating System: DOS Version 3.2 or later
- If PCLStart in use: DOS 6.22 and IBM 80486 or compatible
- Display: VGA type display (640 x 480)
- Service software on 3.5” disk (product code: 0775229)
- Software protection key PKD–1 (product code: 0750018)
- Service MBUS Cable DAU–9P (product code: 0730109)
- Audio cable ADS–1 (product code: 0730011)
- External Antenna Cable XRC–2 (product code 0730180)
- Modular T–adapter (product code: 4626134)

*) Note: A number of PC’s of an older generation use the Intel, National Semiconductor, or United Microelectronics IC 8250 as the serial port UART. This is a comparatively inefficient circuit for current purposes and does not necessarily support the M2BUS adapter at 9600 baud. The newer UART’s NS16450 and NS16550AF of National Semiconductor offer solutions for these problems.

Installation

Mechanical Connections

Caution: Make sure that you have switched off the PC and the printer before making connections.

Caution: Do not connect the PKD–1 key to the serial port. You may damage your PKD–1 !

The software controls the phone via a separate adapter connected to the serial port of the PC, and to the telephone's M2BUS (DAU–9S).

Attach the dongle PKD–1 to the parallel port 1 (25–pin female D–connector) of the PC. When connecting PKD–1 to the parallel port, be sure that you insert the computer side of the PKD–1 to the PC (male side). If you use a printer on parallel port 1, install the PKD–1 between the PC and your printer cable.

The PKD–1 should not affect devices working with it. If some errors occur (errors in printing are possible) please try printing without the PKD–1. If printing is OK without the PKD–1 please contact your dealer. We will offer you a new PKD–1 in exchange for your old one.

Installing the Software on PC Hard Disk

The program is delivered on a diskette and is copy protected with a dongle PKD–1. It must be present in parallel port when using Service software.

The program can also be installed on the hard disk, which is recommended to obtain a maximal data access rate.

Keep the original diskette safe to enable upgrading of the program !

If you plan to use PCL Start service software, you must install it before installing Service software, see the PCL Start installation instructions.

To install the new Service software program, follow the steps below:

1.	insert the new Service software diskette into drive A: of your computer	
2.	start Windows, and open File Manager	
	log into drive a:	*type* **A:** *and press <Enter>*
3.	start INSTALL.EXE and install Service software to drive C:	*type* ***C:*** *and press <Enter>*

Common Properties of the User Interface

This chapter describes how the User Interface CLF must appear to the user.

The User Interface MUST be capable of being driven without the use of a mouse, as the service engineer rarely has space on the bench to use a mouse.

Login Dialog

When the Service Software application is invoked, by clicking on the Service Software icon, the **Login** dialog box will be displayed on the screen.

Nokia logo and application name bitmap (–)

Displays Nokia logo and name of the application.

Application version static text (–)

Contains the name and version of the application.

Copyright notice static text (–)

Copyright is informed as: "**Nokia Mobile Phones (c) 1995–1999. All Rights Reserved**".

Login Box edit box (–)

The user Login ID edit box, where the user enters his faultlog user name. (See Faultlog User Guide)

OK button (default key)

The user name is stored in memory and the dialog box is closed. When the dialog box is closed, the application starts.

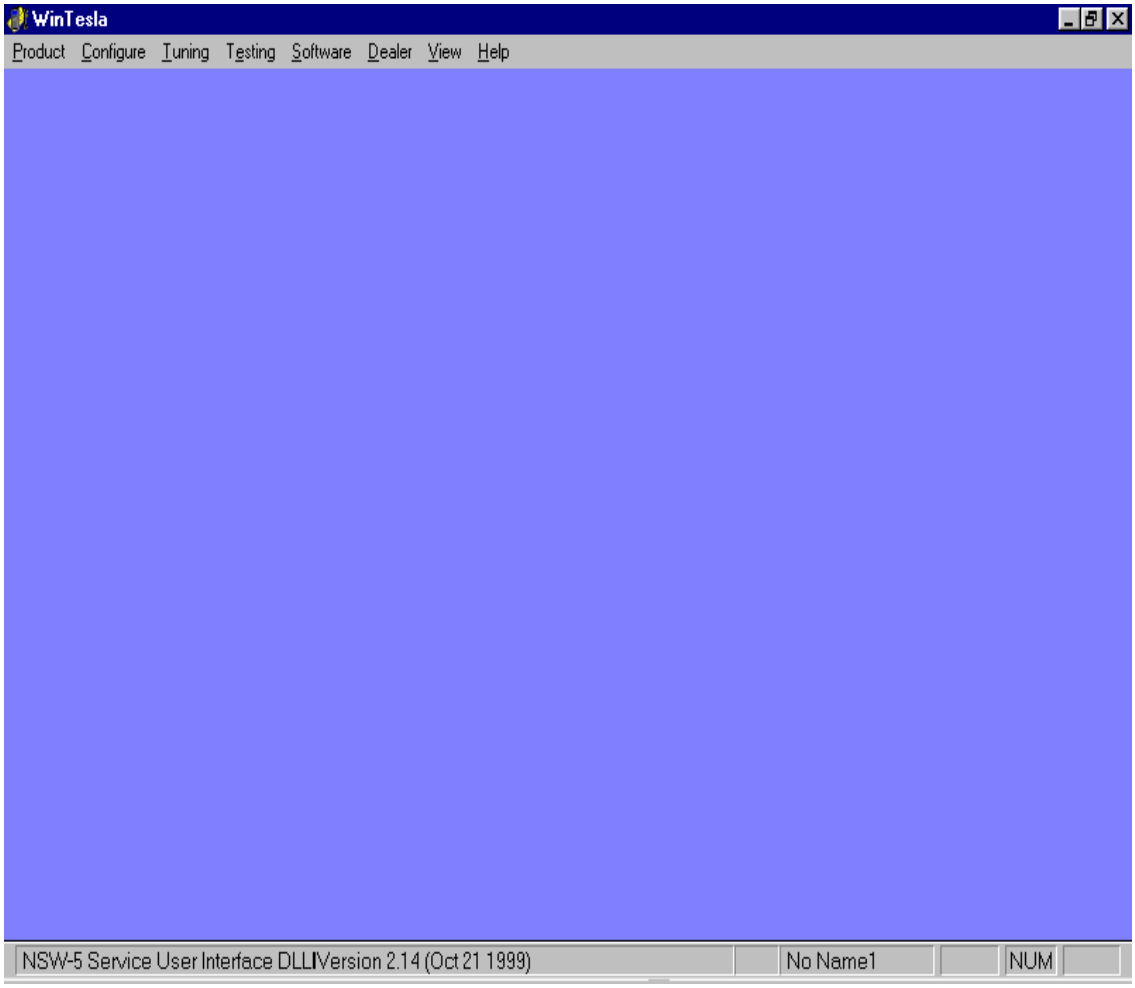
Cancel button (ESC)

The Dialog box is closed and application is started, but the Faultlog feature is disabled.

Help button (F1)

Activates the Windows Help application and displays context sensitive Help.

Main Window



Title bar

The *title bar* is located at the top of the window.

A title bar contains the following elements:

- Application Control–menu button
- Maximise button
- Minimise button
- Name of the application
- Restore button

The properties of these elements and their usage is described in Ref 3– Microsoft Windows Version 3.1 Users Guide chapter one (Windows Basics) and chapter two (Application Basics).

Menu bar

The *menu bar* is below the title bar and contains all available menu selections. The menu bar is a dynamic element and is dependent on the dongle type fitted, and whether a phone is connected.

Underlined characters in menu names and options indicates that the menu selection can be done by pressing *Alt*+ *underlined character*. Options can also be selected by activating menu bar with *Alt*– key (or *F10* key) and using arrow–keys to highlight the desired menu. In that case, selection is done by pressing *Enter*.

Menus can also be selected by using the mouse as described in Ref 3–Microsoft Windows Version 3.1 Users Guide

Status bar

The *status bar* is displayed at the bottom of the Service Software main window. The status bar contains information about the menu selections and events.

The left area of the status bar describes the actions of menu items as the user uses the arrow keys to navigate through menus.

The status bar texts are explained in detailed in each of command's description.

The right areas of the status bar indicate which of the following keys are latched down:

Indicator	Description
USER	Entered Login ID.
CAP	The Caps Lock key is latched down.
NUM	The Num Lock key is latched down.
SCRL	The Scroll Lock key is latched down.

Tool bar

The *tool bar* is NOT defined and will not be implemented until specified by this document.

Menu Bar

The Service Software package includes two menu bar configurations. The first is an abbreviated version that contains the minimum number of menus that allows package configurations when a phone is NOT connected.

The second is described below:

The menu bar MUST only contain the following menus for the Service Software package when a phone is connected:

- Product*
- Configure*
- Tuning
- Testing
- Software
- Dealer
- View
- Help* (* – always displayed, even if no phone is connected).

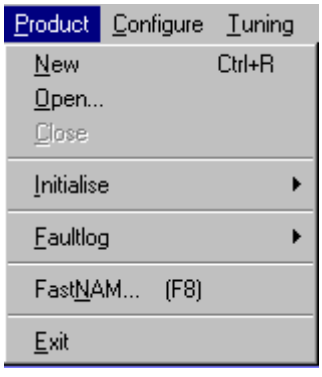
A menu is broken down into sections that are indicated with menu separators. Each sections identifies a logical difference from itself and other sections, i.e. between transmitter and receiver. Any items that are required to be added to a menu lists will be added on the bottom of the appropriate menu section list. If a new item is to be added which is common to two or more phone types, then that menu item will become a common menu item.

The menu lists will use the Microsoft [...] symbol after an item name to indicate that selecting that item will NOT initiate an operation immediately, i.e. a dialog box will be displayed for the user to select options or type in data and press the OK button before the operation is performed.

Product

The Product menu contains the following menu items:

- New Ctrl+R
- Open...
- Close
- Initialise
  - Normal Mode F5
  - Local Mode Shift+F5
- Faultlog
  - Activate Faultlog... F9
  - Edit Faultlog...
- Fast NAM (available only if fastNAM installed)



•Exit Alt+F4

Configure

The Configure menu contains the following items:

- Options...
- Buses...
- Directories...
- Faultlog...
- Fast NAM (active if installed)

Tuning

The Tuning menu contains the following menu sections:

- AFC..(Analog)
- VCTCXO...
- Modulator Output
- Tx Power...
- Tx I/Q...
- Rssi Digital (AGC)
- Rssi Analog
- Rx Audio
- Tx Audio
- Charging...
- LCD...

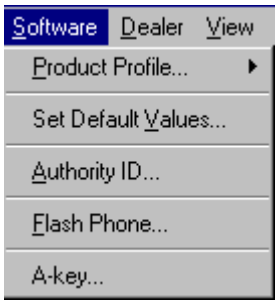
Testing

The Testing menu contains the following sections:

- RF Controls...
- Self Tests
- ADC Readings
- Audio
- User Interface

Software

The Software menu contains the following menu sections:



- Product Profile...
- Set Default Values...
- Authority ID...
- Flash Phone...
- A key...

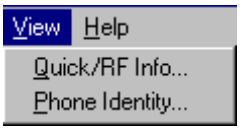
Dealer

The Dealer menu contains the following menu sections:

- User Settings...
- Short Code Memory...
- Calling cards...
- System Service Feature codes..
- Subscriber data programming..
- P/RSID programming...
- Intelligent Roaming Database...
- WAP Settings
- User Data Transfer...

View

The View menu contains the following sections:

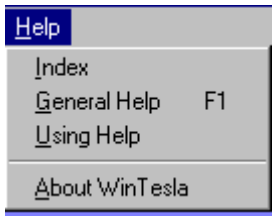


- Quick/RF Info...
- Phone Identity...

Help

The Help menu contains the following menu items:

- Index
- General Help
- Using Help
- About WinTesla



Mouse Cursors

The standards Windows pointer is used as the mouse cursor.

During time consuming tasks e.g. communication to phone, an hour glass is shown informing the user that a task is in progress. The application uses the hour glass cursor to inform user that the application has taken the control and any actions from user will be ignored.

When a function is initiated, the hour glass is displayed and when the function has finished the mouse pointer will return to normal.

Reserved Keys

The following Hot keys and Short Cut keys are reserved either as Microsoft standard keys or as part of the Common Look and Feel specified by this document.

Short Cut Function Keys

Key	Description	Defined by
F1	Context Sensitive Help	Microsoft
F5	Normal Mode	NMP
Shift+F5	Local Mode	NMP
F9	Activate Faultlog	NMP
F10	Goto Menu Bar	Microsoft
Ctrl+F4	Close Active Window	Microsoft

Alt Hot Keys

Key	Description	Defined by
Alt+F4	Exit Active Application	Microsoft
Alt+H	Help	Microsoft

Ctrl Hot Keys

Key	Description	Defined by
Ctrl+N	File – New	Microsoft
Ctrl+O	File – Open	Microsoft
Ctrl+P	File – Print	Microsoft
Ctrl+R	Product – New	NMP

Shift Hot Keys

Shift+F5	Local Mode	NMP

Key Strokes

Key	Description	Defined by
Alt+P	Product Menu	NMP
Alt+P,N	New	NMP
Alt+P,O	Open	NMP
Alt+P,C	Close	NMP
Alt+P,I	Initialize Pop–up	NMP
Alt+P,I,N	Normal Mode	NMP
Alt+P,I,L	Local Mode	NMP
Alt+P,F	Faultlog Pop–up	NMP
Alt+P,F,A	Activate Faultlog	NMP
Alt+P,F,E	Edit Faultlog	NMP
Alt+P,N	Fast NAM	NMP
Alt+P,X	Exit Application	NMP
Alt+C	Configure	NMP
Alt+C,O	Option	NMP
Alt+C,S	Buses	NMP
Alt+C,D	Directories	NMP
Alt+C,F	Faultlog	NMP
Alt+C,N	Fast NAM	NMP
Alt+C,G	GPIB instruments (disabled)	NMP
Alt+T	Tuning Menu	NMP
Alt+T,A	AFC (Analog)	NMP
Alt+T,V	VCTCXO	NMP
Alt+T,M	Modulator Output	NMP
Alt+T,X	Tx Power	NMP
Alt+T,Q	Tx I/Q	NMP
Alt+T,D	Rssi Digital (AGC)	NMP
Alt+T,N	Rssi Analog	NMP
Alt+T,R	Rx Audio	NMP
Alt+T,T	Tx Audio	NMP
Alt+T,C	Charging	NMP
Alt+T,L	LCD	NMP
Alt+E	Testing Menu	NMP

Alt+E,R	RF Controls	NMP
Alt+E,S	Self Tests	NMP
Alt+E,A	ADC Readings	NMP
Alt+E,D	Audio	NMP
Alt+E,U	User Interface	NMP
Alt+S	Software Menu	NMP
Alt+S,P	Product Profile	NMP
Alt+S,V	Set Default Values	NMP
Alt+S,A	Authority ID	NMP
Alt+S,F	Flash Phone	NMP
Alt+D	Dealer Menu	NMP
Alt+D,U	User Settings	NMP
Alt+D,C	Short Code Memory	NMP
Alt+D,L	Calling cards	NMP
Alt+D,V	Set UI/DEV Default Values	NMP
Alt+D,F	System Service Feature codes	NMP
Alt+D,S	Subscriber data programming	NMP
Alt+D,R	P/RSID programming	NMP
Alt+D,I	Intelligent Roaming Database	NMP
Alt+D,D	User Data Transfer	NMP
Alt+V	View Menu	NMP
Alt+V,Q	Quick/RF Info	NMP
Alt+V,P	Phone Identity	NMP
Alt+H	Help Menu	Microsoft
Alt+H,I	Index	Microsoft
Alt+H,G	General Help	Microsoft
Alt+H,U	Using Help	Microsoft
Alt+H,A	About WinTesla	NMP

Help Functions

The Help User Interface is the standard Windows help tool called Win-Help.

The context sensitive help is activated with **F1**–key. Help contains also Using Help which describes how to use help facility. Refer to the Windows manual for detailed description on the Windows Help.

Dialog boxes

The Service Software application uses many different dialog boxes. Dialog boxes are used to display data and prompt the user for input.

Dialog boxes are opened from menus or with shortcut keys. Dialog boxes have different properties but some features are common.

All service dialog boxes must be modal, that is, the user is not able to start another operation without first closing the present dialog box.

All dialog boxes contain the following entities:

– Help button

– Title bar

– At least one button other than Help

– Application Control–menu Button

Common Dialog boxes

This sections describes the common dialog boxes used in the Service Software package, and the context in which they are used.

Note Message Box

When the user has made an illegal selection, a *note message box* dialog is opened and message text is displayed. The message box is also opened when the program has some information for the user. The size of the dialog box may vary. An information dialog box is recognized by the **!**–icon.

The dialog box also contains an OK button and a Help button.

OK button (default key):

Acknowledge displayed information and continue. The dialog box is closed after selection.

Help button (Alt+H):

Opens context sensitive help as F1–key does.

Query Message Box

Confirmations and questions are asked in *a query message box*. A query dialog box is recognized by the **?**–icon.

The dialog box also contains a Yes button, a No button, and a Help button.

Yes button (Alt+Y or Y) (default key):

Accepts confirmation or question.

No button (Alt+N or N):

Denies confirmation or question.

Help button (Alt+H):

Opens context sensitive help as F1–key does.

The buttons may also be OK and Cancel. The operation of these buttons are the same as in the Note dialog box.

Error Message Box

Error message dialog boxes use the Stop–icon. When a “Stop”–dialog box is shown, the current operation is terminated.

The dialog box has a description about the failed operation and reason. Pressing F1 (Help) application opens the appropriate help topic that gives information about recommended actions.

The dialog box also contains an OK button and a Help button.

OK button (default key):

Acknowledges displayed information and terminate current operation. The dialog box is closed after selection.

Help button (Alt+H):

Open context sensitive help as F1–key does.

Custom Dialog boxes

All custom dialog boxes contain the predefined buttons as defined below in the section – *Buttons.* However, it is recognised that features may require additional button types, but the addition of these non–standard buttons should be carefully considered to minimise any inconsistencies between implementations.

The buttons are positioned down the right–hand side of the dialog boxes. The default action is **OK**, except where that default action could result in an irretrievable failure.

All tuning dialogs that contain tuning results, display the old tuned data read from the phone before the tuning was performed, as well as the newly tuned data.

List boxes are used to display lists of data, such as tuning data, test results etc.

Buttons

All buttons are Microsoft style buttons.

In general, the default button is the action button, the Close button or the Yes button, but this depends on the context of the dialog box that the button is associated with.

(action) button:

Accepts and validates entered settings and values and closes the dialog. If the values have not been changed, then no action will be taken. The status bar will reflect the status. The user should only be queried, if the settings or values accepted will over–write data that CAN NOT be reproduced.
A greyed **OK** button indicates that settings selected by the user are not acceptable.

Close button:

Closes the current dialog box. Does not send or store anything and closes the dialog. The Close button is only used for dialogs that do not set or change any data.

Cancel button (Esc):

Cancel operation. Does not send or store anything and closes the dialog box.
A greyed **Cancel** button indicates that it is not possible to quit from this dialog box.

Yes button (ALT+Y or Y):

Replies Yes to a question asked of the user.

No button (ALT+N or N):

Replies No to a question asked of the user.

Help button (ALT+H):

Opens context sensitive help as F1–key does.

Reporting Status

The status bar will be used to report the present status to the user. When a feature is initiated, the status bar will be updated with a brief description of the function. The status bar will also be updated at key points in a time consuming function.

If an error is reported to the user, it is displayed in the status bar as well as displayed in a common error dialog box. This will mean the user is not delayed from progressing on to the next operation unless an error occurs, in which case, the user will have to acknowledge the error by pressing the OK button.

NSW-5 FEATURES

Menu bar

After Sales SW's menus follows the menu structure specified in WinTesla User Interface Specification. This specification will describe functionality that differs from WinTesla specification.

Product

New command

Activation	Status Bar Text
Alt, P, N Ctrl+R	Rescan a new phone

If phone is changed (with same phone type only serial number is changed) phone will be initialised to local mode. If phone is changed to different phone type the current DLLs are unloaded and new ones are loaded for that phone.

If the Quick/RF Info view is open, window will be automatically updated.

If Phone Information view is open, it will be automatically updated.

Open... command

Activation	Status Bar Text
Alt, P, O	Force load phone specific functionality

Phone is set to local mode.

Initialise... command

Activation	Status Bar Text
Alt, P, I	

Opens a submenu for Normal Mode and Local Mode

Normal Mode

Activation	Status Bar Text
Alt, P, I, N	Initialises phone to normal (cellular) mode
F5	

When normal mode has been activated or program has been started, self–test results will be asked from MCU. If any fault was found in the tests, an error message is shown. If normal mode has been set successfully (no self test error has been found), and paging listening has been started, the used AFC value is requested from MS.

Initialisation routine checks phone's cellular type and if unsupported phone is detected, application unloads the DLLs.

The After Sales SW sets automatically the MS state to normal mode when needed.

If phone identification view is open, window will be automatically updated. Also if RF Information Window is open it will be updated to quick info view.

Local Mode

Activation	Status Bar Text
Alt, P, I, L	Initialises phone to local mode
Shift+F5	

Selection will change the MS state to *local*. When user selects item from Testing or Tuning menus, the After Sales SW software will change automatically the MS state to local.

The After Sales SW sets automatically the MS state to normal mode when needed.

Also if quick info view is open it will be updated to RF Information view.

Faultlog command

Activation	Status Bar Text
Alt, P, F	

Opens a submenu. Only enabled when user has logged in.

Activate Faultlog

Activation	Status Bar Text
Alt, P, F, A F9	Activates the faultlog. Only enabled when user has logged in.

Edit Faultlog

Activation	Status Bar Text
Alt, P, F, E	Allows user to edit faultlog entries. Only enabled when a user has logged in.

FastNAM command

Activation	Status Bar Text
Alt, P, N F8	This menu is only enabled when FastNAM functionality is included in WinTesla.

Exit command

Activation	Status Bar Text
Alt, P, X	Exits the WinTesla application.

Tuning

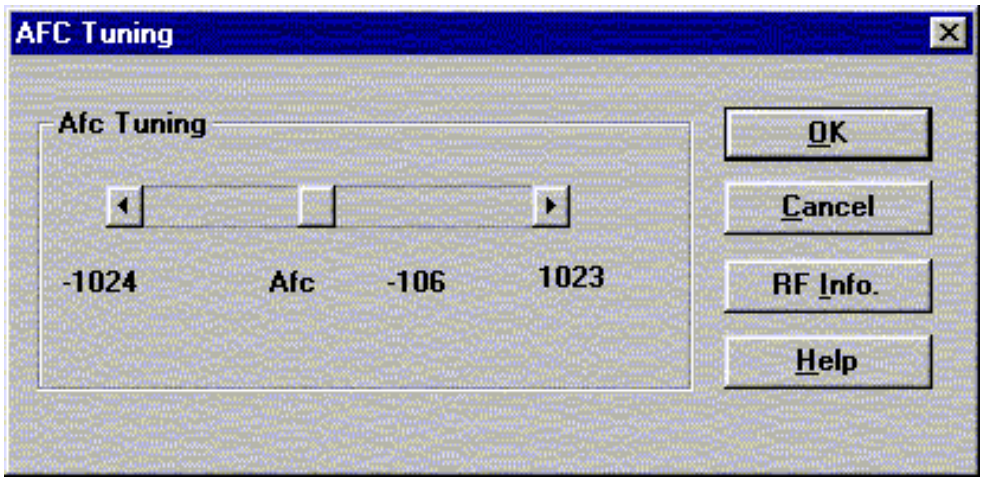
The tuning menu offers functions for ME adjustments.

AFC... command

Activation	Status Bar Text
Alt, T, A	Open AFC Tuning dialog box

The next automatic selections are made when this tuning function is activated:
- Active Unit = TX
- Operation mode = Analog
- Channel 250 (low)
- Power level 4
- low band

The **AFC Tuning** dialog is opened.



AFC tuning dialog box includes the following items:

Afc scroll bar

Set calibration value to phone

RF Info button (ALT+I):

The current rf state is shown

OK button (ALT+O):

Dialog box is closed and tuning *is saved* to phone.

Cancel button (ESC):

Dialog box is closed and tuning *is not saved* to phone.

Help button (Alt+H):

Opens context sensitive help.

VCTCXO... command

Starts Voltage Controlled Temperature compensated oscillator tuning

Activation	Status Bar Text
Alt, T, V	Open Tuning VCTCXO dialog box

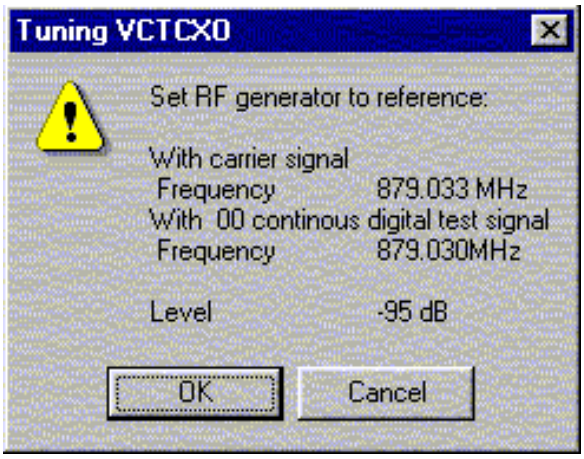
The next automatic selections are made when this tuning function is activated:

– Active Unit = RX
– Operation Mode = Continuous digital
– low band
– Channel 301
– Power level OFF

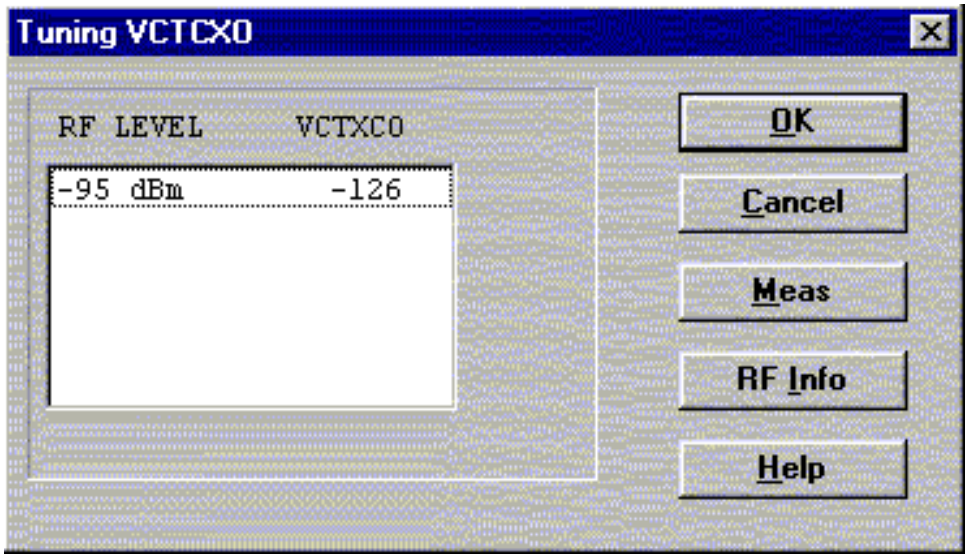
EEPROM DAC value is shown.

The measurement is started when ”meas” button is pressed and it is executed in two steps:

1. User is requested to put signal generator input level –95 dB and frequency 879.030 Mhz



2. Measurement with input level is executed and the value is shown in the list box



VCTCXO tuning dialog includes the following items:

VCTCXO List box (ALT+A):

VCTCXO value is shown

Meas button (ALT+M):

The measurement can be started by pressing this button.

RF Info button (ALT+I):

The current rf state is shown

OK button (ALT+O):

Dialog is closed and tuning *is saved* to phone.

Cancel button (ESC):

Dialog is closed and tuning *is not saved* to phone.

Help button (Alt+H):

Opens context sensitive help.

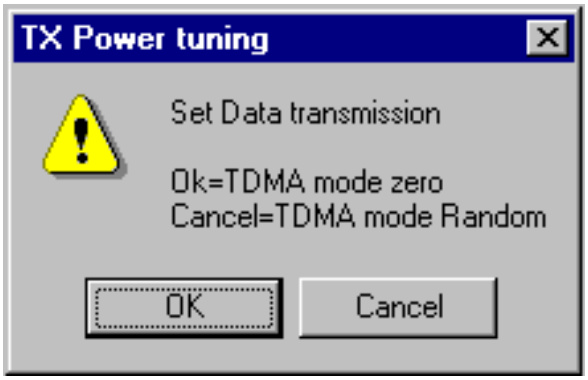
Tx Power... command

Activation	Status Bar Text
Alt, T, X, H or L	Open TX Power Tuning dialog box

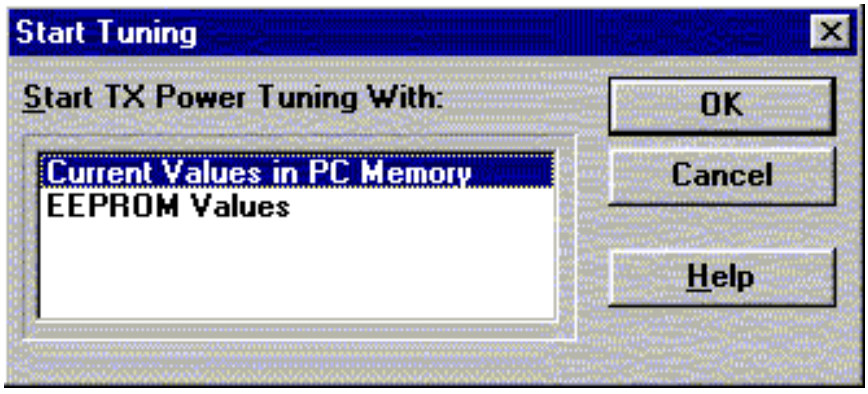
Starts TX power tuning.

The user is first requested to select which data transmission type is used in **Set data transmission** dialog.

OK = TDMA mode zero modulation
Cancel= TDMA mode random modulation



The user is then requested to select the values with which the tuning is started in **Start Tuning** dialog.



Start Tuning dialog includes the following items:

Current Values in PC memory

Tuning values are load from program's internal memory.

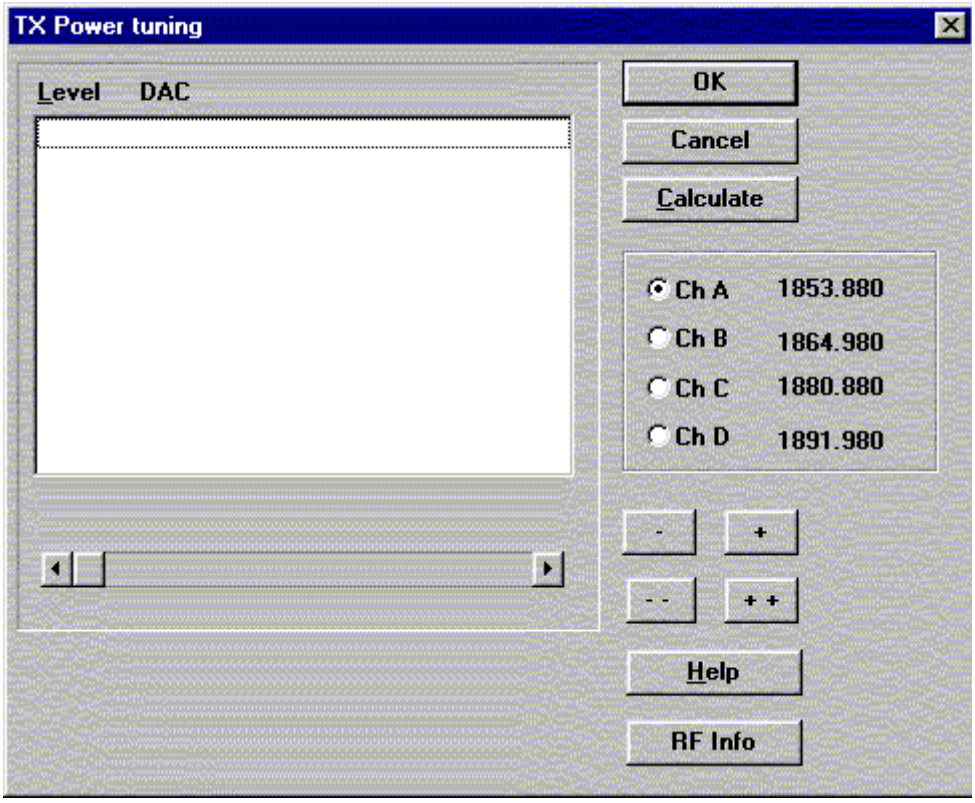
Phone EEPROM Values

Tuning values are load from ME's EEPROM.

The next automatic selections are made when this tuning function is activated:

– Active Unit = TX
– Operation Mode = Continuous digital
– Selected band
– Channel 190 (low) or 500 (high)
– Power level 6

The **TX Power Tuning** dialog will be activated automatically after value selection.



TX Power Tuning dialog includes the following items:

Level DAC list box (ALT+L):

The power is presented in DAMPS level values (2..10) .DACs can have values from –511 to 512.The tuning position is high-lighted and can be tuned with +/– keys or left/r**ight cursor keys or scroll bar.**

Ch A radio button: Tuning channel A. Frequency is shown.

Ch B radio button: Tuning channel B. Frequency is shown.

Ch C radio button: Tuning channel C. Frequency is shown.

Ch D radio button: Tuning channel D. Frequency is shown.

+/– buttons:

+ and – buttons will cause power DAC changing by 1steps .

++/— buttons:

+ and – buttons will cause power DAC changing by 10 steps .

OK button (ENTER):

Dialog is closed and tuning *is saved* to phone.

Cancel button (ESC):

Dialog is closed and tuning *is not saved* to phone.

Calculate button (ALT+C):

Activate calculation

When selections are used, the power value checking is made and if it is not succeeded, error message is shown.

Help button (Alt+H):

Opens context sensitive help.

RF Info button (ALT+I):

The current rf state is shown

Tx I/Q... command

Activation	Status Bar Text
Alt, T,Q	Open TX I/Q Tuning dialog box

This function is used for tuning TX I and Q branch DC offset and phase offset.

The function opens same **Start Tuning** dialog as with TX Power Tuning.

Start Tuning With list box (ALT+S):

Current in PC memory

Tuning values are load from program's internal memory.

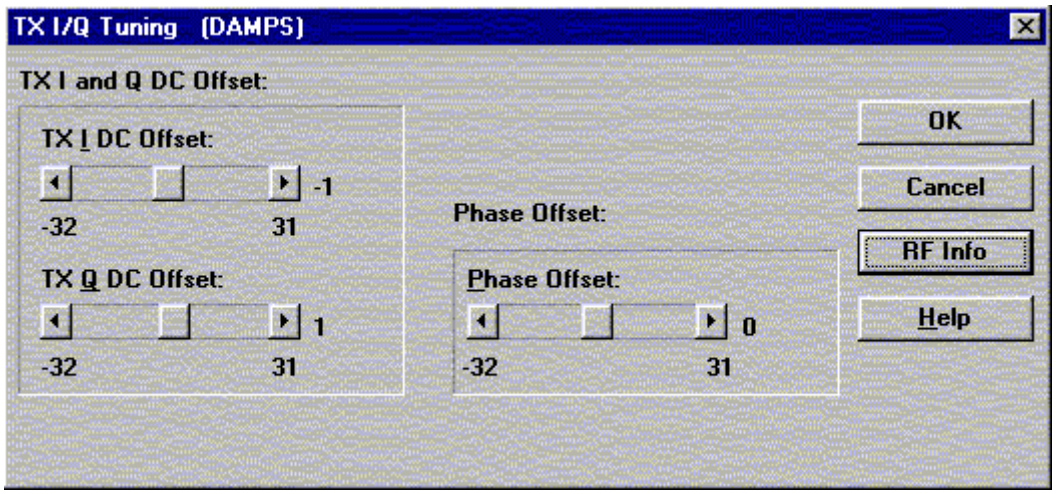
Phone EEPROM

Tuning values are load from ME's EEPROM.

The next automatic selections are made when this function is activated:

– Active Unit = TX
– Operation Mode = analog
– Low band
– Channel 190
– Power level 4

The **TX I/Q Tuning** dialog is opened.



TX I/Q Tuning includes the following items:

Tune TX I DC Offset scroll bar (ALT+I):

The DC Offset is shown as DAC value.
With this selection the I branch DC Offset is tuned.
The value range is –32...31.

Tune TX Q DC Offset scroll bar (ALT+Q):

The operation of this function is the same as one above, except with this selection the Q branch DC Offset is tuned.
The value range is –32...31.

Tune Phase Difference scroll bar (ALT+P):

The operation of this function is the same as one above, except with this selection the Phase Offset is tuned. The value range is –32...31.

OK button (ALT+O):

Dialog box is closed and tuning *is saved* to phone.

Cancel button (ESC):

Dialog box is closed and tuning *is not saved* to phone.

RF Info button (ALT+I):

The current rf state is shown

Help button (Alt+H):

Opens context sensitive help.

RSSI Digital (AGC)... command

Activation	Status Bar Text
Alt, T, D, H or L	Open the Tuning AGC dialog box

Starts Automatic Gain Control calibration. This means Received Signal Strenght indicators in digital mode.

The next automatic selections are made when this tuning function is activated:

– Active Unit = RX
– Operation Mode = Continuous digital
– Selected band
– Channel 301 (low) or 500 (high)
– Power level 2

EEPROM DAC values is shown and the measurement is started by pressing Meas button. Measurement is done in eleven steps:

1. User is requested to put signal generator input level –95 dB and frequency 879.030 MHz

2. Measurement with input level is executed

3. User is requested to put signal generator input level –85 dB and frequency 879.030 MHz

4. Measurement with input level is executed

5. User is requested to put signal generator input level –75 dB and frequency 879.030 MHz

6. Measurement with input level is executed

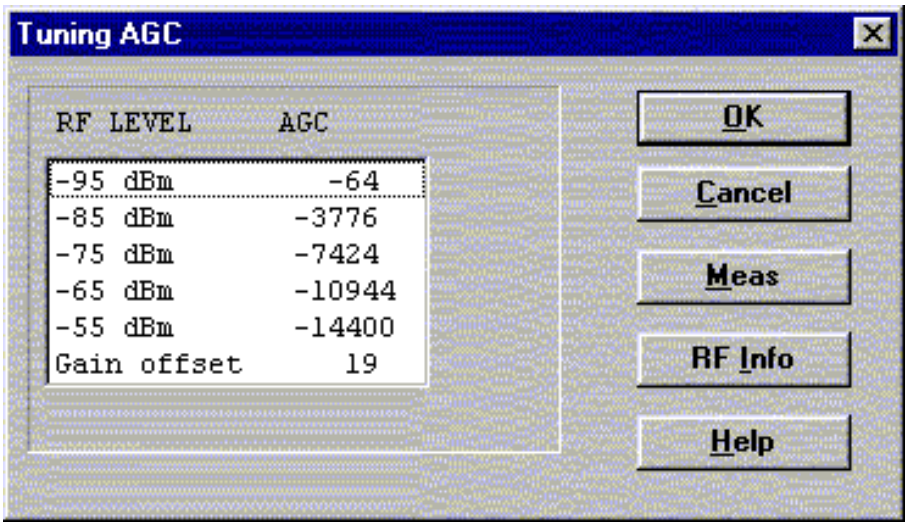
7. User is requested to put signal generator input level –65 dB and frequency 879.030 MHz

8. Measurement with input level is executed

9. User is requested to put signal generator input level –55 dB and frequency 879.030 MHz

10. Measurement with input level is executed

11. The AGC tuning dialog will be updated when previous steps are done



AGC tuning dialog includes the following items:

RF level AGC List box (ALT+R):

DAC values is shown

Meas button (ALT+M):

The measurement can be started by pressing this button.

OK button (ALT+O):

Dialog is closed and tuning *is saved* to phone.

Cancel button (ESC):

Dialog is closed and tuning *is not saved* to phone.

RF Info button (ALT+I):

The current rf state is shown

Help button (Alt+H):

Opens context sensitive help.

RSSI Analog... command

Activation	Status Bar Text
Alt, T, N	Open the Tuning RSSI dialog box

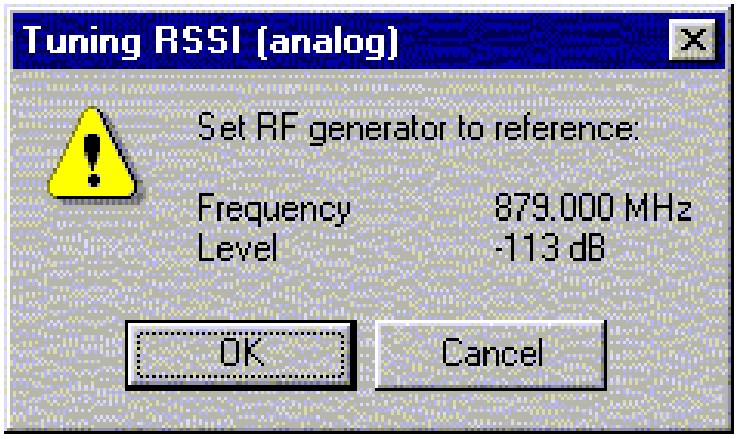
This function is used for tuning analog RSSI.

The next automatic selections are made when this tuning function is activated:

– Active Unit = RX
– Operation Mode = analog
– Power Level OFF
– Channel 300
– Low band

Values from EEPROM is shown and the measurement is started when the ”meas” button is pressed and it is executed in five steps:

1. User is requested to put signal generator input level –113 dB and frequency 879.300 MHz



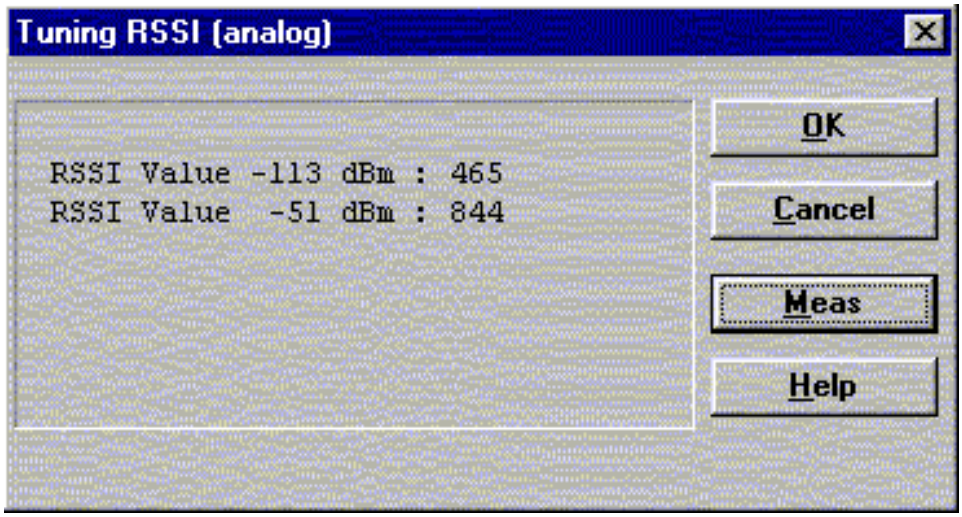
2. Measurement with input level is executed

3. User is requested to put signal generator input level –51 dB and frequency 879.300 MHz

4. Measurement with input level is executed

5. The RSSI tuning dialog will be updated when previous steps are done

RSSI analog tuning dialog has following items:



RSSI value list box

DAC values is shown

Meas button (ALT+M):

The measurement can be started by pressing this button.

OK button (ENTER):

Dialog is closed and tuning *is saved* to phone.

Cancel button (ESC):

Dialog is closed and tuning *is not saved* to phone.

Help button (Alt+H):

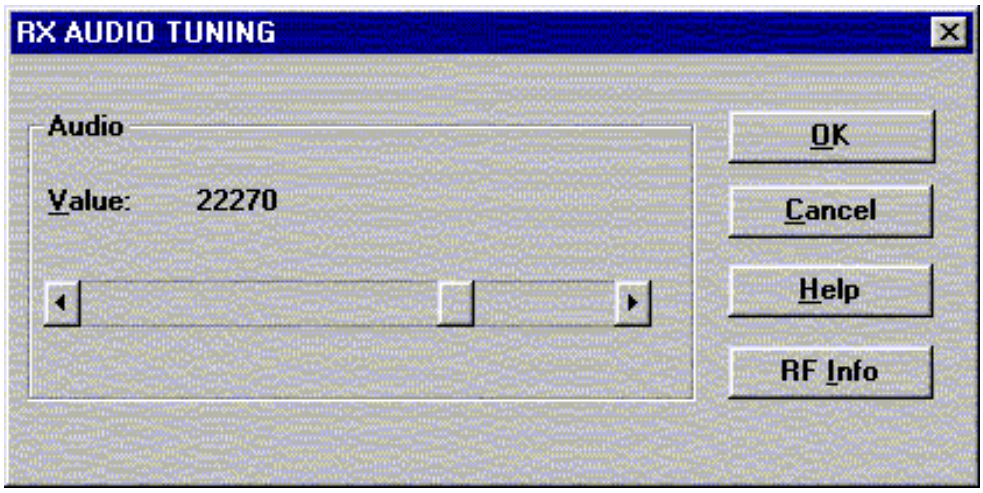
Opens context sensitive help.

Rx Audio... command

Activation	Status Bar Text
Alt, T, R	Starts Rx audio tuning

The next automatic selections are made when this function is activated:

– Active Unit = RX
– Operation Mode = analog
– Channel 990
– Power level OFF
– low band



RX audio tuning dialog includes the following items:

Value scroll bar **(**ALT–V**)**

Set Calibration value to phone

OK button (ENTER):

Dialog is closed and tuning *is saved* to phone.

Cancel button (ESC):

Dialog is closed and tuning *is not saved* to phone.

RF Info button (ALT+I):

The current rf state is shown

Help button (Alt+H):

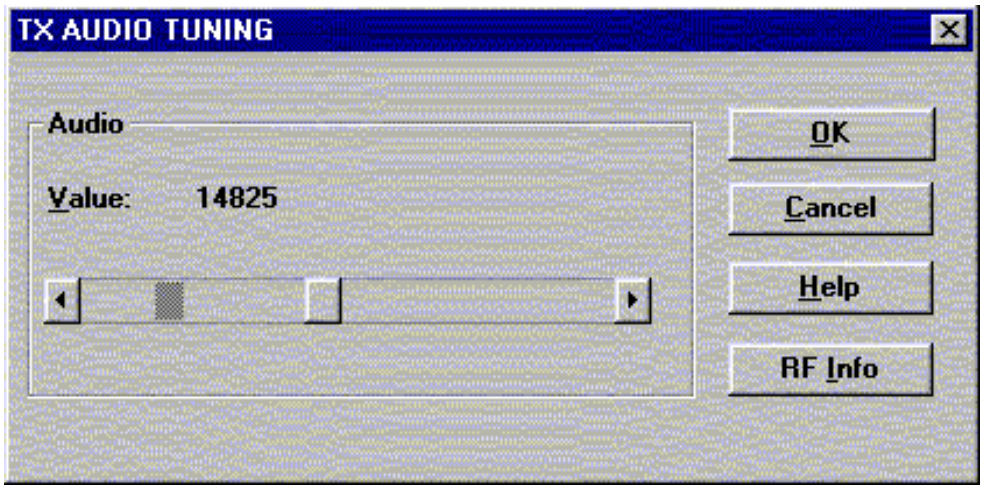
Opens context sensitive help.

Tx Audio... command

Activation	Status Bar Text
Alt, T, T	Starts Tx audio tuning

The next automatic selections are made when this function is activated:

– Active Unit = TX
– Operation Mode = analog
– Channel 990
– Power level 3
– low band



RX audio tuning dialog includes the following items:

Value scroll bar **(**ALT–V**)**

Set Calibration value to phone

OK button (ENTER):

Dialog is closed and tuning *is saved* to phone.

Cancel button (ESC):

Dialog is closed and tuning *is not saved* to phone.

RF Info button (ALT+I):

The current rf state is shown

Help button (Alt+H):

Opens context sensitive help.

Charging... command

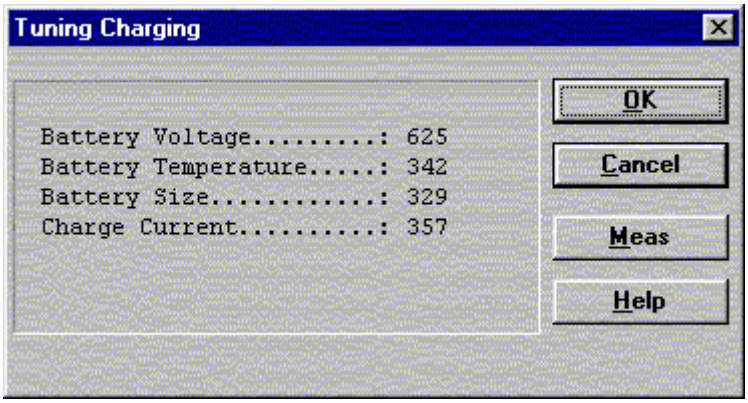
Activation	Status Bar Text
Alt, T, C	Starts charging tuning

The next automatic selections are made when this function is activated:

Active Unit = RX
Operation Mode = analog
Power Level = OFF
Channel 300
Low band

Before charging tuning is started, the battery setting request is shown.

EEPROM DAC values is shown and the measurement is started when the ”meas” button is pressed.



Charging tuning dialog includes the following items:

Values list box:

DAC values are shown.

Meas button (ALT+M):

The measurement can be started by pressing this button.

OK button (ENTER):

Dialog is closed and tuning *is saved* to phone.

Cancel button (ESC):

Dialog is closed and tuning *is not saved* to phone.

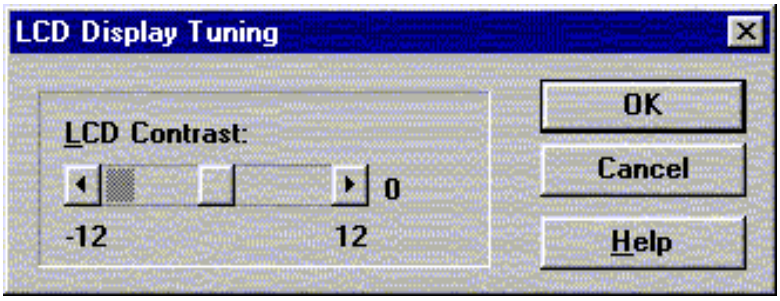
Help button (Alt+H):

Opens context sensitive help.

LCD... command

Activation	Status Bar Text
Alt, T,L	Opens LCD Display contrast tuning box

Command opens LCD Display Tuning dialog box which contains scrollbar to make display adjustments.



LCD Display Tuning dialog box includes the following items:

LCD Contrast scrollbar (ALT+L):

Enables user to tune display contrast between –12 and 12.

OK button (ENTER):

Dialog box is closed and tuning *is saved* to phone.

Cancel button (ESC):

Dialog is closed and tuning *is not saved* to phone.

Help button (Alt+H):

Opens context sensitive help.

Testing

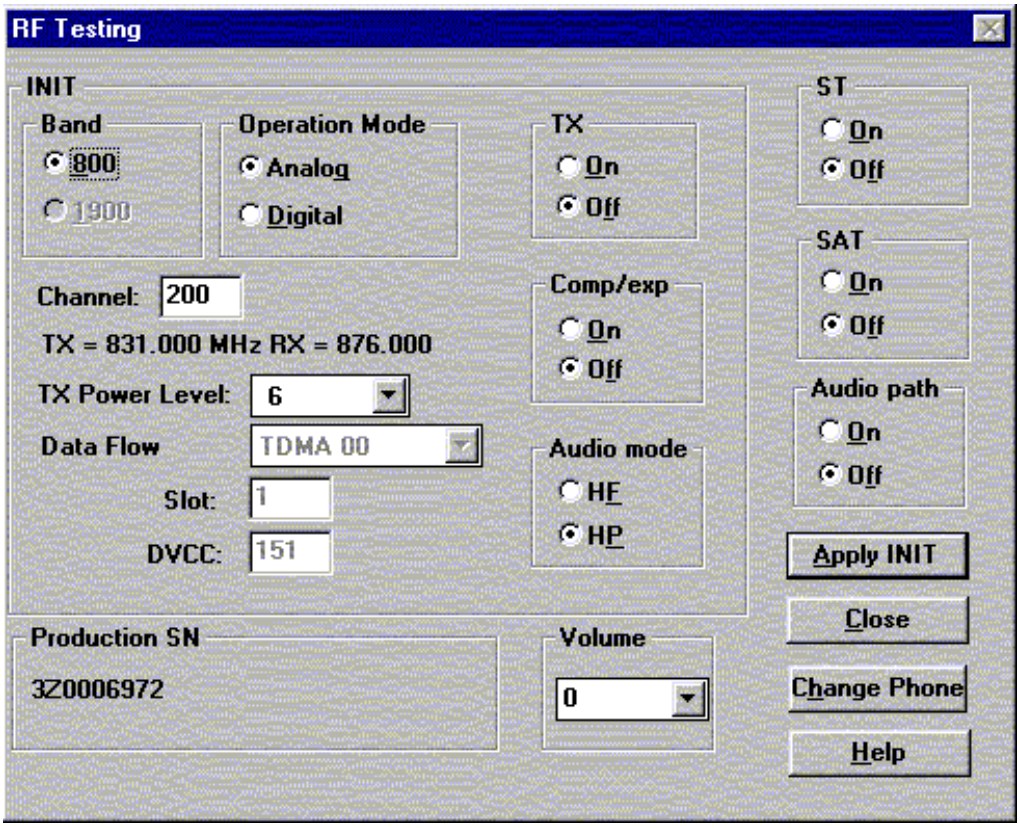
The Testing sub menu offers functions for ME testing.

RF Controls... command

Activation	Status Bar Text
Alt, E,R	Open RF Controls dialog box

This function is used for quick RF testing.

Command opens **RF Controls** dialog, which contains data for testing and adjustments.



RF Controls dialog includes the following items:

Band group:

800 radio button
: Select low band

1900 radio button
: Select high band

Operation mode group

Analog radio button
: Select analog mode

Digital radio button
: Select digital mode

TX group

On radio button
: Activate tx power

Off radio button
: Deactivate tx power

Comp/exp group

On radio button — Set compander on
Off radio button — Set expander on

Audio mode group

HF radio button — Set audio handsfree mode
HP radio button — Set audio hand portable mode

ST group

On radio button
Set signalling tone on in analog mode only
Off radio button
Set signalling tone off in analog mode only

SAT group

On radio button
Set Supervisory Audio Tone on in analog mode only
Off radio button
Set Supervisory Audio Tone off in analog mode only

Audio path group

On radio button — Set external audio path on
Off radio button — Set external audio path off

Data Flow Type drop list (gray text = feature not active)

This list changes the transmission data type. List consists following transmissions:
* TDMA mode zero data transmission
* TDMA mode random
* Continuous digital 11

TX Power Level drop list

With this value is possible to change the transmission power. The user can give the needed D–AMPS power value (2..10).

Channel edit box

User can enter here channel number that is used for both transmission and receiving. The frequency of the selected channel is shown after selection.

Slot edit box (gray text = feature not active)

Value of used time slot in digital mode only

DVCC edit box (gray text = feature not active)

Value of Digital verification color code in digital mode only

Volume drop list

Value of audio volume can be selected

Apply init button (ALT+A):

Accepts INIT group values and validates them. After validation application sends corresponding messages to ME.

Close button (ESC)

Close dialog

Change phone button (ALT+H)

Read production serial number

Production SN static

Show production serial number

Help button (Alt+H):

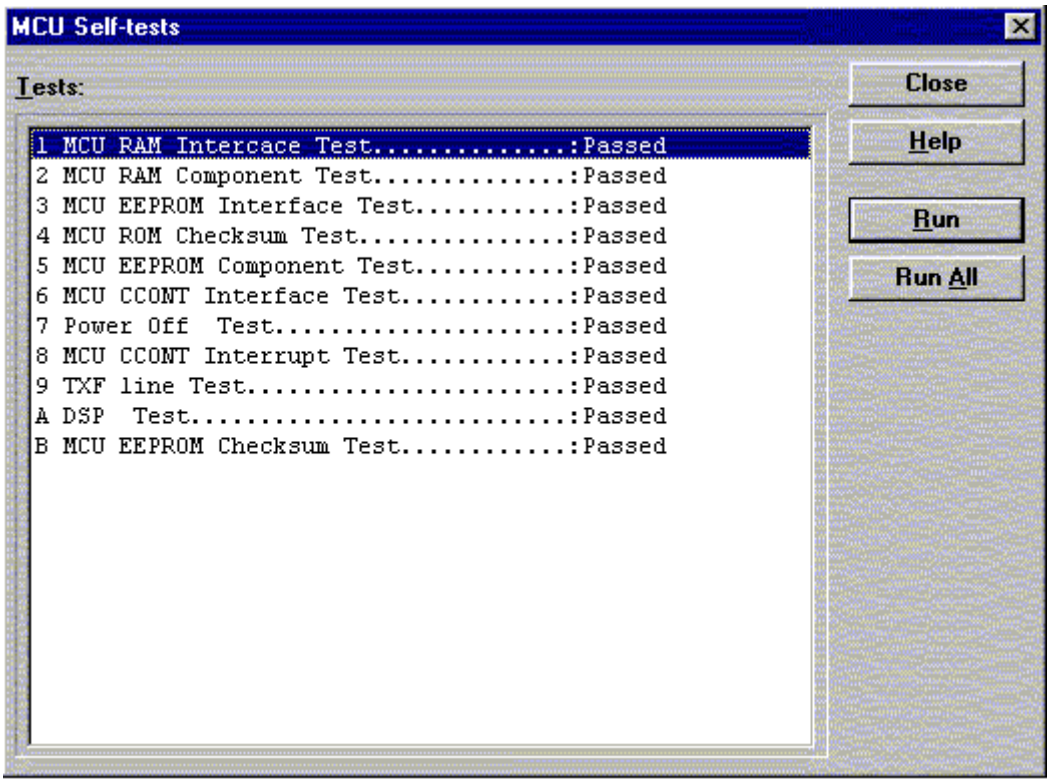
Opens context sensitive help.

Self Tests... command

Activation	Status Bar Text
Alt, E,S	Open MCU Self–tests dialog box

Command is used for reading self test results and running self tests.

When the selection is made, the test result is read from ME. The test result will be shown to the user within **MCU Self–test** dialog.



MCU Self–test dialog box includes following items:

Tests list box (ALT+T):

Test states are updated according to results received from the phone. Possible test states will be one of the next:

Passed
Failed
No response
Not executed
RUNNING....

Run button (ALT+R):

User can select desired test from list and hit **Run** button. When user selects test to be run the text *RUNNING...* is shown in test state field. When results are received the test state field is updated according to the result.

If no response was received in the defined time, an *error message box* will be shown and the test state is changed to *No response*.

Run All button (ALT+A):

User can run all listed tests. The text *RUNNING...* is shown in test state field and test is run. When results are received the test state field is updated according to the results. When state field is updated application moves to next test and repeats previous cycle.

Only last test is not executed (Power off Test) because it will turn phone power off.

Close (ENTER) button:

Dialog box is closed.

Help button (Alt+H)

Context sensitive help

Supported Self Tests

The following tests are available:

1 MCU RAM Interface.....

2 MCU RAM Component.....

3 MCU EEPROM Interface.....

4 MCU ROM Checksum.....

5 MCU EEPROM Component.....

6 MCU CCONT Interface.....

7 Power Off.....

8 MCU CCONT Interrupt.....

9 TXF line.....

A DSP.....

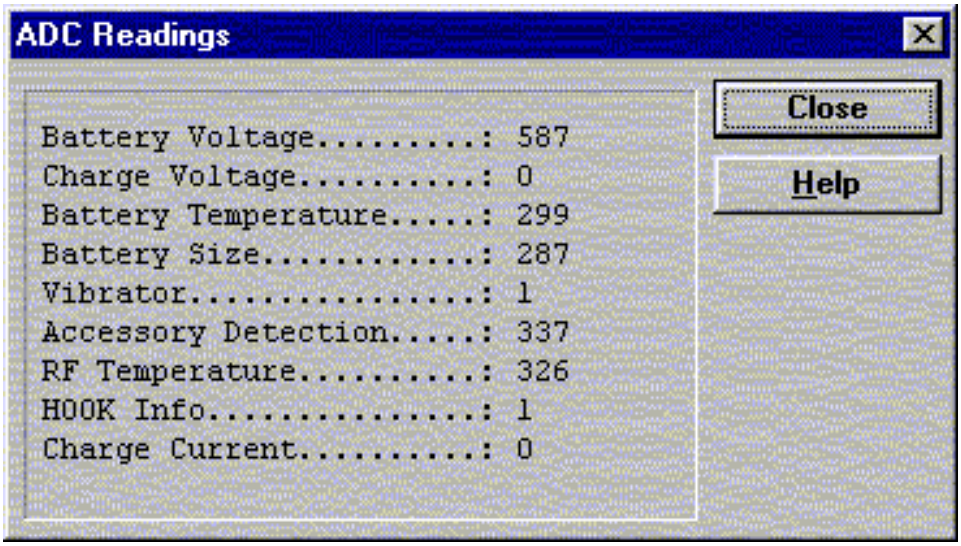
B MCU EEPROM Checksum.....

ADC Readings... command

Activation	Status Bar Text
Alt, E, A	Open ADC Readings dialog box.

Command is used to read and show A/D values from phone.

Command opens **ADC Readings** dialog.



ADC Readings dialog has static text field where measurements are updated to every second.

ADC Readings dialog has following items:

Close (ENTER) button:

Dialog box is closed and tuning *is not saved* to phone.

Help button (Alt+H)

Context sensitive help

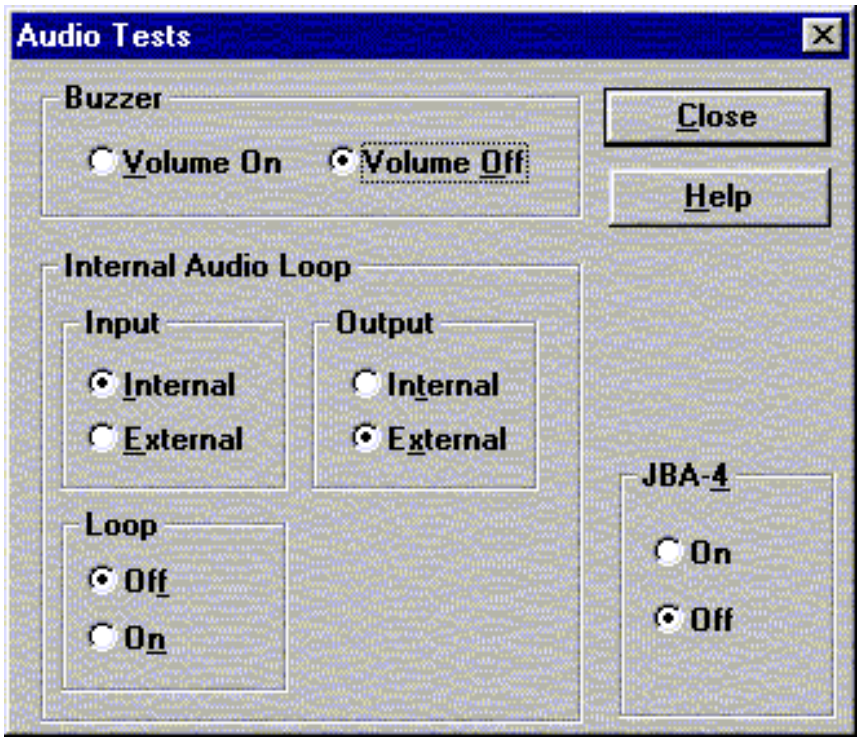
Following A/D readings are measured:

Battery Voltage.....:
Charge Voltage.....:
Battery Temperature.....:
Battery Size.....:
Vibrator.....:
Acessory Detection.....:
RF Temperature.....:
HOOK Info.....:
Charge Current.....:

Audio... command

Activation	Status Bar Text
Alt, E,U	Open Audio Tests dialog box

Command is used for making **Audio Tests**.



Audio Tests dialog includes the following items:

Buzzer Volume group:

Volume On radio button (ALT+V):

Turns buzzer on.

Volume Off radio button (ALT+O):

Turns buzzer off.

Internal Audio Loop group:

Input group:

Internal radio button (ALT+I):

Turns on internal input.

External radio button (ALT+E):

Turns on external input.

Output group:

Internal radio button (ALT+T):

Turns on internal output.

External radio button (ALT+X):

Turns on external output.

Loop group:

Off radio button (ALT+F):

Turns audio loop off.

On radio button (ALT+N):

Turns audio loop on.

JBA–4 group (Alt+4):

On radio button

Activate audio box
Deactivate loop controlling

Off radio button

Activate loop controlling

Microphone test:

Connect a headset in the phone
Select Testing –> Audio
Loop: Internal –> External
Loop ON

Now everything spoken in the mic is heard in the headset.

Close button (ESC)

Close dialog

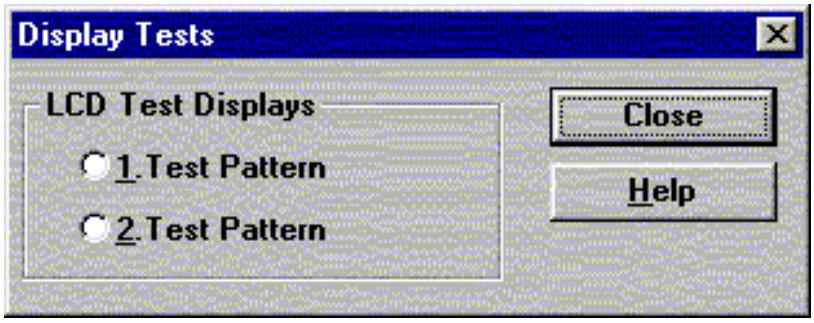
Help button (Alt+H)

Context sensitive help

User Interface... command

Activation	Status Bar Text
Alt, E,U	Open User Interface Tests dialog box

Allows user to test all display pixels and back lights of attached phone. Command is used for making display tests in Display Tests dialog box.



Display Tests dialog includes the following items:

1. Test Pattern radio button (ALT+1):

   In test display 1 the phone LCD display is cleared.

2. Test Pattern radio button (ALT+2):

   In test display 2 the upper and left side of display is filled with chessboard letters.

Close button (ESC)

Close dialog

Help button (Alt+H)

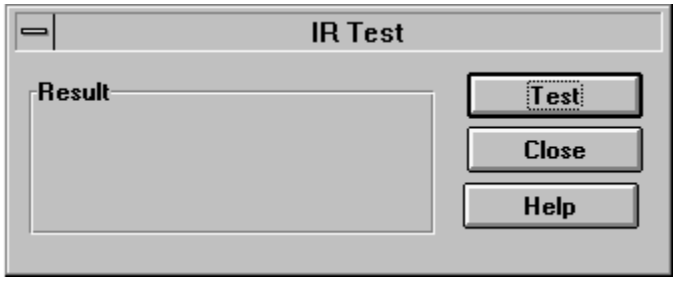
Context sensitive help

IR Test... command

A Combox and the infrared thes modlue JLP–1 are needed for this test.

Activation	Status Bar Text
Alt, E,I	IR module test

Command is used for making IR module test. Function opens **IR Test** dialog:



Dialog mode: **modal**

IR Test dialog has following items:

Result box:

Result can be OK/FAILED

Test button (ALT+T):

Starts the IR Test.

Close button (ENTER):

Closes the IR Test dialog.

Help button (Alt+H)

Context sensitive help

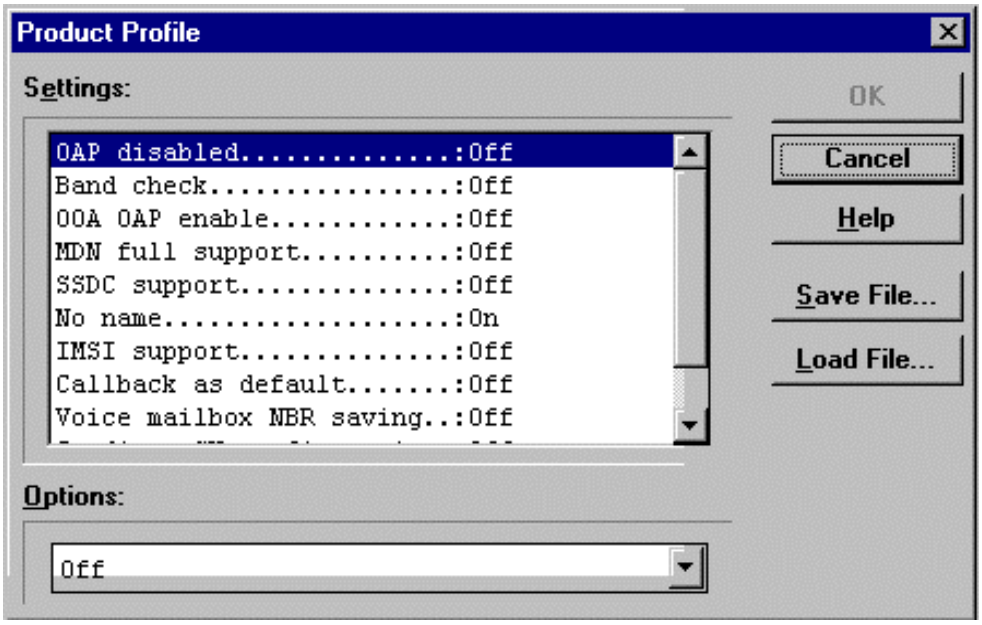
Software

Product Profile... command

Activation	Status Bar Text
Alt, S,P,L,H	Open Product Profile settings dialog box.

This function is used for making product profile settings.

When the command is activated the product profile information is read from EEPROM and **Product Profile** dialog is opened.



Product Profile dialog includes the following items:

Settings list box (ALT+E):

A list where user can select desired setting.
User can toggle setting with following **Options** drop list or by double clicking desired setting in list box.

Options drop list (ALT+O):

List allows user to set options to each settings which are listed in **Settings** list box. Possible options per setting are:

Save File button (ALT+S):

Saves all product profile setting to a file. Filename will be asked from the user in a common file save dialog box.

Load File button (ALT+L):

Loads all product profile setting from a file. Filename will be asked from the user in a common file open dialog box.

OK button (ENTER)

Selections are accepted and saved to EEPROM.

Cancel button (ESC)

Selections are ignored and control is returned back to main menu.

Help button (Alt+H)

Context sensitive help

NSW–5 Product Profile Settings

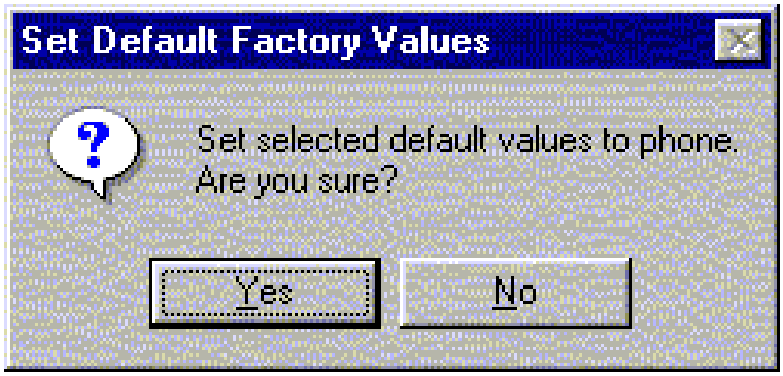
Field test display.....:	On/Off
OAP disable.....	On/Off
Band Check.....:	On/Off
OOA OAP enable.....:	On/Off
MON full support .....:	On/Off
IMSI support.....	On/Off
Callback as default.....:	On/Off
Voice mail.box NBR saving.....	On/Off
Gradiente SW configuration.....	On/Off
Nokia tune.....	On/Off
Main bookmarks.....:	On/Off

Set Default Values... command

Activation	Status Bar Text
Alt, S,V	Set default values

Command is used for resetting default values to phone's EEPROM.

After selection application asks confirmation:



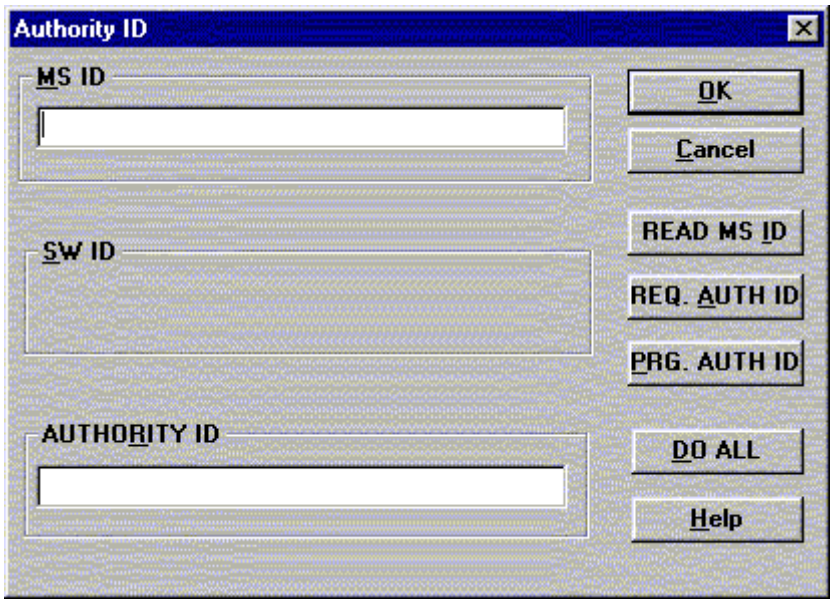
If Yes is confirmed, the default settings are made to the phone:

Warranty info
Phone identity
Production data edit

Authority ID... command

Activation	Status Bar Text
Alt, S,A	Open Authority ID dialog box

This command is used for programming software authorization data remotely and locally.



The **Authority ID** dialog box includes the following items:

MS ID edit box (ALT+M)

Mobile station security id number for remote authority id programming

SW ID edit box (ALT+S)

Software id number may be needed later with with authority id
Not yet supported

AUTHORITY ID edit box (ALT+E)

Software authority id for remote authority id programming

READ MS ID button (ALT+E)

Pressing this button updates MS ID edit box from phone
Shall be used only for remote programming

REQ AUTH ID button (ALT+E)

Only for R&D use

PROG AUTH ID button (ALT+E)

Pressing this button updates value from AUTHORITY ID edit box to phone. Shall be used only for remote programming

DO ALL button (ALT+E)

Pressing this button updates authority id to phone. This button shall be used when TDF–4 (or TDD–4) is connected to PC

OK button (ENTER)

Selections are accepted and saved to EEPROM.

Cancel button (ESC)

Selections are ignored and control is returned back to main menu.

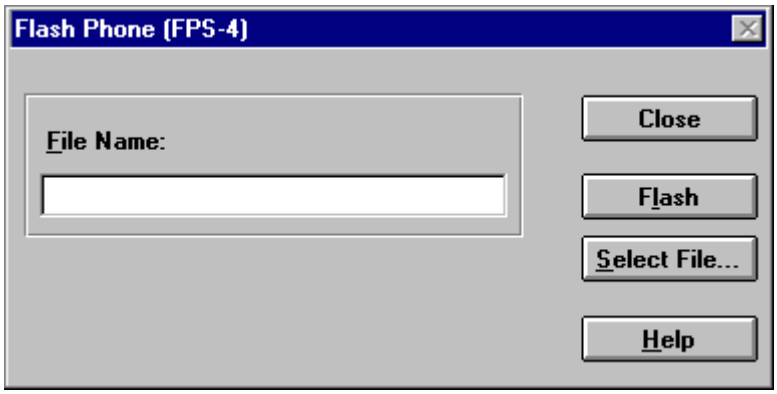
Help button (Alt+H)

Context sensitive help

Flash Phone... command

Activation	Status Bar Text
Alt, S, F	Opens Flash Phone dialog box

This command is used for flashing new software into the phone. While flashing the phone, user is shown approximately flashing time.



The **Flash Phone** dialog box contains the following items:

File Name... edit filed:

Diplays file path to be flashed.

Flash button (ALT+L)

Starts flashing of selected file to the phone.

Select File... button (ALT+S)

Starts flashing of selected file to the phone.

Close button (ESC)

Closes the dialog button and *does not* start flashing.

Help button (Alt+H)

Context sensitive help

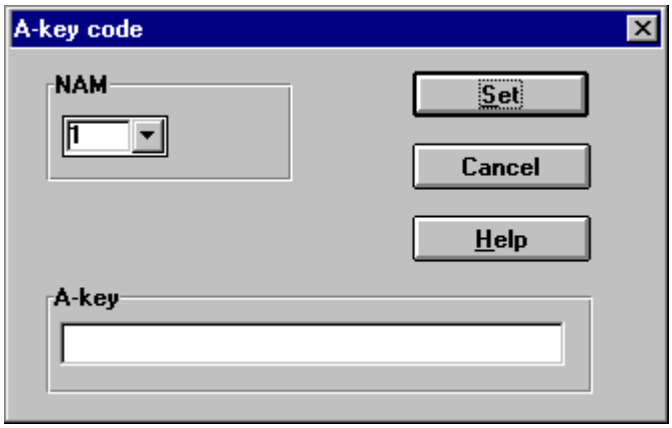
During flashing status dialog is shown. After phone is flashed Authority ID is set to the phone.

A–key... command

Activation	Status Bar Text
	Opens A–key code dialog box

This command avoids programming A–key to the phone.
Not possible to calculate A–key.

If programming is successful there is text ’code ok’ otherwise ’wrong response’.



The **A–key Code** dialog box contains the following items:

NAM list box
: Number Module for programming

A–key edit field
: Value of key

Set button (ALT +L)
: Write value to the phone

Cancel button (ESC)
: Closes the dialog box

Help button (Alt+H)
: Context sensitive help

Dealer

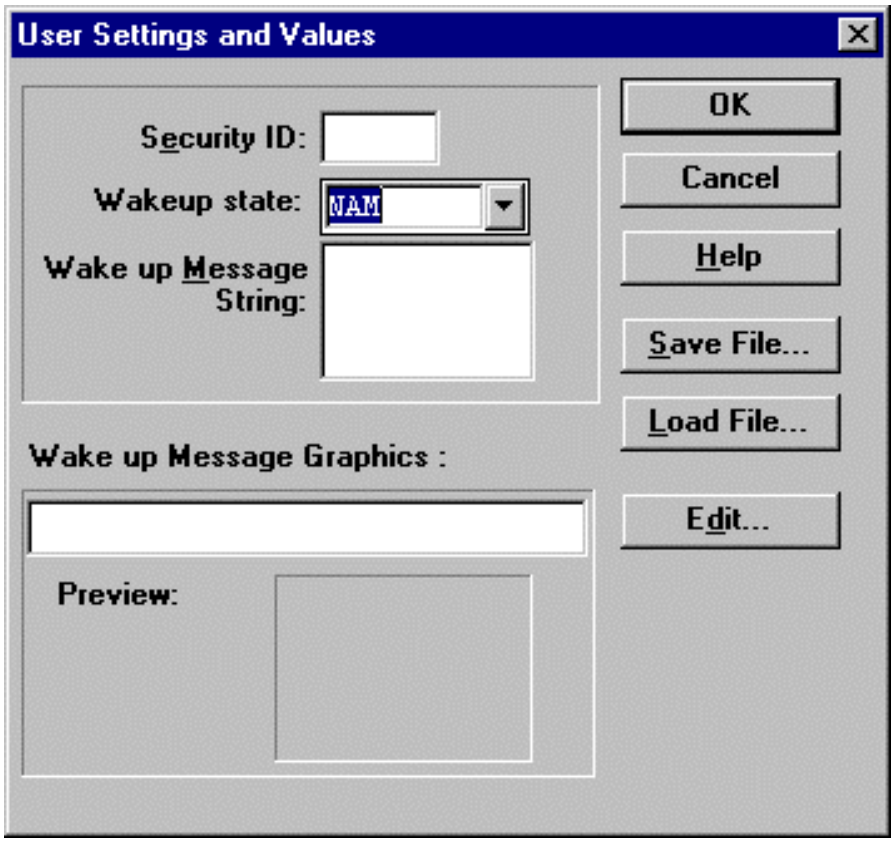
The dealer sub menu offers functions for settings for dealers.

User Settings... command

Activation	Status Bar Text
Alt, D,U	Open User Setting dialog box

This command is used for reading, storing, and modifying the user settings and values.

After menu selection, the program opens a *query* dialog box: “Read user settings from phone?”. If you answer **Yes**, all user settings are read from the ME including menu settings. If reading fails, an error dialog box is shown. If reading is OK, the **User Settings and Values** dialog box is opened.



The **User Settings and Values** dialog box contains the following items:

Security ID edit box (ALT+E):

Edit the security code which is saved to the ME memory together with other user settings and values. Only digits are accepted for Security code. Length must be 5 digits.

Wake up state:

Select NAM, Bitmap or Animation to be shown after phone power up:

Wake up Message String edit box (ALT+M):

Edit Wake up message. The message can contain up to 16 characters.

Wake up Message Graphics group

Save File... button (ALT+S):

Opens a common **File Save As** dialog box and asks for the name of the file to contain user settings and values.

Load File... button (ALT+L):

Opens a common **File Open** dialog box, and asks for the name of the file containing the user settings and values.

Edit button (ALT+D)

Starts Windows Paintbrush to edit the graphical Wake up message bitmap.

OK button (ENTER)

Selections are accepted and saved to EEPROM.

Cancel button (ESC)

Selections are ignored and control is returned back to main menu.

Help button (Alt+H)

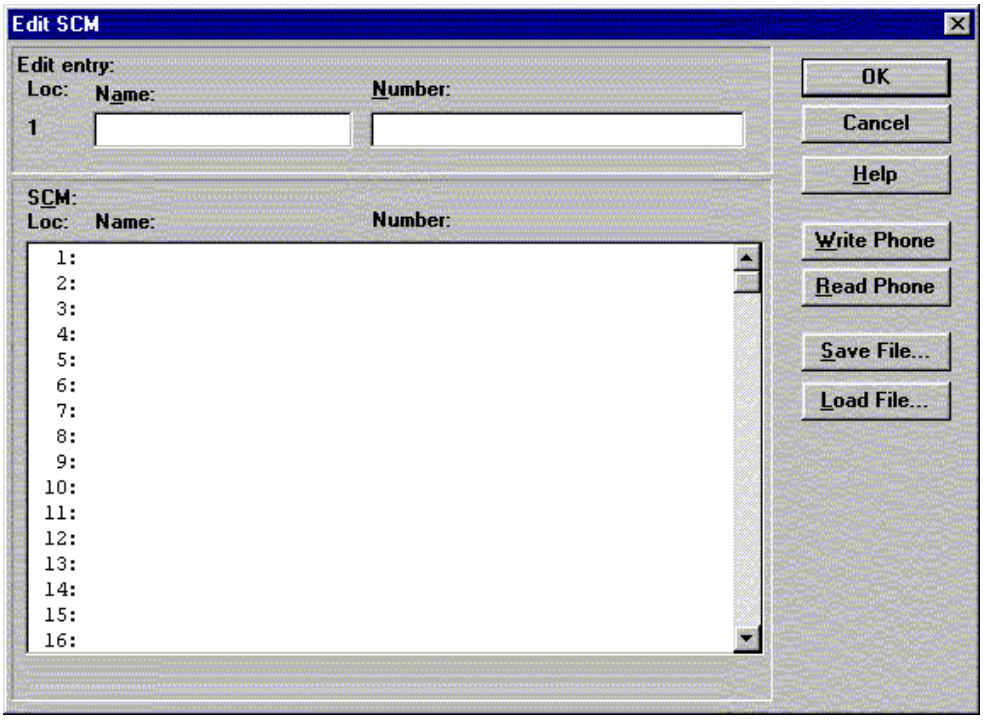
Context sensitive help

Short Code Memory... command

Activation	Status Bar Text
Alt, S,C	Open Edit SCM dialog box.

This command is used for reading, storing and modifying the SCM values. Only one number stored in NSW–5 is shown after the name.

Note:
SCM command can be used to transfer SCM values from other DCT3 type phones to NSW–5.



Edit SCM dialog box includes the following items:

Loc statix text:

Display current location

Name edit box (ALT+A):

Edit the Name.

Number edit box (ALT+N):

Edit the number.

SCM list box (ALT+C):

List for available names and numbers.

Write Phone... button (ALT+W):

Write SCM values to phone and checks the validity of names and numbers.

Read Phone... button (ALT+R):

Read SCM values from phone.

Save File... button (ALT+S):

Opens a default Windows File Save As dialog box and asks filename where to save SCM values.

Load File... button (ALT+L):

Opens a default Windows File Open dialog box and asks file-name where from to load SCM values. Checks the validity of names and numbers.

OK button (ENTER)

Selections are accepted and saved to EEPROM.

Cancel button (ESC)

Selections are ignored and control is returned back to main menu.

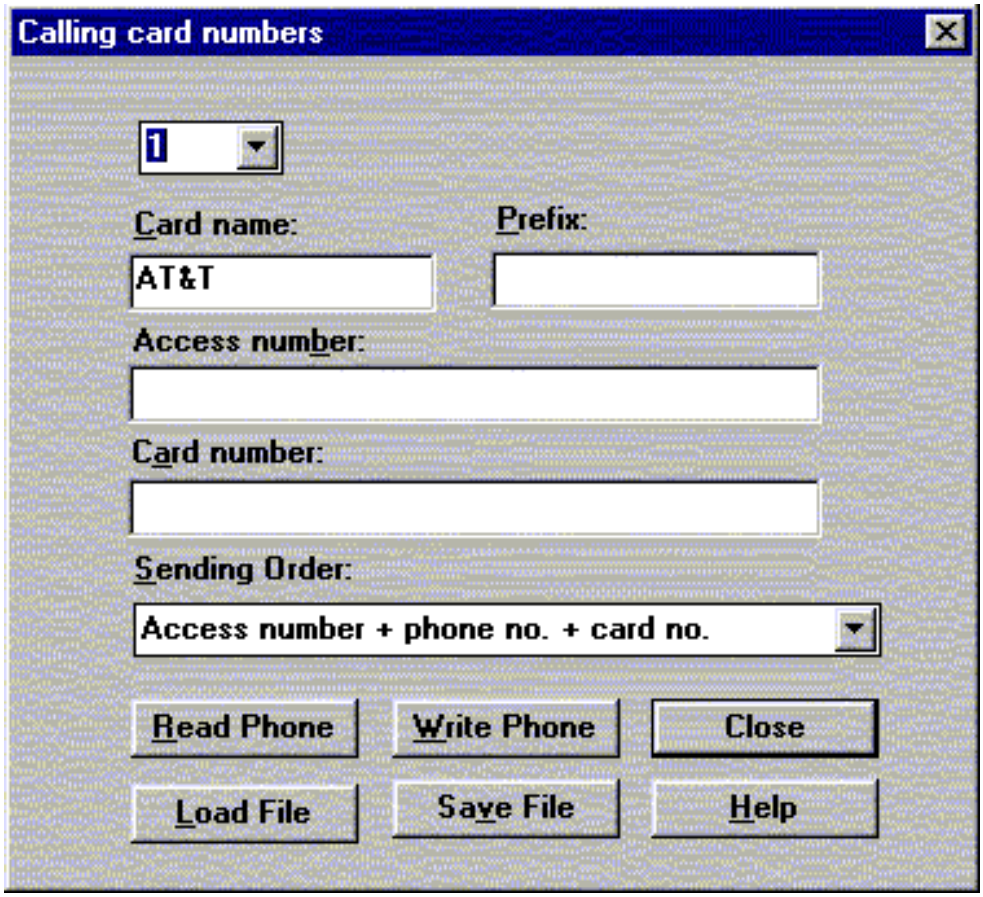
Help button (Alt+H)

Context sensitive help

Calling cards... command

Activation	Status Bar Text
Alt D, L	Open Calling card dialog box.

This dialog enables to program the calling card numbers and operator telephone numbers used in credit card calls.



Calling card numbers dialog includes the following items:

Calling Card drop list

Card can be selected up to four

Card name edit box (ALT+C)

Card name can be edited.

Prefix edit box (ALT+P)

Card prefix can be edited.

Access number edit box (ALT+B)

Card access number can be edited

Card number edit box (ALT+A)

Card number can be edited

Sending order drop list (ALT+S)

Sending order can be selected

Read Phone... button (ALT+R):

Read calling card data from phone and update dialog items

Write Phone... button (ALT+W):

Write data to calling card data to phone

Close... button (ESC)

Closes the dialog button.

Save File... button (ALT+S)

Opens a Windows default File Save As dialog box and asks filename where to save settings.

Load File... button (ALT+L)

Opens a Windows default File Open dialog box and asks file-name where to load settings.

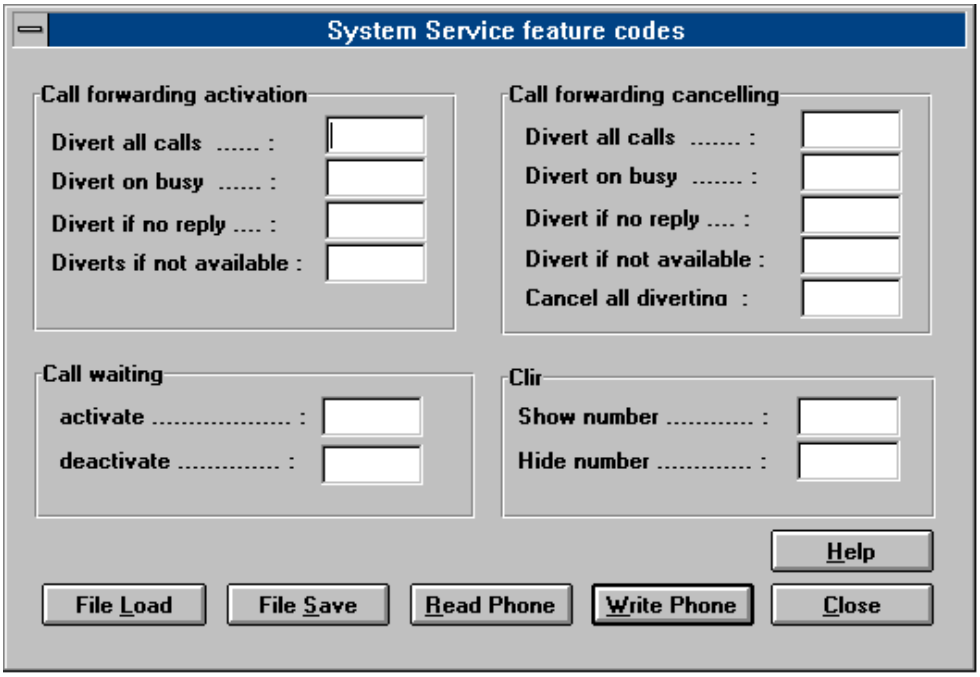
Help button (Alt+H)

Context sensitive help

System Service Feature codes... command

Activation	Status Bar Text
Alt, D,F	Open System service feature codes editing dialog box.

System service feature codes editing dialog box is opened displaying codes in editing fields.



System service feature codes dialog includes the following items:

Call forwarding activation group	Values can be edited
Call forwarding cancelling group	Values can be edited
Call waiting group	Values can be edited
Call identification and restriction group	Values can be edited

Read Phone... button (ALT+R):
Read values from phone and update dialog

Write Phone... button (ALT+W):
Write values to phone

File Load ... button (ALT+L):
Read values from file

File Save ... button (ALT+W):
Write values to file

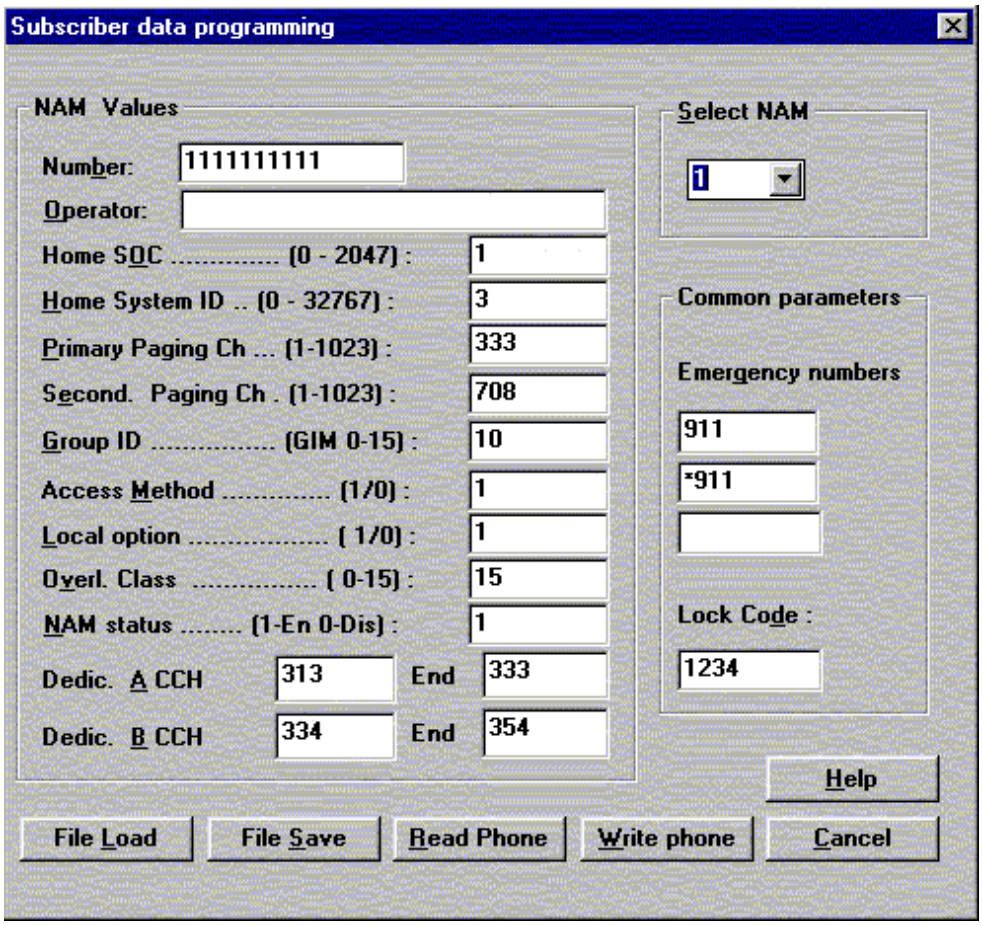
Help button (Alt+H)
Context sensitive help

Close button (ESC) Closes the dialog button.

Subscriber data programming... command

Activation	Status Bar Text
Alt, D,S	Open Subscriber data programming dialog box.

On the upper right corner there is a drop down box, where you can select the NAM you want to edit. The per NAM data below is updated according to the highlighted NAM. Note that emergency numbers and lock code are common to all NAMs.



Subcriber data programming dialog includes the following items:

Select NAM drop list (ALT+S):

The selected position is highlighted

Number edit box (ALT+B)

The alphanumeric MIN value can be edited

Operator edit box (ALT+O):

The alphanumeric value can be edited

Home SOC edit box (ALT+O:

Numeric value can be edited if not locked

Home System ID edit box (ALT+H):

Numeric value can be edited

Primary paging ch edit box (ALT+P):

Numeric value can be edited

Secondary paging ch edit box (ALT+E):

Numeric value can be edited

Group ID Mark edit box (ALT+G):

Numeric value can be edited

Access method edit box (ALT+M):

Numeric value can be edited

Local Option edit box (ALT+L):

Numeric value can be edited

Overl. Class edit box (ALT+V):

Numeric value can be edited

Nam status edit box (ALT+N):

NAM to enable or disable can be edited

Dedic. A CCH start edit box (ALT+A):

Numeric value can be edited

Dedic. B CCH start edit box (ALT+B):

Numeric value can be edited

End

Numeric value can be edited

Emergency numbers edit boxes (ALT+G):

The alphanumeric values can be edited

Lock code edit box (ALT+D):

The alphanumeric value can be edited

File Save... button (ALT+S):

Opens a default Windows **File Save As** dialog and asks file-name where to save user settings and values.

File Load... button (ALT+L):

Opens a default Windows **File Open** dialog and asks filename where from load user settings and values.

Read Phone... button (ALT+R):

Read selected NAM’s values from phone and update dialog items

Write phone... button (ALT+W):

Write selected NAM’s values to phone

Close... button (ALT+S): Close dialog

Cancel button (ESC):

Exit without any changes

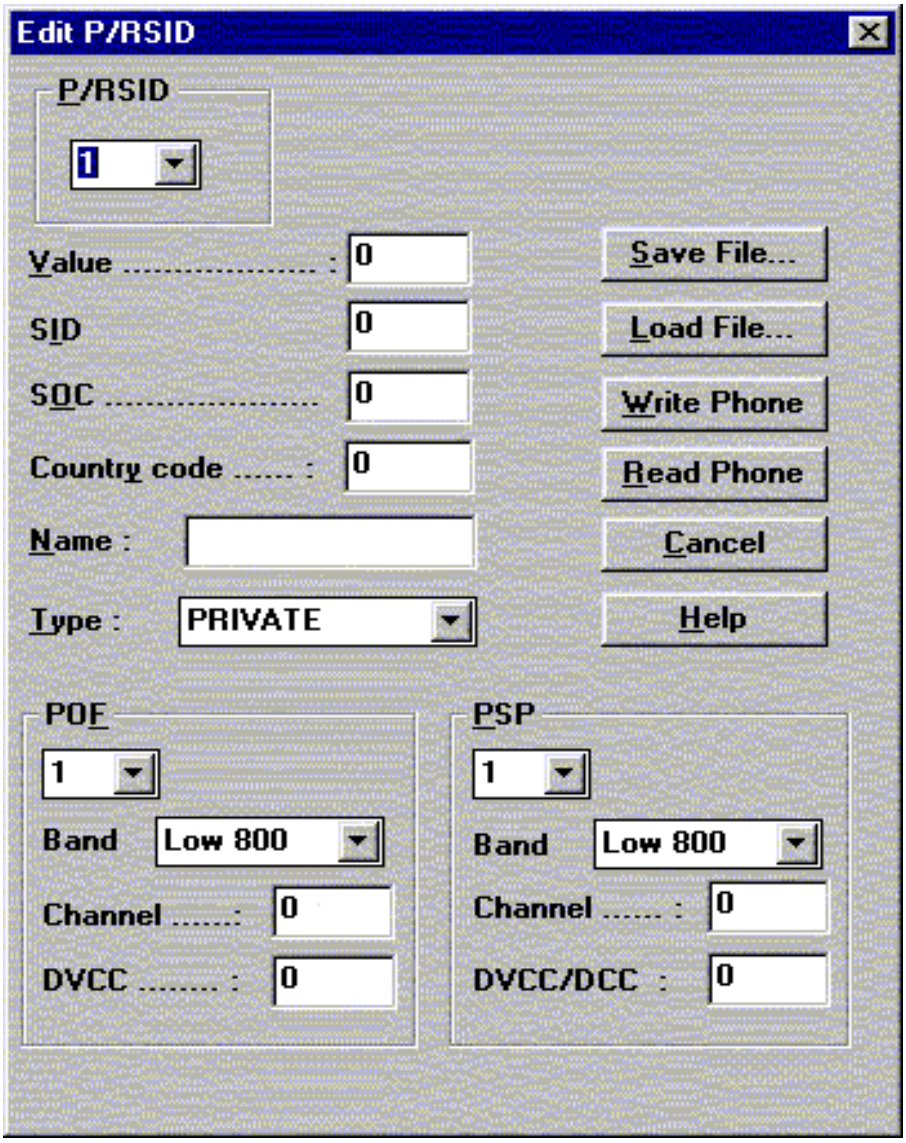
Help button (Alt+H)

Context sensitive help

P/RSID programming... command

Activation	Status Bar Text
Alt, D,R	Open P/RSID programming dialog box.

This command is used to modify the Private and Residential System IDentity values. The list contains up to 5 P/RSIDs.



P/RSID programming dialog includes the following items:

P/RSID list box (ALT+P):

Index to P/RSID list up to 5

Value edit box (ALT+V)

The numeric value of P/RSID

SID edit box (ALT+I)

The Numeric value of Home system ID stored in the mobile and uniquely associated with a MIN

SOC edit box (ALT+O)

Spesifies the System operator accociated with a P/RSID

Country code edit box (ALT+Y)

Numeric values of symbolic value which indicates if this is a Private or Residential

Name edit box (ALT+N)

The alphanumeric designator accociated with a P/RSID

Type list box (ALT+T)

Symbolic value which indicates if this is a Private or Residential

POF List box (ALT+F)

Index to private operating frequencies list up to 4

Band list box

Symbolic Value selected POF‘s band

Channel edit box

Numeric value of selected POF’s channel

DVCC edit box

Numeric value of selected POF’s module control channel

PSP List box (ALT+P)

Index to public service profiles list up to 4

Band list box

Symbolic Value selected PSP ‘s band

Channel edit box

Numeric value of selected PSP’s channel

DVCC/DCC edit box

Numeric value of selected PSP’s module control channel

Save file button

Saves file

Load file button

Loads file

Write phone button

Writes values to phone

Read phone button

Reads phone values

Cancel button (ESC):

Exit without any changes

Help button (ESC)

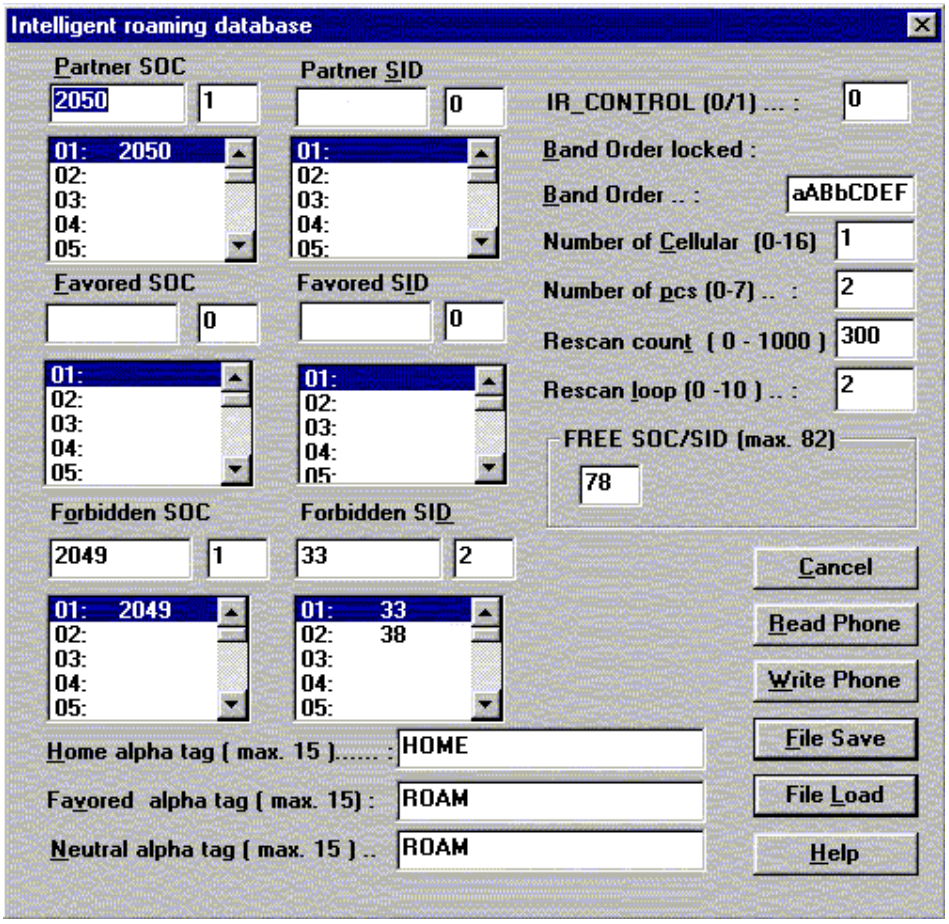
Context sensitive help

Intelligent Roaming Database... command

Activation	Status Bar Text
Alt, D,I	Open Intelligent Roaming Database dialog box.

This command is used to modify database which affects directly to the mobiles behaviour when scanning for control channels.

IRDB includes max 82 lenght SOC/SID list. This is calculated automaticly from tables. If selected more than max. then error code is shown when write to phone.



Intelligent roaming database dialog includes the following items:

Partner SOC list box (ALT+P)

Number of partner SOCs in soc_sid_list. The selected position is highlighted and can be edited.

Partner SID list box (ALT+S)

Number of partner SIDs in soc_sid_list. The selected position is highlighted and can be edited.

Favored SOC list box (ALT+F)

Number of favored SOCs in soc_sid_list. The selected position is highlighted and can be edited.

Favored SID list box (ALT+I)

Number of favored SOCs in soc_sid_list. The selected position is highlighted and can be edited.

Forbidden SOC list box (ALT+O)

Number of forbidden SOCs in soc_sid_list. The selected position is highlighted and can be edited.

Forbidden SID list box (ALT+D)

Number of forbidden SIDs in soc_sid_list. The selected position is highlighted and can be edited.

IR_control edit box (ALT+T)

”1”, only the systems broadcasting. HOME SID or SOC are accepted as a service providers.
”0”, all other systems, except systems broadcasting SID or SOC set as a forbidden in a soc_sid_list, are accepted as a service providers.

Band order locked static

Band order which are not editable

Band order edit box (ALT+B)

The table tells which bands (cellular or/and PCS) and in what order the bands are searched.
a = 800 MHz
b = 800 MHz
A = 1900 MHz
B = 1900 MHz
C = 1900 MHz
D = 1900 MHz
E = 1900 MHz
F = 1900 MHz
00 = NONE

Number of cellular edit box (ALT+ C)

Number of probability blocks to scan in cellular band.

Number of pcs edit box (ALT+ P)

Number of sub blocks to scan in PCS band

Rescan count edit box (ALT+T)

Rescan time in hyperframes (HF = 1,28 seconds).

Rescan loop edit box (ALT+C)

Defines when all the band in band_order are to be scanned

FREE SID/SOC static

Number of free elements in soc_sid_list

Home alpha tag edit box (ALT+H)

Alpha tag is shown on phone’s display when on service with HOME SID or SOC. System is home system if the broadcasted SID or SOC or both of them matches with SID/SOC in a phone’s NAM.

Favored alpha tag edit box (ALT+V)

Alpha tag which is shown on the phone display when on service with PARTNER or FAVORED system.
System is PARTNER/FAVORED system when the broadcasted SID or SOC matches with PARTNER/FAVORED SID/SOC in a phone's soc_sid_list in IRDB.

Neutral alpha tag edit box (ALT+N)

Alpha tag which is shown on phone's display when on service with NEUTRAL.
System is NEUTRAL system when the broadcasted SID and SOC does not match the values in NAM and neither in soc_sid_list in IRDB.

Read Phone button (ALT+R):

Read values from the phone

Write Phone button (ALT+W):

Write values to phone and checks the validity of names and numbers.

Save File button (ALT+S):

Opens a default Windows **File Save As** dialog and asks filename where to save values.

Load File button (ALT+L):

Opens a default Windows **File Open** dialog and asks filename where from load values. Checks the validity of names and numbers.

Cancel button (ESC)

Exit without saving any changes

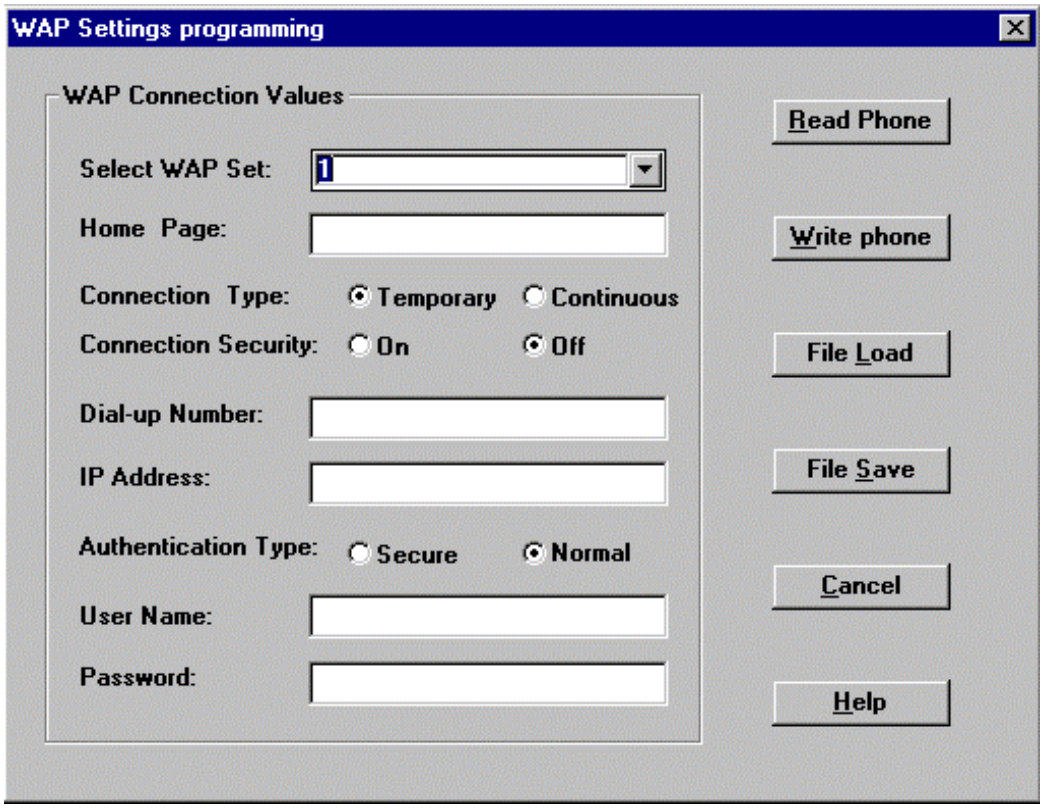
Help button (ESC)

Context sensitive help

WAP Settings... command

This command avoid to modify WAP Settings and WAP Bookmarks. The list contains up to 5 WAP Settings.

Note: Locked WAP Settings cannot be read, written or modified.



WAP Settings dialog includes the following items

WAP Connection Values group:

Select WAP Set list box

Index to WAP Settings list up to 5

Home Page edit box

The alphanumeric Internet address value can be edited

Connection Type radio buttons

One of the following values can be chosen:
Connection Type **Temporary**
Connection Type **Continuous**

Connection Security radio buttons

One of the following values can be chosen:
Connection Security **On**
Connection Security **Off**

Dial–up Number edit box

The numeric Dial–up number value can be edited

IP Address edit box

The alphanumeric Internet Protocol address value can be edited

Authentication Type radio buttons

One of the following values can be chosen:
Authentication Type **Secure**
Authentication Type **Normal**

User Name edit box

The alphanumeric value can be edited

Password edit box

The alphanumeric value can be edited.
Password characters show as asterisks (*).

Read Phone button (ALT+R):

Read values from the phone

Write Phone button (ALT+W):

Write values to phone and checks the validity of names and numbers.

File Save button (ALT+S):

Opens a default Windows **File Save As** dialog and asks file-name where to save values.

File Load button (ALT+L):

Opens a default Windows **File Open** dialog and asks filename where from load values.

Close button (ESC)

Exit without saving any changes

User Data Transfer... command

Activation	Status Bar Text
Alt, D, D	Open User Data Transfer dialog box.

This command is used for transfer user data from phone to the file and from file to the phone.

User Data Transfer dialog comprises the following items:

Load All button (ALT+L)

Load all user data from file to the phone.
NAM1 number is restored

Save All button (ALT+S)

Save all user data from the phone to the file.

Save Wakeup button (ALT+W):

Save graphical wakeup message from the phone to the file.
This file is only for FastNAM use.

Cancel button (ESC)

Exit without any changes

Help button (ALT+H)

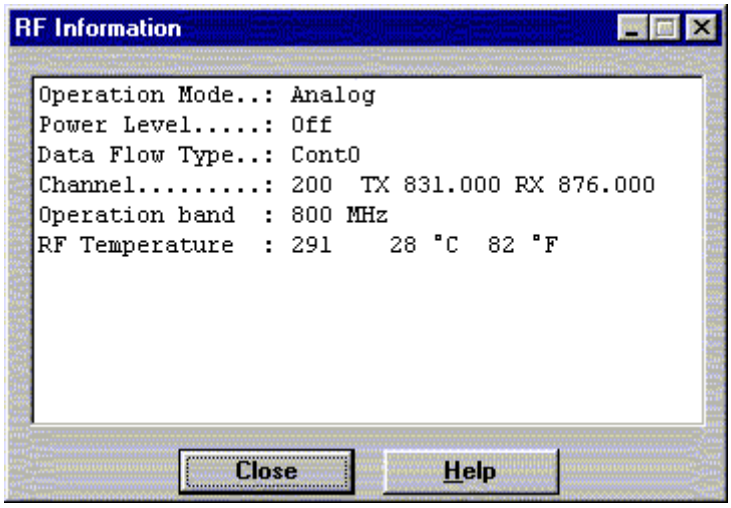
Context sensitive help.

View

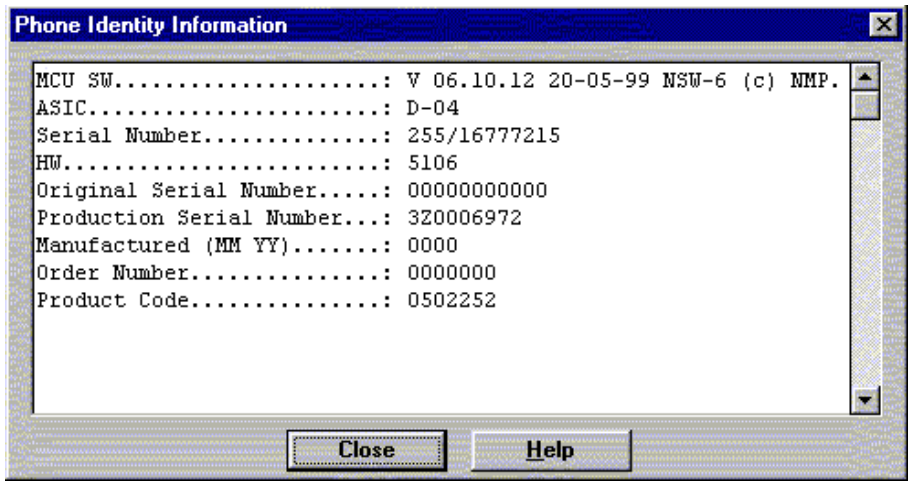
Quick/RF Info... command

Activation	Status Bar Text
Alt, V,Q	View Quick/RF information.

If phone is in *normal* mode the following **Quick Info** is shown:



If the phone is in local mode the **RF Information** window is shown. Information is shown in a modeless dialog box which may be left open during other operations. It is also updated when ever needed.



Close... button (ALT+S):

Close dialog

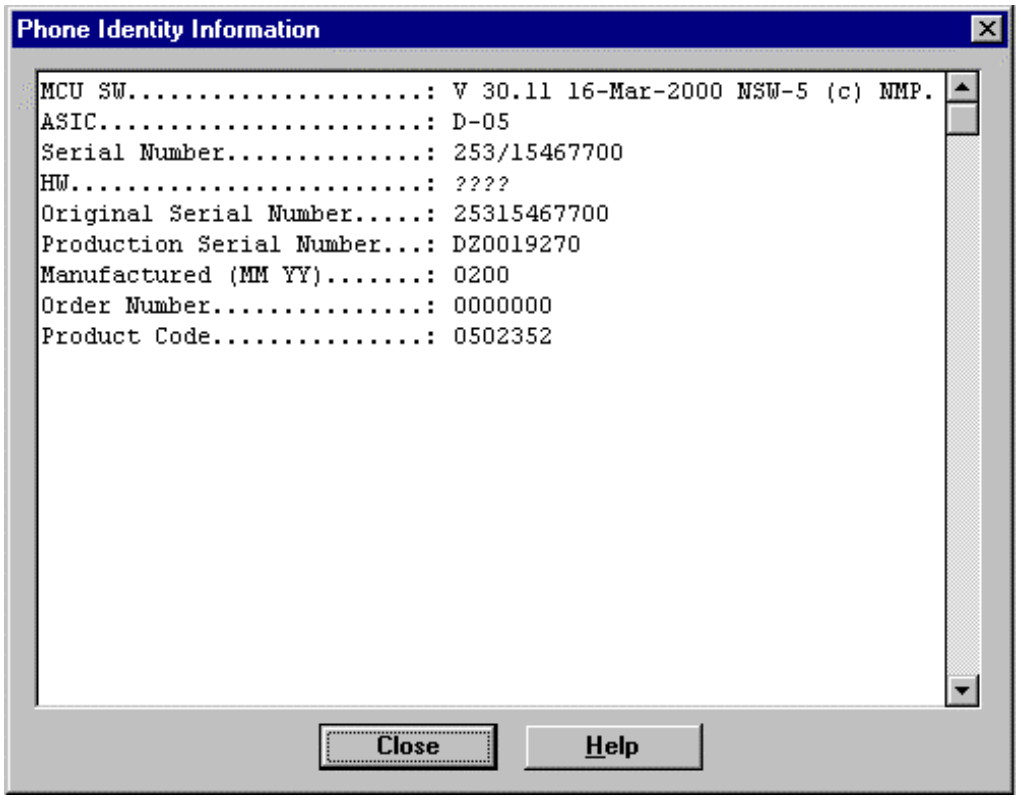
Help button (Alt+H)

Context sensitive help

Phone Identity... command

Activation	Status Bar Text
Alt, V,P	View Phone Identity.

Command opens the **Phone Identity Information** dialog box, which shows identification information. The information is shown in a modeless dialog box which may be left open during other operations. It is also updated when ever needed.



Close... button (ALT+S):

Close dialog

Help button (Alt+H)

Context sensitive help

Appendix 1, Vocabulary

Abreviation	Description
ADC	Analog to Digital Converter
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
ASIC	Application Specific Custom Circuit, for instance the one that controls communication between the MCU and DSP
BBD–3	Service battery
CLF	Common Look and Feel
CLI	Calling Line Identification
COBBA	Common Base Band Analog
DAC	Digital to Analogue Converter
DATA	DATA interface module
DAU–9S/P	MBUS/FBUS cable
DLL	Dynamic Link Library
DSP	Digital Signal Processor which controls radio interface and speech coding/decoding
EEPROM	Memory for adjustment parameters (Electrically Erasable and Programmable Read Only Memory)
ESN	Electrical Serial Number
FBUS	Fast serial bus
GPIB	General Purpose Instrument Bus, also know as HPIB. Specified by IEE488.2.
IMEI	International Mobile Equipment Identification code
IR	Infra Red transmitter
M2BUS	Serial communication bus which can be connected to accessory devices and test PC
MCU	Master Control Unit processor
MDI	MCU DSP Interface; message interface via ASIC registers
ME	Mobile Equipment
MODAL (dialog box)	A modal dialog box requires the user to complete interaction within a dialog box, and close it before continuing with any further interaction outside the window.
MODELESS (dialog Box)	A modeless dialog box allows the user to interact with other windows and applications.

MS	Mobile Station
PC	IBM PS/AT or compatible personal computer
PCI	Phone Controlling Interface SW for PC
PKD–1	Hardware protection key (DESKEY DK2) for protecting service software from illegal copying. The software will not work without this key !
RF	Radio Frequency parts
RSSI	Received Signal Strength Indication
RTC	Real Time Clock
SW	Software
TDF–4	Flash security box
Tesla	Acronym, stands for **T**est and **S**ervice **L**ocals **A**pplication.
UI	User Interface
WinTesla	This Service Software program. Name copyright Nokia Mobile Phones (1996).

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PAMS Technical Documentation
NSW-5 Series Transceivers

Service Tools

Issue 1 10/2000

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue 1	**10/00**	OJuntune	

CONTENTS

SERVICE TOOLS

Service Battery BBD-3

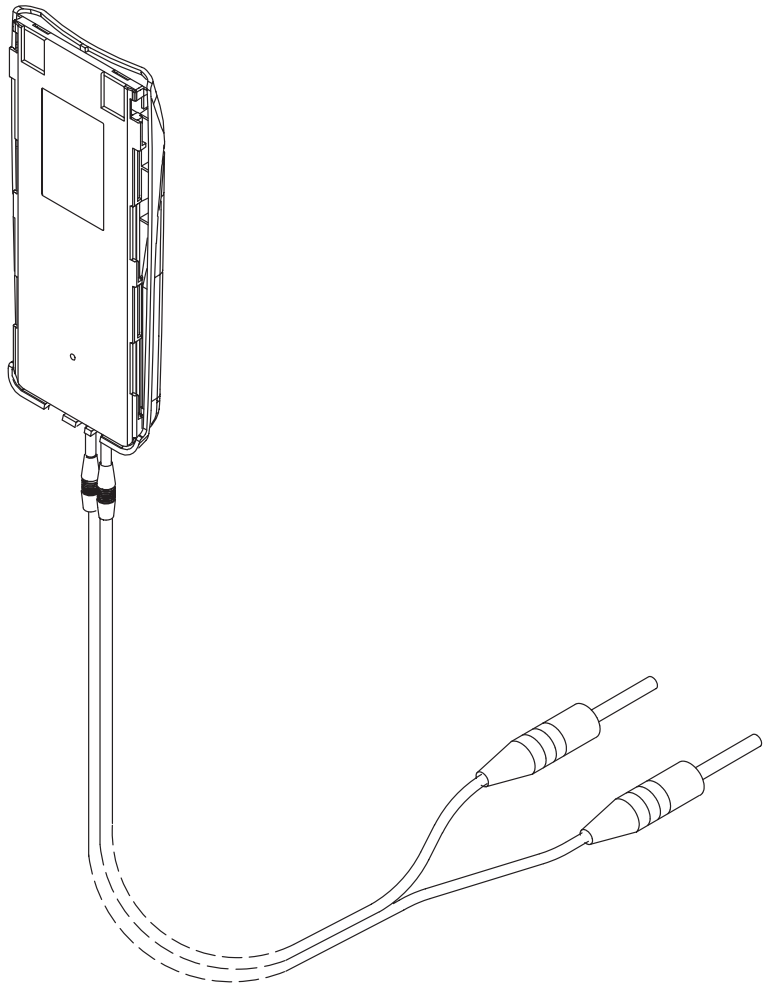
The Service Battery BBD-3 is used in place of the phone's normal battery during service, to supply a controlled operating voltage to the phone for current and charger calibration, and is also required when flashing the phone. Nominal supply voltage for BBD-3 is 8.5V.

Note that the cable SCB-3 (0730114) is also required for charger calibration.

Product Code

Service Battery BBD-3: 0775071

View of BBD-3



Service Battery BTD-3

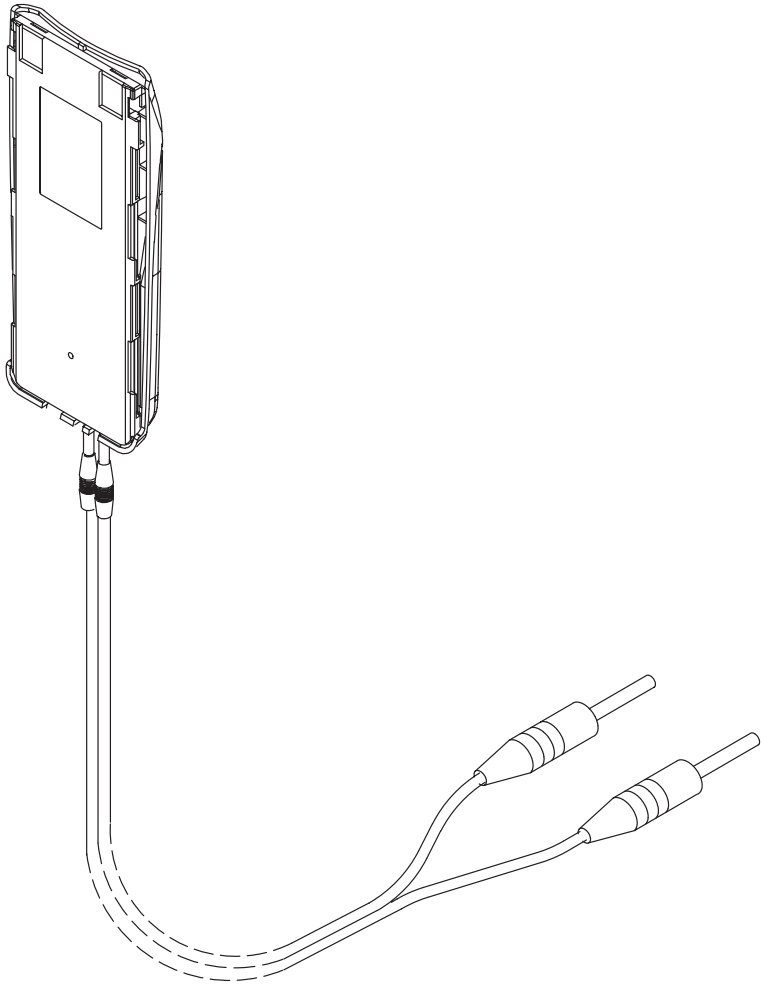
The Service Battery BTD-3 is used in place of the normal battery of the phone during service, to supply a maximal operating voltage to the phone also in AMPS mode.

Nominal Supply voltage for BTD-3 is 8.5 V.

Product Code

Service Battery BTD-3:	0670280

View of BTD-3



Battery Adapter BDC-3

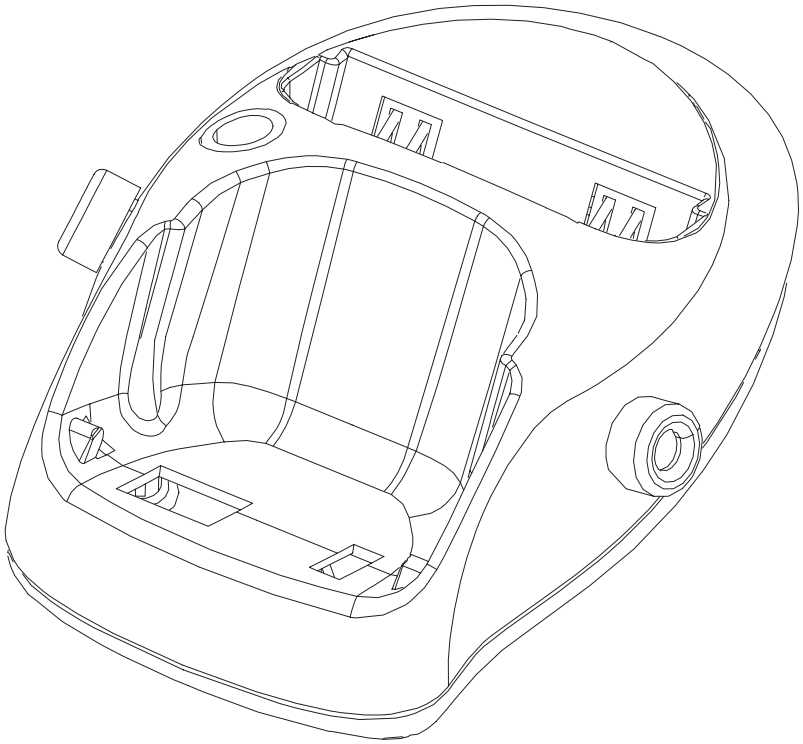
The Battery Adapter BDC-3 is used along with an external battery capacity meter to check battery capacity.

Note that Li-ion batteries have an internal protection circuit to prevent deep discharge.

Product Code

Battery Adapter BDC-3:	0770083

View of BDC-3



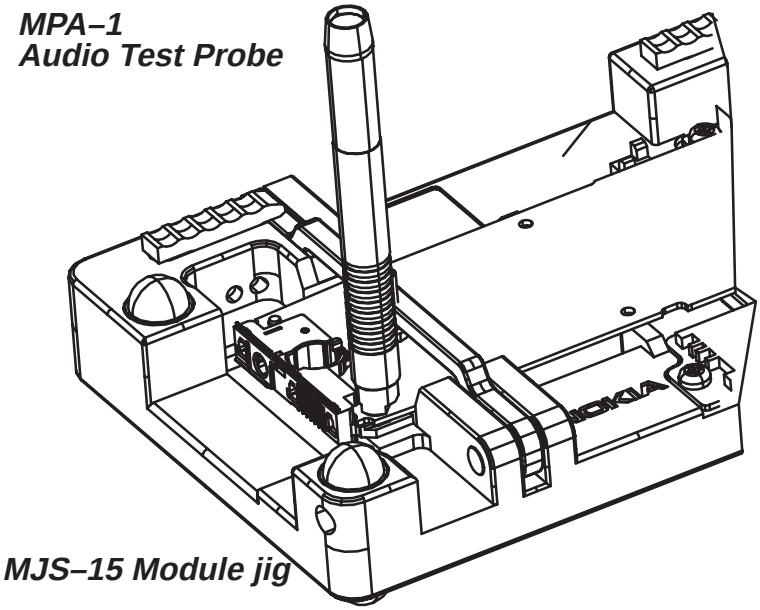
Audio Test Probe MPA-1

MPA-1 is a Audio Test Probe used for testing the microphone signal together with the Module Jig MJS-15.

Product Code

Audio Test Probe MPA-1: 0775169

View of MPA-1



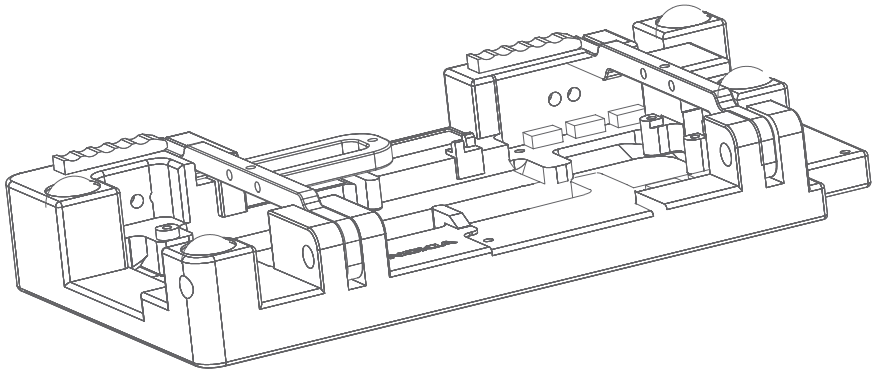
Module Jig MJS-15

The MJS-15 jig is designed for testing/repairing the engine separately, engine mounted with light guide assembly or /and with keymat.

Product Code

Module Jig MJS-15: 0770180

View of MJS-15



Connect the external antenna cable XRC-2, service Cable SCH-5A, and the DC-Cable PCS-1 to the MJS-15 jig.

The service cable SCH-5A can be replaced by the DAU-9M cable.

Note: The nominal supply voltage for MJS-15 is +3.6V.

The supply voltage must not exceed +5.0V.

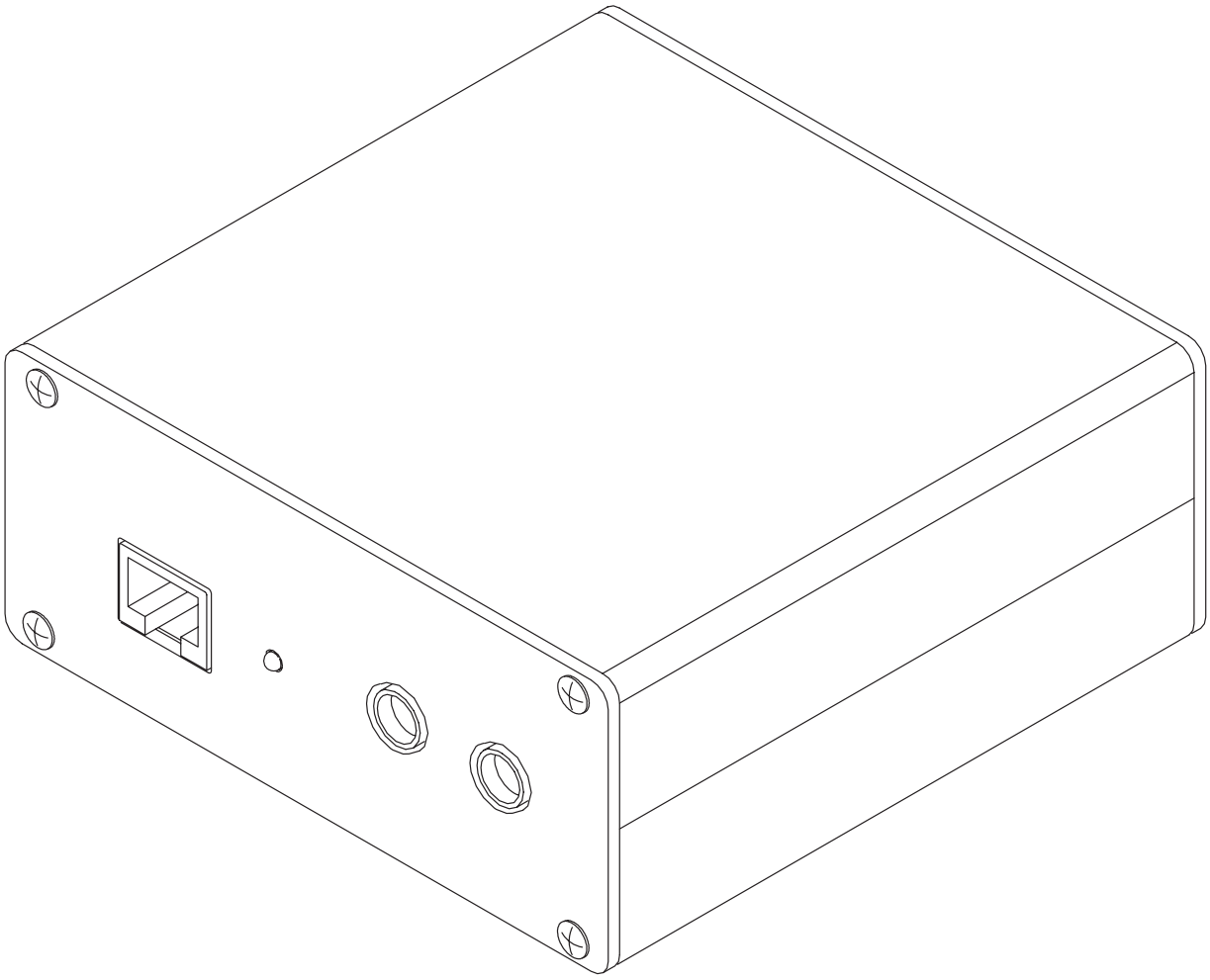
Flash Loading Adapter FLA–5

The Flash Loading Adapter FLA–5 is used with the Service Battery BBD–3 or BTD–3 and Service Cable SCH–5A. Power is supplied to FLA–5 from the Flash Security Box TDF–4 via the DC cable PCC–1, (The PCC–1 cable can be replaced with a Travel Charger ACH–6), and it is connected to the Flash Prommer FPS–4S with the cable AXS–5.

– Flash Loader Adapter FLA–5 0770085

Note: No longer available for purchase!

View of FLA–5



Flash Loading Adapter FLA–7

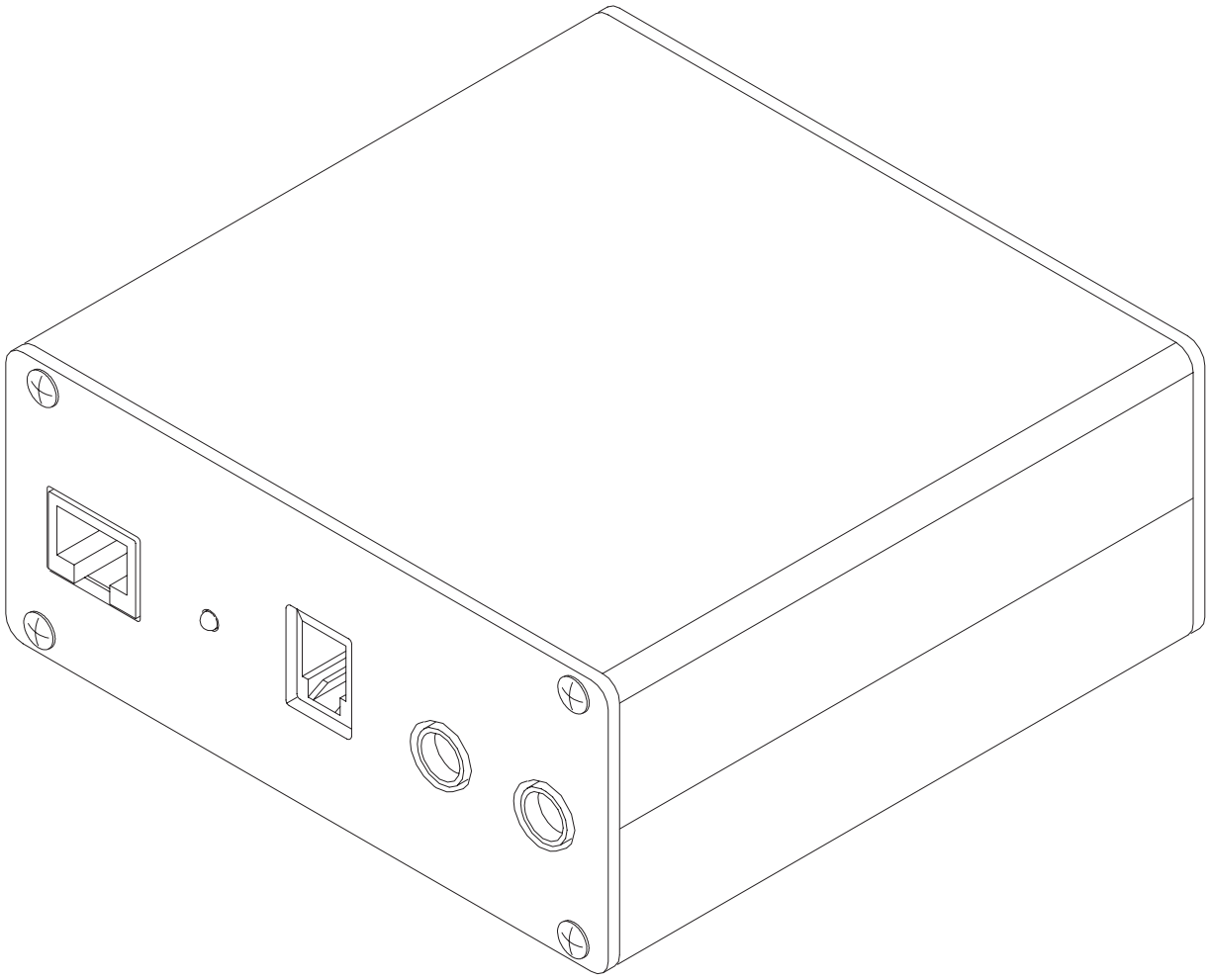
NOTE: If you already have FLA–5, FLA–7 is not needed. The Flash Loading Adapter FLA–7 is used with the Service Battery BBD–3 or BTD–3 and Service Cable SCH–5A.

Power is supplied to FLA–7 from the ACL-3 Charger. Power for the FPS-4 can be connected via the FLA-7 by power cable SCF-7. The adapter is connected to the Flash Prommer FPS–4S by the cable AXS–5 and to the security box TDF-4 by the XCM-1 cable.

Sales package code

Flash Loading Adapter FLA–7: 0080326

View of FLA–7



Flash Prommer FPS-4S

The Flash Prommer FPS-4S is used to update the main software of the phone. Updating is done by first loading the new MCU software from the PC to the flash prommer, and then loading the new SW from the prommer to the phone. When updating more than one phone in succession, the MCU software only needs to be loaded to the prommer once.

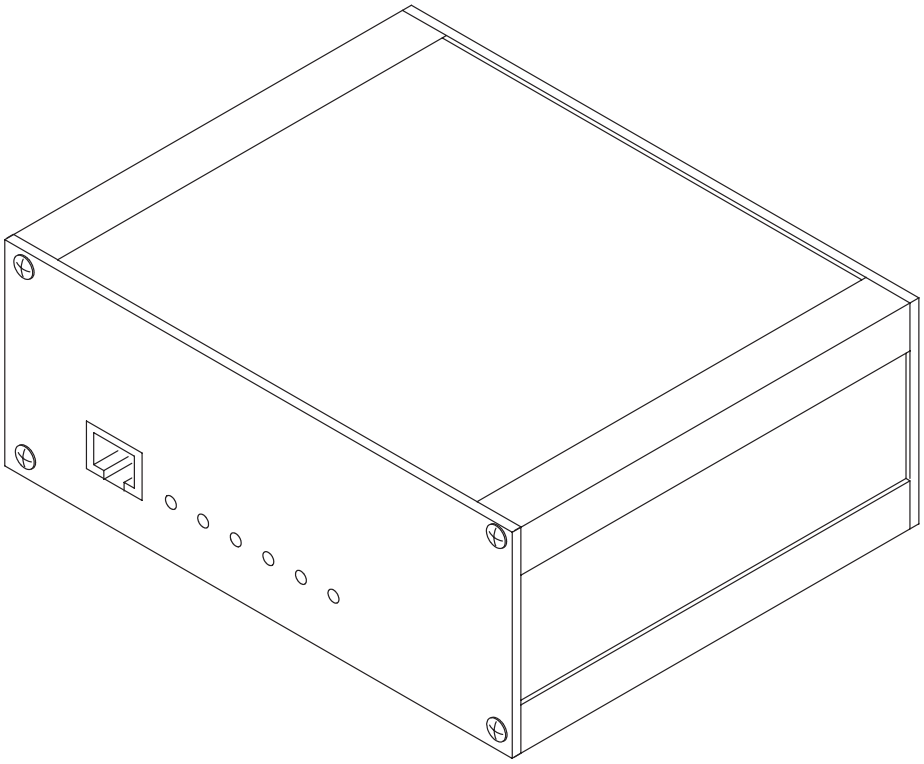
Sales Pack Code

Flash Prommer FPS-4S (Americas): 0081275

The FPS-4S sales pack **0081275** includes:

– Flash Prommer FPS-4:	0750090
- Installation software FPS–4	8400041
- D9 - D9 Cable AXS-4	0730090
- Printer Cable IBM DB25F/57–30360	0730029

View of FPS-4S



Security Box TDF-4

The Security Box TDF-4 is required for updating MCU software, and infra red testing.

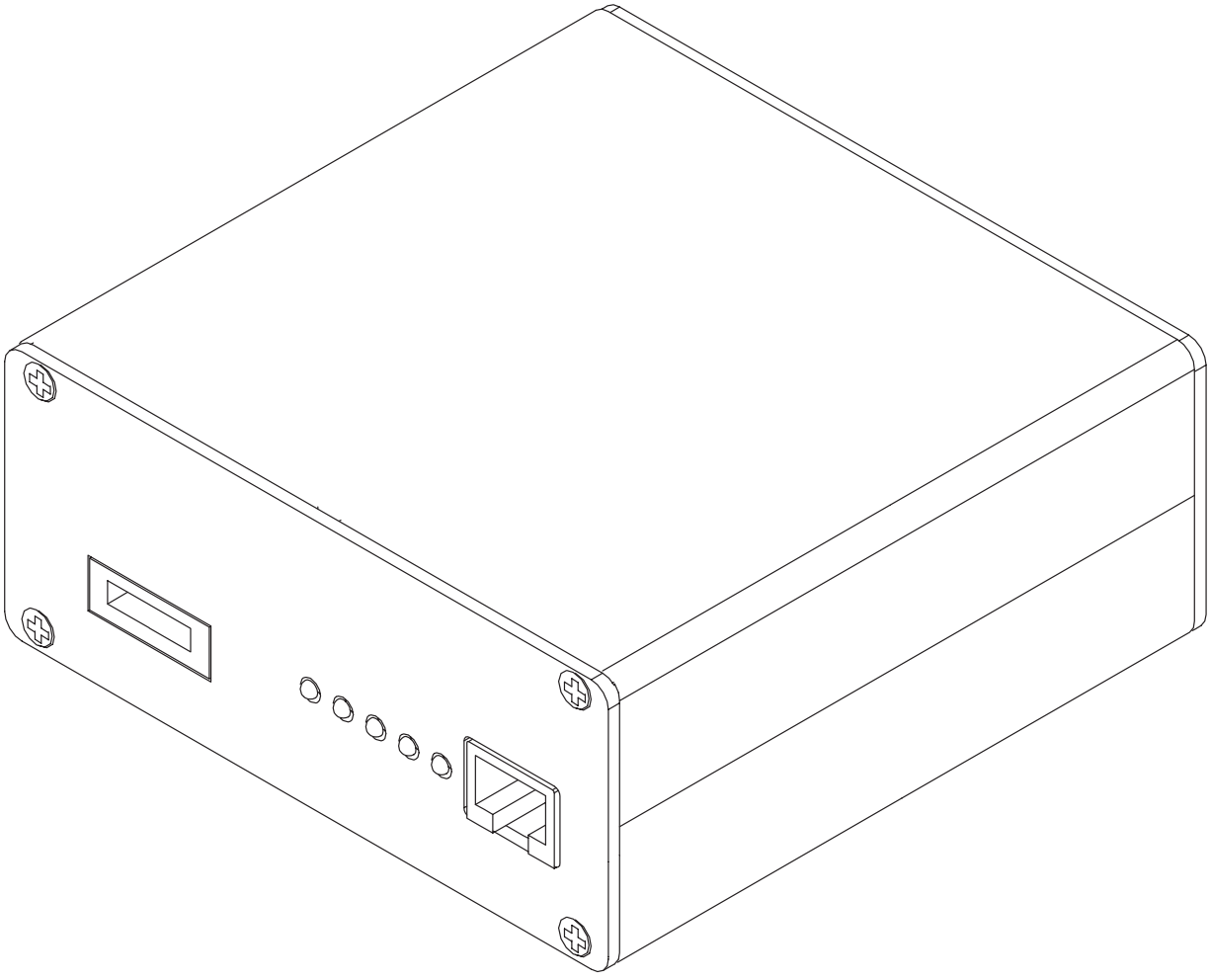
Note1: TDF-4 is delivered in de-activated mode. Fill in the enclosed Activation Request Form, and fax to NMP Salo to get the activation code

Note2: The infra red module JLP-1 is not included in the TDF-4 sales package

Product Code

Security Box TDF-4:	0770106

View of TDF-4



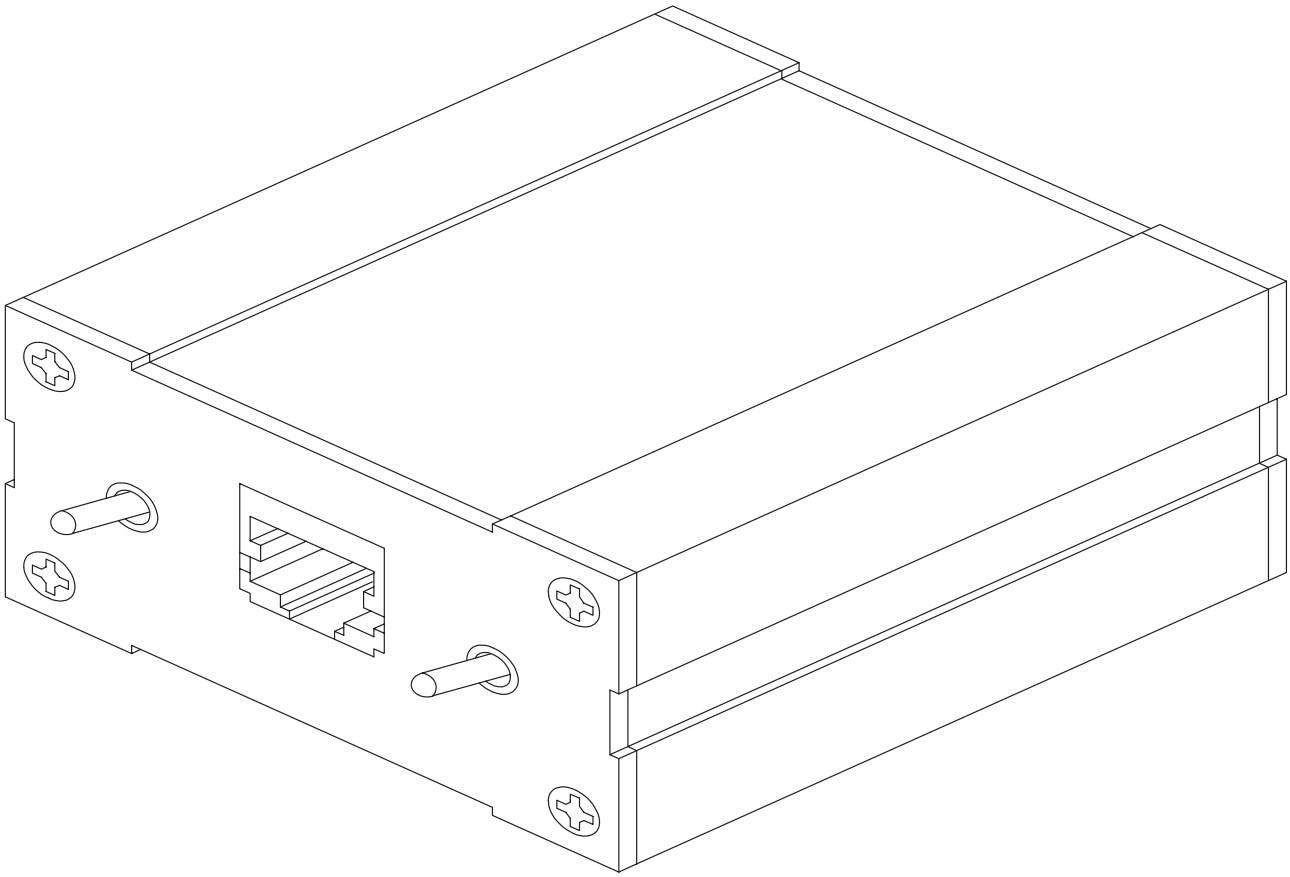
Service Audio Box JBA-4

The Service Audio Box JBA-4 is used between the Service Cable SCH-5A, MBUS Cable DAU-9S, and Audio Cable ADS-1.

Product Code

Service Audio Box JBA-4:	0770094

View of JBA-4



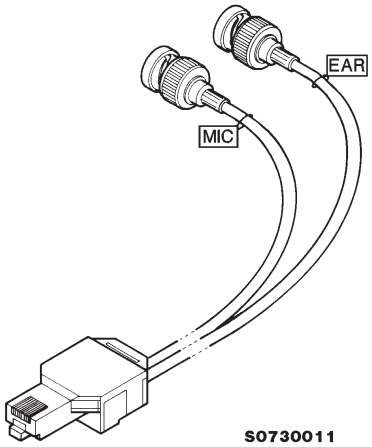
Audio Cable ADS-1

Audio cable is an adapter routing AF signals (MIC/EAR) from 8 pin modular connector to two BNC connectors. It is used to connect JBA-4, SCH-5A and DAU-9S.

Product code

Audio Cable ADS-1: 0730011

View of ADS-1



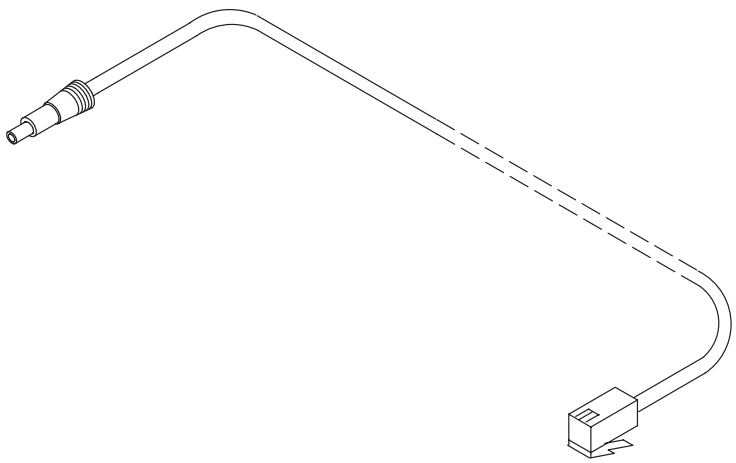
DC Cable PCC-1

The DC Cable PCC-1 is used to connect TDF-4 and FLA-5.

Product Code

DC Cable PCC-1: 0730053

View of PCC-1



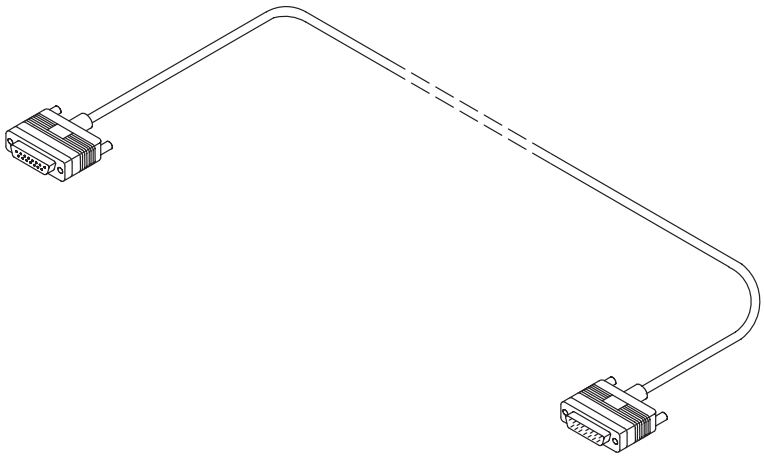
D15-D15 Cable AXS-5

The D15-D15 Cable AXS-5 is used to connect two 15 pin D connectors. e.g. between FLA-7 and FPS-4S.

Product Code

D15-D15 Cable AXS-5: 0730091

View of AXS-5



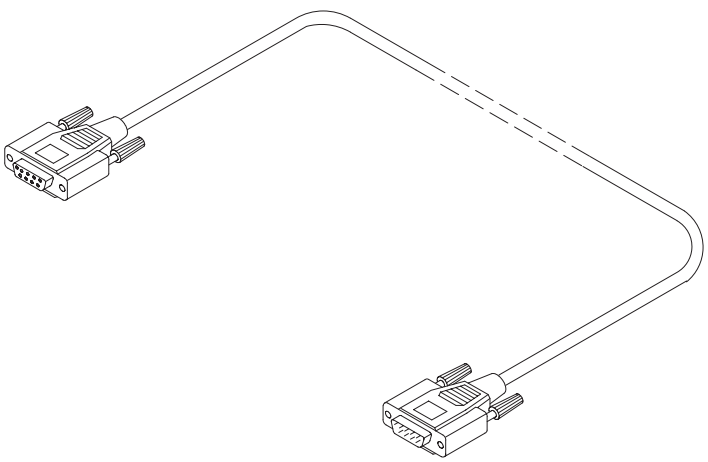
D9-D9 Cable AXS-4

The D9-D9 cable AXS-4 is used to connect two 9 pin D connectors. e.g. between PC and TDF-4 security box.

Product Code

D9-D9 Cable AXS-4: 0730090

View of AXS-4



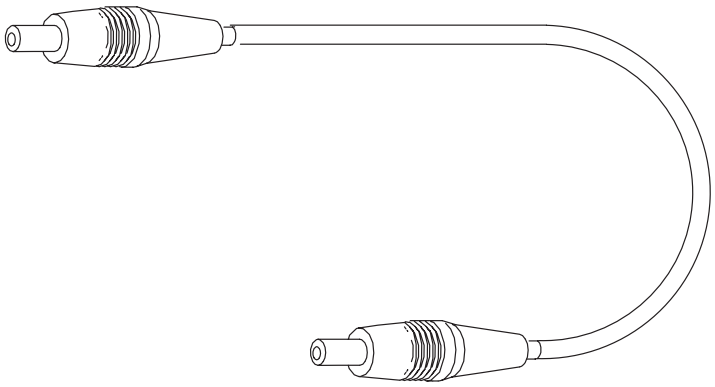
DC Cable SCB-3

The DC Cable SCB-3 is used to connect the Service Battery to the charger connection Vin of the phone when doing the charger calibration service procedure.

Product Code

DC Cable SCB-3: 0730114

View of SCB-3



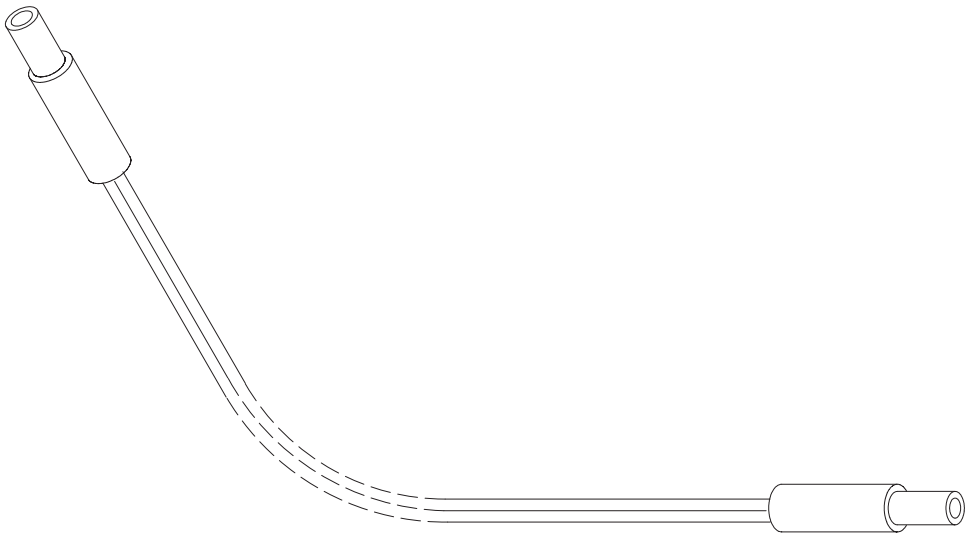
DC Power Cable SCF-7

The DC power cable SCF-7 is used for connecting power from ACL-3 charger via FLA-7 to FPS-4.

Product Code

DC Power Cable SCF-7: 0730141

View of SCF-7



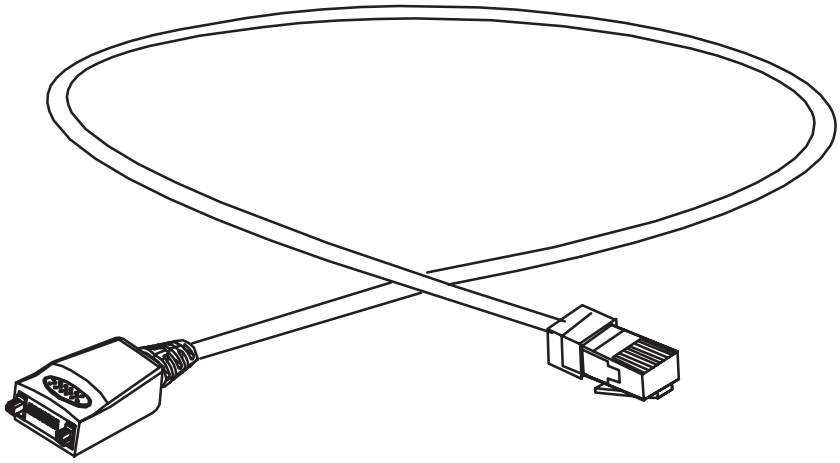
Service Cable SCH-5A/SCH-11

The Service Cable SCH-5A features a lower connector and it is used between the NSW-5 phone and Service Audio Box JBA-4 or modular T-adapter. It is also used between the phone and the flash loading adapter FLA-7.

SCH-11 is identical with SCH–5A except longer.

Product Code

Service Cable SCH-5A:	0730166
Service Cable SCH-11:	0730198



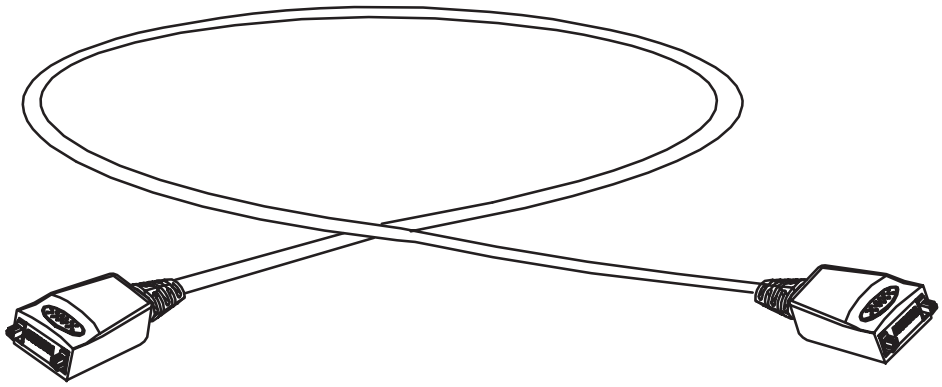
Warranty Cable SCH-10

The Warranty Cable SCH-10 is used to connect two phones for the purpose of transferring data (stored numbers etc.) from one to the other.

Product Code

Warranty Cable SCH-10:	0730175

View of SCH-10



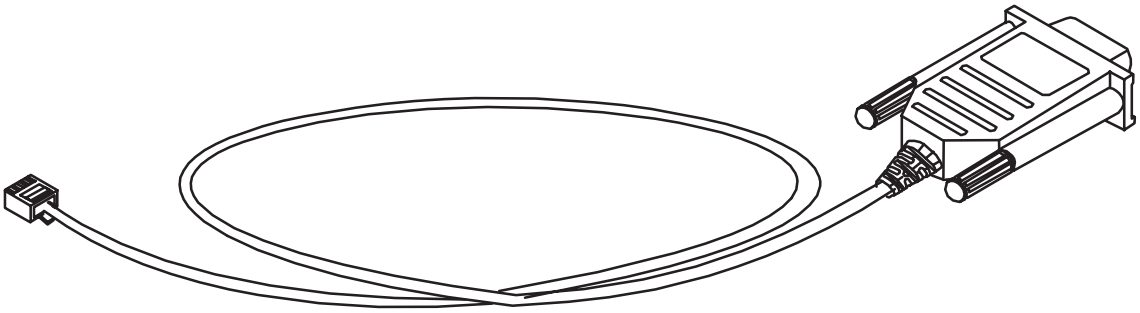
MBUS Cable DAU-9S

The MBUS Cable DAU-9S has a modular connector, and is used with the service Audio Box JBA-4, or a modular T-adapter.

Product Code

MBUS Cable DAU-9S: 0730108

View of DAU-9S



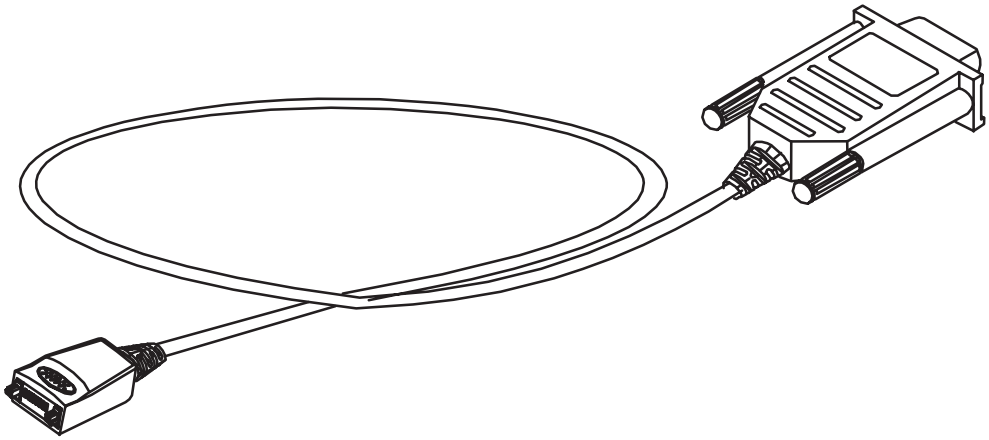
MBUS Cable DAU-9M

The MBUS Cable DAU-9M features a phone system connector, and is used between the phone and external devices.

Product Code

MBUS Cable DAU-9M: 0730162

View of DAU-9M



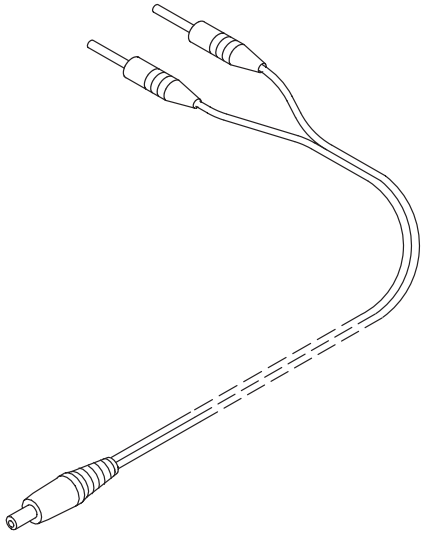
Power Cable PCS-1

The Power Cable PCS-1 is used to connect the module jig MJS-15 to an external power supply.

Product Code

Power Cable PCS-1: 0730012

View of PCS-1



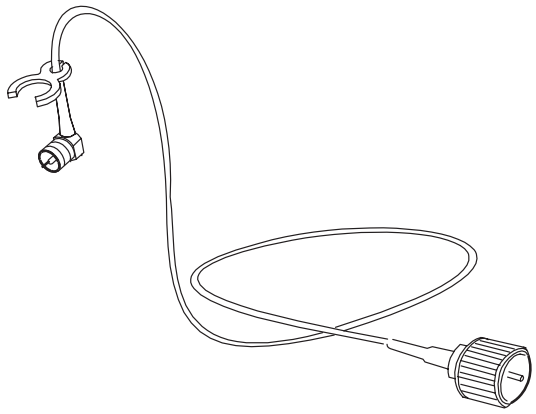
External Antenna Cable XRC-2

XRC-2 is a modular cable with N-connector for RF measurements

Product Code

External Antenna Cable XRC-2: 0730180

View of XRC-2



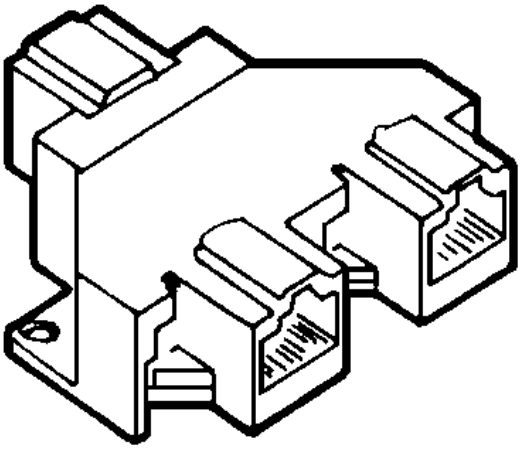
Modular T-adapter

The modular T-adapter is a suitable branching unit to provide the needed parallel modular connections.

Product Code

Modular T-adapter: 4626134

View of Modular T-adapter



SW Security Device PKD-1

SW security device is a piece of hardware enabling the use of the service software when connected to the parallel (LPT) port of the PC. Whitout the dongle present it is not possible to use the service software. Printer or any such device can be connected to the PC through the dongle if needed.

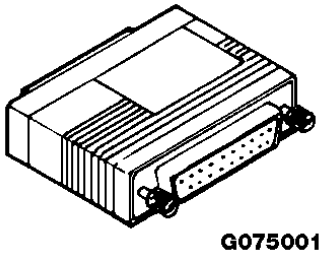
Caution: Make sure thet you have switched off the PC and the printer before making connections!

Caution: Do not connected the PKD-1 to the serial port. You may damage your PKD-1!

Product Code

SW Security Device PKD-1: 0750018

View of SW Security Device



G0750018

Dongle/Flash Device FLS-2D (Sales Pack)

FLS-2D is a dongle and flash device incorporated into one package, developed specifically for POS use.

Product Code

Sales Pack -Americas	0081309
Sales Pack -APAC	0081310
Sales Pack - Europe/Africa	0081311

View of FLS-2D

Sales Pack Contents

Part no.	Description
0774168	FLS-2D Flash Device.
0730163	AXS-4U Cable.
0770177	Disk- Installation package,16bit Dongle Drivers.
0770176	Disk - Installation package, 32bit Dongle Drivers.
0774120	Disk - Installation package for the FLE-5 Drivers.
0774123	Disk - Remote Update Application Installation Package.
0275405	Installation and User Guide
0275404	Registration Request Form

***Note**: in addition to this Sales Pack, a Service Cable will be required to connect the FLS-2D to the Product/Phone to be flashed, e.g. SCH-5A, and a software package to run the flashing process.*

The picture below shows how to connect the FLS-2D device and associated cables to the PC and Product/Phone.

FLS-2D Connection Diagram

1. FLS-2D (connects to parallel port)
2. SCH-5A
3. AXS-4U
4. PC

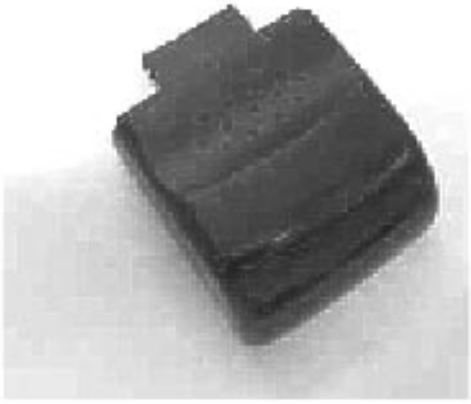
IR Data Interface Module JLP-1

IR Data Interface Module JLP-1 fits in the Security Box TDF-4 and can be used to perform IR tests with Wintesla.

Product Code

IR Data Interface Module JLP-1	0750079

Views of JLP-1



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PAMS Technical Documentation
NSW-5 Series Transceivers

Tuning and Flashing Instructions

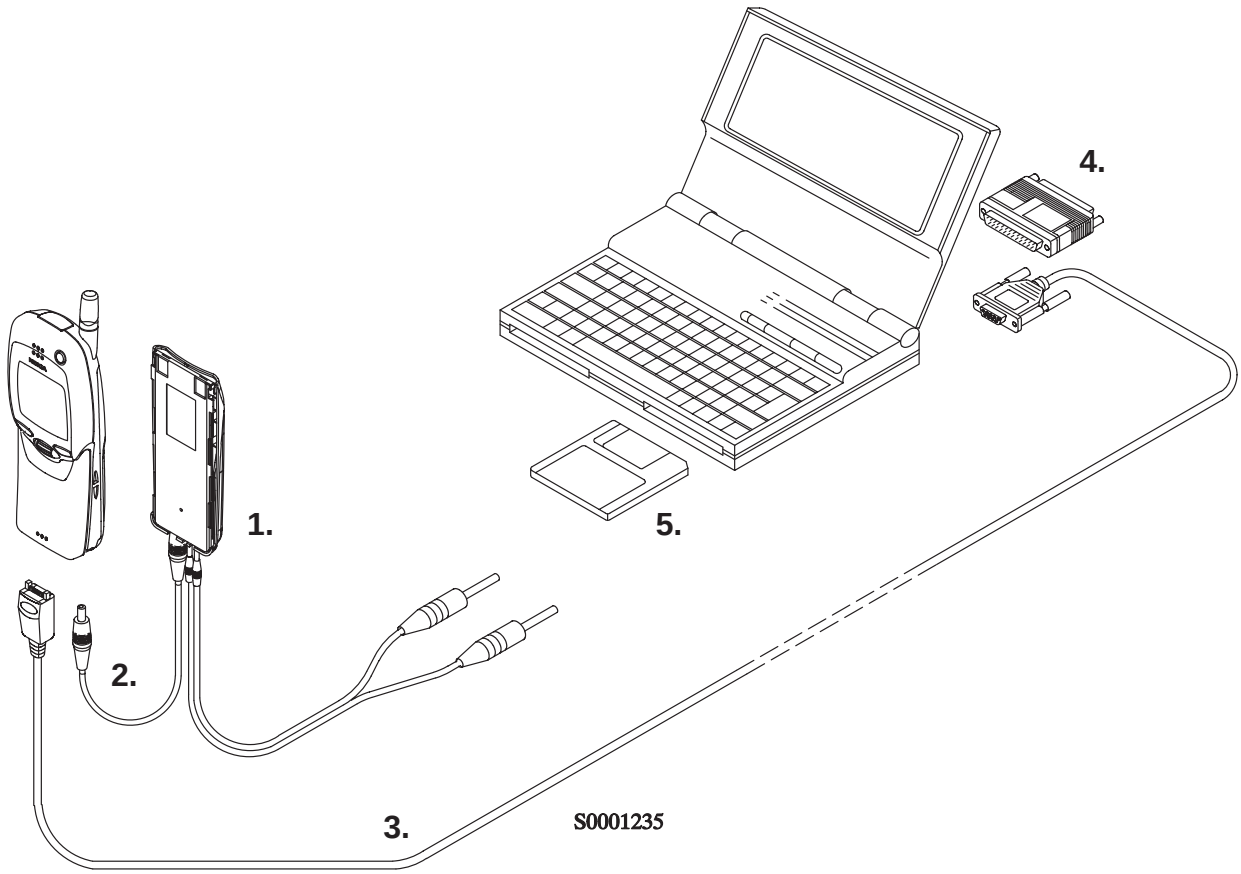
Issue 1 10/00

AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue 1	**10/00**	OJuntune	

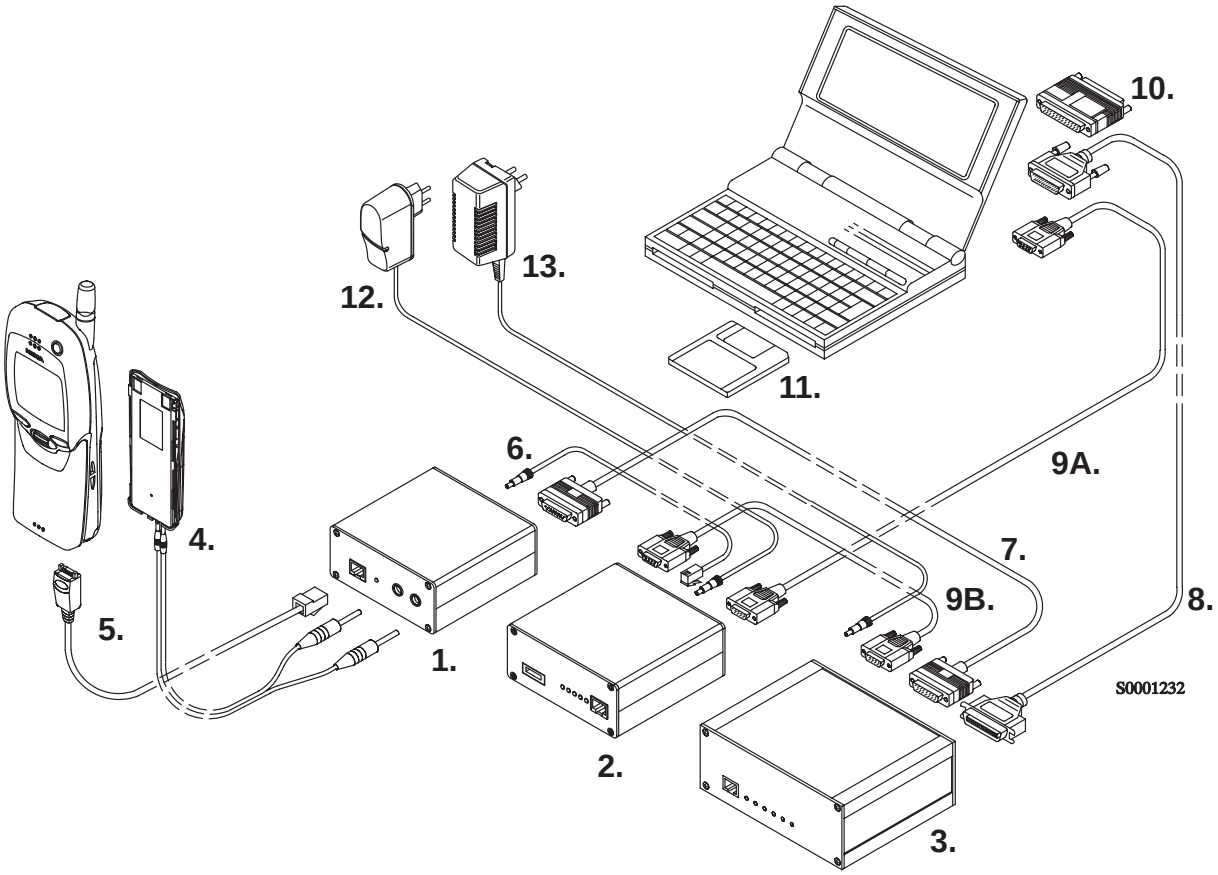
CONTENTS

Equipment Setup for Tuning NSW-5 without Removing Covers



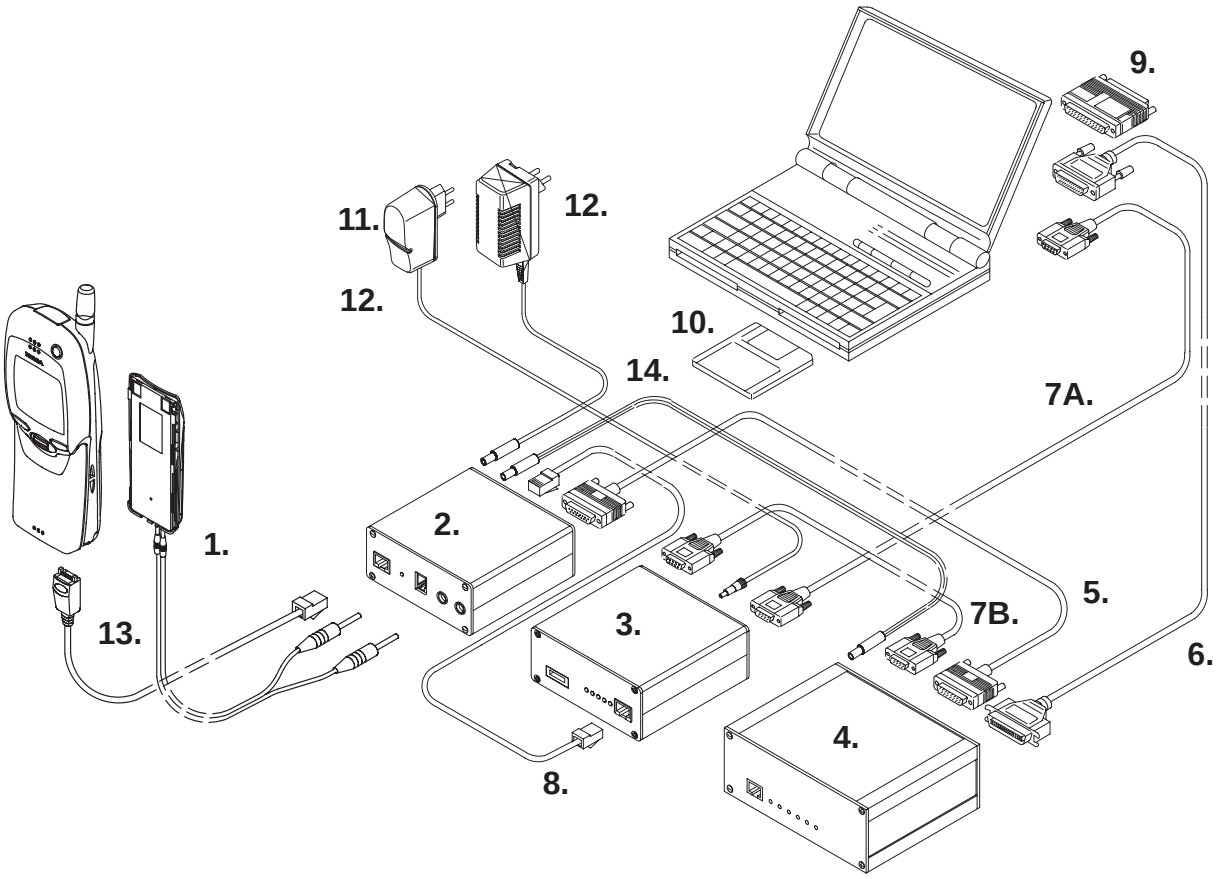
Item: code:	Service accessory:	Type	Product
1	Service Battery	BTD-3	0670280
2	DC Cable	SCB-3	0730114
3	Service MBUS Cable	DAU-9M	0730162
4	Software protection key	PKD-1	0750018
5	Service SW diskette 3.5”		0775229

Flash Concept for NSW-5, using FLA-5



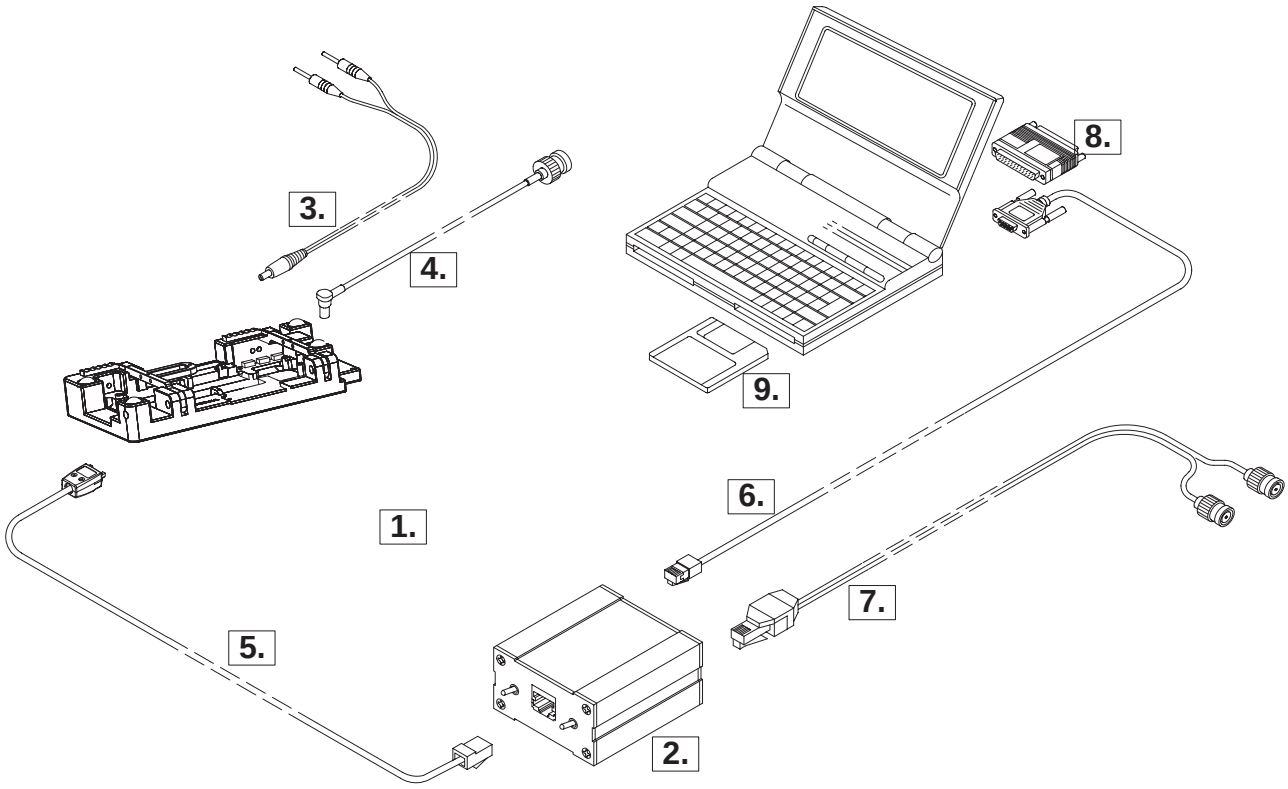
Item:	Service accessory:	Type	Product code:
1	Flash Loading Adapter sales pack FLA–5 (No longer available for purchase)		(0080178)
2	Flash Security Box	TDF–4	0770106
3	Prommer (sales pack Americas)	FPS–4S	0081275
4	Service Battery	BTD–3	0670280
5	Service Cable	SCH–5A	0730166
6	DC Cable	PCC–1	0730053
7	D15 – D15 Cable (Included in FLA–5 sales pack)	AXS–5	0730091
8	Printer Cable (Included in FPS–4 sales pack)		0730029
9A	D9 – D9 Cable (Included in FPS–4S sales pack)	AXS–4	0730090
9B	D9 – D9 Cable	AXS–4	0730090
10	Software protection key	PKD–1	0750018
11	Service SW diskette 3.5”		0775229
12	Travel Charger	ACH–6E (Euro)	0270381
	Travel Charger	ACH–6U (USA/Japan)	0675085
	Travel Charger	ACH–6X (UK)	0270380
13	AC Charger for 220V	ACL–3E	0680015

Flash Concept for NSW-5, using FLA-7



Item:	Service accessory:	Type	Product code:
1	Service Battery	BTD-3	0670280
2	Flash Loading Adapter	FLA–7	0770119
3	Flash Security Box TDF–4		0770106
	IR Module JLP–1 for TDF–4		0750079
4	Prommer FPS–4S (Sales Pack Americas)		0081275
5	D15 – D15 Cable	AXS–5	0730091
6	Printer Cable (Included in FPS–4S Sales Pack)		0730029
7A	D9 – D9 Cable AXS–4 (Included in FPS–4S Sales Pack)		0730090
7B	D9 – D9 Cable	AXS–4U	0730163
8	Service Cable	XMS–3	0730174
9	Software protection key	PKD–1	0750018
10	Service SW diskette 3.5” for NSW-5		0775229
11	Travel Charger	ACH–6E (Euro)	0270381
	Travel Charger	ACH–6U (USA)	0675085
	Travel Charger	ACH–6X (UK)	0270380
12	AC Charger	ACL–3E for 220V	0680015
13	Service Cable	SCH-5A	0730166
14	Power Cable	SCF–7	0730141

Tuning With Covers Off

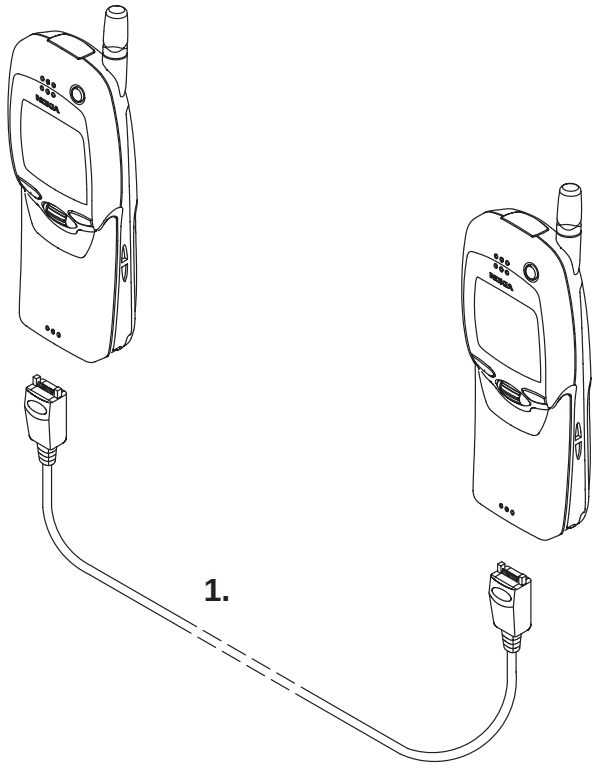


Item: code:	Service accessory:	Type	Product
1	Module Jig	MJS-15*	0770180
2	Service Audio Box	JBA-4 **	0770094
3	DC Cable	PCS-1	0730012
4	External Antenna Cable	XRC-2	0730180
5	Service Cable	SCH-5A	0730166
6	Service MBUS Cable	DAU-9S **	0730108
7	Audio Cable	ADS-1	0730011
8	Software Protection Key	PKD-1	0750018
9	Service SW diskette 3.5”		0775229

* The nominal operating voltage for MJS-15 is 3.6 V.
The supply voltage for MJS-15 must never exceed 5.0 V

** SCH-5A, JBA-4, and DAU-9S can be replaced with DAU-9M

Warranty Transfer service concept



Item: code:	Service accessory:	Product
1	Warranty Cable SCH-10	0730175

Warranty Transfer Instructions

The Warranty cable SCH-10 is used to connect two phones and transfer the warranty data (user settings and serial numbers) from one phone to another.

The warranty transfer procedure is described below:

Point of Sale

- Phone 1 is broken.
- Number the phones 1 and 2 to avoid mix-up.
- Plug the warranty cable SCH-10 to the phones. In this case phones 1 and 2.

- Start the warranty data transfer by selecting code ***#92772689#** in phone 2.
- Select option **”Transfer user data?”** and press OK ,”Confirm transfer?” Press OK.
- Wait untli the transfer is completed.
- Turn Phone 2 off, then back on and check welcome note and profile.

Tuning Steps

1. AFC Tuning (Analog)

This tuning adjusts reference oscillators frequency so that network's frequency criterias will be met.

This adjustment loads the Analog center frequency DAC value into the EEPROM. When doing this, a spectrum analyzer must be used.

Note: Do not leave tuning on. The analog transmitting takes maximium current. The tunning can damage the phone or service battery. The service battery will be heated.

The Spectrum analyzer settings are shown in AFC tuning window.

-Set power supply voltage 8.5 V to service battery (or 3.6 V to jig).

- Connect the spectrum analyzer to antenna connector.
- Check that spectrum analyzer frequence is correct.
- Tune the center frequence 832.500 Mhz +/- 200 Hz.
- Once Center frequence (CFR) is correct, press *OK* button.

2. VCTCXO Tuning

This tuning is to check that the radio unit has correct adjustment to meet networks criteria for frequency stability.

This adjustment loads the VCTCXO DAC value into the EEPROM. RF generator must be used in this.

The Spectrum analyzer settings are shown in AFC tuning window.

- Set power supply voltage 8.5 V to service battery (or 3.6 V to jig).
- Connect the antenna connector to RF generator.
- Once all RF generator frequency is correct, press *Meas button.*
- Set correct RF level to signal generator *(Note: attenuation!)*
- Once frequency and RF level are correct press *OK* button.

3. Tx I/Q Modulator Amplitude Balance and Phase Shift Tuning

This tuning is to adjust IQ-modulators DC-offset and phase offset so that the system requirements for modulation accuracy will be met.

– Select *Tuning –> TX I/Q...*
– Connect spectrum analyzer to antenna adapter or to diagnostic jig.
– Settings for spectrum analyzer:

•centre frequency to 830.700 Mhz

•span 80 kHz.

•Ref LVL 20 dB

•RWB and VBW 1 kHz

•sweep time 0.3 s

– Use ”TX I DC Offset” and ”TX I DC Offset” option to adjust CFR -5.9kHz to minimum.
The amplitude difference between CFR and CFR –5.9 kHz should be >40 dB.

– Use the ”Phase Offset” option to adjust CFR –14.2 kHz to minimum.
The amplitude difference between CFR and CFR –5.9 kHz should be >40 dB. .

– Once TX I, TX Q and phase shift are aligned, press SAVE.

5. TX Power... LOW BAND / HIGH BAND

NOTE: Use Service Battery connected to 1.5A 8.5V power supply or use phone's own battery.

This tuning is to adjust the output power level values of the radio unit according to the system specification.

This adjustment loads the power levels of the phone transmitter into the EEPROM. When doing this, a pulse power meter or spectrum analyzer must be used.

Tuning targets are listed in the following pages

The <Settings> shows spectrum analyzer settings.

Power levels programming:

– Set power supply voltage, see the Note above

– Connect pulse power meter or spectrum analyzer. Use attenuator if necessary.

– Settings for spectrum analyzer in power level tuning:

•span 80 Hz.

•Ref LVL 30 dB

•Ref LVL offset and –>Attenuation to EXT Antenna connector.

•RWB and VBW 300 kHz

•sweep time 50 ms

•TRIG: SWEEP CONT, VIDEO –10 dBm

•marker in the middle of the slot.

•Check that the spectrum analyzer frequency is correct

– Settings for pulse power meter:
  - •Calibrate if necessary
  - •Correct frequency
  - •Ref LVL offset and –>Attenuation to EXT Antenna connector
  - •Correct duty cycle: 33.3 % in digital mode and 100% in analog mode
– Select Tuning –>Using WinTesla Select Tuning –> TX Power –>LOW BAND / HIGH BAND –> EEPROM values
– All power channel have to be tuned. Repeat this test for A, B, C and D power channel. The Power channel change reads old tuning values from phone's EEPROM.
– Adjust the power level by clicking the + and – buttons, and change levels with keyboard ↑ and ↓ keys.
– Tune power levels which are shown by "# for calculate".
– Press Calculate button to calculate all other power levels.
– Check tuning of intermediate power levels. Do Fine tuning if necessary.
– Once all TX levels are correct, press SAVE button.
– Tuning is successful if both Analog mode and 800 MHz and 1900MHz digital mode are tuned.

800MHz Analog TX output power

Power level	RF Power at ext. RF connector (*	Tuning target tolerance	Testing Limits
2	24.5 dBm	+/– 0.1 dB	**+0.5…– 0.5 dB 25.0 – 24.0 dBm**

800MHz Digital TX output power

Power level	RF Power at ext. RF connector (*	Tuning target tolerance	Testing Limits
2	26.8 dBm	+/– 0.1 dB	+0.5...–1.0 dB 27.3 – 25.8 dBm
3	23.5 dBm	+/– 1.0dB	+/– 2.0 dB
4	19.8 dBm	+/– 1.0dB	+/– 2.0 dB
5	15.8 dBm	+/– 1.0dB	+/– 2.0 dB
6	11.8 dBm	+/– 1.0dB	+/– 2.0 dB
7	7.8 dBm	+/– 1.0dB	+/– 2.0 dB
8	3.8 dBm	+/– 1.0dB	+/– 2.0 dB
9	–0.2 dBm	+/– 1.0dB	+/– 2.0 dB
10	–3.8 dBm	+/– 1.0dB	+/– 2.0 dB

Check that the power level PL2 TXC DAC value is in the allowed range +50...+270.

TDMA1900 TX output power

Power level	RF Power at ext. RF connector (*	Tuning target tolerance	Testing Limits
2	25.2 dBm	+/– 0.1 dB	+0.5...–1.0 dB 25.7 – 24.2 dBm
3	23.3 dBm	+/– 1.0dB	+/– 2.0 dB
4	19.3 dBm	+/– 1.0dB	+/– 2.0 dB
5	15.3 dBm	+/– 1.0dB	+/– 2.0 dB
6	11.3 dBm	+/– 1.0dB	+/– 2.0 dB
7	7.3 dBm	+/– 1.0dB	+/– 2.0 dB
8	3.3 dBm	+/– 1.0dB	+/– 2.0 dB
9	–0.2 dBm	+/– 1.0dB	+/– 2.0 dB
10	–3.8 dBm	+/– 1.0dB	+/– 2.0 dB

Check that the power level PL2 TXC DAC value is in the allowed range:

Ch.A, Ch.B, Ch.D –100...+100.

Ch.D –100...+130.

6. RSSI Digital (AGC) ...

This tuning is to measure the small signal gain of radio unit to meet system requirements for RSSI reporting.

– Select *Tuning –> RSSI Digital (AGC) –> Low Band / High Band*

– Set power supply voltage 8.5 V to service battery (or 3.6 V to jig).

– Connect the RF generator to antenna connector.

– Press *Meas –>* The program shows correct frequency and signal level.

–. Once RF generator settings are correct, press *OK* button.
(*Note the insertion loss of the cable!)*

– Repeat measurement with all signal levels.

– Once the tuning is correct, press *OK* button.

7. RSSI Analog ...

This measurement is for RSSI in analog mode. The analog mode works only with 800 Mhz.

– Select *Tuning –> RSSI Analog...*

– Set power supply voltage 8.4 V to service battery (or 3.6 V to jig).

– Connect the RF generator to antenna connector.

– Press *Meas –>* The program shows correct frequency and signal level.

– Once RF generator setting are correct, press *OK* button.
(*Note the insertion loss of the cable!)*

– Repeat measurement with all signal levels.

– Once the tuning is correct, press *OK* button.

8. Rx Audio...

This measurement is for Audio output calibration for DAMPS mode.

When doing this the oscilloscope or multimeter must be used.

– Select *Tuning –>RX Audio*

– Connect the XEAR line to oscilloscope or multimeter.

– tune the signal to correct level

– Once tuning is correct, press *OK* button

9. Tx Audio...

This measurement is for Audio output calibration for DAMPS mode.

When doing this the signal generator must be used.

– Select *Tuning –>RX Audio*

– Connect the XMIC line to the signal generator.

– tune the signal to correct level

– Once the tuning is correct, press *OK* button

10. Charging...

– Select *Tuning –> Charging...*

– Connect service battery to phone and dc cable (SCB–3)
between phone and service battery

– Set supply voltage to 10.5 V

– Run calibrations all at once

– Run calibrations by pressing <MEAS> button

– Set supply voltage back to 8.5 V

Nokia 7160 cellular telephone NAM programming instructions

All Nokia 7160 cellular telephones are capable of supporting both Random and Default authentication methods. This programming guide describes the programming of generic 7160 handsets. The programmer must decide which A–Key type is desired for use.

There are two methods to program the NAM described below.

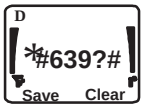
If a RANDOM A–Key is desired for use, use the Easy NAM 1 programming sequence.

If a DEFAULT A–Key is required, then use the Easy NAM 2 sequence.

Use the appropriate NAM if the Long NAM programming method is used. Use the CLEAR key to erase any mistakes.

Menu driven easy NAM programming for NOKIA 7160 Handportables

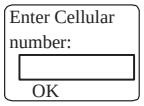
1. Turn on the phone and enter the Programming Access Code



*#6391# For NAM1 with a Random A–Key Value

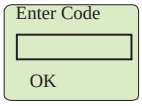
*#6392# For NAM2 with a Default A–Key Value

*#6393# For NAM3 with a Default A–Key Value



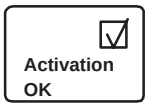
2. Enter the 10 digit Area Code and Phone Number

Press the TALK key (or the ”OK” softkey in the display)



3. Enter the System ID Code (SID) supplied by the cellular service provider (1 –5 digit SID) and press the TALK key (or ”OK” softkey in the display)

- Optional settings are Language and Lock Code (see below)



4. Short NAM Programming is completed
- The phone automatically powers off and then back on

NOTE:

Change the Lock code by adding # sign and the new lock code after the SID. (Example: 175#7788; Lock code = 7788).

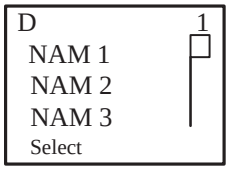
Change the Language by adding # and new language code after the code (Example: 175#0; Language = English).

Language Code: 0 (default) = English, 1 = French, 2 = Spanish, 3 = Portuguese.

Change the Lock Code and Language code by separating each set of numbers by # sign (Example: 175#7788#2; Where the SID = 00175, Lock code = 7788, Language = Spanish).

Complete NAM Programming Instructions

Access NAM Programming Mode:



1. Turn the phone on.

2**.** Enter the NAM access code.
Factory default is: *** 3 0 0 1 # 1 2 3 4 5** #

3. If the screen to the right appears, the access code was entered correctly.

If after several attempts you can not access NAM programming, it is possible that the NAM 2 access code has been changed, or the phone is in need of service.

MAIN MENU Selection

4. Press the [Scroll–Key] up or down until the indicator highlights the desired menu option. Select from the following:

NAM_1	NAM_2	NAM_3	Security	Emergency
SW version	Serial No.	Programmed	Field Test	

5.Press the [Select] softkey to access the Sub–Menu from and of the above Main Menu selections.

Programming NAMs 1 through 3

6. If the value is incorrect, press the [Select] softkey and use the keypad to enter new information.

Home system ID	Home SOC (when unlocked)	Mobile station	Alpha tag	Message center number	PSID/ RSID lists	Change defaults see below

Change defaults			
NAM Status (Enable/Disable)	Access method	Local option	Primary paging channel
Secondary paging ch	Dedicated A cch	Dedicated A cch number	Dedicated B cch
Dedicated B cch number	Overload class	Group ID	SID alpha tag control
A–key code	Public systems	Private systems	Residential systems

7. Use the [OK] softkey to store the new information that has been entered.

8. Repeat steps 6 and 7 for the remaining NAM parameter options to be viewed and/or changed.

Programming the Security Code:

9. From the Main Menu, use the scroll keys to select the “Security” Sub–Menu, press [Select] and the current 5–digit security code will appear in the display. Default is 12345

10. If you wish to change the Security Code at this time, use the numeric keys to enter the new value.

11. Press the softkey [OK] to store changes.

Programming Emergency numbers:

12. From the Main Menu use the scroll key to select the ”Emergency” Sub–Menu, press the [Select] softkey to access the emergency numbers.

Emergency number 1 (911)
Emergency number 2 (*911)
Emergency number 3 (None)

13. If you wish to change the displayed value, use the scroll key to select the emergency number you wish to change and press [Select]. Then use the numeric keys to enter the new values

14. To save the value, press the softkey [OK].

15. Press [Back] to exit the menu.

Serial Number (ESN):

17. From the Main Menu, use the scroll key to display the “Serial No.” or ESN of the phone.

18. Press [Back] to exit the menu.

Programmed: (Date the phone is first programmed)

19. From the Main Menu, use the key to display the “Programmed” menu.

20. Press [Select] and enter a four digit number that corresponds to the month and year the phone is sold. Example (mmyy)

0199 = January 1999, 0401 = April 2001.

NOTE: This menu location can be programmed only one time. Once the date has been entered it can not be changed. Any attempt to enter the menu once it has been programmed will receive a short beep and the message “Date already saved”.

Exiting NAM Programming:

21. To exit the NAM programming mode, turn the phone off and leave it off for five seconds.

Field test:

The Field Test Display Mode is used to investigate how the phone and the cellular network are interfacing together.

The Field Test Display Mode reports valuable information about the signal strength, battery charging status, cellular state and encryption status.

The information is organized to display information relating to Analog Control Channels, Digital Control Channels, Analog Voice Channels, and Digital Voice channels. All the information provided in this display is in accordance with IS–136.

To activate the Field Test Display Mode you must be in NAM programming. Instructions for entering NAM programming are on the previous pages.

From the Main Menu use the scroll key to display the ”Field test” menu and press the [**Select**] softkey.

Use the Scroll key to select “Enable” and press the [**OK**] softkey.

Turn the 7160 off then back on. The FIELD TEST display will begin automatically after wake–up as long as the user does not enter any characters into the display.

Scroll through the 7 different displays using the scroll key. Note that the automatic scroll feature for the Short Code Memory is disabled.

To disable the FIELD TEST mode. Return to NAM programming and disable the function under the FIELD TEST menu. Or, select MENU 10 and enter [00] in the field and press [OK].

Programming PSIDS and RSIDS:

The Nokia 7160 provides the option to program Private (PSIDs) and Residential (RSIDs) System ID’s as prescribed by IS–136. The PSID / RSID list is programmed to support system selection / re–selection processes, and SID display functions.

The Nokia 7160 product will support up to 5 different Private or Residential Systems in NAM 1. Using the NAM programming menu to program the PSID / RSID is just one of several ways that this information can be programmed. The phone also supports automatic programming of the PSID / RSID values via registration accept message from a Public & Private system, manually prompting with System Scan sub–menu option “**New Search**”, or via Over the Air Programming. Follow these instructions to program the PSID / RSID lists.

1. Enter the NAM programming menu and select NAM 1 (or the desired NAM). (Note: PSID / RSID is currently only available in the NAM 1 location. PSID / RSID locations for NAM 2 and 3 are reserved for future use.)

2. Use the scroll key to display “PSID / RSID LISTS” then press [Select].

3. Use the scroll key to select the PSID / RSID 1 or the desired PSID / RSID (1 through 5). Press the [Select] softkey.

4. Each list contains:

System type: Select Private or Residential system type.

PSID / RSID: System ID of the Private or Residential system. Indicates which PSID / RSID the mobile will respond to.

Connected system ID: Connected System ID. The SID that the PSID / RSID is connected to.

Alpha tag: The name of the Private or Residential SID that will be displayed when the phone uses the PSID / RSID. The micro system can over–write the alpha tag once the phone is using the system with its network broadcast name.

Operator code (SOC): (SOC) This is the System Operator Code.

US		
AWS	=	2049,
Canada		
Rogers Cantel Inc.	=	2050,
Bell South Cellular	=	003,
Southwestern Bell Mobile Systems	=	004,
Vanguard	=	007,
Century Cellunet	=	008,
Pacific Telecom Cellular	=	009,
Midwest Wireless Communications	=	010.

These (inter)national SOC values are only an approximation from available information. Please call Customer Service (888–Nokia–2U) with corrections.

Country code: Enter the Country Code of the PSID / RSID.

Public service profiles: Contains up to 4 channel and color code values for each private or residential system. This information is necessary to initiate scanning for the Private or Residential System.

Private operating frequencies: Enter the channel number(s) of the private system. The parameters allow for up to 4 channels per PSID / RSID.

[]

PAMS Technical Documentation
NSW-5 Series Transceivers

Disassembly and Troubleshooting Instructions

Issue 1 10/00

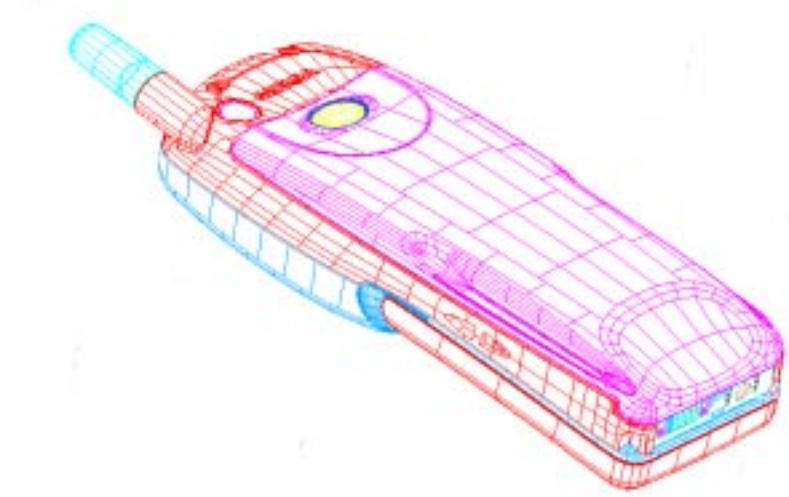
AMENDMENT RECORD SHEET

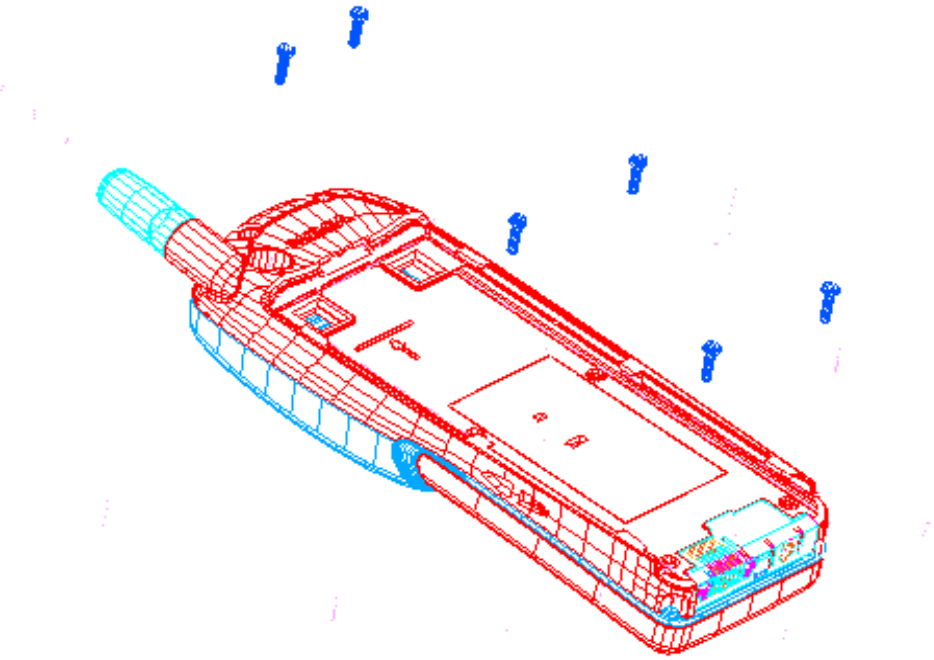
Amendment Number	Date	Inserted By	Comments
Issue 1	**10/00**	OJuntune	Issue1

CONTENTS

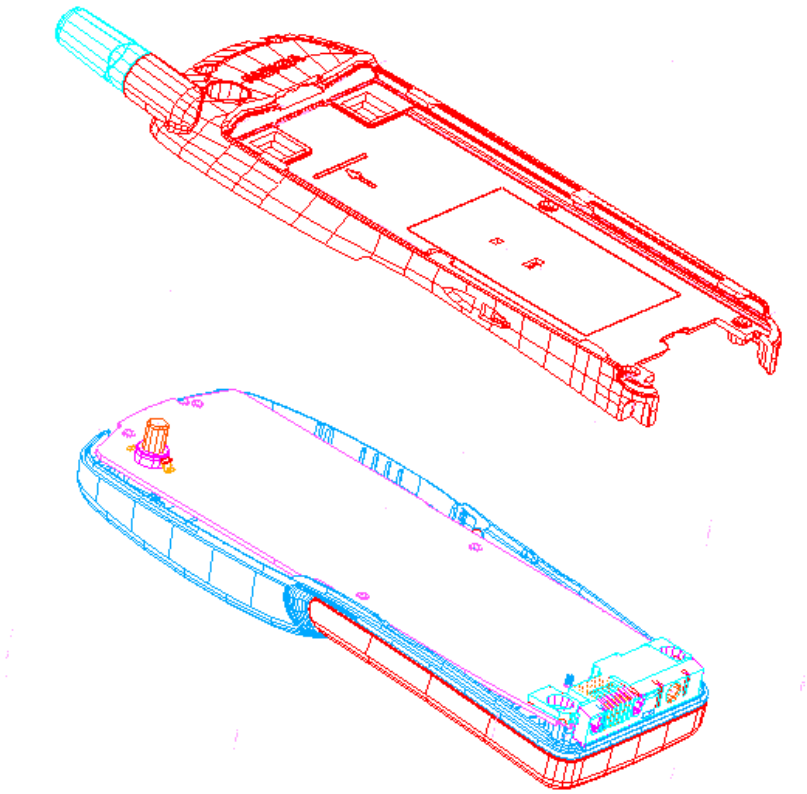
NSW-5 Disassembly

1. Remove the Battery, Dust Cap and Elastic Plug (2 pcs)

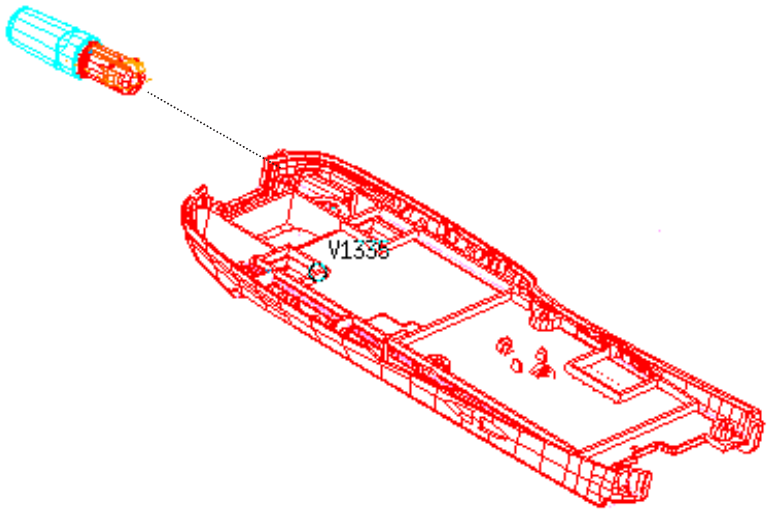




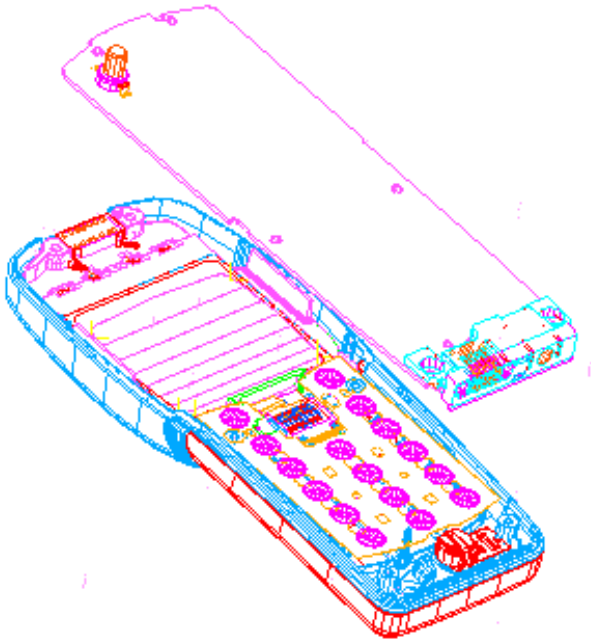
2. Remove the Screws (6 pcs)



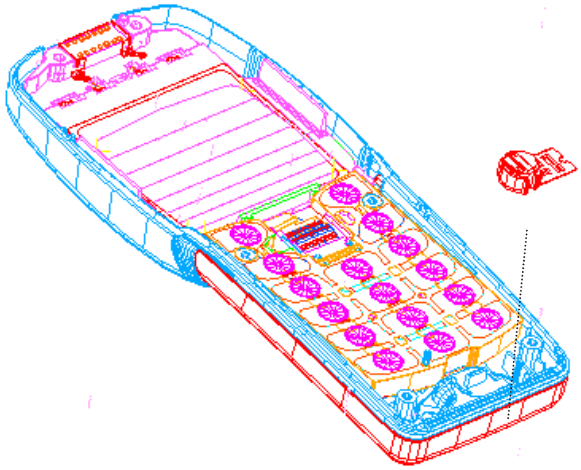
3. Lift off B–cover



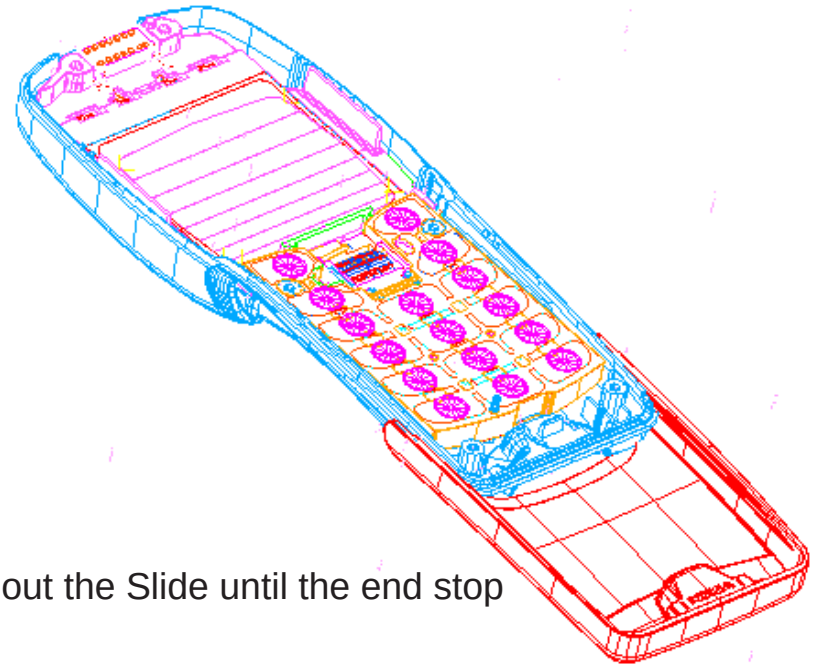
4. Pull out Antenna, note snap fitting



5. Lift off the PWB



6. Lift off the Sensor Switch



7. Pull out the Slide until the end stop

Removing Slide Cover Assembly

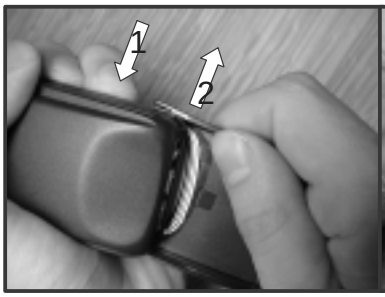


Fig.7.1
1. Hold the plunger of the metal slide against the phone
2. Bend open the Slide Cover (plastic part

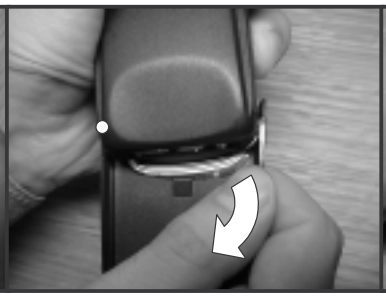


Fig. 7.2
Carefully twist the slide cover off in the direction indicated.

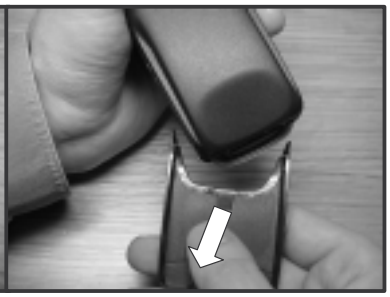


Fig. 7.3 Mind the middle snap !

Mounting Slide Cover Assembly

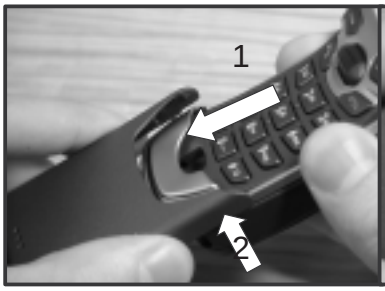


Fig. 9.1
1.Make sure that the metal slide is pulled out up to the end stop (a double click)
2. Place the Slide cover on the metal slide on the right hand side (whre the mic connector is situated)

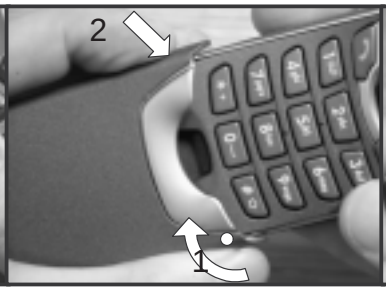


Fig. 9.2
1.Twist the Slide cover on the metal slide. Make sure that the middle snap locates properly (turn the phone over to check)
2. Press the Slide cover on the Metal slide until it snaps home.

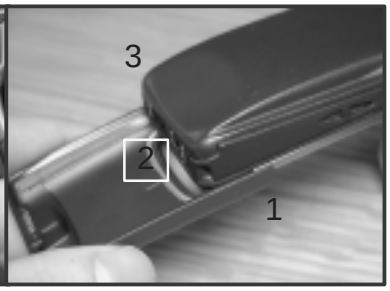
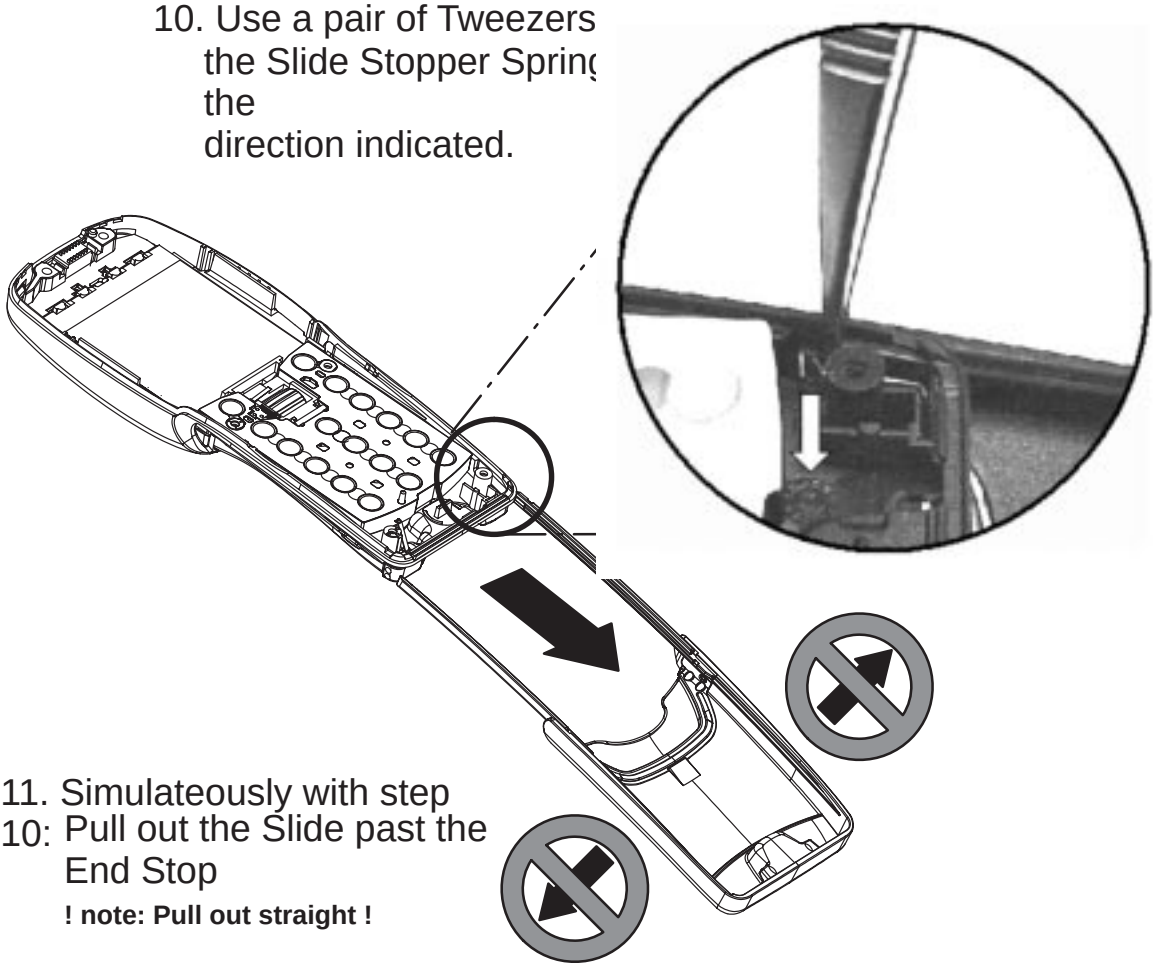


Fig 9.3
Check that all three snaps are in place.

Slide disassembly

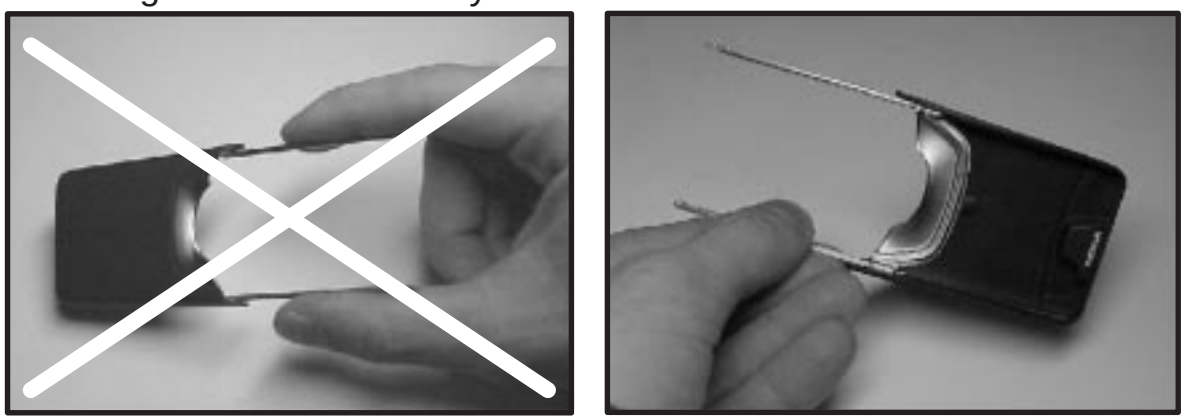
10. Use a pair of Tweezers
the Slide Stopper Spring
the
direction indicated.



11. Simulateously with step 10: Pull out the Slide past the End Stop

! note: Pull out straight !

Handling the Slide Assembly:

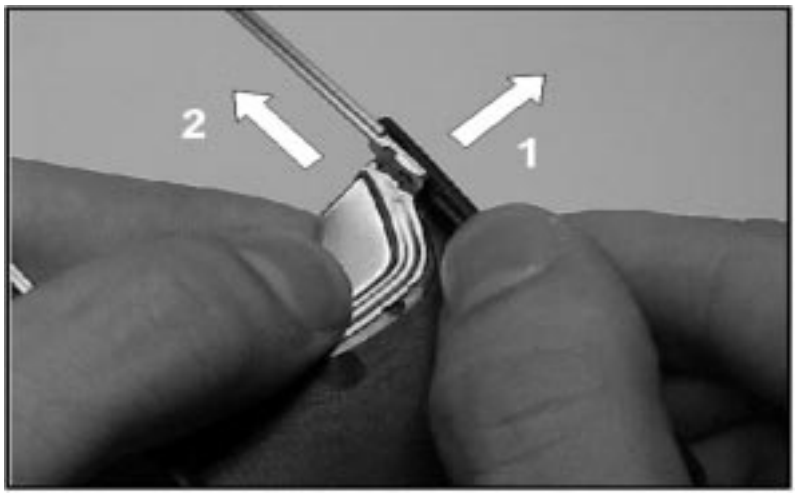


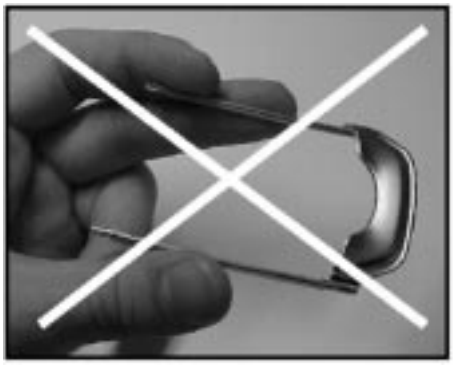
! DO NOT handle the Slide like this **!ALWAYS** handle the slide like this.

The Metal Slide is bent very easily when it is not protected by the phone.
Avoid bending of the Plungers at all times.

Metal Slide manipulation

12. Bend open one side of the (plastic) Slide Cover and take out the Metal Slide





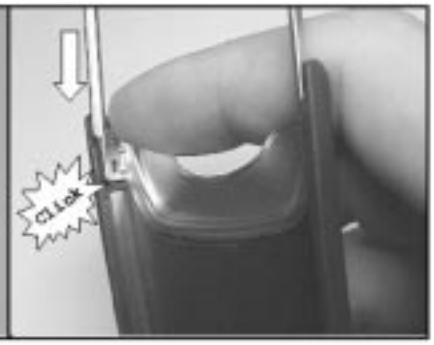
! DO NOT !
Hold the Metal Slide like this.
The Metal Slide is bent very easily when it is not protected by the phone. Avoid bending of the Plungers <u>at all times.</u>

ALWAYS
Handle the Metal Slide like this.
The Metal Slide can be held by the *Targa Bow* or by one of the Plungers.

Fitting a Metal Slide onto a Slide Cover:

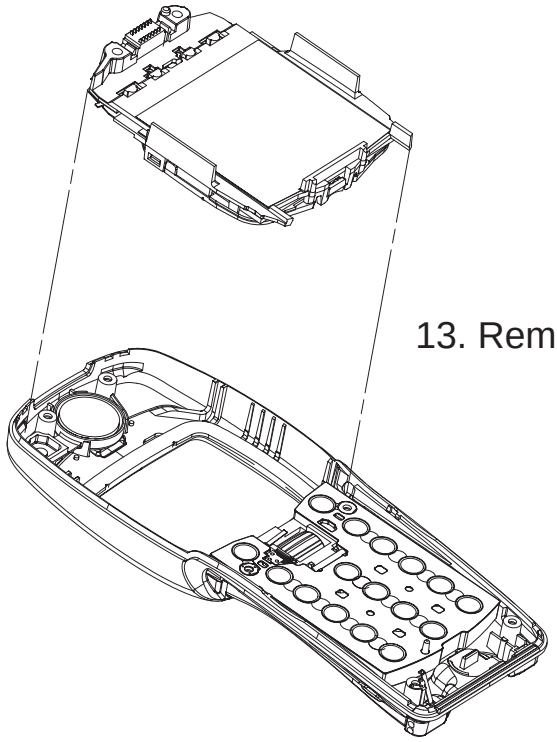
Push the Metal Slide onto the snap on one side of the Slide Cover.

Push down the other side, but do not hit the middle snap.

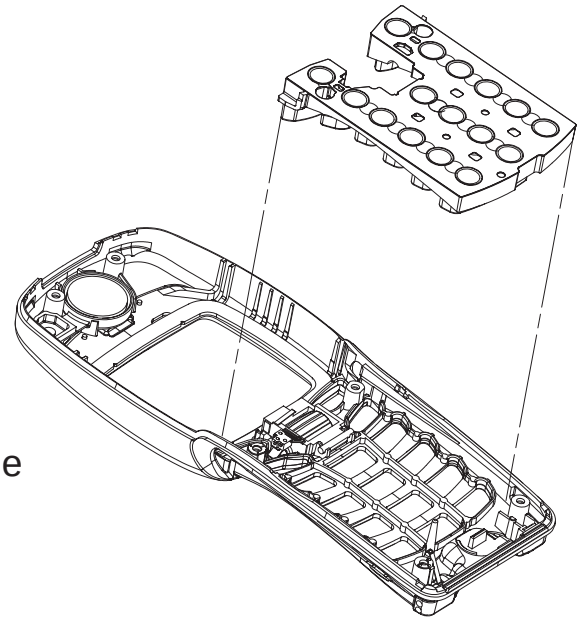


Push the Metal Slide onto the snap on the opposite side. A click should be noticed.

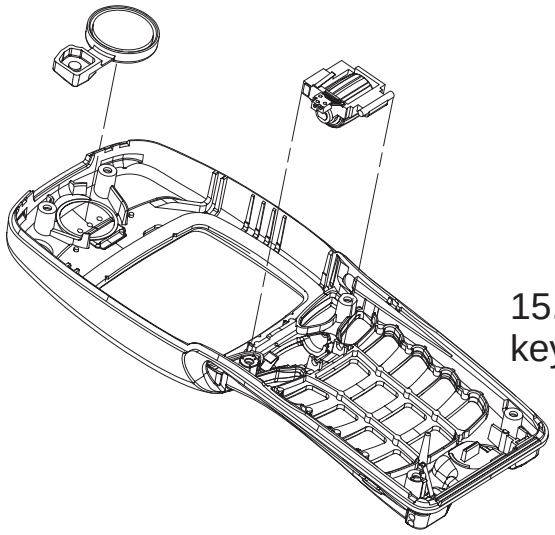
UIF Disassembly



13. Remove the Display assembly



14. Remove the Keymat module



15. Remove the Speaker and the Roller key

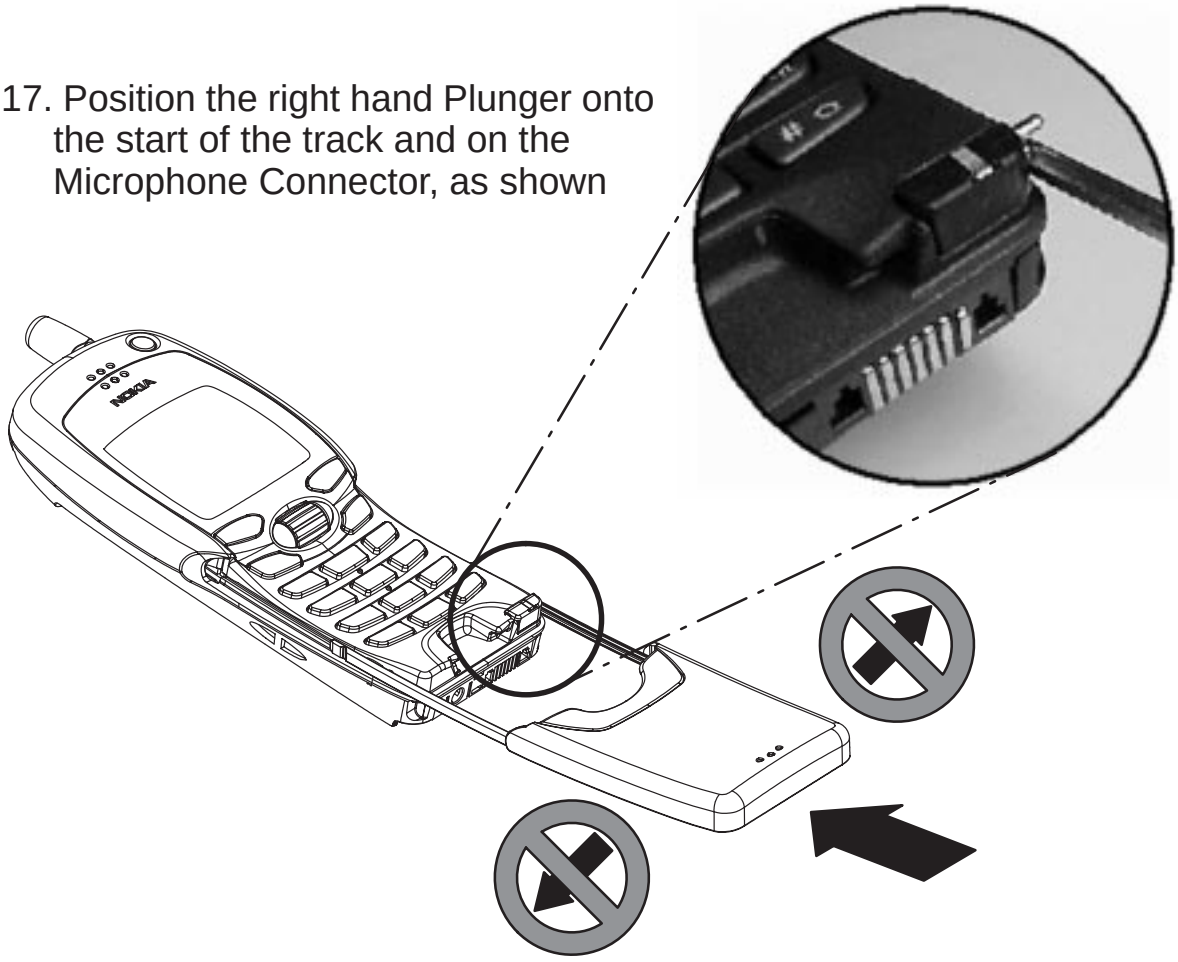
Figure 1.

Reassembly

16. **! Assemble the phone completely before fitting the Slide Assembly !**
The remaining assembly is done in the reversed order of the disassembly.

Note Torque for screws 0.23Nm

17. Position the right hand Plunger onto the start of the track and on the Microphone Connector, as shown



18. Position the left hand Plungers onto the start of the track and push the Slide Assembly into the phone.
! Push the Slide Assembly straight into the phone to avoid bending the Plungers !

Lubricating the slide with the Grease Service Pack

The Lubricant is applied on the A–cover, before inserting the Slide assembly.

Note: Code for the lubricant: **7511021**

The lubricant is applied inside the A–cover tracks, from the middle and down towards the microphone connector.

The lubricant is applied in one movement, leaving a strip of grease in approx. a diameter of 1mm and in a length of 25 mm. There must be a 5 mm clearance towards microphone connector. A similar amount in size and position is applied in the opposite track.

Be sure that the grease does not spill over the plunger.

Troubleshooting NSW–5

Baseband

The following hints should facilitate finding the cause of the problem when the circuitry seems to be faulty. This troubleshooting instruction is divided following section.

1. Phone is totally dead
2. Flash programming doesn‘t work
3. Power doesn‘t stay on or the phone is jammed
4. Phone doesn‘t register to the network or phone doesn‘t make a call.
5. Audio fault.
6. Charging fault

The first thing to do is carry out a through visual check of the module.

Ensure in particular that:

a) there are not any mechanical damages
b) soldered joints are OK

1. Phone is totally dead

Phone does not consume current at all when the power switch is pressed, or when the watchdog disable (J150) is grounded.

Battery voltage must be higher than 3.0 V. Otherwise CCONT prevents power–on.

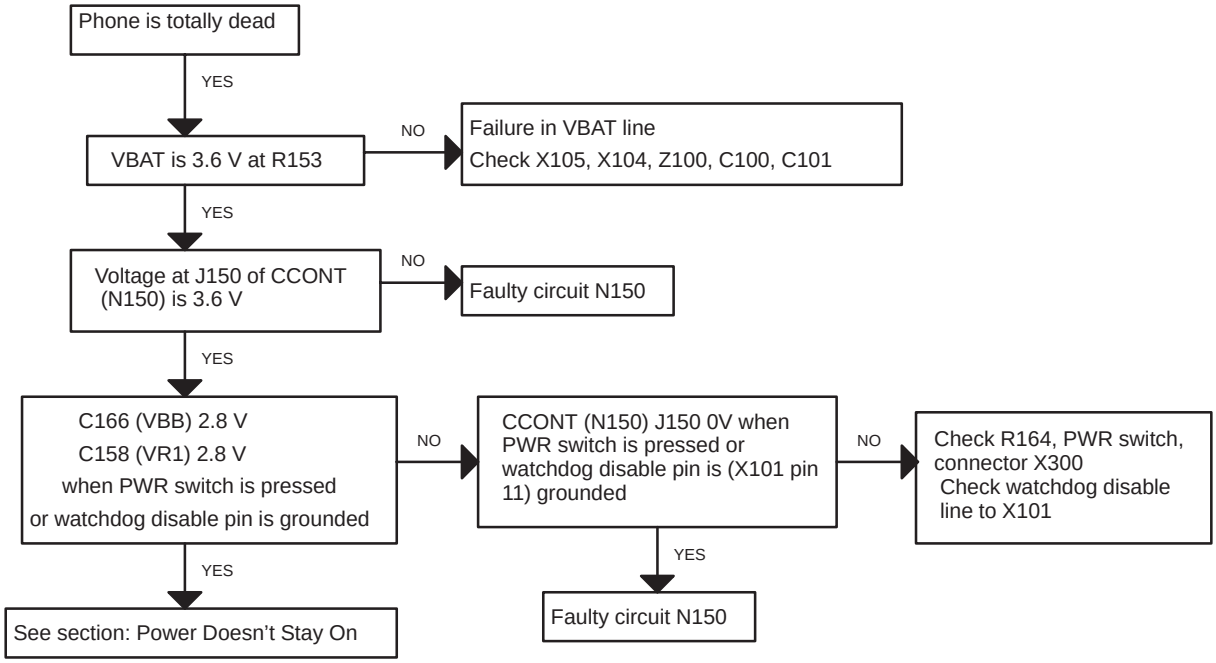


Figure 1. Troubleshooting diagram for a totally dead phone

2. Flash programming doesn't work

The flash programming is done via system connector X100.

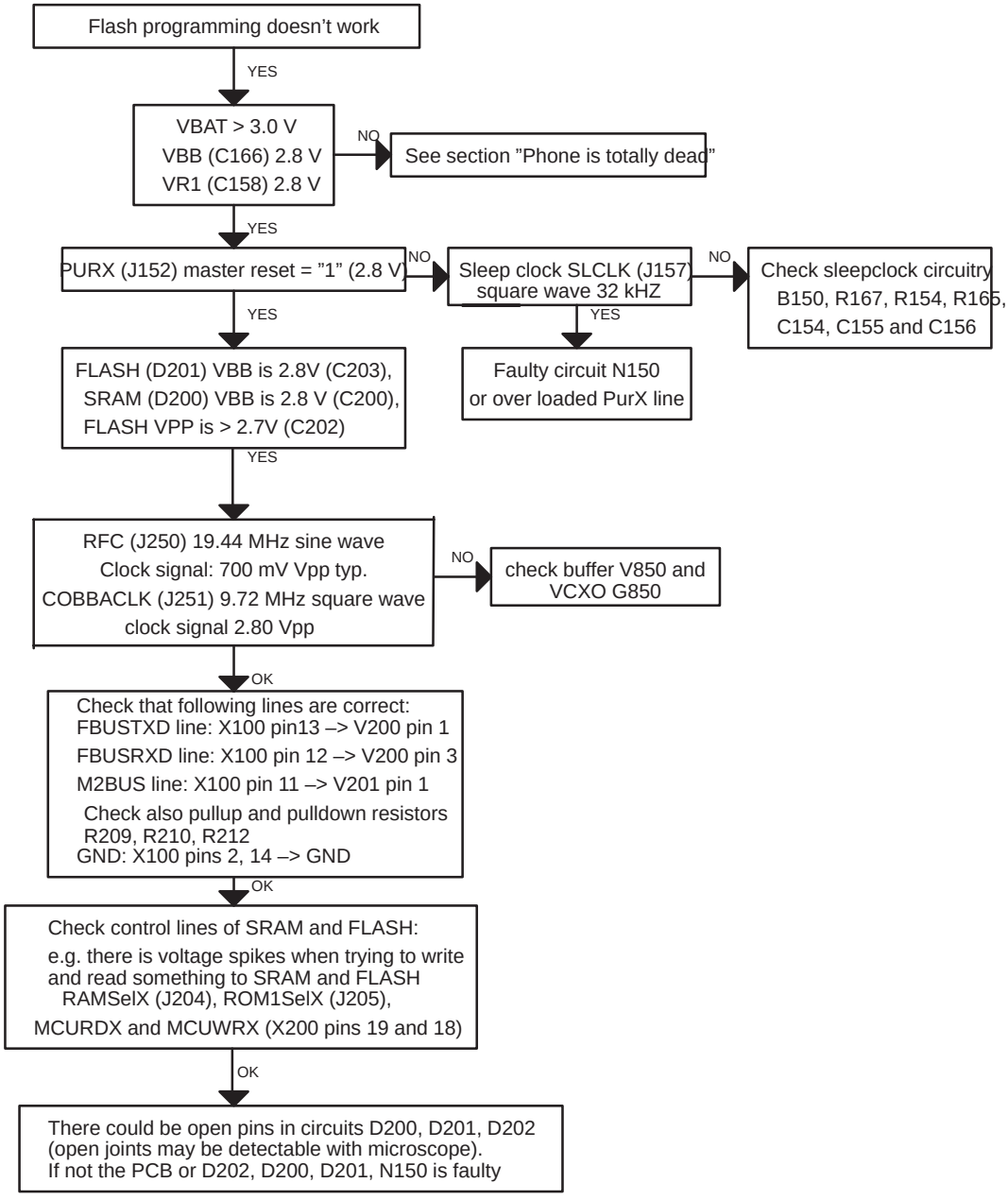


Figure 2. Troubleshooting diagram 1 in case flash programming does not work

3. Power doesn't stay on or phone is jammed

If this kind of fault has come after flash programming, there are most probably open pins in ICs. The solder joints of ICs MAD1 (D202), Flash (D201), and SRAM (D200) are to be checked at the extent possible (by microscope from the side of PWB and lightly pressing components while switching power on).

Normally the power will be switched off by CCONT (N150) after 32 seconds, if the watchdog of the CCONT can not be served by software. The watchdog updating can be seen by oscilloscope at CCONT's J154 (DataselX). In normal case there is a short pulse from "1" –> "0" every 8 seconds. The power off function can be prevented by connecting a short circuit wire from WDDIS (CCONT E4 (J150)) to ground (J156).

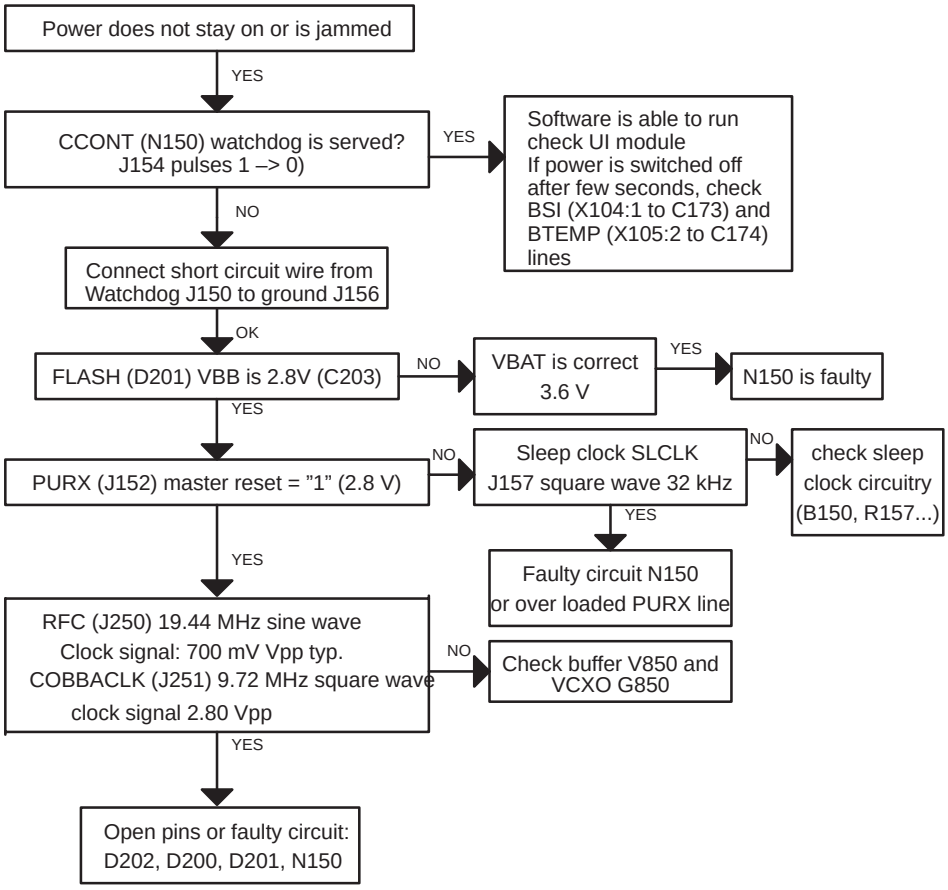
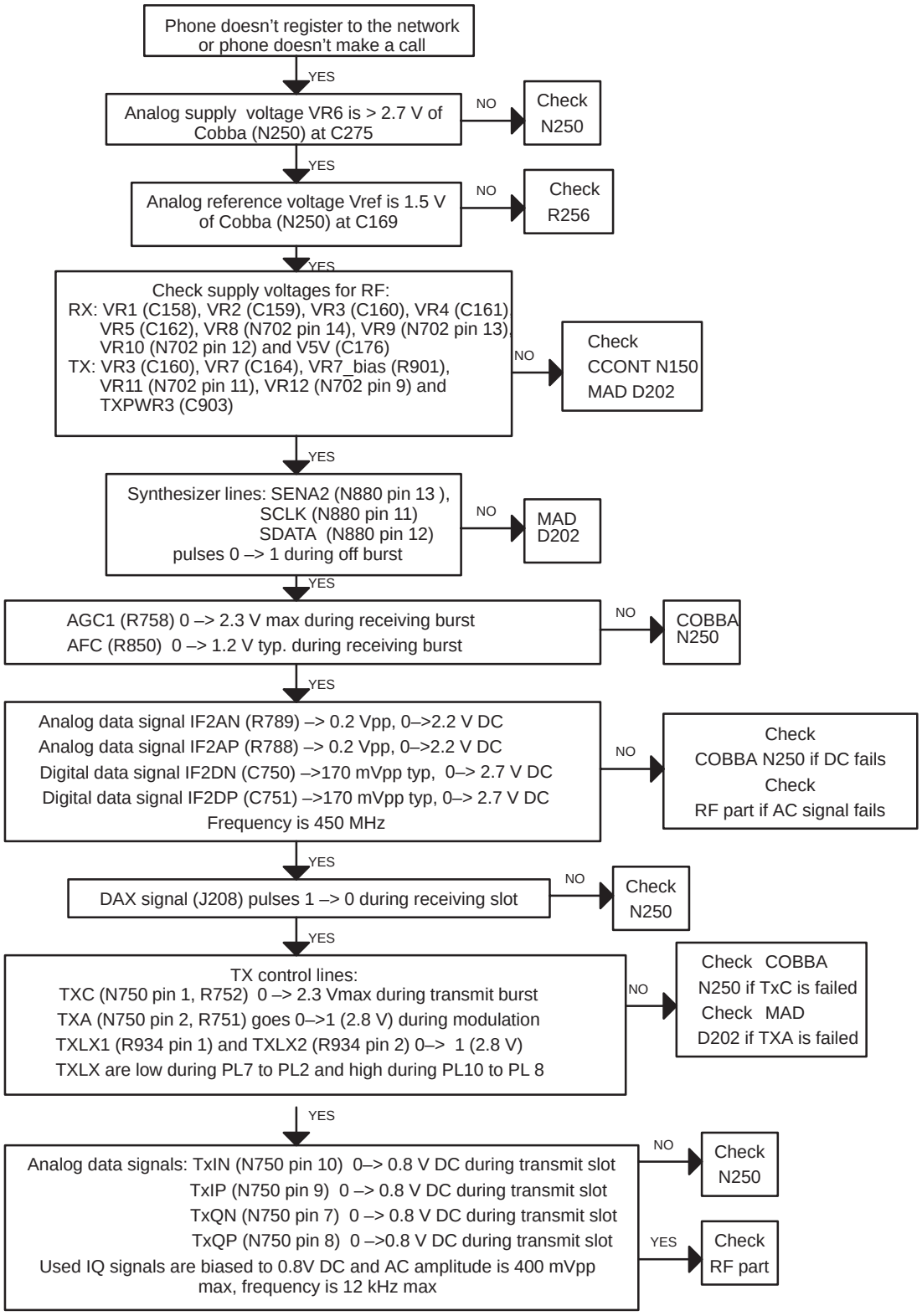


Figure 3. Troubleshooting diagram in case the phone does not stay on or is jammed.

4. The phone does not register to the network or make a call

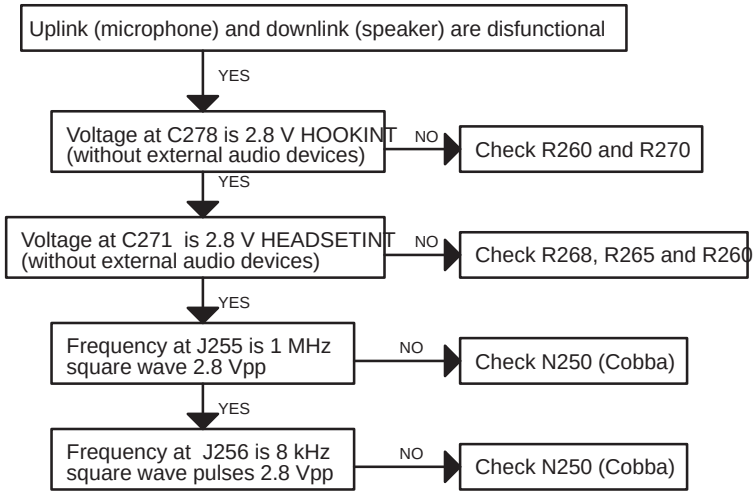
If the phone doesn't register to the network or the phone doesn't make a call, the reason could be either the baseband or the RF part. The phone can be set to wanted mode by WinTesla service software and determinate if the fault is in RF or in baseband part (RF interface measurements).

The control lines for RF part are supplied both the System Asic (MAD D202) and the RFI (Cobba N250). MAD handles digital control lines and Cobba handles analog control lines.



5. Audio Failure

In this kind of fault, it is useful to check first that slide rails and the rail connector are OK.



If the downlink is broken, check that speaker is OK; ie. the grey metal parts are not sticking out of the black plastic causing short circuits on the speaker pads, or the membrane broken.

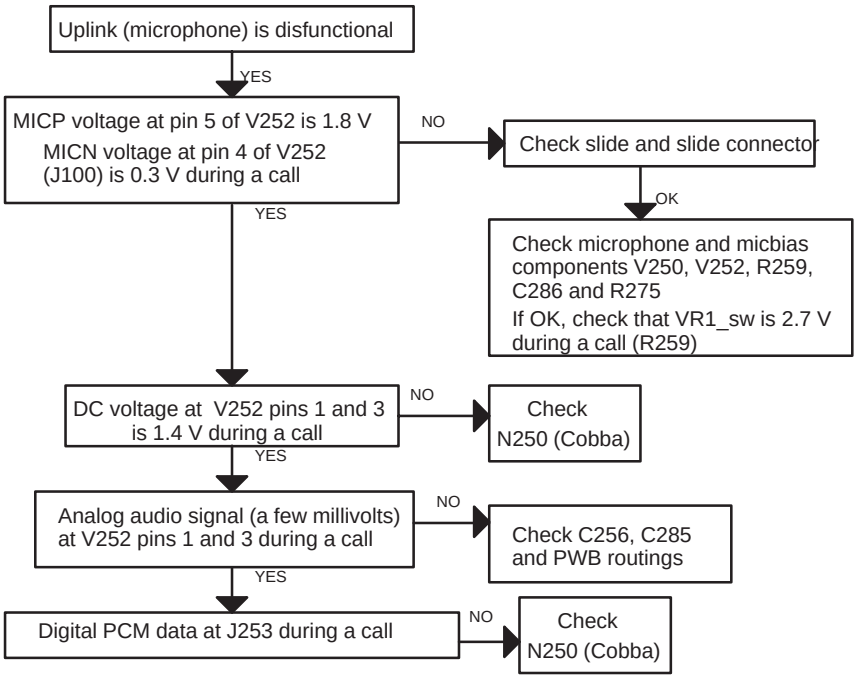


Figure 4. Troubleshooting diagrams for Audio failure

6. Charging Failure

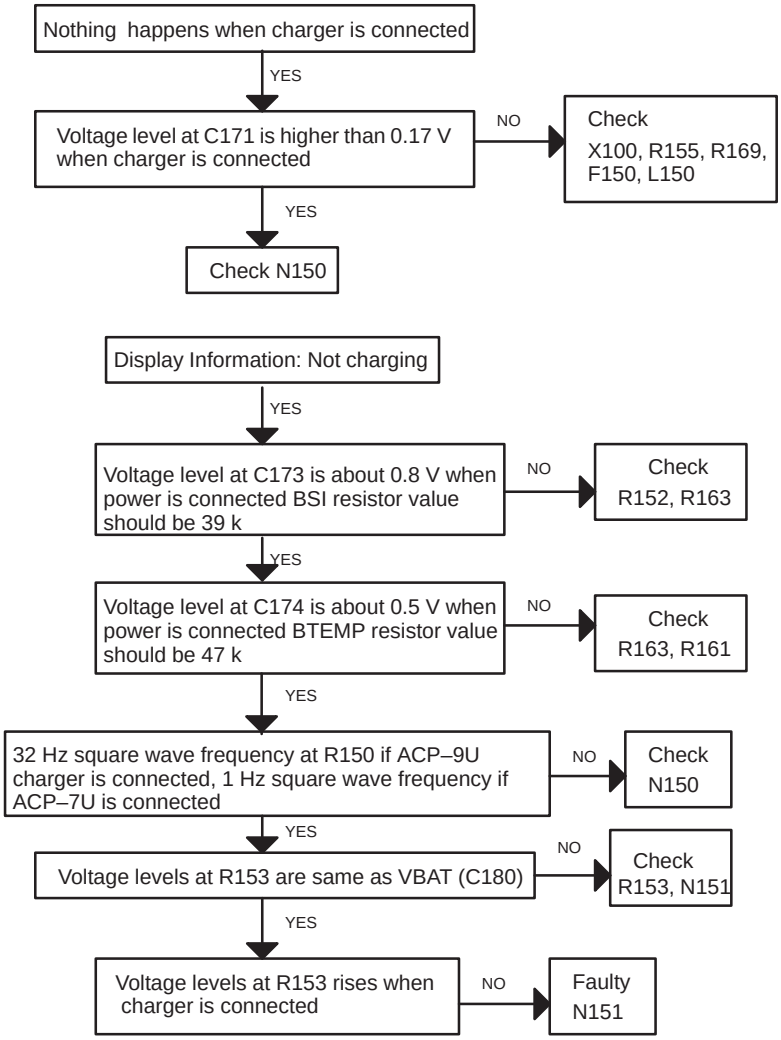


Figure 5. Troubleshooting diagram for charging failure

RF Troubleshooting

Introduction

Measurements are done using a spectrum analyzer and a high–frequency probe (Local and reference frequencies and RF–powerlevels in intermediate stages of TX/RX–chains). An oscilloscope is used to measure DC–voltages and low frequency signals. A multimeter is also a useful measurement instrument in fault finding.

The RF section is mainly built around EROTUS–IC (N750). The RF block has separate external filters, UHF synthesizers, Power Amplifiers, TX Driver amplifiers, LNA/Mixer and upconverter circuit for both frequency bands. In TDMA1900 mode a RF regulator IC is provided to supply voltage for RF parts.

To simplify troubleshooting, this RF troubleshooting document is divided into three bigger sections: Receiver, Transmitter and Synthesizer blocks. The tolerances are specified for critical signals/voltages.

Before changing single ASICS or components, please check the following details:

1. The soldering and connections of pins of ASICS
2. That supply voltages and control signals are OK
3. Signals from the synthesizers are coming to ASICS. This will prevent unnecessary changing of ASICS.

Please note that the grounding of the Power Amplifier–IC is directly underneath, so it is difficult to check. **The PA is ESD sensitive!** So ESD precaution must be used when dealing with the PA–IC (ground straps and ESD soldering irons). The PAs are also moisture sensitive components, and it is important to follow additional information about handling the components.

There are also lots of discrete components (resistors, inductors and capacitors) the troubleshooting of which is done just by checking that component is soldered or that it is not missing from the PWB.

Abbreviations used in Troubleshooting charts

BB	Baseband
f	Frequency of signal (measured with spectrum analyzer)
IF	Intermediate Frequency
LO	Local Oscillator
P	Power of signal in desibels compared to a milliwatt (dBm) (measured with spectrum analyzer)
PA	Power Amplifier
PWB	Printed Wiring (Circuit) Board
PLL	Phase Locked Loop
RF	Radio Frequency
RX	Receiver
T	Time (between pulses)
TX	Transmitter
UHF	Ultra High Frequency
V	Voltage of signal (measured with oscilloscope)
VCO	Voltage controlled oscillator
VHF	Very High Frequency
AF	Audio Frequency

Interface signals between RF and BB/DSP

Signal name	From	To	Parameter	Min	Typ	Max	Unit	Function
VBAT	Battery	RF	Voltage	3.1	3.6	5.3	V	Supply voltage for RF and regulators
VREF	CCONT	EROTUS	Voltage	1.485	1.500	1.522	V	Reference voltage for EROTUS
RFTEMP	RF	CCONT	Voltage	0 HOT	1.4 ROOM TEMP	2.7 COLD	V	RF temperature sensor 47k NTC to GND
AFC	COB-BA_D	VCTCXO	Voltage	0.05	1.1	2.25	V	Automatic frequency control
AGC1	Cobba_D	EROTUS	Voltage	0.7		1.4	V	Gain control for EROTUS RX AGC
AGC2	MAD	RX LNA	Voltage	0		2.85	V	LNA Gain switch “1” min 2.0 V “0” max 0.5 V
PD1	EROTUS	VHF VCO	Voltage	0 1.0 2.8	 1.5 3.3	4.0 2.0 3.8	V V V	VCO control voltage 322.38 MHz 392.46 MHz
PD2	EROTUS	1GHz UHF VCO	Voltage	1.3		3.5	V	1 GHz
IF2AP/ IF2AN	EROTUS	COB-BA_D	Voltage/Frequency		0.2 / 450		Vpp / kHz	Differential limiter output to DEMO–FM demodulator
IF2DP / IF2DN	EROTUS	COB-BA_D	Voltage/Frequency		170 / 450	1400	mVpp / kHz	Differential IF2–signal to RX A/D–converter
SENA1	MAD	EROTUS	Logic high ”1”	2.0		2.85	V	1 Ghz PLL enable
			Logic low ”0”	0		0.8	V	
SDATA	MAD	EROTUS	Logic high ”1”	2.0		2.85	V	Synthesizer data
			Logic low ”0”	0		0.8	V	
SCLK	MAD	EROTUS	Logic high ”1”	2.0		2.85	V	Synthesizer clock
			Logic low ”0”	0		0.8	V	
RFC	EROTUS	COB-BA_D	Voltage/Frequency	0.2	0.4 / 19.44	1.0	Vpp / MHz	Clock signal for the logic circuits
RFCEN	MAD	CCONT / PENTA regulator	Voltage	0		2.85	V	“1” min 2.0 V “0” max 0.4 V

Signal name	From	To	Parameter	Min	Typ	Max	Unit	Function
RSSI	EROTUS	CCONT/ COB-BA_D	Output level	0.1		1.5	V	Analog mode field strenght indicator
TXIP/ TXIN	COBBA	EROTUS	Differential voltage swing (static)		0.62	0.82	Vpp	Differential in–phase TX base-band signal for the RF modulator
			Single ended output level	0.760	0.8	0.84	V	
TXQP/ TXQN	COBBA	EROTUS	Same as TXIP/TXIN					Differential quad-rature phase TX baseband signal for the RF modu-lator
TXC	COBBA	EROTUS	Number of bits	10			bits	Transmitter power control (ramps & power levels)
			Output voltage swing	2.09	2.15	2.21	V	
			Minimum code output level	0.12	0.15	0.18	V	
			Maximum code output level	2.27	2.3	2.33	V	
TXF	EROTUS	MAD	Voltage	0		2.85	V	False transmis-sion indicator, function controlled via EROTUS reg-ister
TXP2	MAD	PENTA regulator	Logic high ”1”	2.0			V	2 Ghz Transmitter enable
			Logic low ”0”			0.5	V	VR11 ON/OFF
TXA	MAD	EROTUS	Logic high ”1”	2.0			V	PWR control loop during TX burst (slow mode)
			Logic low ”0”			0.5	V	PWR control loop during ramp up/ down (fast mode)
TXLX1	MAD	TX 800	Logic high ”1”	2.1		2.85	V	Low power level mode for power detector
			Logic low ”0”	0		0.6	V	High power level mode for power detector

Signal name	From	To	Parameter	Min	Typ	Max	Unit	Function
TXLX2	MAD	TX 1900	Logic high ”1”	2.1		2.85	V	Low power level mode for power detector
			Logic low ”0”	0		0.6	V	High power detector mode power detector
SENA2	MAD	2 Ghz UHF PLL	Logic high ”1”	2.0		2.85	V	2 Ghz PLL enable
			Logic low ”0”	0		0.8	V	
RXPWR2	MAD	PENTA	Logic high ”1”	2.0			V	VR8 ON, 1Ghz frontend
			Logic low ”0”	0		0.5	V	VR8 OFF
RXPWR3	MAD	PENTA	Logic high ”1”	2.0			V	VR9 ON 2Ghz frontend
			Logic low ”0”	0		0.5	V	VR9 OFF
SPWR3	COB-BA_D	PENTA	Logic high ”1”	2.0			V	VR10 ON , 2Ghz UHF
			Logic low ”0”	0		0.5	V	VR10 OFF
TXPWR1	MAD	CCont	Logic high ”1”	2.0			V	VR5 ON , TX pwr control enable
			Logic low ”0”	0		0.5	V	VR5 OFF
TXWR2	MAD	PENTA	Logic high ”1”	2.0			V	VR12 ON , TDMA1900 TX–upconverter enable
			Logic low ”0”	0		0.5	V	VR12 OFF
TXWR3	MAD	TDMA800 TX–up-converter	Logic high ”1”	2.0			V	AMPS & TDMA800 TX–up-converter enable
			Logic low ”0”	0		0.5	V	TX–UC disable
VR1	CCont	RF	Voltage	2.7	2.8	2.9	V	Supply for VCTCXO, Erotus VHF prescaler and bias, and 2 GHz PLL
VR2	CCont	RF	Voltage	2.7	2.8	2.9	V	Supply voltage for 1GHZ UHF VCO and prescaler
VR3	CCont	RF	Voltage	2.7	2.8	2.9	V	Supply voltage for VHF VCO, LO buffer, 1 Ghz TX–mixer and power detector
VR4	CCont	RF	Voltage	2.7	2.8	2.9	V	Supply voltage for EROTUS IF–parts and IF–amplifier

Signal name	From	To	Parameter	Min	Typ	Max	Unit	Function
VR5	CCont	RF	Voltage	2.7	2.8	2.9	V	Supply voltage for EROTUS TX modulator and TX pwr control circuits
VR7	CCont	RF	Voltage	2.7	2.85	2.9	V	TX800 PA bias and driver amplifier supply voltage
VR7_bias	CCont	RF	Voltage	2.7	2.85	2.9	V	TX800 PA bias switching voltage ”0”=AMPS ”1”=TDMA
V5V	CCont	EROTUS	Voltage	4.8	5.0	5.2	V	Erotus and 2 Ghz PLL chargepump

Receiver

General Instructions for RX Troubleshooting

Start the Wintesla–software and use it to start the desired RX–mode of the mobile phone. The troubleshooting flowchart is divided into three steps, general checking, local cheking and RX–chain checking. Please notice that before changing ASICs or filters, all solderings and missing components are checked.

IF any RX–filters and/or ASICs are changed, AGC– and RSSI–tunings have to be made!

Connect the desired channel frequency and level to the external antenna (RF) connector (notice different input levels of signal with AMPS, TDMA800 and TDMA1900).

It's recommended to use "*0 dB attenuation*"–setting in spectrum analyzer (better to measure weak signals). When measuring TDMA800 and TDMA1900 signal levels it's recommended to use "*MAX HOLD*"–option of spectrum analyzer (better to measure pulsed signals).

Note! Measurement results of RF–signal level (dBm) in fault finding charts are measured with active RF–probe (low input capacitance and high input impedance).

Also note that the measurement results in RX Troubleshooting charts are typical (approximate) values.

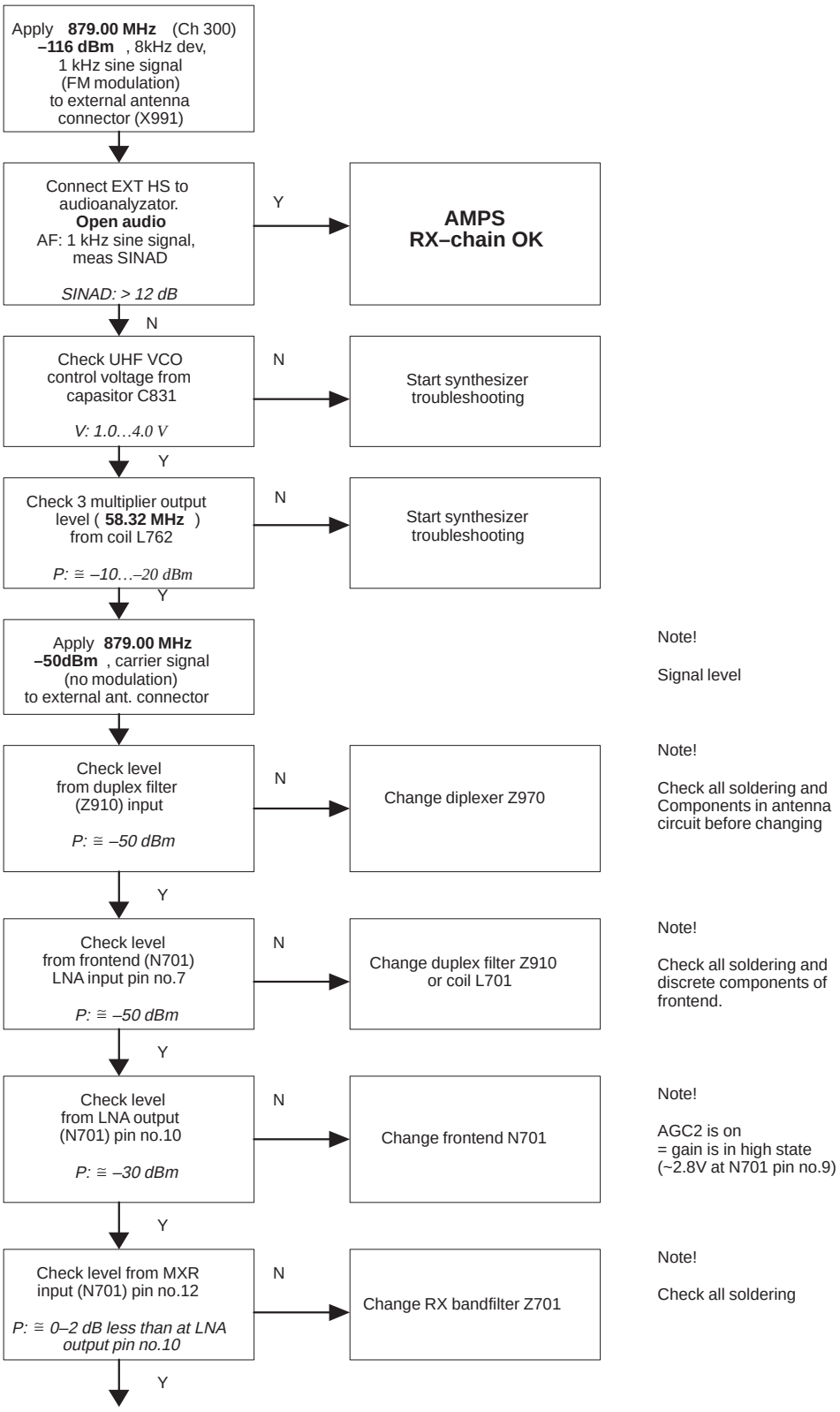
Path of the received signal

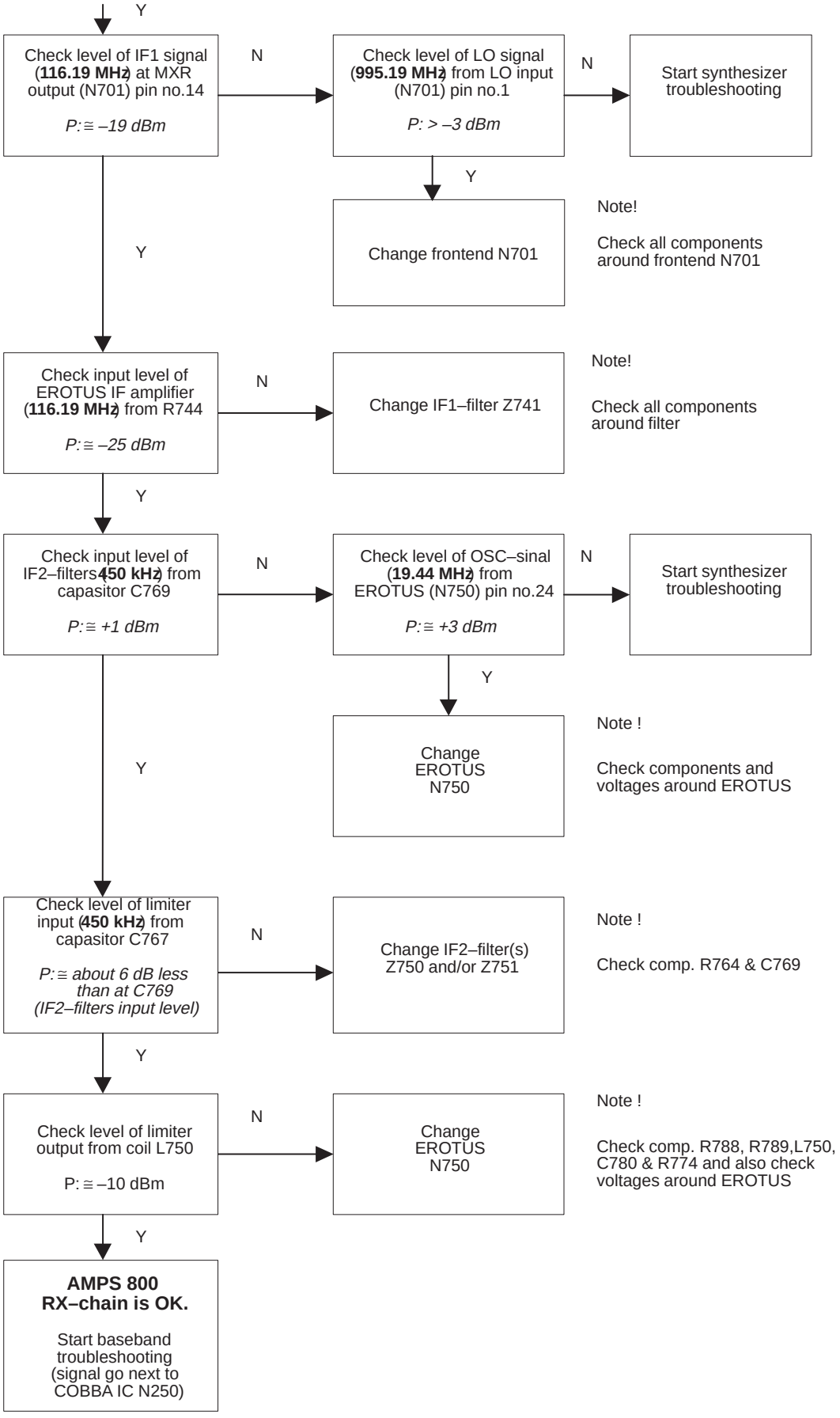
Block level description of the receiver:

Antenna –
Diplexer –
Duplexer –
Low Noise Amplifier (LNA) –
RX filter –
First mixer –
116.19 MHz filter –
IF–amplifier –
AGC/buffer –
second mixer –
450 kHz filters –
buffer/limiter –
Baseband(FM–detector).

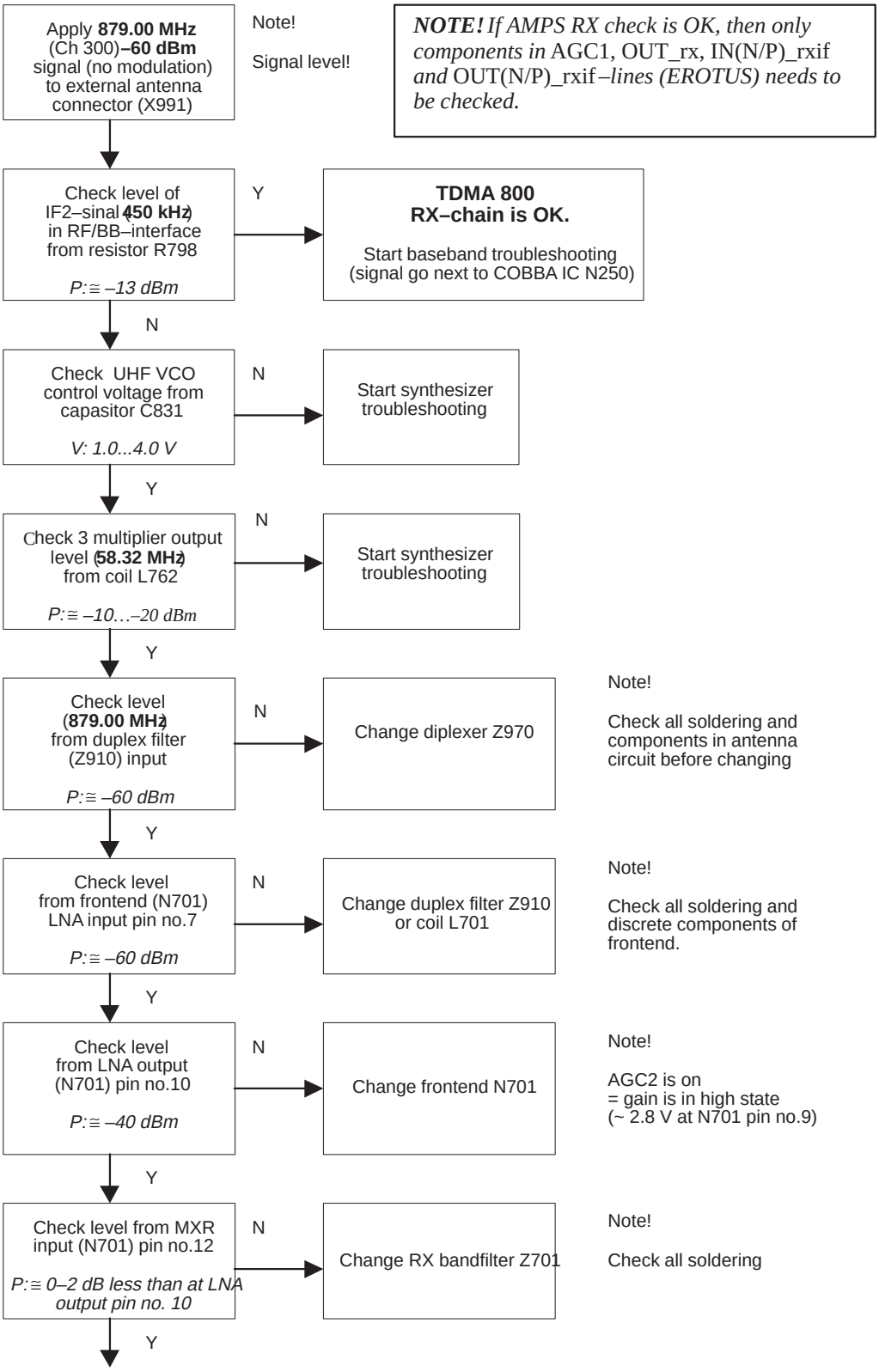
Troubleshooting charts for the receiver chain

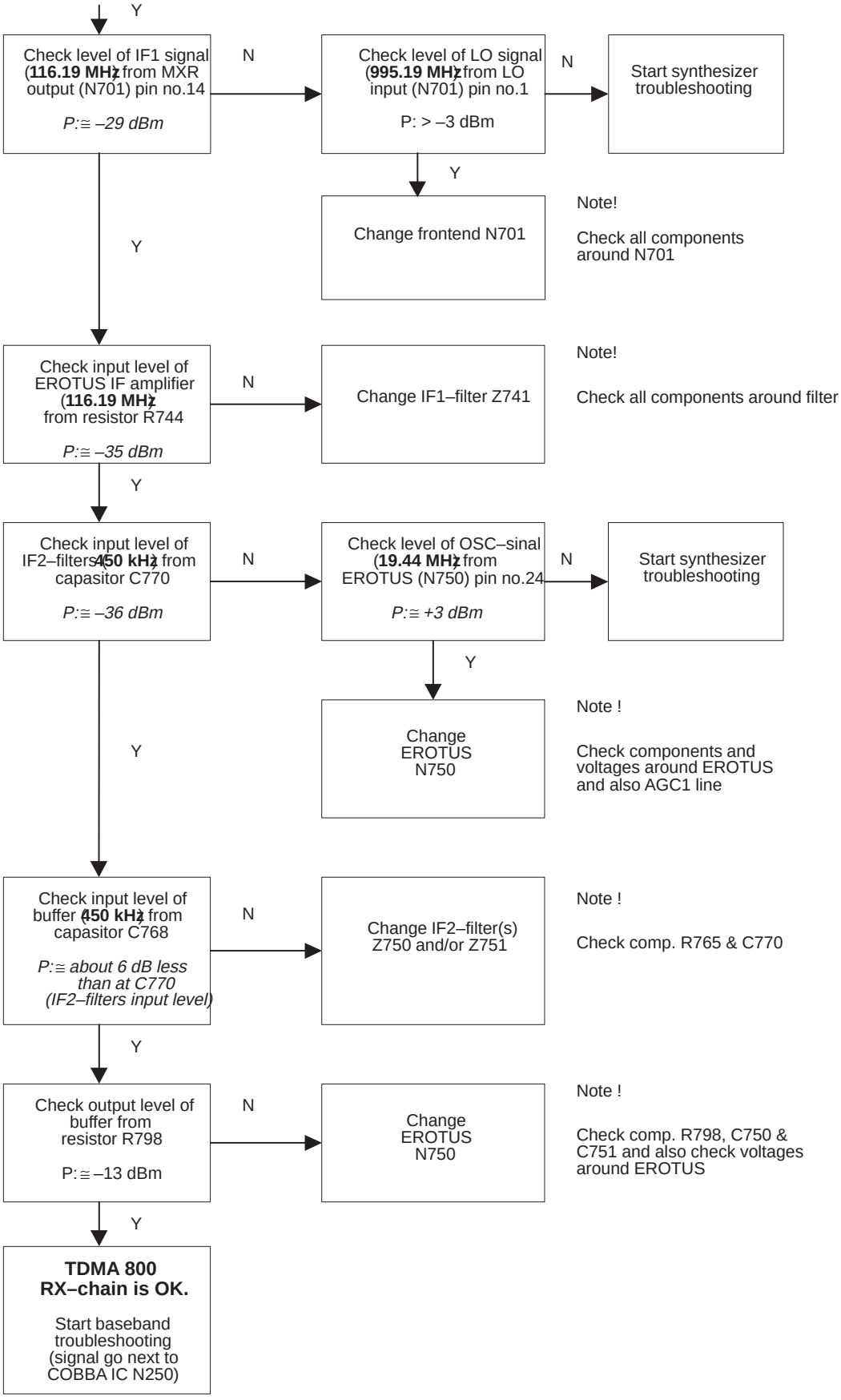
AMPS RX



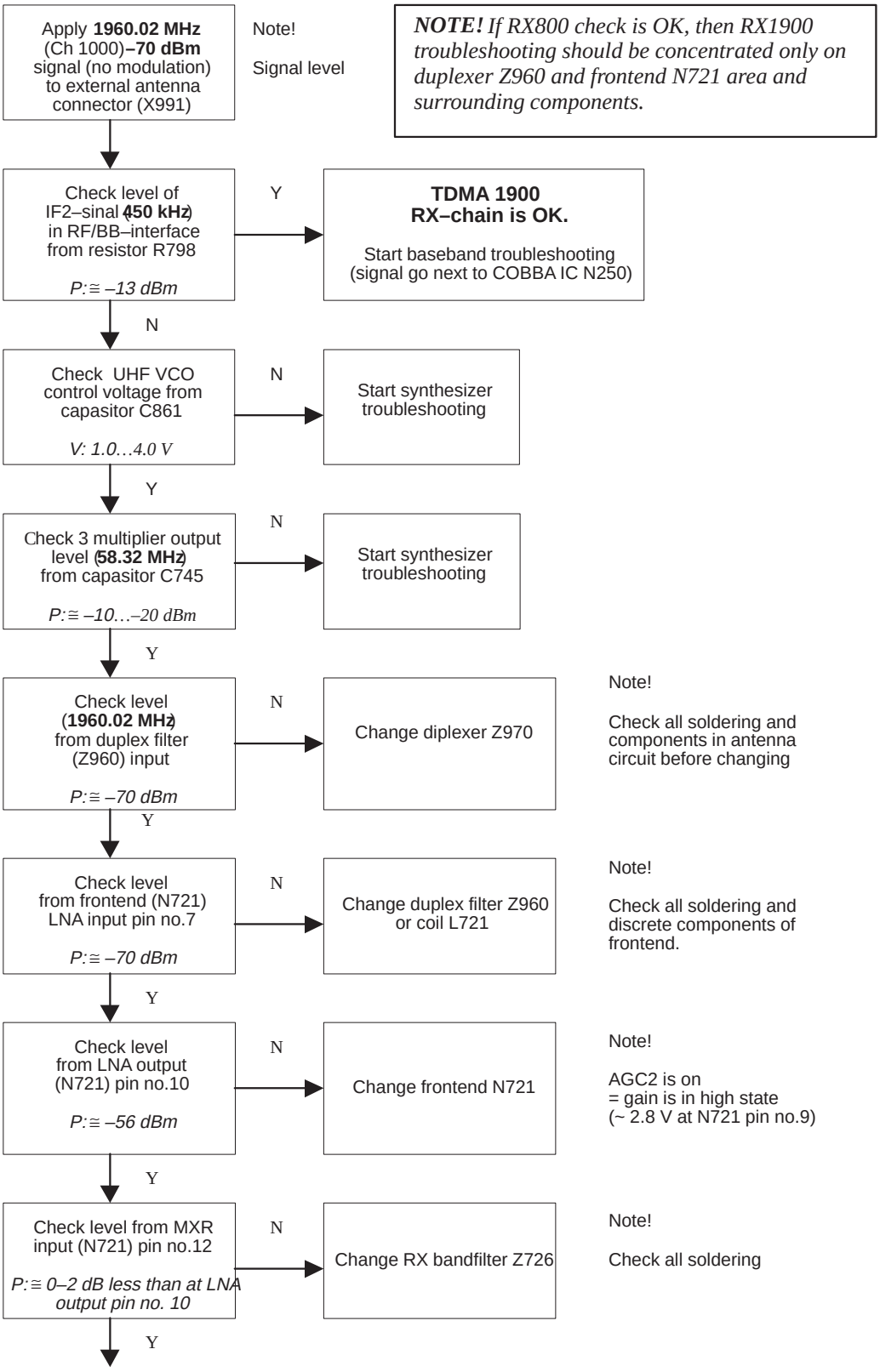


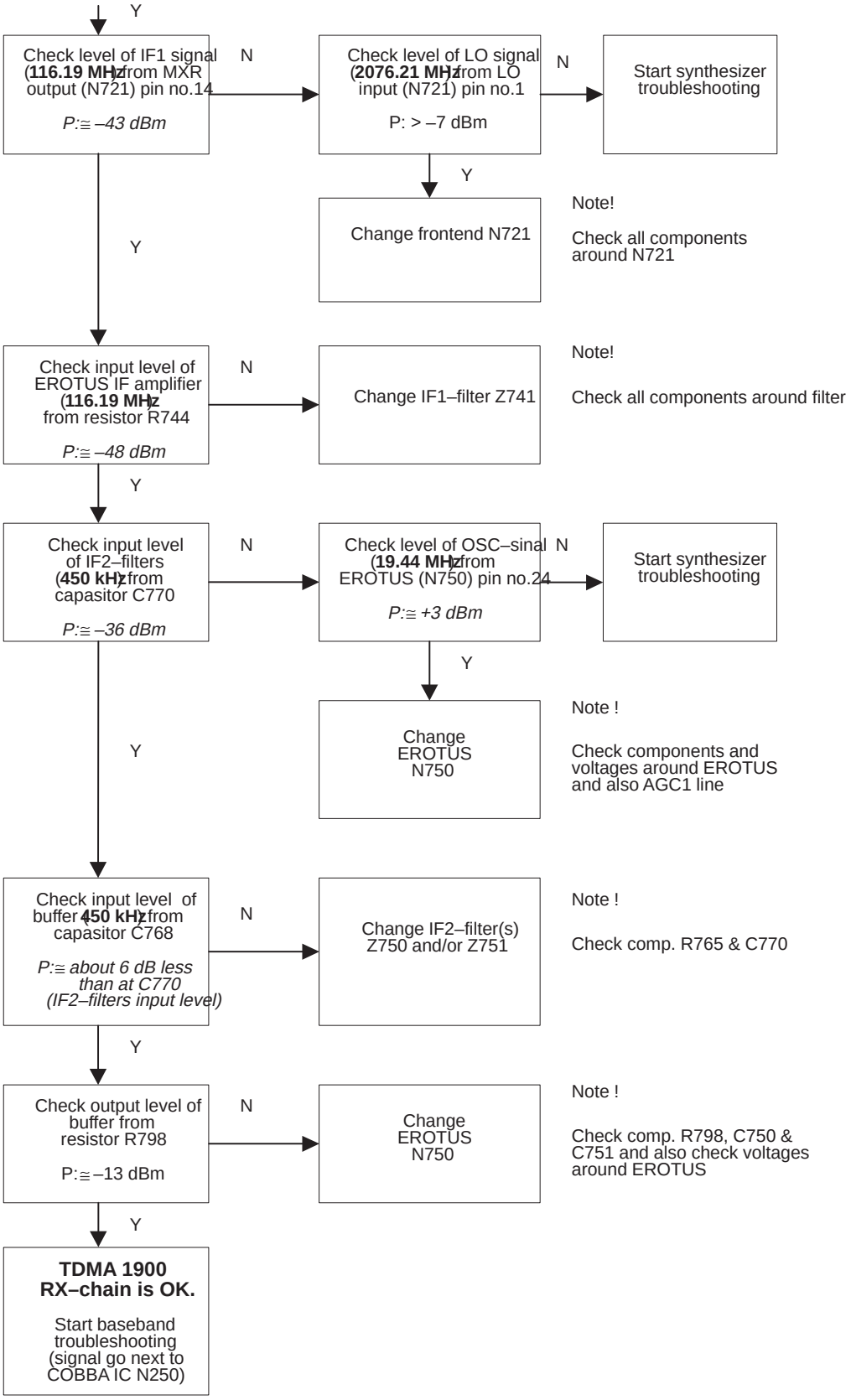
TDMA 800 RX





TDMA 1900 RX





Transmitter

General Instructions for TX Troubleshooting

Always use RF–cable connected from antenna connector to analyzer through a 10 dB attenuator. This is important to protect analyzer against excessive rf–power and not to let leake unwanted RF power to the cellular frequencies.

Start Wintesla–software and select TX mode under testing (AMPS,DAMPS or TDMA1900). It is useful to select mid channel (383 for AMPS/DAMPS or 1000 for TDMA1900) and power level 2. Select random data for digital mode of operation.

One of the basic test is to monitor current when transmitter is on. If current consumption does not change when transmitter is set on the fault is in the PA area.

Nominal current consumptions on power level 2 in mid channel:

AMPS:	700–900 mA
TDMA800:	350–400 mA
TDMA1900:	400–470 mA

Also, if pressing the PA package more tightly to PWB does have an effect on current consumption the fault is in the PA. In case of a faulty PA, the replacement should be done only under correct ESD precaution and using a hot air gun set to 10 m/s and 300 degrees centigrade. The new PA must be taken from a vacuum package and the heating process should be done in less than 30 seconds. Note, that the ground slug of the package must be properly soldered and excessive solder material, if any, has to be removed.

If any components in the TX chain are replaced, the power level tunings have to be checked and retuned.

Path of the transmitted signal

AMPS/DAMPS

Cobba TX I/Q DAC – I/Q–modulator – gain step amplifier – linear gain control amplifier – IF BPF – Upconverter – TX Driver amplifier – BPF– Power Amplifier – Directional Coupler– Duplexer –Diplexer – Antenna.

TDMA1900D

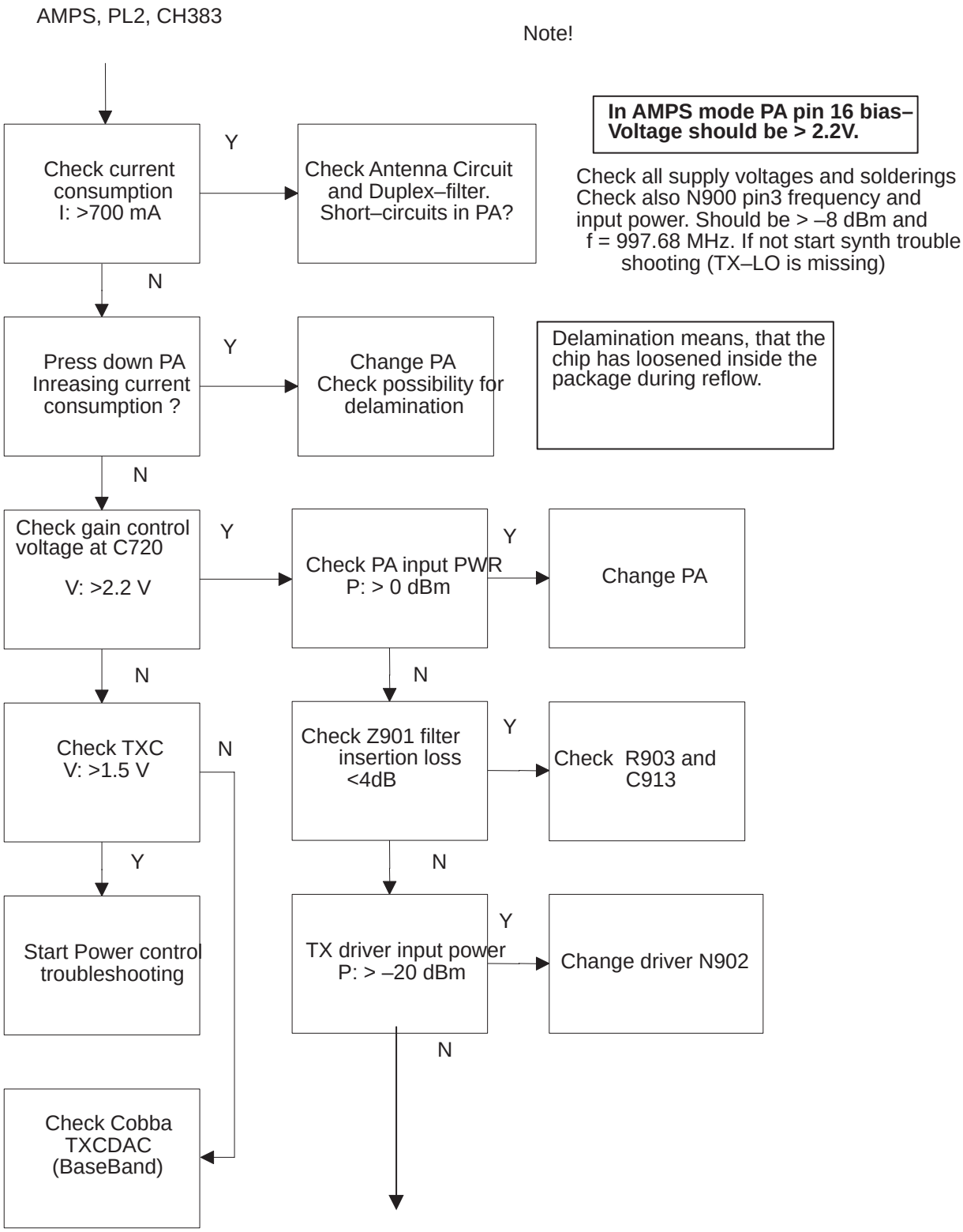
Cobba TX I/Q DAC – I/Q–modulator – gain step amplifier – linear gain control amplifier – IF BPF –Upconverter – BPF– TX Driver amplifier – BPF– Power Amplifier – Directional Coupler– Duplexer – Diplexer – Antenna.

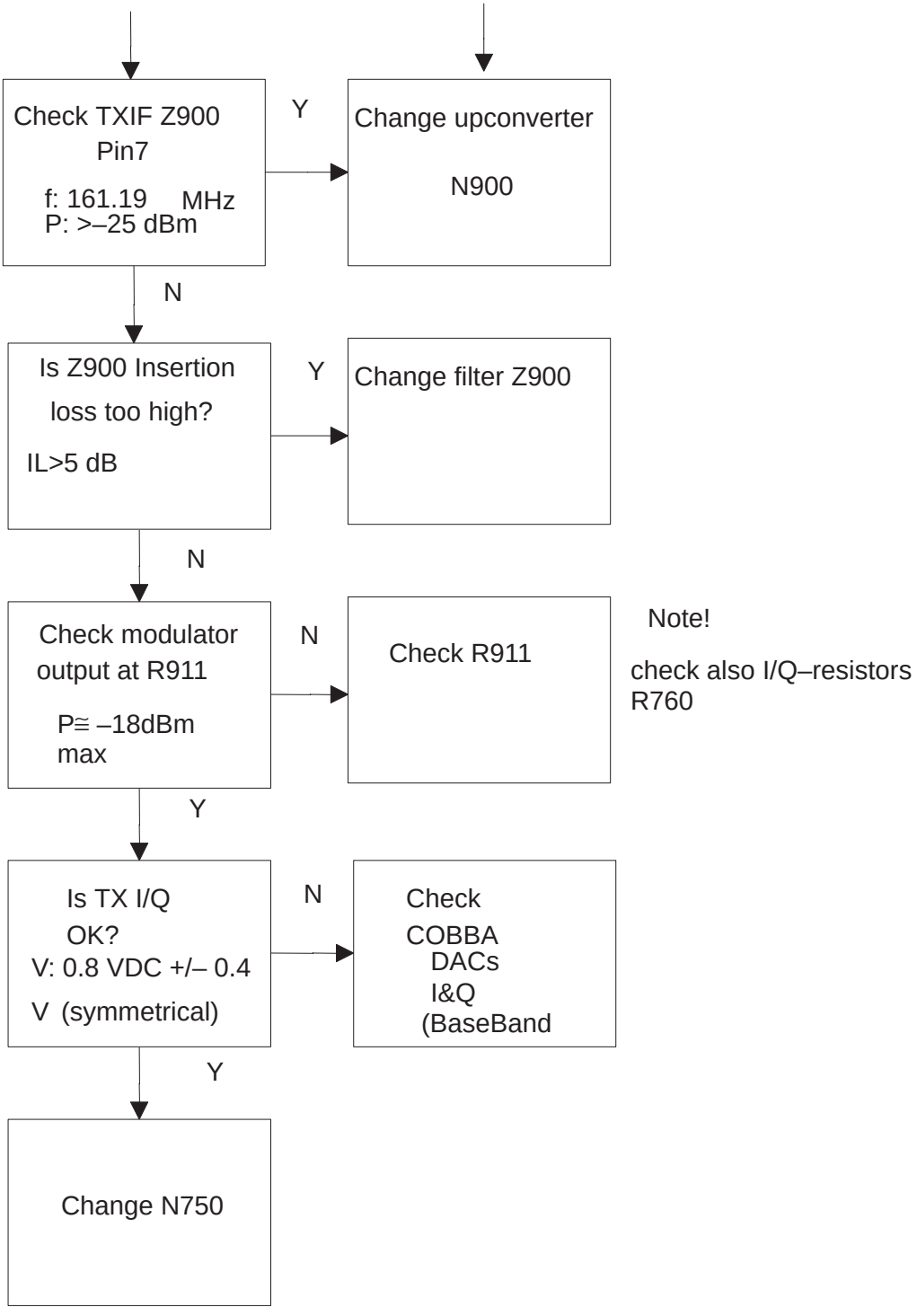
Power detection and power control circuits are located under the power control part of this guide.

Troubleshooting chats for Transmitter

AMPS TX

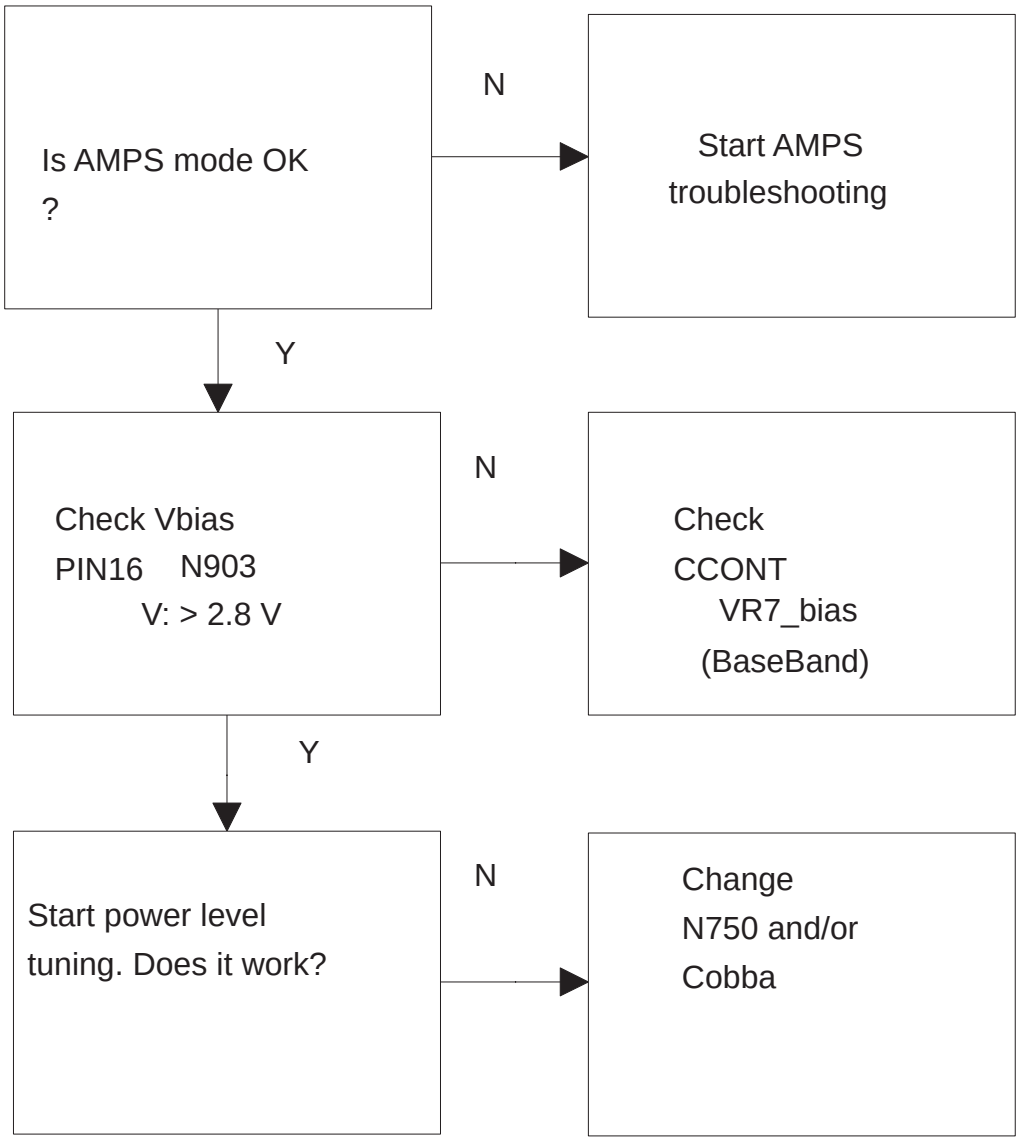
Connect an RF–cable to the antenna connector and connect the cable to a spectrum analyzer input. Start Wintesla–software and set the phone to Analog mode. Set channel 383 and Powerlevel 2 and measure RF ouput level. Please notice insertion loss of the cable. It is recommended to use an external attenuator to avoid overloading the spectrum analyzer.





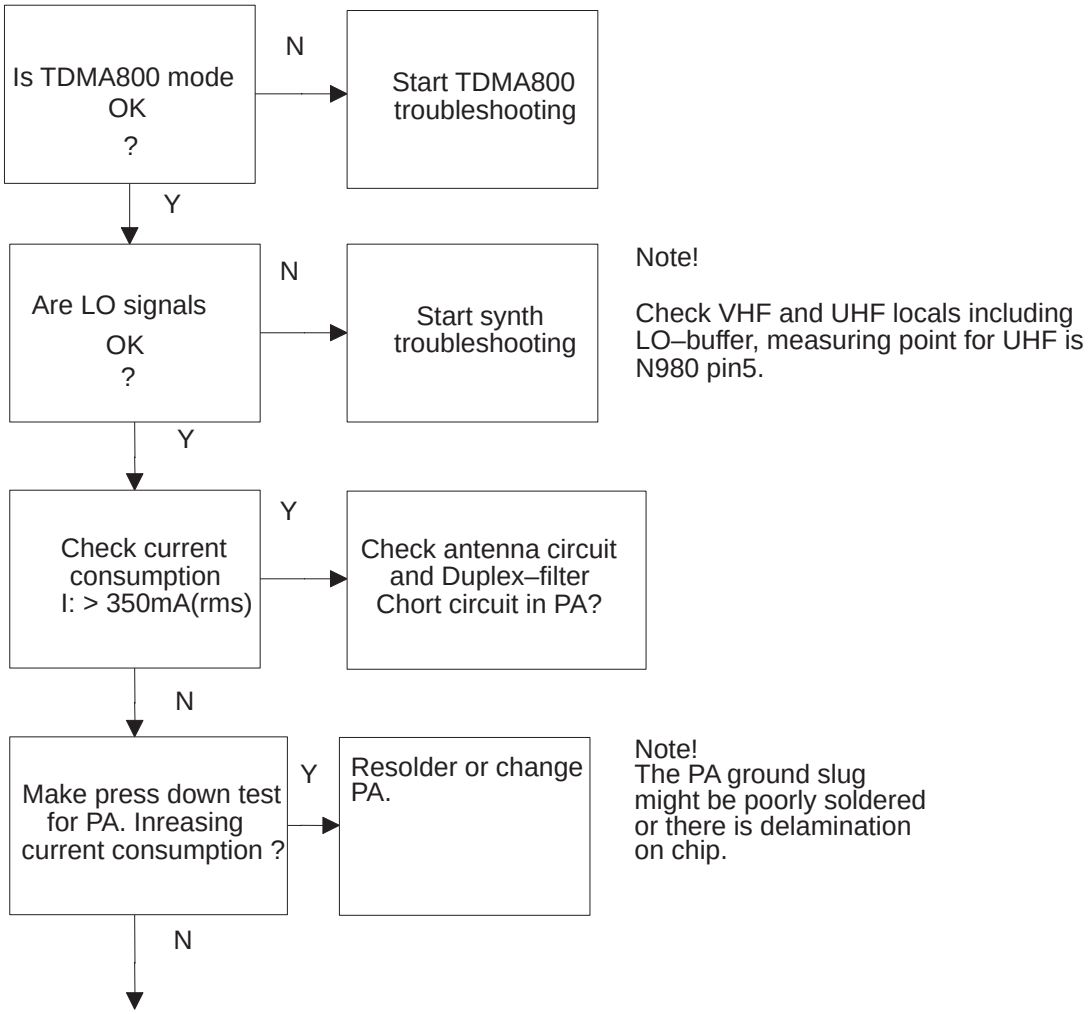
TDMA800 TX

The transmitter chain is exactly same as in AMPS–mode, but the power amplifier is biased to more linear mode, so it is important, that AMPS have no faults.



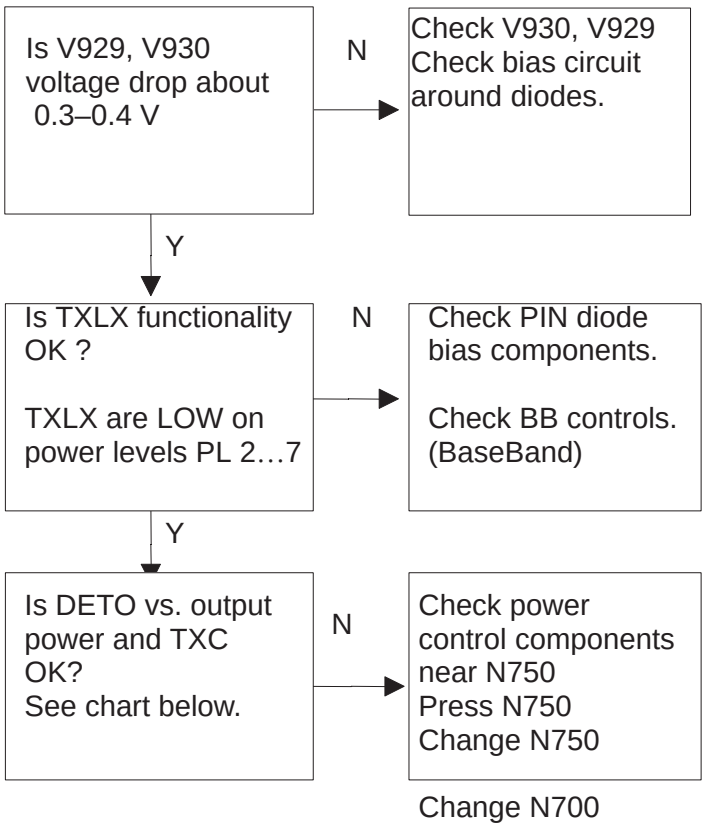
TDMA1900 TX

TDMA1900 mode and DAMPS mode have common IF section and antenna circuit and thus it is important that DAMPS mode have no faults.



Power Control Loop

Power control section is basically similar for both bands, except for that both bands have their own directional coupler and detector. The power control is actually made in EROTUS IC.



Note !

See DETO vs. Output power curve

Note:

1. DETO and TXC will be about same in each mode.

2. TXA is high during modulation.

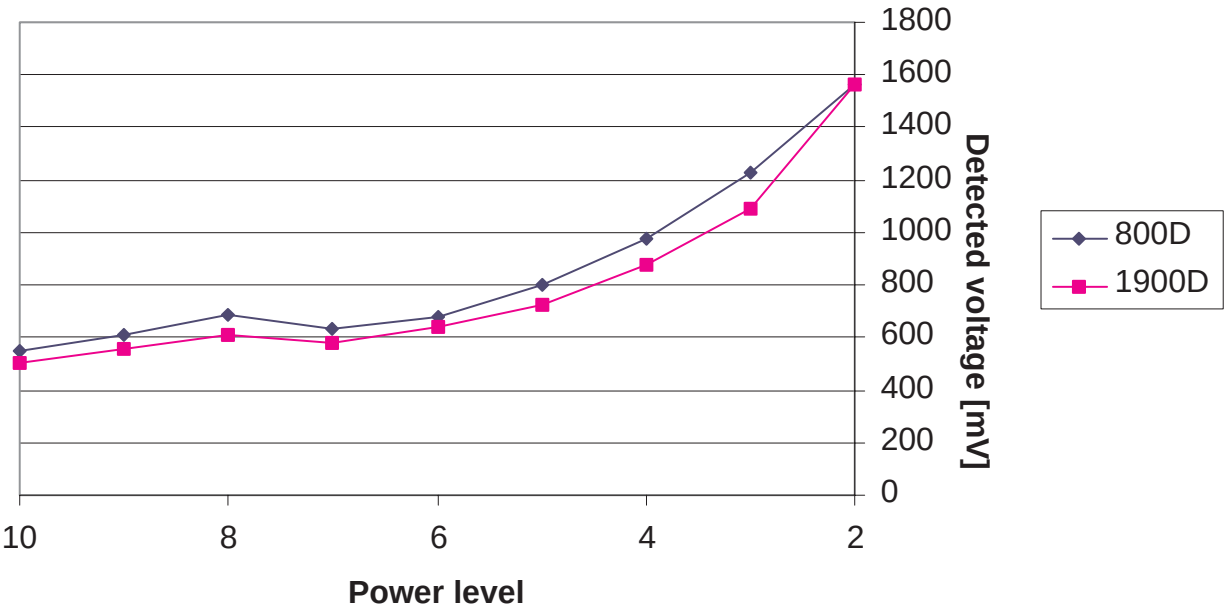
3. TXLX signals will draw about 4mA current in high state.

Detected voltages are described in the next table and diagram:

TYPICAL DETECTED VOLTAGES AT POWER LEVELS PL2…PL10 HD965

800D					1900 D			
	Pout	TXC	LB–DETO			Pout	TXC	UB–DETO
PL	dBm	dac	mV		PL	dBm	dac	mV
2	26.8	183	1560		2	25.2	15	1260
3	23.5	16	1230		3	23.3	–53	1090
4	19.8	–108	980		4	19.3	–163	880
5	15.8	–195	800		5	15.3	–230	730
6	11.8	–250	680		6	11.3	–275	640
7	7.8	–296	630		7	7.3	–307	580
8	3.8	–265	690		8	3.3	–287	610
9	–0.2	–306	610		9	–0.2	–318	560
10	–3.8	–343	550		10	–3.8	–347	500

NOTE: DAC VALUES MAY VARY +/– 150 DAC UNITS



Synthesizers

There are four oscillators generating the needed frequencies for RF–section.

19.44 MHz reference oscillator:
1GHz UHF VCO,
2Ghz UHF VCO and
VHF VCO.

Only VHF VCO is discrete solution and it has two fixed frequencies, 322.38 MHz for lowband and 392.46 MHz for upper band. VHF VCOs operating frequency is controlled by the PLL–circuit of EROTUS. All locals are locked to the stable reference oscillator.

The frequency range for 1GHz UHF VCO is 985.23 – 1010.16 MHz and for 2Ghz UHF VCO is 2046.27 – 2106.15 MHz.

A practical way to check out synthesizer status is to measure the control voltage of the VCO from the integrator capacitor C831 (LB) , C861 (HB) or C790 (VHF). The voltage must be stable and in the right range, and the local oscillator must be running correctly.

19.44 MHz Reference Oscillator

The 19.44 MHz oscillator frequency (G850) is controlled by the COBBA_D. This 19.44 MHz signal is connected to EROTUS and TDMA1900 PLL–circuit.

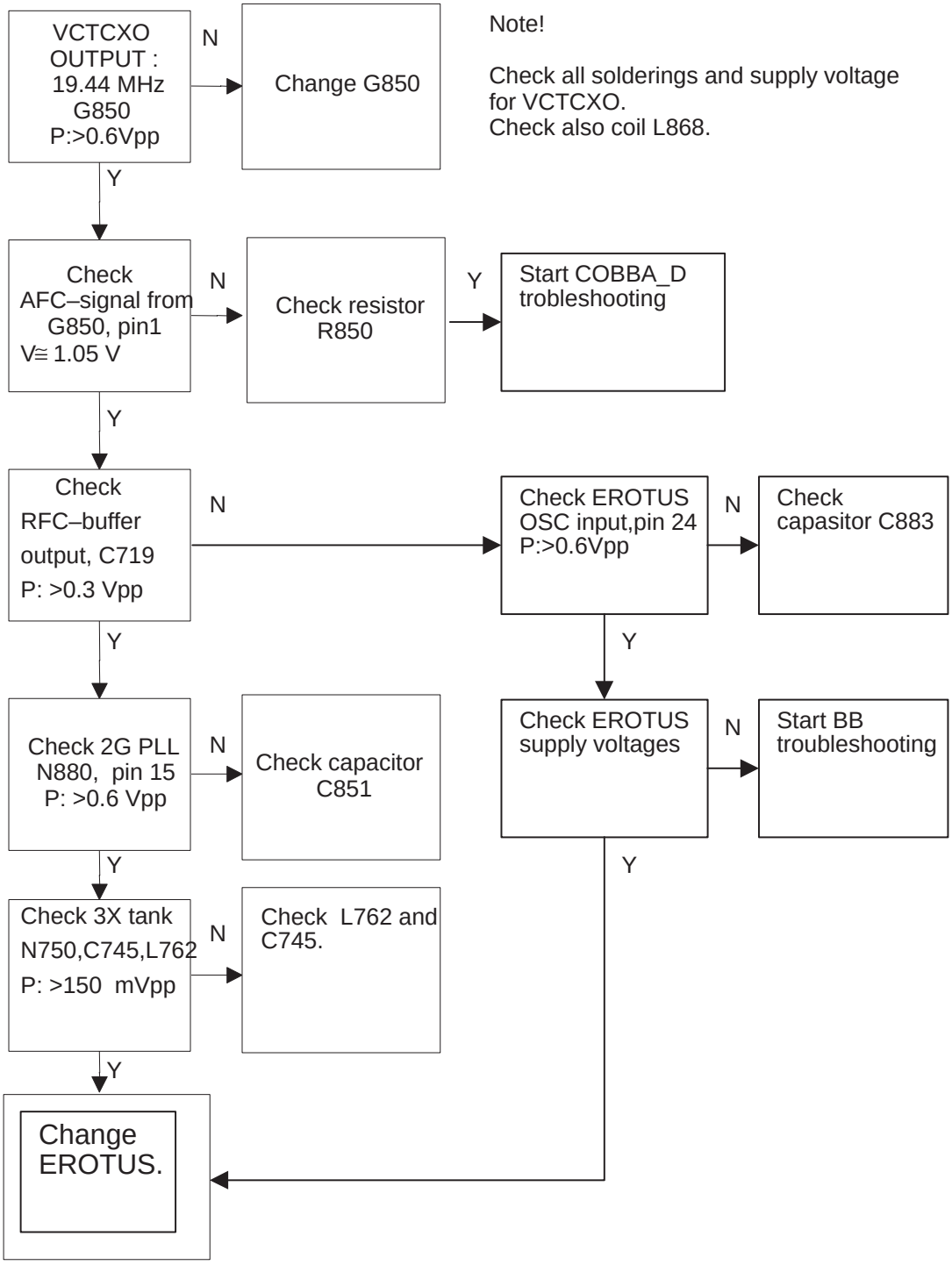
All synthesizers use divided VCTCXO signal as reference signal for Phase locked loop to provide the correct LO–frequency. The VCTCXO output signal is also used to generate multiple LO frequency by multipliers.

Baseband also needs the reference signal so it can generate necessary clock signals, and the VCTCXO output signal is also buffered and connected to MAD.

58.32 MHz 3–Multiplier

The 3–multiplier is an integrated solution in the EROTUS and it is used to generate the second LO frequency for the receivers. The 3*multiplier output signal is multiplied by 2 and then it is fed to the 2nd downconverter.

19.44 MHz Osc. Troubleshoolting



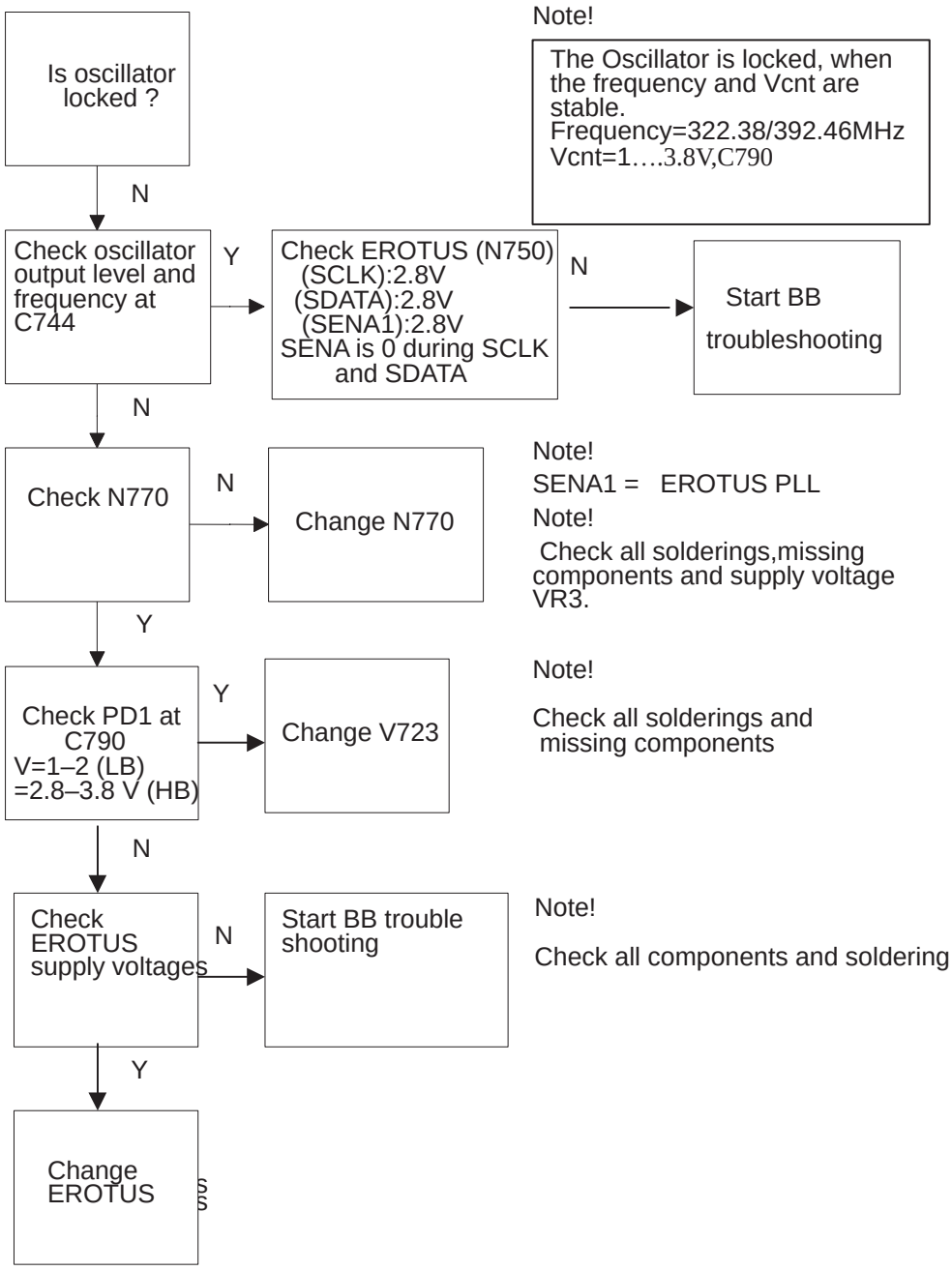
VHF VCO

The VHF VCO signal is used to generate transmitter Intermediate frequencies. The VHF VCO has two fixed frequencies. Operating frequency is locked in a Phase Locked Loop, which is controlled by baseband.

In AMPS and TDMA800 modes the VHF frequency is 322.38 MHz. In TDMA1900 mode a higher intermediate frequency is needed, so the operating frequency is increased to 392.46 MHz.

The VHF VCO output signal is fed to the EROTUS LO–pin VV_in. Inside the EROTUS, the signal is divided for the Phase detector and TX parts. Before injection to the I/Q–modulator, the frequency is divided by 2 .

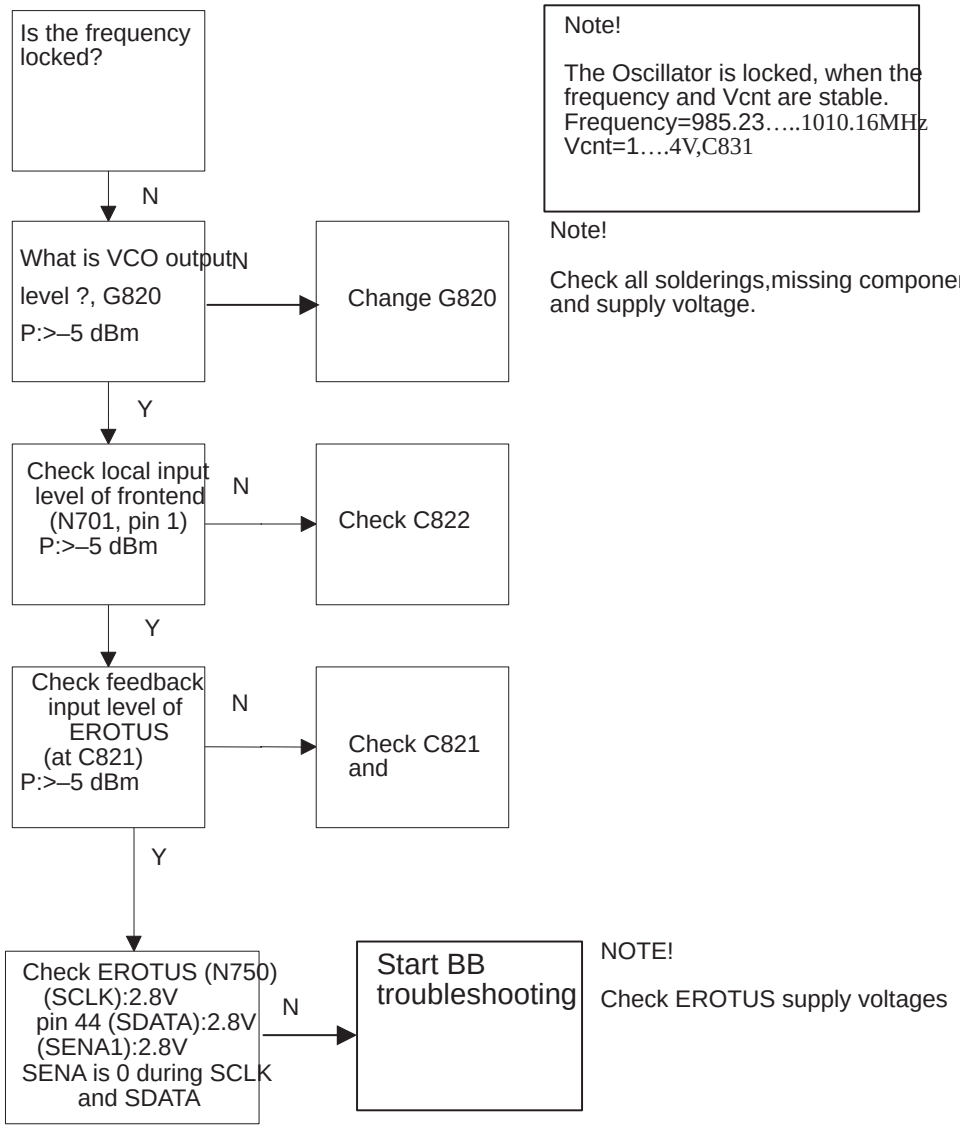
VHF VCO Troubleshooting



AMPS & TDMA800 UHF Synthesizers

1 GHz UHF VCO (G880) generates the first injection for RX (869...897 MHz) and the final injection for TX (824...849 MHz). The output frequency of the module depends on the DC–control voltage supplied by the EROTUS in line PD2.

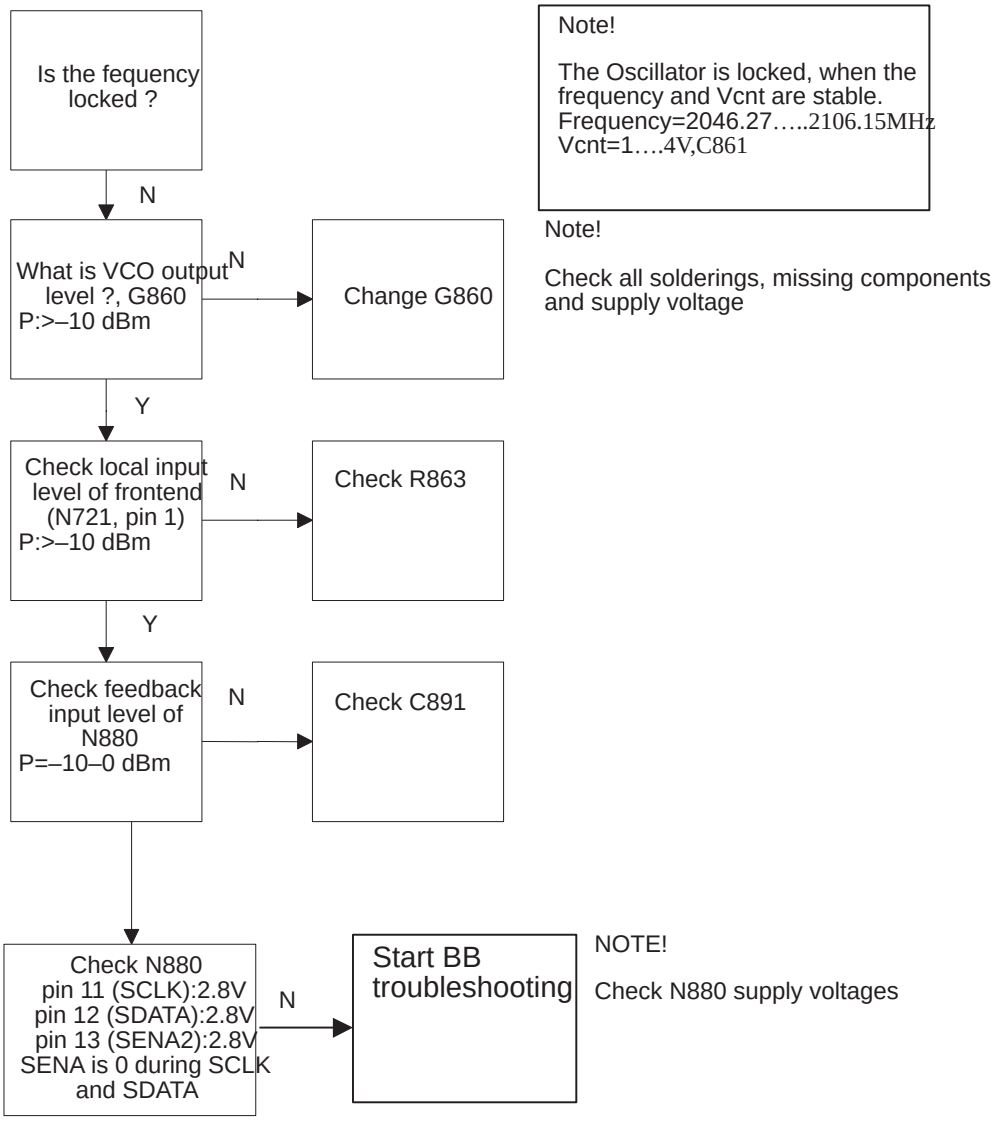
1 GHz UHF Synth Troubleshooting



TDMA1900 UHF Synthesizers

2 Ghz UHF synthesizer generates desired injection frequencies for TX and RX chain. The output frequency of the VCO depends on the control voltage of the PLL–circuit

2 GHz UHF Synth Troubleshooting



RF ASICs

General Information

EROTUS (N750) provides three main RF functions:

1. RX/TX IF blocks
2. PLLs for VHF and 1 GHz UHF
3. TX Power control circuits

The receiver block consists of IF buffers, active mixers, 6–multiplier (3*+2*), AGC amplifier and limiter.

The transmitter section includes a digital gain step amplifier, a linear gain control amplifier, a divider, an I/Q Modulator and control part for the Transmitter Power Control loop.

The PLL section is controlled via the serial bus and contains both 1GHz UHF and VHF PLLs and prescalers.

EROTUS

The EROTUS ASIC is in a TQFP64 type package, so RF probing for the most signals is possible at the EROTUS pins. Signals can also be checked at the components, which the signals are connected to.

Receiver front ends N701, N721

Pin no.	Pin name	Nominal level		Description
1	LO IN	0 dBm –4 dBm	N701 N721	Mixer LO input
2	Vdd buf	2.8V		TX LO–buffer Vdd
3	LO out	–3 dBm –3 dBm	N701 N721	TX LO–buffer output
4	GND	0		Ground
5	Vdd LNA	2.8V		LNA Vdd
6	GND	0		Ground
7	LNA in	–		LNA RF input port
8	GND	0		LNA ground
9	Gain Sel	> 2 V < 0.5 V	High Gain Low Gain	LNA gain select
10	LNA out	–		LNA output port
11	GND	0		Ground
12	Mxr RF	–		Mixer RF input port
13	GND/½IF	0		Ground (½–IF tuning in N721)
14	MXR IF	–		Mixer IF output port

Pin no.	Pin name	Nominal level	Description
15	GND	0	Ground
16	Vdd MXR	2.8V	Mixer LO–buffer Vdd and LO–buffer tuning

Power Amplifiers N903, N960

RF9103 (N903)

Pin no.	Pin name	Description
1	VCC	Power supply pin for bias circuit. Add RF bypass capacitor.
2	N/C	No connection or GND
3	L TUNE	Tuning pin for interstage matching network. A short (TBD) transmission line length is required for tuning interstage match.
4		Power supply pin for the first stage collector. A RF choke and a bypass capacitor is required for this pin.
5	GND1	Ground pin for the first stage.
6	RF IN	RF input. DC coupled.
7	N/C	No connection or GND
8	Vreg	Regulated power supply for bias circuit. PA shut down.
9	N/C	No connection or GND
10	N/C	No connection or GND
11	N/C	No connection or GND
12	RF OUT	RF output and bias for the output stage.The power supply for the output transistor needs to be supplied to this pin.
13	RF OUT	Same as pin 12.
14	2*f0	Second harmonic trap. Add capacitor to ground.
15	N/C	No connection or GND
16	Vbias	Bias control 2.8V. Add RF bypass capacitor.
17	Ground	Ground connection. The backside of the package should be connected to the ground plane through a short path.

RF9111 (N960)

Pin no.	Pin name	Description
1	N/C	No connection. (GND)
2	N/C	No connection. (GND)
3	Q2C	Power supply pin for the 2. stage. A bypass cap is required.
4	Q1C	Power supply pin for the 1. stage. A bypass cap is required.
5	GND	Ground pin for the first stage.
6	RF IN	RF input. DC block on chip.
7	GND	Ground pin for the first stage.
8	Vreg	Regulated voltage supply for the bias circuit.
9	GND	Ground pin for the first stage.
10	BIAS	Bias ground.
11	RF OUT	RF output, Use this pin for an output matching capacitor. **Do not feed bias through this pin.** (DC coupled)

Pin no.	Pin name	Description
12	RF OUT	RF output and bias for the output stage. 3rd stage collector.
13	RF OUT	RF output and bias for the output stage. 3rd stage collector.
14	RF OUT	RF output, Use this pin for an output matching capacitor. **Do not feed bias through this pin.** (DC coupled)
15	N/C	No connection. (GND)
16	N/C	No connection. (GND)
17	Ground	Ground connection. The backside of the package should be connected to the ground plane through a short path.

PENTA Regulator N703

Pin no.	Pin name	Nominal level	Description
1	Bypass	–	Pin for external bypass capacitor
2	Common enable	>2V	Enable for the whole circuit
3	VR1cntrl	>2V	Regulator 1 ON/OFF
4	VR2cntrl	>2V	Regulator 2 ON/OFF
5	VR3cntrl	>2V	Regulator 3 ON/OFF
6	VR4cntrl	>2V	Regulator 4 ON/OFF
7	VR5cntrl	>2V	Regulator 5 ON/OFF
8	GND	0	Ground
9	VR5	2.8V	Regulator 5 output
10	Vcc2	VBAT	VR4 and VR5 common input voltage
11	VR4	2.8V	Regulator 4 output
12	VR3	2.8V	Regulator 3 output
13	VR2	2.8V	Regulator 2 output
14	VR1	2.8V	Regulator 1 output
15	Vcc1	VBAT	VR1, VR2 and VR3 common input voltage
16	N/C		Not connected

TDMA 1900 Upconverter N980

Pin no.	Pin name	Nominal level	Description
1	VDD1	2.8V	Supply voltage
2	N/C		Not connected
3	N/C		Not connected
4	GND	0	Ground
5	LO IN	0dBm	TX local input
6	GND	0	Ground
7	RF OUT	–	RF output
8	VDD2	2.8V	Supply voltage
9	N/C		Not connected
10	N/C		Not connected
11	GND	0	Ground

Pin no.	Pin name	Nominal level	Description
12	VDD3	2.8V	Supply voltage
13	GND	0	Ground
14	IF IN	–	Intermediate frequency input
15	N/C		Not connected
16	TX ENA	>2V	TX enable

TDMA 1900 PLL N880

Pin no.	Pin name	Nominal level	Description
1	FAST	2.8V	Enable input for fast chargepump
2	CPF		Fast charge pump output
3	CP		Normal charge pump output
4	VDD2	2.8V	Power supply voltage
5	Vss3	0	Ground
6	RFI	?	Main divider input
7	Vss2	0	Ground
8	POL	2.8V	polarity select
9	PON	2.8V	Power on input
10	Vss1	0	Ground
11	CLK	?	Programming bus clock input
12	DATA	?	Programming bus data input
13	E	?	Programming bus enable input
14	Vdd1	–	Power supply voltage
15	XTALB	–	Complementary crystal frequency input
16	XTALA	–	Complementary crystal frequency input
17	GND(CP)	0	Ground for charge pump
18	Vcc	4.8V	Supply voltage for charge pump
19	Iset	–	charge pump currents setting
20	LOCK	–	Out of lock detector

PAMS Technical Documentation
NSW-5 Series Transceivers

Non-Serviceable Accessories

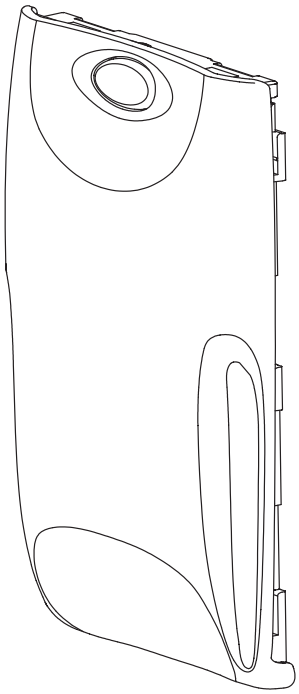
AMENDMENT RECORD SHEET

Amendment Number	Date	Inserted By	Comments
Issue 1	**10/00**	OJuntune	

CONTENTS

Slim Battery BLS-2S

The BLS-2S is a Li-ion light weight battery with 900 mAh capacity.

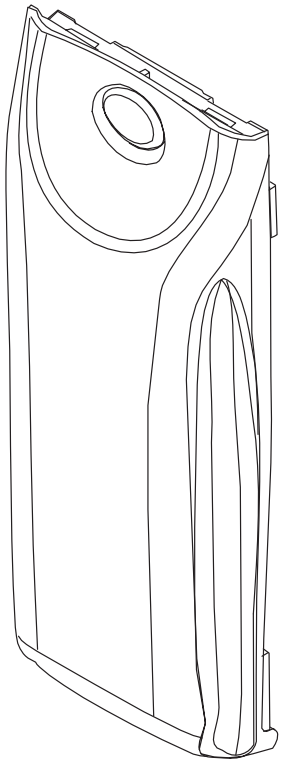


Product Code

Battery pack BLS-2S:	*0670300*

Standard Battery BMS-2S

The BMS-2S is a NiMH battery with 900 mAh capacity.

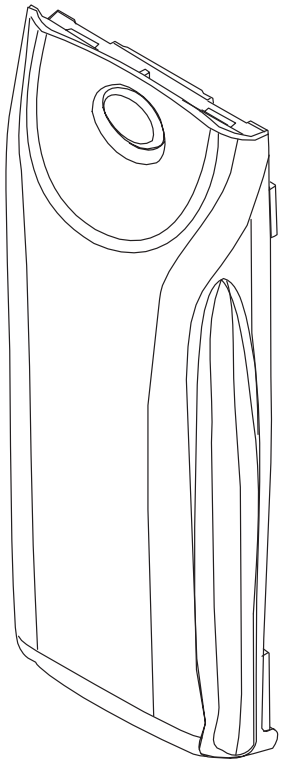


Product Code

Battery pack BMS-2S:	*0670314*

Vibrator Battery BMS-2V

The BMS-2V is a NiMH battery with 900 mAh capacity and vibrator.

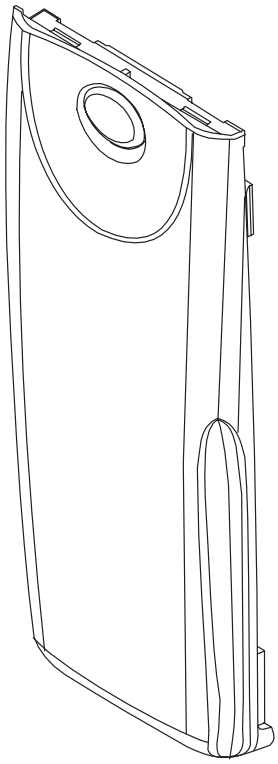


Product Code

Battery pack BMS-2V:	*0670315*

Slim Battery BLS–2N

The BLS–2N is a Li–ion ultra slim battery with 900 mAh capacity.

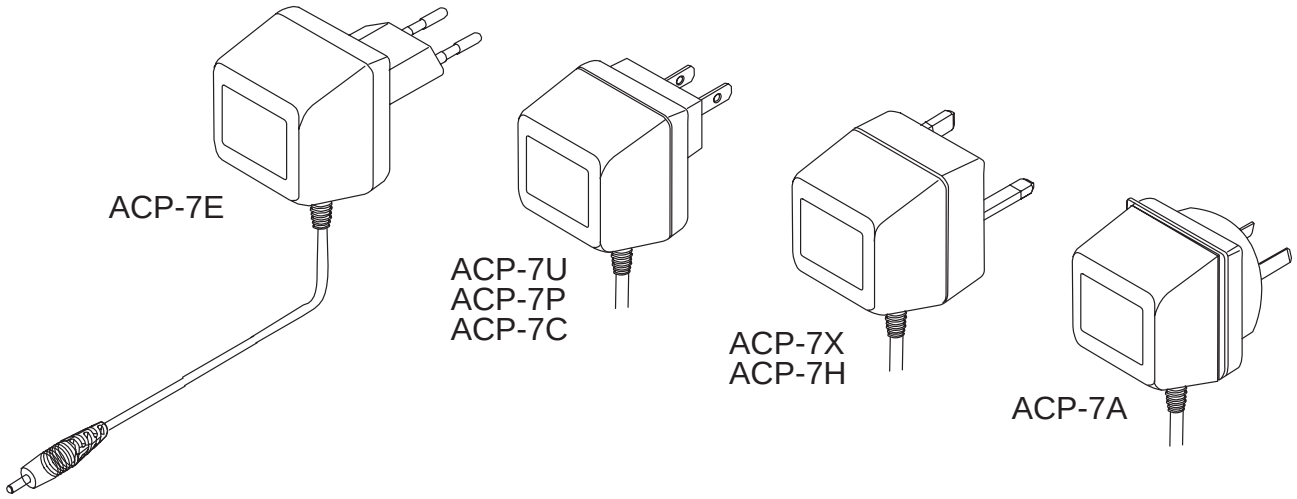


Product Code

Battery pack BLS–2N:	*0670306*

AC Travel Charger ACP-7

The standard charger is available for different voltage levels and comes with different wall plugs. The standard charger can also be used as a power supply for the desktop stand.



S0001160

Product Codes

AC Travel Charger (Euro plug) 207-253 Vac	ACP-7E	0675144
AC Travel Charger (US plug) 108-132 Vac	ACP-7U	0675143
AC Travel Charger (US plug) 207-253 Vac	ACP-7P	0675147
AC Travel Charger (CH) 198-242 Vac	ACP-7C	0675212
AC Travel Charger (UK plug) 207-253 Vac	ACP-7X	0675145
AC Travel Charger (UK plug) 180-220 Vac	ACP-7H	0675146
AC Travel Charger (Australia) 216-264 Vac	ACP-7A	0675148

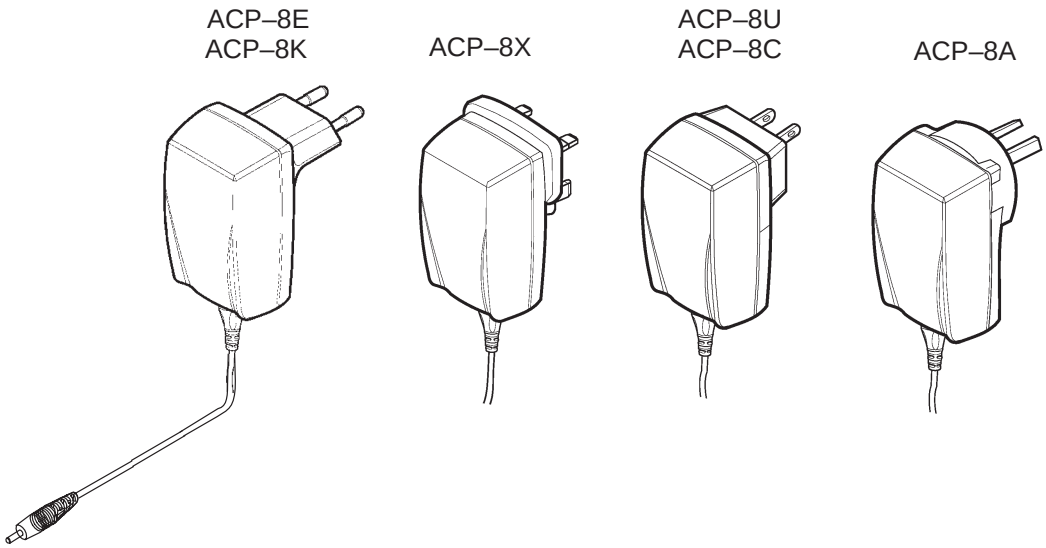
Specification

Output connectors:	*3.5 mm DC plug, 2-pole*
Protection:	PTC protection
Output Voltage /Current (typ)	7.6 V / 370 mA

Performance Travel Charger ACP-8

Operating within the voltage range 90 V...264 V AC (50 Hz...60 Hz), the Performance Travel Charger is practically current independent in normal office and household use. Like the standard charger, it is compatible with all battery options and is available for different wall sockets.

The Performance Travel Charger can also be used with desktop stand CGE-1.



Product Codes

Performance Travel Charger Euro plug 90-264 Vac	ACP-8E	0675195
Performance Travel Charger Korea plug 90-264 Vac	ACP-8K	0675199
Performance Travel Charger UK plug 90-264 Vac	ACP-8X	0675197
Performance Travel Charger US plug 90-264 Vac	ACP-8U	0675196
Performance Travel Charger China plug 90-264 Vac	ACP-8C	0675211
Performance Travel Charger Australia plug 90-264 Vac	ACP-8A	0675214

Specification

Output connectors: 3.5 mm DC plug, 2-pole (+, -, control)

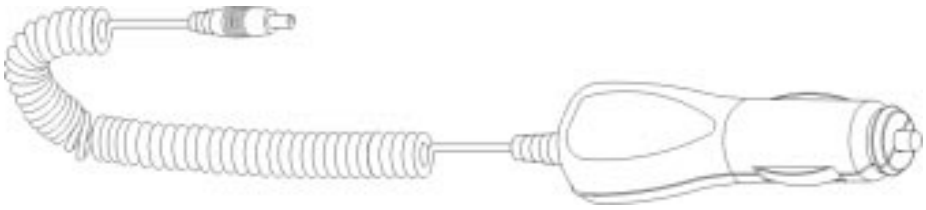
Protection: Output fault voltage 16 V max.

Output voltage/current (typ): 6.0 V (±0.3 V)/620 mA

Cigarette Lighter Charger LCH–8

A green light indicates that the cigarette lighter charger is ready for charging. Check the charging status on the phone display. The main use is with 12V vehicle system. It is using 3–wire charging structure (controlled constant voltage). It has internal output current limitation of 650mA.

The car battery connectors must perform reliable electrical connection to the cigarette lighter socket.



Product Code

Cigarette lighter charger LCH–8: *0675231*

Specification

Output connectors: 3.5 mm DC plug, 3 pin.

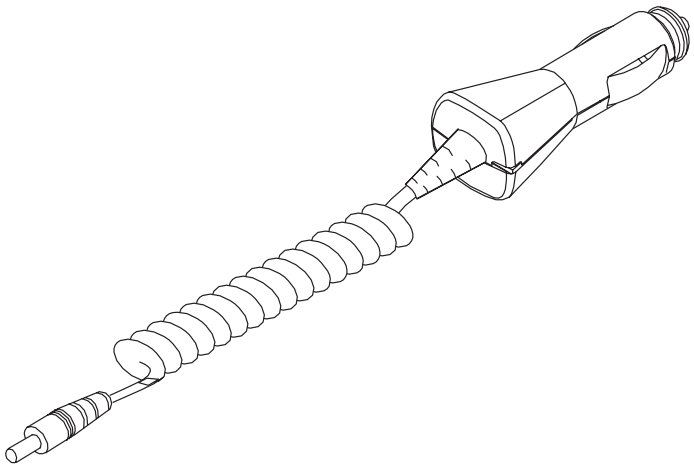
Protection: *input fused, output current limit 650 mA*

Voltage
- input: *10.8...32 V*
- output: The output voltage is controlled by the phone via a 3rd wire.

Cigarette Lighter Charger LCH-9

A green light indicates that the cigarette lighter charger is ready for charging. Check the charging status on the phone display. The input voltage can be from 11 or 32 V d.c., negative grounding.

Universal mobile charger can be used with all car accessories provided for your phone.



Product Code

Universal mobile charger LCH-9: *0675120*

Specification

Connectors
- input: *D 21/23 mm*
- output: *3.5 mm DC plug*

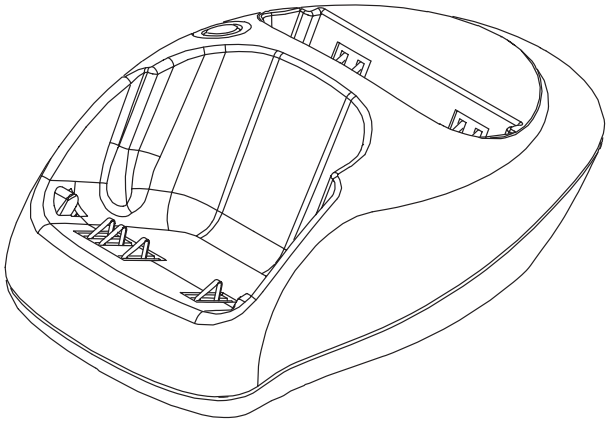
Protection: *input fused, output current limit 850 mA*

Voltage
- input: *11...32 V*
- output (nominal): *8.4 V*

Nominal output current: *800 mA*

Desktop Stand DCH-9

The desktop stand provides mounting place for both the phone and a spare battery.



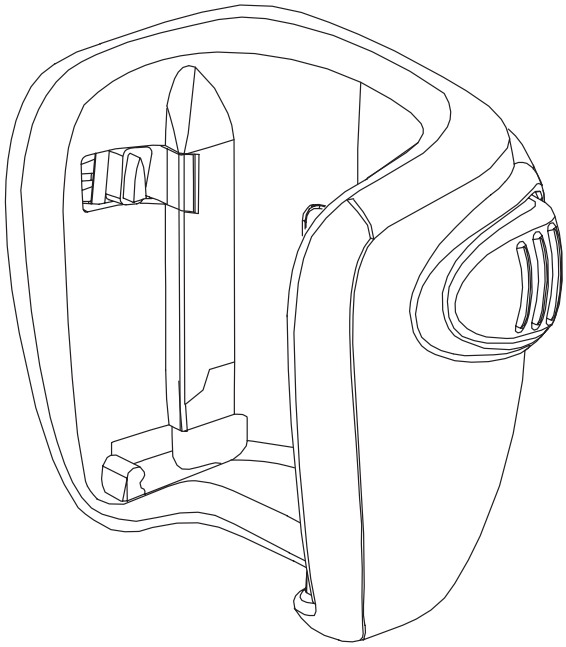
Product Code

Desktop stand DCH-9:	*0700049*

Specification

Connections:	*3.5 mm DC jack*
Charge control:	MCU control for spare battery charging
Operation input voltage:	*9...16 V*

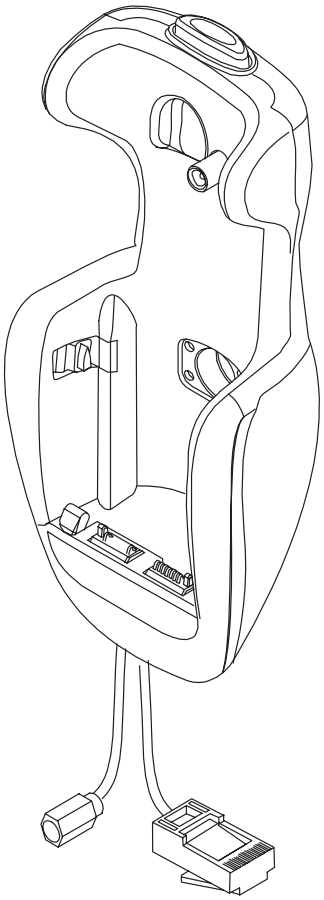
Mobile Holder MBC-1



Product Code

Mobile holder MBC-1: *0700060*

Mobile Holder MCC-1

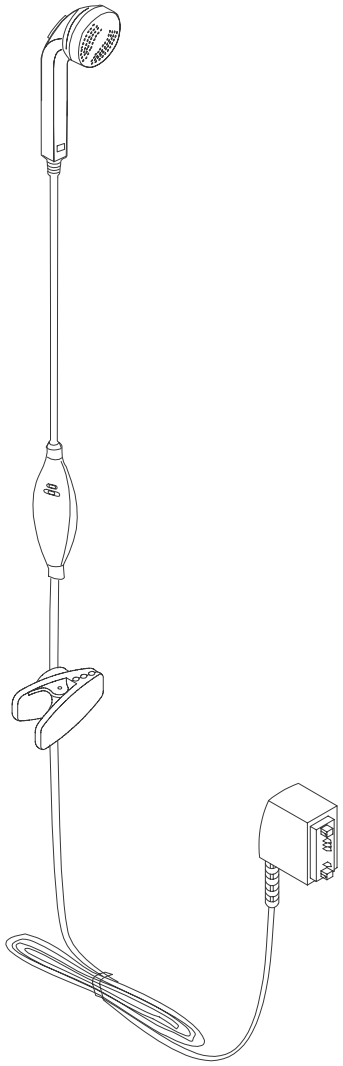


Product Code

Mobile holder MCC-1: *0620043*

Headset HDC-9P

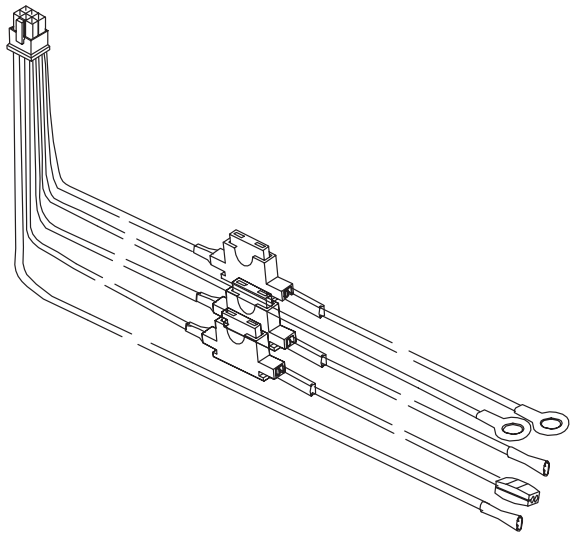
For handsfree operation



Product Code

Headset HDC-9P: *0694063*

Power Cable PCH-4J



Product Code

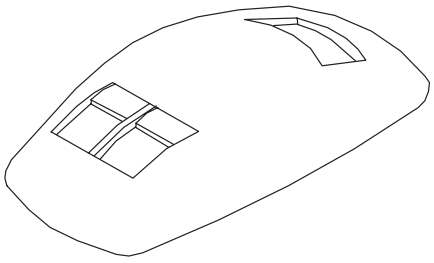
Power cable PCH-4J: *0730055*

Handsfree Microphone HFM-8

The HFM-8 microphone forms part of compact handsfree unit.

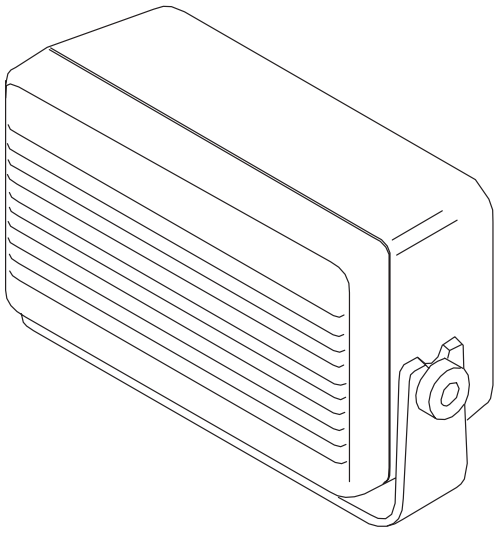
Product Code

Handsfree microphone HFM-8: *0690016*



Handsfree Speaker HFS-12

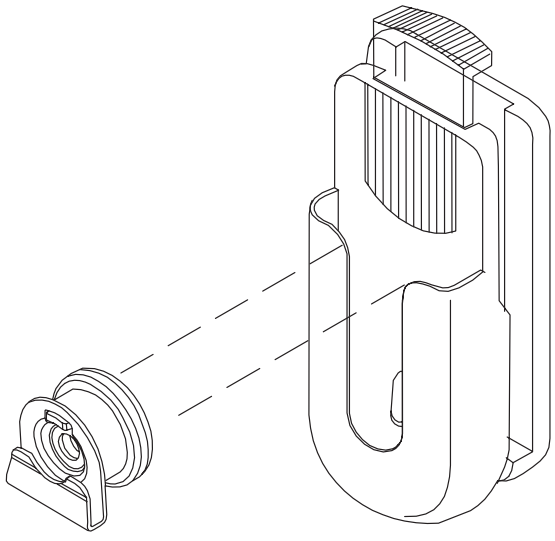
The HFS-12 speaker forms part of compact handsfree unit.



Product Code

Handsfree Speaker HFS-12: *0692008*

Belt Clip BCH-12U

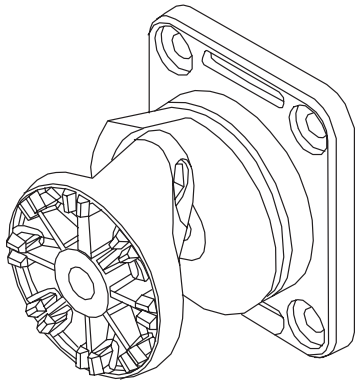


Product Code

Belt Clip BCH-12U: *0720161*

Swivel Mount HHS-9

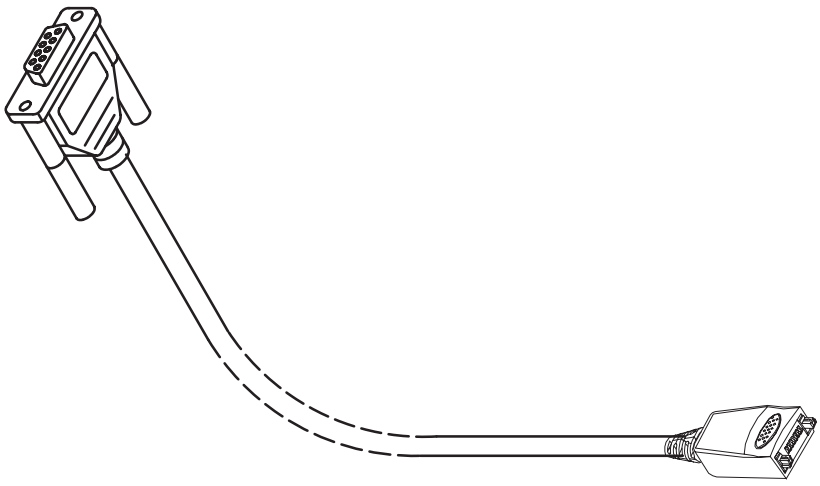
The HHS-9 swivel mounting plate provides an alternative (to MKU-1) method of locating the phone holder, the handsfree unit ,or the handset.



Product Code

Swivel mounting plate HHS-9: *0620037*

RS232 Adapter Cable DLR–3P



Product Code

RS232 Adapter Cable DLR-3P: *0730183*