MINI-LINK C
Radio Module
User's Manual

ERICSSON

EN/LZB 105 494 R6/2

MINI-LINK C

User's Manual

EN/LZB 105 494 R6/2

96-11

ERICSSON

00153 - EN/LZB 105 494 Rev F/2

Rev	Revised pages
R6/1	3-7, 3-8, 3-10, 3-11, 3-20, 4-11, 4-32
R6/2	3-46

Contents

Contents

1. Introduction

1.1 MINI-LINK C

The MINI-LINK radio module is a compact microwave radio link for voice/ data transmission. It is ideal for short hop transmission applications such as common carrier local distribution, cellular telephony and private network communications.

The MINI-LINK C radio modules operate in the following frequency bands:

- MINI-LINK 15-C 14.5 - 15.35 GHz
- MINI-LINK 23-C 21.6 - 23.6 GHz
- MINI-LINK 26-C 25.0 - 26.5 GHz
- MINI-LINK 38-C 37.0 - 39.5 GHz

Each frequency variant of the radio module covers a sub-band of the frequency band and has a fixed duplex distance (difference between transmitted and received frequency). The sub-bands are approximately 100 MHz wide for 15-C, 550 MHz wide for 23-C, 500 MHz for 26-C and 280 MHz for 38-C. The operation frequency is set in field in steps of 1.75 MHz (or 2.5 MHz).

Frequency settings are made on site with a toggle switch, a pocket terminal or a PC. Transmission capacities are 2, 2x2, 8 or 2x8 Mbps in the CEPT hierarchy. Upgrading of the capacity can easily be done since only one of the units (the baseband unit) needs to be changed.

The MINI-LINK radio has a standard UBR waveguide interface and can be installed with an integrated or separate antenna.

The access modules SMM-C, SMM, ICM-C, ICM, ICU or RJB can be used for indoor termination of traffic, power and supervision. An Ericsson multicable is used for connection to the radio. The SMM and SMM-C can be configured for 4x2, 8x2 and/or protected operation with hitless switching.

The RF output power can be controlled from a PC or manually. By installing optional fixed attenuators in the radio, the output power can be attenuated 0-50 dB (0-35 dB for MINI-LINK 15-C).

The maintenance features facilitate fault finding and repair. A microprocessor monitors all functional alarms and transmits them on a databus that extends throughout the network. The service engineer can access the alarm bus at any location using computer or pocket terminal, giving an overview of the network status. Using the same bus, near end and far end loops can be commanded to aid in maintenance. This integrated maintenance system is further supplemented with a high quality service channel for voice communication.

1.2 How to Use the Manual

This document gives an overall explanation of the facilities of the microwave radio MINI-LINK C and its operation.

The manual includes the following chapters:

1. Introduction

Introduction gives a brief description of MINI-LINK C and this manual. It also gives information about the safety requirements, when working with MINI-LINK C.

2. Technical Description

Technical Description describes the function and design of the main parts of MINI-LINK C, that is the radio and the antenna module.

3. Installation

Installation holds all the information necessary when installing the MINI-LINK C radio and antenna. It also includes information required to install some accessories. For installation of access module, see separate manual.

4. Operation and Maintenance

Operation and Maintenance describes how to use and maintain the MINI-LINK C radio module. It also describes how to localizate faults and replace faulty unit.

5. Spare Parts List

Spare Parts List holds lists of recommended spare parts for MINI-LINK C radio and compact antenna. Ordering codes for complete radio and antenna are also given here.

6. Block Diagram

Block Diagram shows a block diagram of MINI-LINK C.

7. Technical Data

Technical Data includes the technical data required for installation and maintenance of MINI-LINK C.

8. Appendices

Appendices holds two documents:

- Line-Up Record
- Failure Report

1.3 Safety Requirements

Electrical Safety

This equipment meets the requirements for class I EN 60950 and EN 41003. For electrical safety the DC power supply shall have reinforced insulation to the mains supply. All external connections are SELV (Safety Extra Low Voltage) except for the DC power connection when fed by a 60 V supply.

Service Personnel

Installation and service must be done by personnel having appropriate technical training and experience necessary to be aware of hazards during installation and/or service and of measures to minimize any danger to themselves or any other person.

Safety Precautions

- Follow all warnings and instructions in the manual.
- This symbol ⚠ appears in the manual and identifies conditions or practices that are hazardous or affect safe operation of the equipment.
- Access to equipment in use shall be restricted to service personnel.
- Do not use any installation components (screws, nuts etc.) other than those enclosed with the equipment or recommended by the MINI-LINK manufacturer.
- Ensure that the installation instructions, including required tightening torques for bolted joints, are followed and that appropriate tools (preferably the recommended tools) are used.
- Use adequate safety devices (helmet, gloves, safety cables etc.) when working on or around the mast. Be aware of the risk of falling objects. Consider the safety catch when hoisting the antenna and radio.

Microwave Radiation

No dangerous levels of microwave radiation exist outside the antenna feeder. However, the body shall not be exposed to the radiation in front of the antenna (<0.5 m from the feeder) for a long time (>6 minutes), see ENV 50166-2.

The transmitter should be switched off before disassembling the equipment, to avoid microwave radiation.

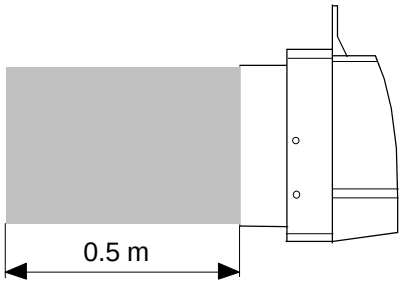


Figure 1-1. Restricted area.

1.4 Terminology

The most important terms used in the manual are listed below:

MNM	The abbreviation of MINI-LINK Network Manager. It is a computer software package for the MINI-LINK Control and Supervision System. See section “4.1 Introduction” for a detailed description.
Terminal	A piece of MINI-LINK equipment in the network.
Near End	The selected terminal.
Far End	The terminal with which the near end terminal communicates.
Hop	A pair of communicating terminals. The minimum hop consists of two terminals (one MINI-LINK at each end) and the maximum of eight terminals (one SMM or SMM-C, two operating and one standby MINI-LINK at each end).
Access Module	SMM, SMM-C, ICM-C, ICM, ICU and RJB are different types of access modules. An access module can be used for indoor termination of traffic, power and supervision.
CSS	The Control and Supervision System supports building of networks for operation and maintenance. See section “4.1 Introduction” for further information.

Contents

2. Technical Description

2. Technical Description

2.1 Introduction

The MINI-LINK C consists of a radio module and an antenna. The radio module can be mounted directly to the antenna, without using a waveguide feeder. The radio module can also be mounted separately and connected by a flexible waveguide to any other antenna with standard waveguide interface 154 IEC-UBR.

The radio module can be disconnected and replaced without affecting the antenna alignment.

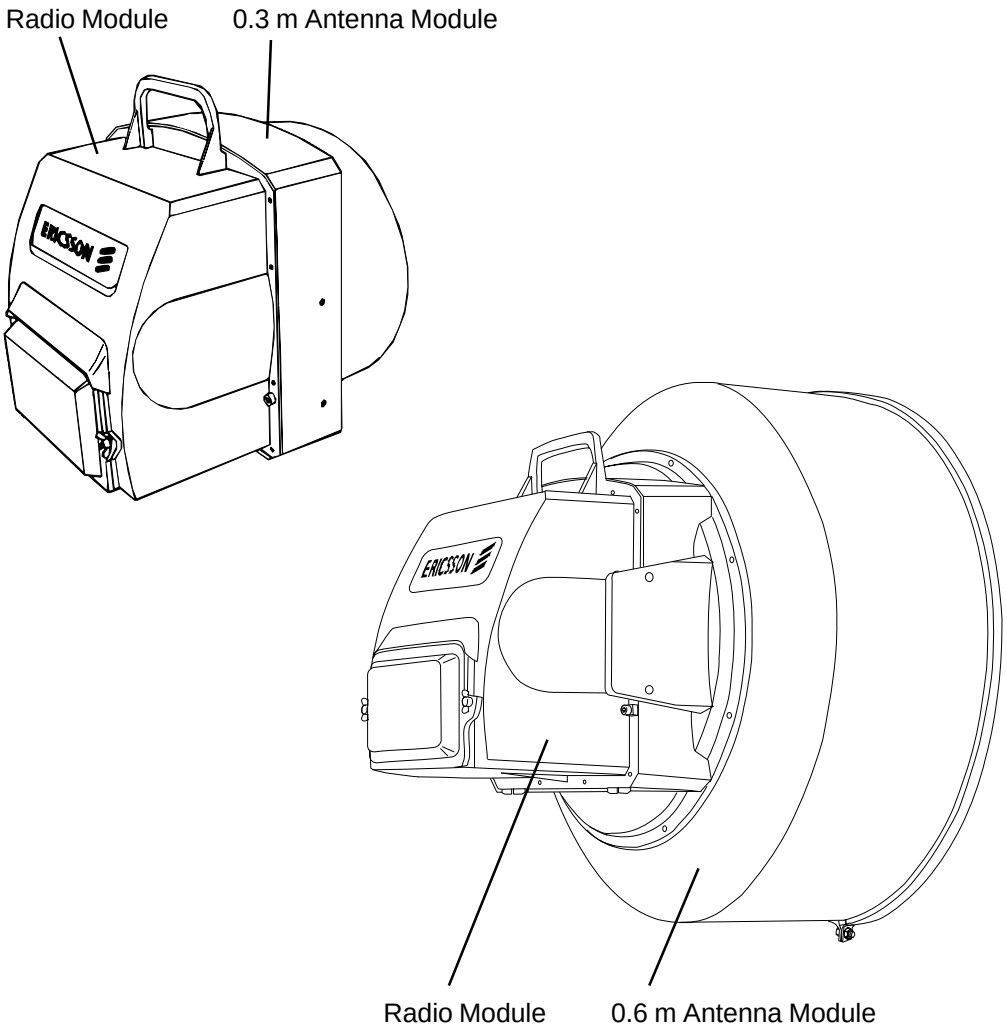


Figure 2-1. The antenna and radio module.

2.2 Radio Module

2.2.1 Mechanical Design

The exchangeable radio module is a weatherproof box with a handle for lifting and hoisting. It fits directly to the back and to the RF-port of the antenna module where it is fastened with three screws.

The radio module is a casting which is painted light grey on the outside. It consists of a vertical frame with a waveguide port and a cover with a quick-disconnect lid on its connector compartment where the external multicable(s) enter via a feed-through in the bottom. Inside the radio module the microwave unit is mounted to the frame and baseband unit is mounted on the cover and its external connectors can be reached in the connector compartment. The microwave unit and the baseband unit are interconnected via flexible cables. A shielding gasket gives protection of the interface between frame and cover.

The radio module has two plugs and latches to guide it so it can be handled with one hand during mounting and dismounting.

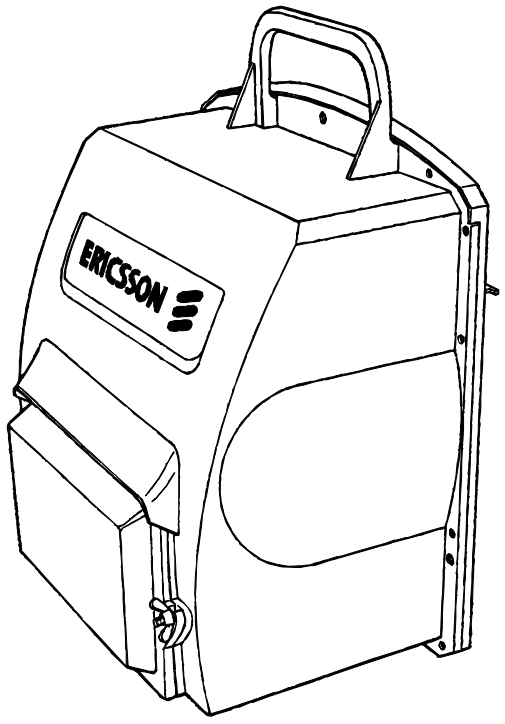


Figure 2-2. Radio module.

The radio module contains the Baseband Unit and the Microwave Unit.

Baseband Unit

The baseband unit consists of one large circuit board assembly. On the back side all input connectors are mounted for access through the opening in the chassis.

Microwave Unit

The microwave unit comprises a frame, a microstrip board, a control circuit board and a DC/DC converter. The microstrip board has an aluminium cover providing shielded compartments for the high frequency circuitry.

The control circuit board is mounted on the back side of the microstrip board. The DC/DC converter is mounted directly to the vertical frame and connected to the Microwave Unit via a flat cable.

Electrical connection between the microwave unit and the baseband unit is made via two coaxial cables and a flat cable. The electrical functions of the two units will be described on the following pages.

Chapter “6. Block Diagram” includes a block diagram of the microwave and baseband unit.

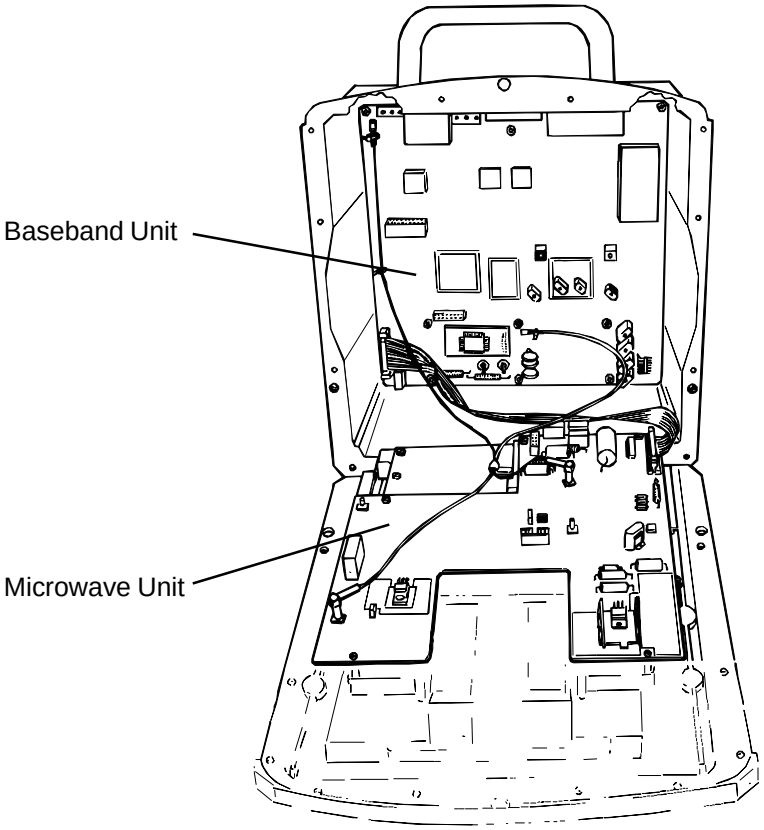


Figure 2-3. Baseband and microwave unit in the radio module.

2.2.2 Baseband Unit

All functions depending on traffic rate are housed in the baseband unit (for block diagrams, see chapter 6). The baseband unit is available in a number of versions for the CEPT hierarchy, i.e. 2, 2x2, 8 and 2x8 with high deviation and 2x2, 8 and 2x8 with low deviation.

The versions with high deviation give the best system performance. The versions with low deviation provide a better adjacent channel suppression.

The following functions are included in the baseband unit:

- Traffic interface
- Service channel interface
- Multiplexer/Demultiplexer
- Baseband encoder
- IF and demodulator
- Baseband decoder
- Control and supervision

Each function is described on the following pages.

Traffic Interface

The balanced traffic input is shaped in a pulse regenerating circuit. The clock is regenerated and the signal is line decoded. The line code is HDB 3 for 2 and 8 Mbps.

Loss of input to the line decoder activates Input Traffic Fault (ITRF).

An AIS (Alarm Indication Signal) replaces the traffic signal in case of failure. The traffic from remote side can be looped back for fault localization.

Service Channel Interface

Versions with one traffic input/output provide one digital full duplex service channel with analogue interface. This service channel is provided with one branching input/output. In versions with two traffic input/output signals (2x2, 2x8, etc) the service channel branching interface can be selected by means of jumpers to provide two fully independent service channels.

The service channel is supported by a signalling channel of omnibus type.

For test purposes a built in test signal (1000 Hz) can be injected by the integrated control and supervision system (CSS).

Multiplexer/Demultiplexer

Three different service types are multiplexed into the data stream to be transmitted over the radio path.

- traffic
- service channel
- internal alarm channel

The composite data stream consists of frames that are 125 µs long, which contain the services above plus frame word, stuff signalling and stuffing bits.

The transmission rate is controlled by an internal clock giving the following gross bitrates:

- 2.25 Mbps for 2 Mbps
- 4.51 Mbps for 2x2 Mbps
- 8.65 Mbps for 8 Mbps
- 17.31 Mbps for 2x8 Mbps

On the receiving side, the demultiplexer provides one frame fault alarm if frame synchronization is lost (two frame fault alarms if there are two traffic channels). The number of errored bits in the frame word is collected by the integrated control and supervision system (CSS) for performance monitoring.

The internal alarm channel is a 8 kbps full duplex synchronous data channel between the CSS processor in the opposite MINI-LINK radio.

Baseband Encoder

The signal from the multiplexer (multiplexers in case of versions with dual traffic ports) is scrambled, four level encoded and pulse shaped to achieve an “optimal spectra”.

The data to be transmitted can be looped back (baseband transmit loop) just before the encoder. This is used for fault localization.

IF and Demodulator

The receiver IF signal at 140 MHz is amplified in an AGC amplifier and bandpass filtered prior to discriminator demodulation.

The DC component of the demodulated signal is passed back to the microwave unit closing at AFC loop.

The AGC voltage, available at a separate connector in the cable compartment, is used for antenna alignment and to generate AGC and RF input alarms.

Baseband Decoder

The demodulated signal is filtered and the clock and data is generated. The regenerated baseband signal is decoded and descrambled.

Control and Supervision

A microprocessor based control and supervision system (CSS) is built into the MINI-LINK radio module. Its main functions are to collect alarms, control the frequency synthesizers and loop tests and to handle the built in performance monitoring. All terminals in a MINI-LINK network can be supervised from a single terminal.

All MINI-LINK control and supervision facilities are available in the terminal interface, which can be accessed both in the radio, in the ICM-C or in the SMM-C. This interface complies with RS232 (V.24) and uses a menu driven protocol for connection to a PC or a pocket terminal. The terminal interface may also be used as a serial interface to external centralized operation and maintenance systems.

MINI-LINK radio module supports the use of telephone (auto-dial) modems to connect to an operation and maintenance center. It also sends wake-up messages to the terminal interface to alert the supervision system.

In addition to the control and supervision signals two user input/output signals (environmental customer controls/alarms) are transmitted in each direction.

MINI-LINK radio module does not require any external alarm collection system. All alarm, control and performance monitoring functions are included.

The operation and maintenance data are transferred on the:

- External alarm channel (EAC)
- Internal alarm channel(IAC)
- Terminal port, to a PC or a pocket terminal.

The EAC is a databus between equipment on the same site, and consists of two pairs of twisted cables. The IAC is a data link across a radio hop. The IAC transmission consists of a number of bits added to the traffic stream between the radio terminals.

2.2.3 Microwave Unit

The microwave unit is available for different frequency channel arrangements. For more details of frequency plans, the reader is referred to section "3.9 Frequency Setting".

The microwave unit is fully independent of transmission rate. A block diagram of the microwave unit is presented in chapter 6.

DC/DC Converter

The DC/DC converter provides stable supply voltages for the microwave unit as well as the baseband unit.

Transmitter Oscillator

The frequency of the transmitter is controlled in a phase locked loop. A sample of the VCO signal is fed to a divider and further on to a programmable phase detector. The error signal is looped back to the VCO through a loop filter. The phase detector is controlled by the integrated control and supervision system through a serial bus. An unlocked VCO generates a transmitter frequency alarm.

The four level transmit data stream from the signal from the baseband unit that frequency modulates the VCO.

Final Amplifier

The transmitter can be turned on or off by switching the final amplifier on and off. For MINI-LINK 15-C, 23-C and 26-C high power, the output power can be set from the PC (0-15 dB).

Multiplication and Filtering

The VCO signal is amplified, frequency multiplied and filtered.

RF Output Alarm

A sample of the transmission signal is used for supervision of the transmission power (output power alarm).

RF loop signal (only MINI-LINK 15-C and 23-C)

The sample of the transmission signal is mixed with a shift oscillator and fed back into the receiver for test purpose.

Branching

On the transmit side, the signal is fed to the antenna via a branching filter and the antenna circulator. RF attenuation (fixed and/or variable) can be inserted between filter and circulator.

On the receiver side the antenna circulator feeds the receive signal to an input branching filter.

Receiver

The received signal is fed from the input branching filter into a Low Noise Amplifier (with the exception of MINI-LINK 38-C) and a down-converter to a first IF of approx. 800 MHz. After bandpass filtering and amplification the signal is down-converted to the second IF, 140 MHz.

LO Oscillator Multiplier and Filter

LO signals for the first two down-conversions are generated in the same way as for the transmission signal. The “DC component” at the demodulator output is fed back to the VCO through a loop filter and is used as reference in the phase locked loop.

This double superheterodyne receiver with a high first IF enables frequency selection over a wide frequency band, with excellent receiver spurious and image rejection.

2.3 Antenna Module

The antenna module is an aluminium casting which is painted light grey. It has a square mounting section around the reflector and a cylindrical part for the integrated radome. The 0.6 m antenna has an integrated sheet metal reflector with or without radome.

The feed is mounted from behind and can be turned 90° for change of polarization between linear vertical or horizontal. To the back side of the antenna a radio module or a flexible waveguide can be connected. The antenna module is fastened to a mast support and does not have to be removed during maintenance after alignment.

Elevation can be adjusted ±15°. Azimuth can be adjusted ±40°.

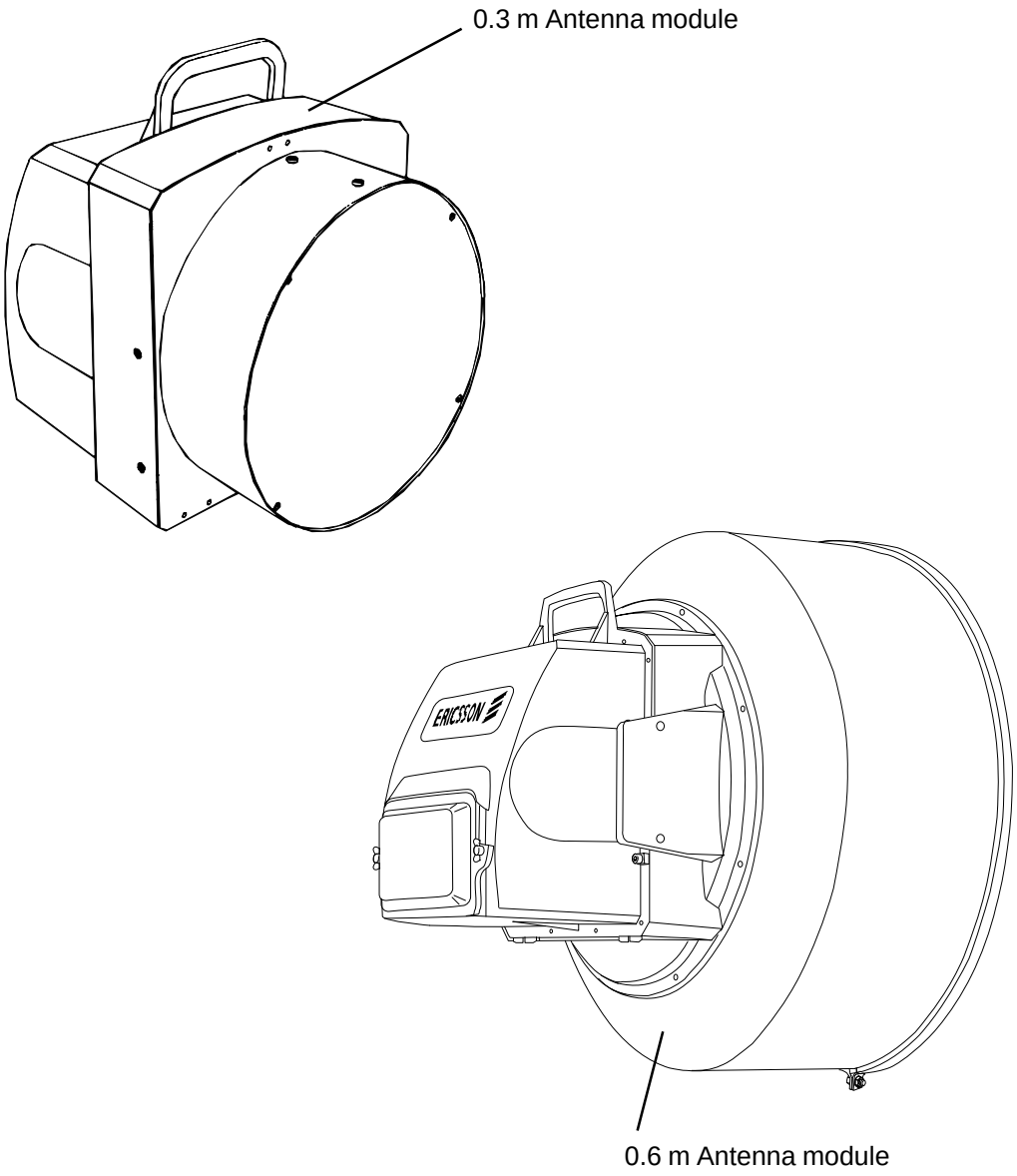


Figure 2-4. Antenna modules.

Contents

3. Installation

Contents (cont.)

3. Installation

3.1 Introduction

This chapter describes the installation procedure for MINI-LINK radio. The instructions show, step by step, how to connect and adjust the equipment. The instructions also include some accessories, to form a complete system.

The radio module is in most cases installed with an access module, that is a SMM-C, SMM(BYB), ICM-C, ICM, ICU or RJB.

Follow the instructions in the manual for the access module when installing a radio module and access module.

The steps required to install a MINI-LINK hop are as follows:

1. Perform the initial settings for the MINI-LINK radio on one site.
2. Perform the initial settings for the access module (if applicable).
3. Mount the access module.
4. Assemble the cables between MINI-LINK radio and access module.
5. Mount the MINI-LINK radio and antenna.
6. Connect the cables between MINI-LINK radio and access module.
7. Assemble and connect the cables between access module and external equipments.
8. Turn power on.
9. Set the frequency.
10. Install the MINI-LINK radio, antenna and access module on the remote site.
11. Align the antennas.
12. Set the software in the MINI-LINK radios.
13. Set the software in SMM-C or SMM (BYB) if applicable.
14. Perform a functional test.
15. Start up the system.

The software can preferably be set before mounting of the MINI-LINK. The MINI-LINK then needs to be powered.

3.2 Unpacking

The equipment is packed in a fibre-board box containing radio module, connector kit and User's Manual. Unpack all equipment.

3.3 Installation Equipment

The following tools and instruments are required for installation of MINI-LINK radio:

- Crimping tool for D-sub connectors, LSD 319 11 or LSD 319 12 (with magazine)
- Insertion/extraction tool, LSY 139 02
- Stripping pliers
- 28 mm ring wrench
- 32 mm ring wrench
- 26 and 27 mm open jaw wrench (included in delivery)
- 5 mm Allen key
- 16 mm ring and open jaw wrench
- Compass
- Voltmeter
- Computer with software MINI-LINK Network Manager or pocket terminal (optional)
- Torx screwdriver TX 10 (M3) for mounting of fixed attenuator and flexible waveguide to antenna module
- Torx screwdriver TX 20 (M4) for dismounting of radio module and change of polarization
- Pliers for cable clamps, LSD 349 20
- Cable clamp kit, SXK 111 0315/1 or SXK 111 0315/2
- Lubricating substance for outdoor screws and nuts, for example Stucarit 309 (blue). Manufacturer: E. Epple o Co, Seidenstrasse 55, D-7000 Stuttgart, Deutschland.
- For severe conditions, sealing substance, for example OKS 2020. Manufacturer: Omnikote GmbH, Triebstrasse 9, D-8000 München, Deutschland. To be applied around waveguide interfaces (note: must be applied outside after connection).

The following additional instruments are required for *MINI-LINK 15-C, 23-C* and *26-C* for adjustment of variable attenuator (optional):

- Power meter for example HP 435B or 438A
- Sensor for example HP 8485A (-30 to +20 dBm) or HP 8485D (-70 to -20 dBm)
- Adapter APC 3.5 mm (female) to standard PBR/UBR waveguide.

The following additional instruments are required for *MINI-LINK 38-C* for adjustment of variable attenuator (optional):

- Power meter for example HP 435B or 438A
- Sensor for example HP R8486A (-30 to +20 dBm) or HP R8486D (-70 to -20 dBm).

3.4 Initial Settings

Some initial settings may have to be performed before mounting the MINI-LINK radio.

3.4.1 Dismounting and Mounting of Radio Module Frame

The frame shall only be dismounted if any initial settings have to be made. The torx screwdriver TX 20 (M4) shall be used.

Dismounting the Frame from the Radio Module

- Undo the 14 screws (pos 1) and remove the frame.

Mounting the Frame to the Radio Module

- Place the frame on the radio module and tighten the screws.

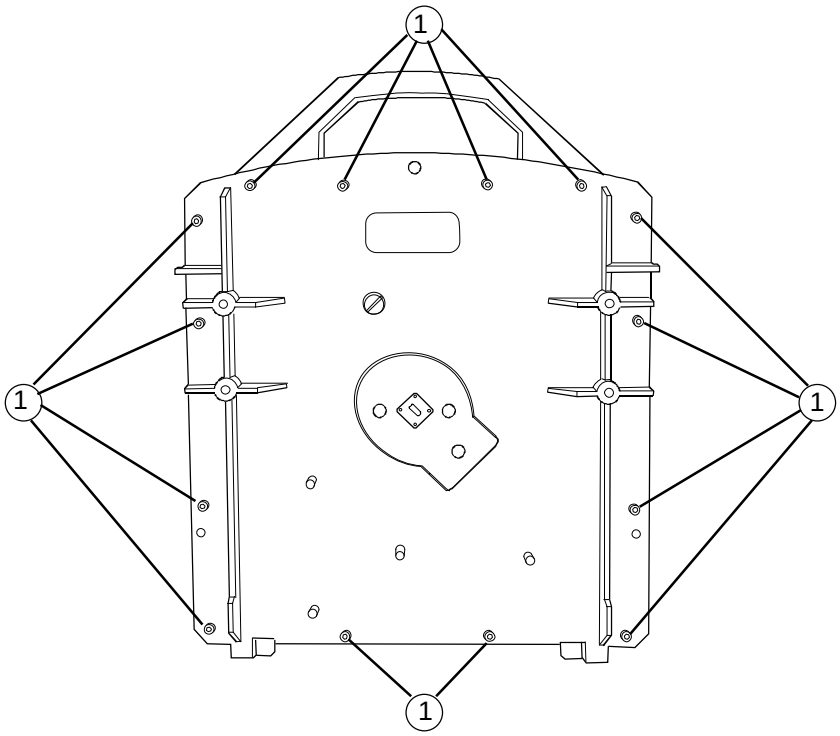


Figure 3-1. Dismounting and mounting the frame of the radio module.

3.4.2 Service Channel Setting for 2x2 and 2x8 Mbps Versions

MINI-LINK radio, in versions with dual traffic channels, can be set to provide either two independent service channels or one service channel with branching interface.

Service channel port 1 is in both cases used for connection of the service channel equipment. Service channel port 2 is either used for connection of a second service telephone or for branching. The function of service channel port 2 is selected by wiring the pins on the baseband unit. The baseband unit is prepared for two traffic channels when delivered from Ericsson.

To change function, follow the instruction below:

- Remove the vertical frame from the radio module.
- Undo the 9 screws ① on the baseband unit.
- Lift out the baseband unit from the radio module.
- Connect the pins by wiring (or soldering) in accordance with figure below.

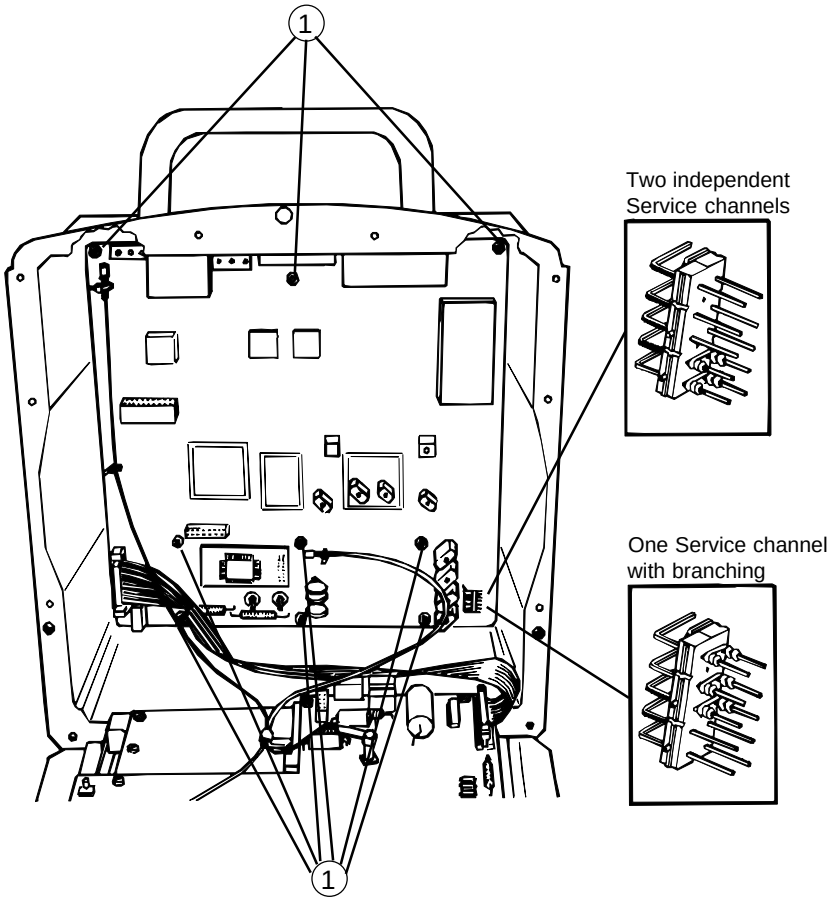


Figure 3-2. Service channel setting of the baseband unit.

3.4.3 RF Output Attenuation

For MINI-LINK 15-C, 23-C and 26-C High Power the output power can be set with MNM, MSM or MIM, see section 4.4 (not possible with MNM LZY 202 307 revision <1.4.) The desired value is entered in the setup window, and reduction of the nominal level with up to 15 dB is possible.

For other radios, or if not using MNM, it is possible to reduce the output power manually with the built-in variable attenuator (see section 3.4.4). If this reduction is not enough, there are fixed attenuators available as accessories.

The variable attenuator attenuates the RF signal 0-15 dB for MINI-LINK 15-C, 23-C and 26-C and 0-25 dB for MINI-LINK 38-C. In combination with a fixed attenuator the RF signal can be attenuated up to 50 dB from the nominal value, as shown in the list below.

MINI-LINK radio	Article code for attenuator	Attenuation	Guaranteed Output power	
			Standard	High Power
MINI-LINK 15-C	None		4 to 18 dBm	11 to 25 dBm
	SXK 111 0279/1	12.1±0.9 dB	-7 to 4 dBm	0 to 11 dBm
	SXK 111 0279/2	22.5±1.7 dB	-17 to -7 dBm	-10 to 0 dBm
MINI-LINK 23-C	None		6 to 20 dBm	
	SXK 111 0273/1	12.1±0.9 dB	-5 to 6 dBm	
	SXK 111 0273/2	22.5±1.7 dB	-15 to -5 dBm	
	SXK 111 0273/3	31.5±2.3 dB	-23 to -15 dBm	
	SXK 111 0273/4	39.0±3.0 dB	-30 to -23 dBm	
MINI-LINK 26-C	None		-4 to 10 dBm	4 to 18 dBm
	SXK 111 0274/1	12.1±0.9 dB	-15 to -4 dBm	-7 to 4 dBm
	SXK 111 0274/2	22.5±1.7 dB	-25 to -15 dBm	-17 to -7 dBm
	SXK 111 0274/3	31.5±2.3 dB	-33 to -25 dBm	-25 to -17 dBm
	SXK 111 0274/4	39.0±3.0 dB	-40 to -33 dBm	-32 to -25 dBm
MINI-LINK 38-C	None		-8 to 15 dBm	
	UMF 101 13/10	10.0±1.0 dB		
	UMF 101 13/15	15.0±1.5 dB		
	UMF 101 13/20	20.0±2.0 dB	-24 to -8 dBm	
	UMF 101 13/35	35.0±3.5 dB	-35 to -24 dBm	

The variable attenuator must be adjusted for selected output power at an indoors service centre before the installation of radio module in mast.

3.4.4 Mounting of Attenuator and Adjustment of Attenuation

Note: Using MINI-LINK 15-C, 23-C and 26-C High Power, the output power can be adjusted with MNM, MSM or MIM. See section 4.4.

3.4.4.1 Mounting of fixed Attenuator

The fixed attenuator is inserted in the following way:

- Remove the vertical frame of the radio module.
- Remove the lid at the waveguide circulator using the torx screwdriver TX 10 (M3).
- Insert the attenuator as shown in the following figures.

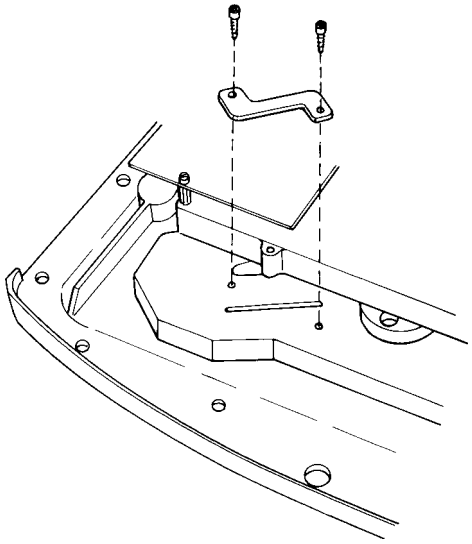


Figure 3-3. Insertion of attenuator in MINI-LINK 15-C.

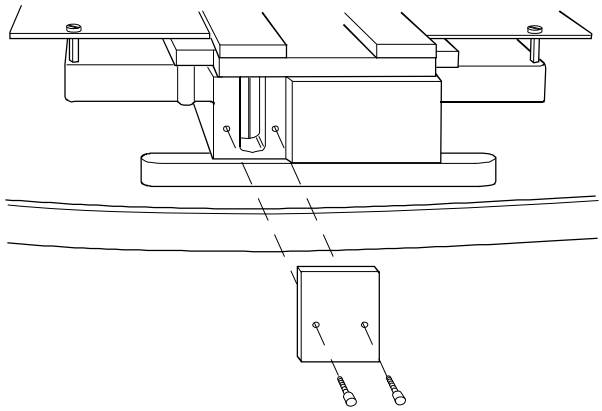


Figure 3-4. Insertion of attenuator in MINI-LINK 23-C and 26-C.

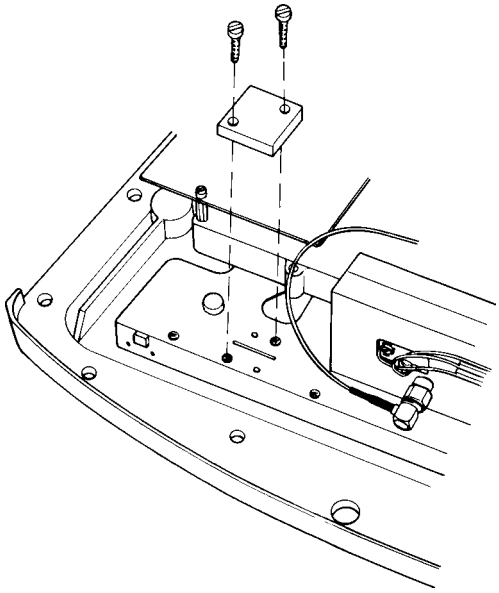


Figure 3-5. Insertion of attenuator in MINI-LINK 38-C.

3.4.4.2 Adjustment of variable Attenuator

Note: Using MINI-LINK 15-C, 23-C or 26-C High Power, the output power can be adjusted with MNM, MSM or MIM. See section 4.4. The setting of the variable attenuator on the radio unit **does not affect** the adjustment with MNM, MSM or MIM - the software adjustment is superior to the mechanical.

⚠ **WARNING - To avoid microwave radiation: Do not leave the waveguide and RF port on the microwave unit open when the power supply is on.**

Hazardous voltage may exist when working on the microwave unit.

Adjustment of the variable attenuator is made with the radio module frame dismounted for MINI-LINK 15-C and MINI-LINK 26-C High Power.

Adjustment Instruction for MINI-LINK 15-C and MINI-LINK 26-C High Power (if not using MNM)

(See section 3.3 for recommendation on instruments)

- Connect the power meter to the antenna port on the radio module.
- Connect power supply.
- Set the frequency channel number, see section “3.9 Frequency Setting”.
- Use a screwdriver to adjust the potentiometer to the decided output power.

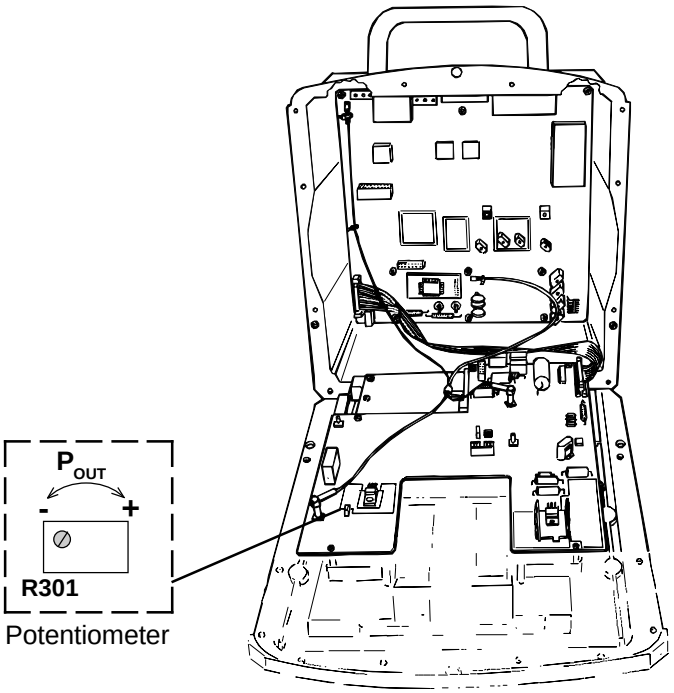


Figure 3-6. Trimming of variable attenuator.

Adjustment Instruction for MINI-LINK 26-C Standard and 38-C

(See section 3.3 for recommendation on instruments)

- Connect the power meter to the antenna port on the radio module.
- Connect power supply.
- Set the frequency channel number, see section “3.9 Frequency Setting”.
- Remove the attenuator lock using a screwdriver.
- Put the screwdriver into the hole and adjust to the decided output power.
- Fasten the attenuator lock.

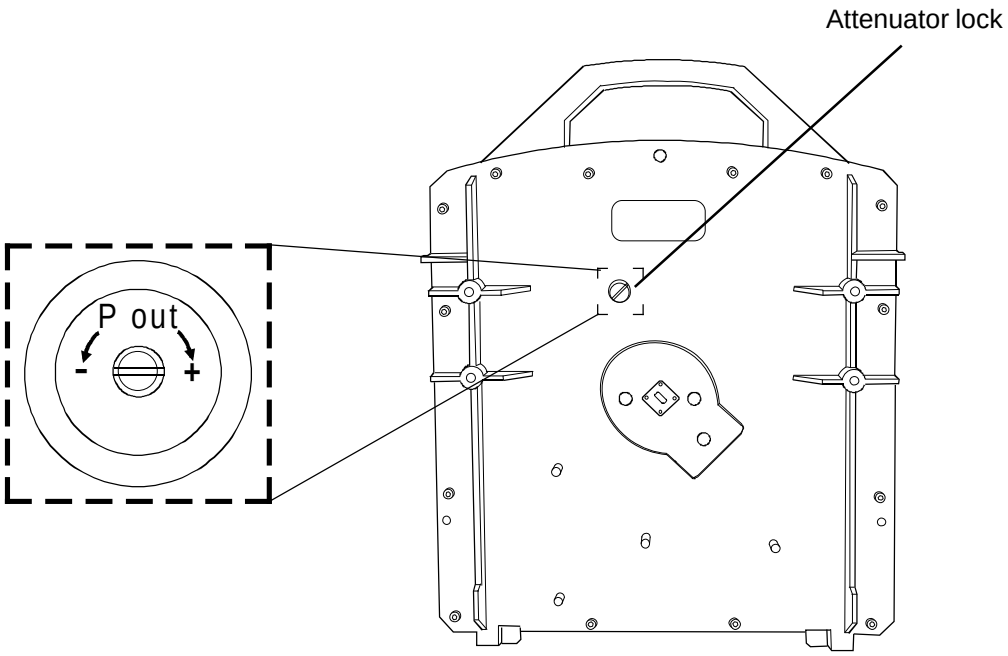


Figure 3-7. Trimming of variable attenuator.

3.5 Description of Connections

3.5.1 Overview

This chapter describes the connection to be made for MINI-LINK radio. For specification of the ports see chapter “7. Technical Data”. All connections to/from the MINI-LINK radio are made at the connection field of the radio module.

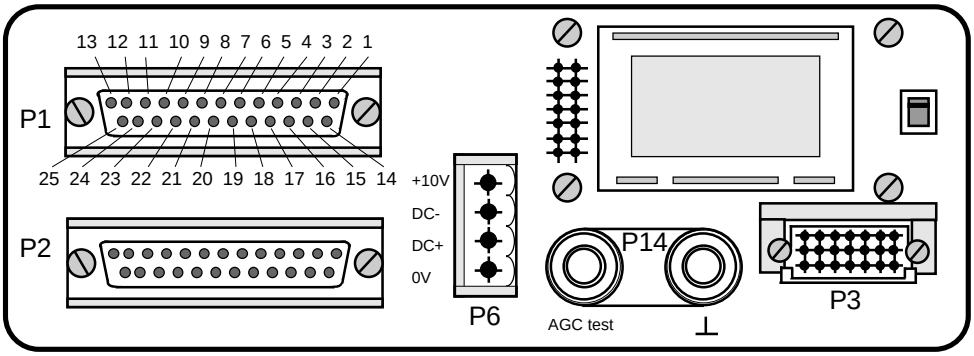


Figure 3-8. Connection field.

The connection field has five connector plugs: P1, P2, P3, P6 and P14.

P1, P2 and **P6** are used for connection to access module that is SMM-C, SMM, ICM-C, ICM, ICU or RJB. P1 and P6 are always connected while P2 is mainly used for 1+1 and 2+1 configurations. For further information on connection between radio and access module see user's manual for the access modules.

P3 is used for connection of service telephone, PC or pocket terminal.

P14 is an AGC testport with a ground contact.

Jack	Pin No	Signal	Used for
P1	1	BB OUT 1A	Traffic output 1
	14	BB OUT 1B	
	2	BB OUT 2A	Traffic output 2 (only 2x2 and 2x8 Mbps)
	15	BB OUT 2B	
	3	EAC CLOCK B	EAC connection to access module (for example SMM-C and ICM-C)
	16	EAC CLOCK A	
	4	EAC DATA B	
	17	EAC DATA A	
	5	RS232 FROM RADIO	Terminal interface
	18	RS232 TO RADIO	
	6	MODEM CONNECT	External supervision
	7	RADIO ALARM	External supervision, 1+1 configurations
	19	WAKE UP RECEIVED	External supervision
	8	TX ALARM	External supervision, 1+1 configurations
	20	RX ALARM	
	9	SERV OUT 1A	Service channel port 1
	21	SERV OUT 1B	
	10	SERV IN 1A	
	22	SERV IN 1B	
	11	CALL IN	Service channel call in/out
	23	CALL OUT	
	12	BB IN 2A	Traffic input 2 (only 2x2 and 2x8 Mbps)
	24	BB IN 2B	
	13	BB IN 1A	Traffic input 1
	25	BB IN 1B	
P2	1	NOT USED	1+1 configurations, hitless switching
	14	DELAY RETURN	
	2	DELAY CONTROL 1	
	15	DELAY CONTROL 2	
	3	USER IN 2	Environmental alarm
	16	USER OUT 2	Environmental control
	4	USER IN 1	Environmental alarm
	17	USER OUT 1	Environmental control
	5	TX OFF	1+1, 2+1 configurations
	18	AGC ALARM	
	6	0V	Alarm return
	7	RADIO ALARM	2+1 configurations
	19	WAKE UP RECEIVED	External supervision
	8	TX ALARM	2+1 configurations
	20	RX ALARM	
	9	SERV OUT 2A	Service channel port 2
	21	SERV OUT 2B	
	10	SERV IN 2A	
	22	SERV IN 2B	
	11		Not used
	23		
	12		
	24		
	13		
	25		
P6	1	0 V	Ground connection
	2	DC +	Power supply +
	3	DC -	Power supply -
	4	+ 10 V	+10 V output from radio
P3	A04	SERV IN 1A	Service channel port 1
	A08	SERV OUT 1A	
	C04	SERV IN 1B	
	C08	SERV OUT 1B	
	C06	MODEM CONNECT	Modem connection (option to P1:6)
	B08	+10 V	+10 V output
	C02	0 V	Ground connection
	B02	RS232 FROM RADIO	Terminal Interface
	B04	RS232 TO RADIO	

Figure 3-9. Description of signals in P1, P2, P3 and P6.

3.5.2 Traffic Interfaces

Balanced ports are available for connection of traffic input and output:

BB IN 1A **BB IN 1B** **BB OUT 1A** **BB OUT 1B**

The impedance is 120Ω.

For 2x2 and 2x8 Mbps versions, additional balanced ports are available for connection of second traffic input and output:

BB IN 2A **BB IN 2B** **BB OUT 2A** **BB OUT 2B**

3.5.3 EAC

The EAC (External Alarm Channel) is a data bus for exchange of control and supervision information between equipment on the same site. See section “4.1 Introduction” for further information.

3.5.4 Terminal Interface (RS 232)

The PC or pocket terminal is connected to the RS 232 interface, also called terminal interface. This is available in connector P3 for field use and connector P1 for extension to access module (SMM-C, SMM, ICM-C, ICM, ICU or RJB).

3.5.5 Service Channel Interfaces

Two ports are available for the service channel.

Service channel port 1 is used for connection of service channel equipment.

Service channel port 2 can either be used for connection of a second service channel equipment (2x2 and 2x8 Mbps versions only) or branching to other MINI-LINK equipment at the same site when building a MINI-LINK network.

The CALL IN port can be used to distribute call signal from service channel equipment on one MINI-LINK to the CALL OUT port on the remote MINI-LINK (and all other MINI-LINKs in the network).

3.5.6 External Supervision

For connection to an external alarm collection system the following interfaces in P1 are available:

- Summary alarms: Radio, TX and RX alarm
- Wake up received
- Modem connect

For further information see section “4.5 Alarms”.

3.5.7 Interfaces for 1+1 or 2+1 Configurations

The following interfaces in P2 must be connected for switching and control in a SMM or a SMM-C in 1+1 or 2+1 configurations:

- TX alarm
- RX alarm
- AGC alarm
- Radio alarm (not for SMM-C and 2+1)
- TX Off

To achieve hitless switching for 1+1 configurations it may be required to adjust the phase of the incoming traffic streams from the radio. The interfaces used for this is:

- Delay control 1
- Delay control 2
- Delay return

For further information see SMM User's Manual.

3.5.8 User In/Out (Environmental alarm/control)

In a supervision network it is possible to collect user's alarms into the MNM (MINI-LINK Network Manager), for example a fire alarm or a power supply alarm. It is also possible to control user's functions via MNM, for example starting air conditioning equipment.

Two user inputs (USER IN 1 and 2) and two user outputs (USER OUT 1 and 2) are available at the MINI-LINK radio.

3.6 Cabling

3.6.1 Cabling between Access Module and Radio

Connection to SMM-C and ICM-C

Multicable TFR 463 13 is recommended. TRF 463 11 is an alternative when not all of the facilities shall be used (service channel network, call in/out and user in/out is not connected).

Connection to SMM, ICM, ICU, RJB or SMM 2+1

Multicable TFR 46311 is recommended. Two cables may have to be used if all interfaces provided by the radio shall be connected.

See user's manual for the access module for further information about selection of cable.

TFR 463 11 and TFR 463 13 contains:

- 4 balanced pairs for traffic (attenuation < 14 dB/km for 2 Mbps, ≤ 29 dB/km for 8 Mbps)
- 2 pairs for DC supply (resistance 14 Ω/km)
- 7 pairs (TFR 463 11) / 12 pairs (TFR 463 13) for other interfaces (DC resistance ≤ 55 Ω/km)

Maximum cable length: 200 meters (8 Mbps) / 400 meters (2 Mbps).

For access module **without preconverter** minimum required supply voltage at the radio module (39V) must be considered. Minimum supply voltage versus cable length can be read from the diagram below.

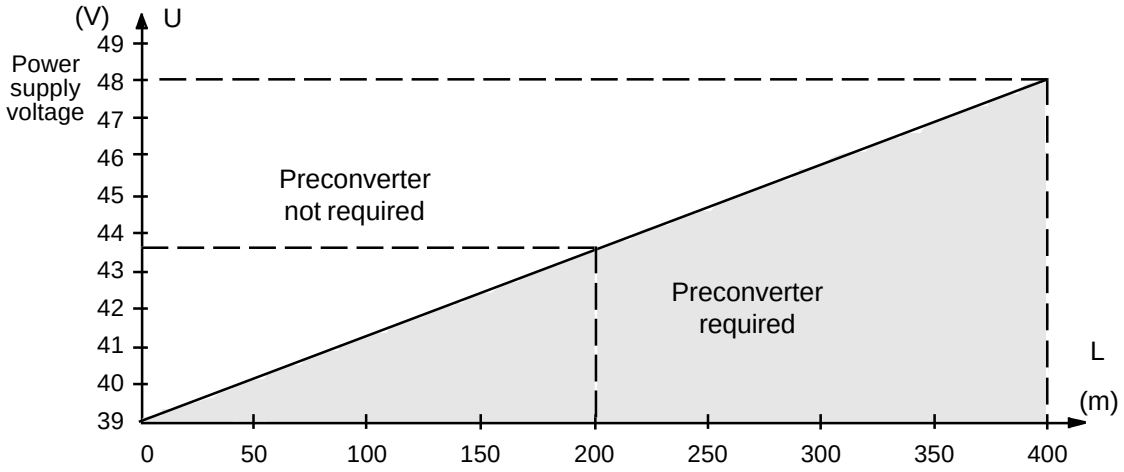


Figure 3-10. Maximum cable length for connection between access module without preconverter and MINI-LINK.

3.6.2 EAC Cabling

The EAC is connected to the access module via the multicable and then connected to other MINI-LINK equipment on the site, see figure below.

Maximum total cable length for EAC is 1200 m. All cable lengths on the site shall be included except for the cables to the MINI-LINK radios belonging to the SMM-C or SMM 2+1.

Maximum number of terminal on one site

6 SMM, ICM-C, ICM, ICU or RJB with its radios

plus

26 SMM with divided EAC, SMM-C or SMM 2+1 with its radios.

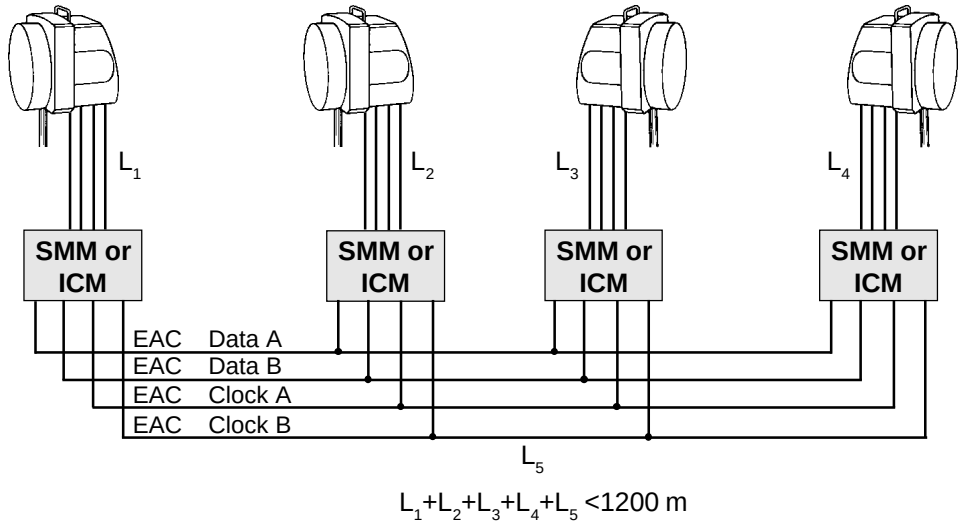


Figure 3-11. Connection of EAC.

If the radio is connected to an SMM-C, an SMM with divided EAC or an SMM 2+1, the cable between radio and SMM is **excluded** in the total length.
Example: If the L_4 cable is connected to an SMM-C the total cable length will be: $L_1+L_2+L_3+L_5$ <1200 m.

See SMM, SMM 2+1 and SMM-C User's Manuals for further information.

3.6.3 Service Channel Cabling

The service channel is connected to the access module via the multicable. For a point to point use of service telephone just connect the service telephone to the radio or access module.

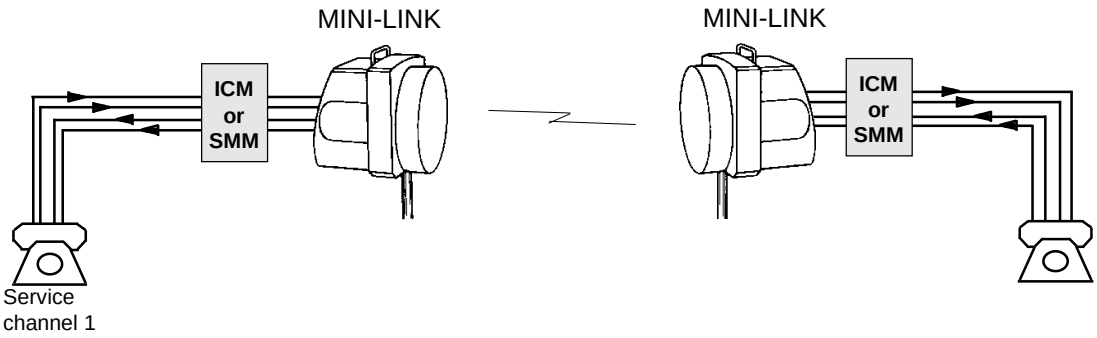


Figure 3-12. Connections of service telephones from point to point.

Figure 3-14 shows another example of service channel installation. In the example both service channel 1 and 2 must be connected between radio and access module. See MINI-LINK Network Realization manual and manuals for access modules for further information.

A service channel in a network

In figure 3-14 external attenuators of 15 dB must be included. Such attenuators are included in the SMM-C, ICM and ICM-C.

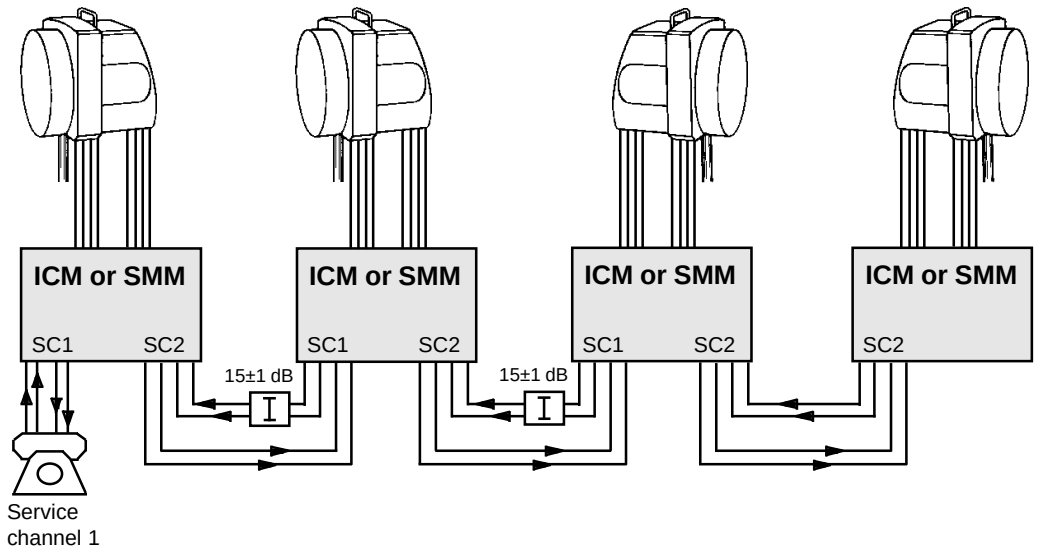


Figure 3-14. Connections for one service channel at a site with four hops.

3.6.4 Earthing Recommendations

We recommend a combination of several pieces of earthing equipment for the MINI-LINK sites, unless there are other national standards which need to be considered. The combination consists of indoor earthing, lightning rod, radio earthing kits and cable earthing kits, and will handle even severe conditions. Normally the outdoor earthing equipments are connected to a separate earth cable. The multicable is recommended to be earthed in its lower part, for example before entering a building, and for long cables every 50 meters.

If the earthing has been properly done, the system has a good protection against overvoltages. As an extra protection a Lightning Protection Board, ROA 115 2234, can be installed in the radio module. On this board gas tubes are fitted in parallel with all in/outgoing cables. The radio and the access module can be ordered with extra lightning protection which means that the unit contains a board with gas tubes.

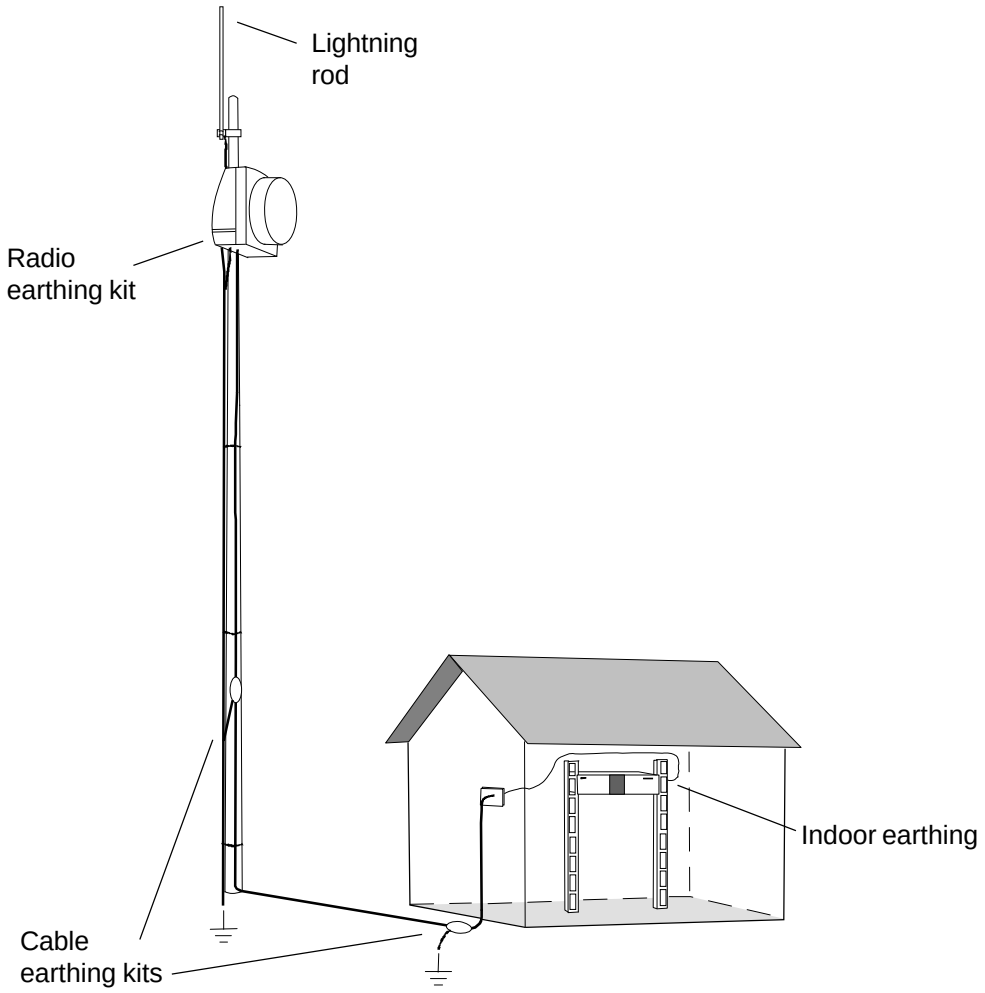


Figure 3-15. Earthing recommendations on a site.

3.7 Trimming the Cables and Assembling

3.7.1 Connector kit

The Radio Module delivery holds connector kit SXA 1076268/1

- 2 complete 25-pin D-sub connectors for access modules (P1 and P2)
- 1 screw connector for DC (P6)
- 2 complete cable bushings for multicable
- 2 cover plates
- 2 locking nuts
- 26/27 open jaw wrench
- 0.7 m string to tie the wrench to the equipment
- 5 wire clamps
- Radio earthing kit
- Dust protection plate

200 mm

150

3.7.2 Trimming the Cables and Assembling the Cable Bushing

Use cable TFR 463 11 or TFR 463 13 depending on the type of access module connected to the radio (see section 3.6.1).

1. Trim the cables according to the dimensions shown in the figure below. When using one cable, trim as Cable A. When using two cables TFR 463 11, trim one cable as Cable A and the other as Cable B.

   Cable A is the cable to be positioned in the left hole on the back of the radio module. Cable B is the cable to be positioned in the right hole on the back of the radio module. The left hole is positioned closer to the connector plugs, that is why Cable A shall be shorter.
2. Dismount the entire cable bushing.
3. Push the rubber sealing into the domed nut.
4. There are three washers going with the connector kit, each of them with a different sized hole. For cable TFR 463 13, place the domed nut and the washer with the bigger hole on the cable. For cable TFR 463 11, place the domed nut and the washer with the medium sized hole on the cable.

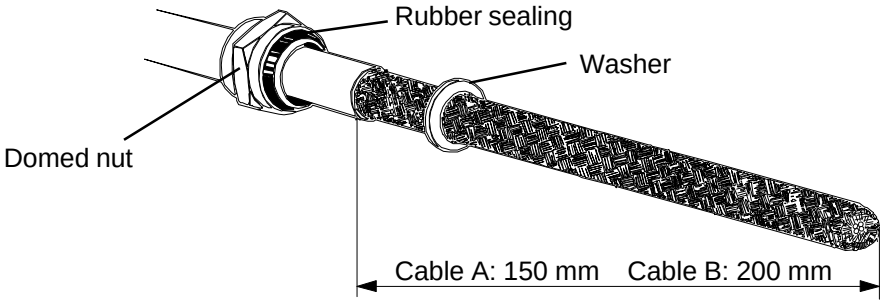


Figure 3-16. Trimming of cables.

10

0

5. Remove the shield and the aluminium sheet. Leave 10 mm of the shield and press the shield towards the washer using a screwdriver.
6. For cable TFR 463 13, place the washer with the medium sized hole on the cable. For cable TFR 463 11, use the washer with the smallest hole. Trim the shield.
7. Place the bottom part on the cable and press it.
8. Tighten the cable bushing using two 32 mm ring wrenches. Make sure the rubber sealing is tight to the cable.
9. Place the locking nut on the cable.

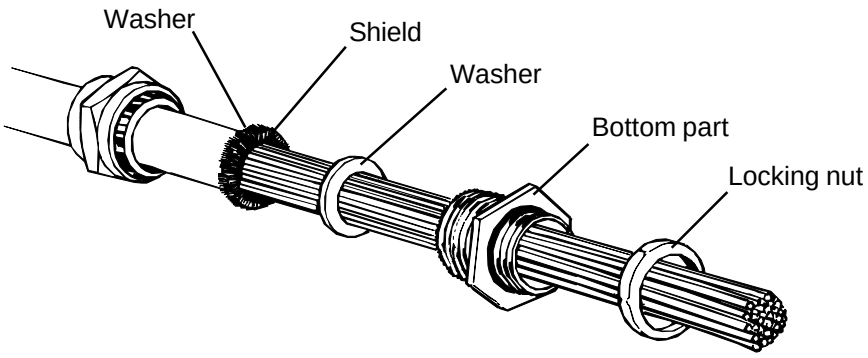


Figure 3-17. Assembling of cable bushing.

3.7.3 Assembling the Jack for P6

The table below shows how to assemble the wires for P6, when using cable TFR 463 11 or TFR 463 13.

Jack	Signal	Wire colour	
P6	**+10 V**	turquoise	Cable 1
	DC-	violet	
	DC+	pink	
	0 V	grey	

Strip the wires, insert them according to the figure below and tighten with a screwdriver.

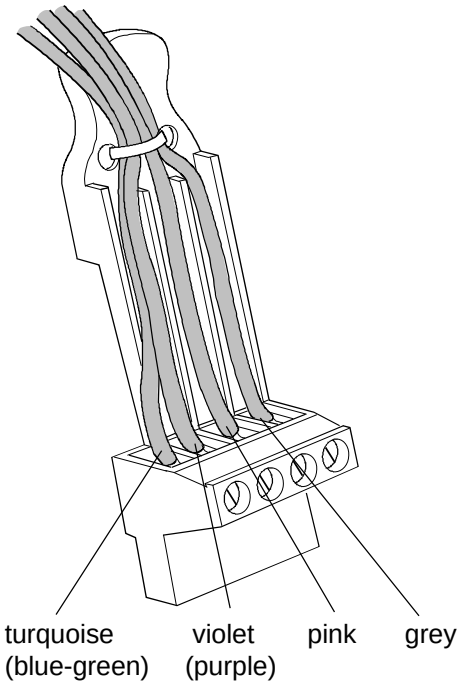


Figure 3-18. Assembling of the jack for P6.

3.7.4 Assembling the Jacks for P1 and P2

Note: For information of the wires to be connected, see manual for access module.

1. Strip and crimp all remaining wires to be used, in accordance with the figure.

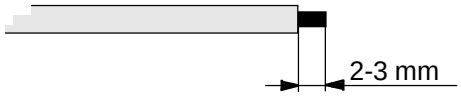


Figure 3-19. Stripping a wire.

2. Insert the contact pin in the crimping tool and tighten gentle until the contact pin is fixed.
3. Put in the wire and crimp.

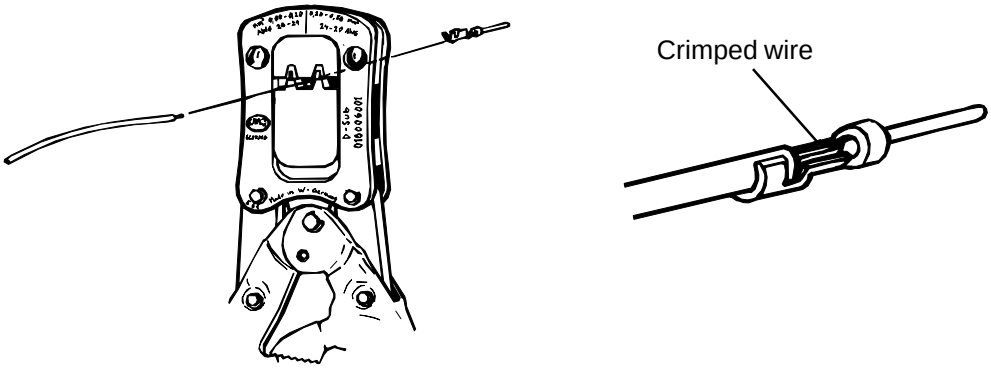


Figure 3-20. Crimping a wire (crimp tool LSD 319 11).

4. Inspect the crimp.
5. Twist all wires in pairs (as presented in the table in the manual for the access module) down to crimp, 2-3 cm per turn.
6. Insert the contact pin into the cavity and make sure the contact pin is fixed.

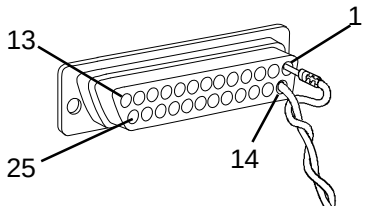


Figure 3-21. Inserting contact pins into cavity.

7. If a contact pin has been inserted in the wrong cavity, place the extraction tool LSY 139 02 in the cavity, positioned as shown in the figure, and press out the contact pin from the opposite side.

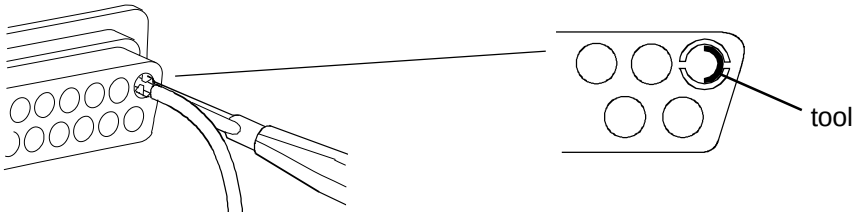


Figure 3-22. Extracting a contact pin from the cavity.

8. Fasten the wires as illustrated in figure.
   Note: Use both clamps when fastening the wires.
9. Insert the sliding locks on both sides of the connector.
10. Assemble the top.

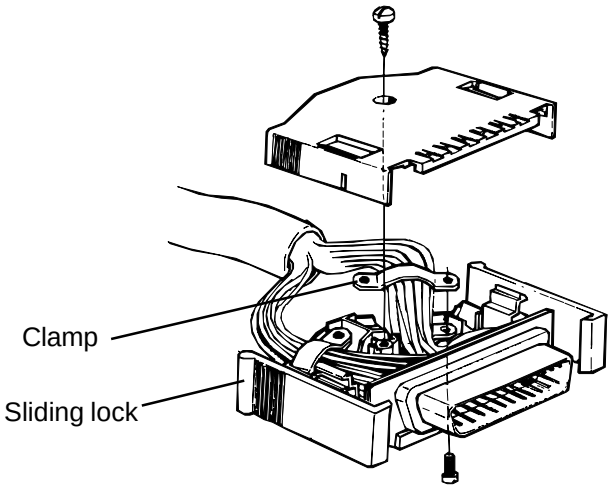
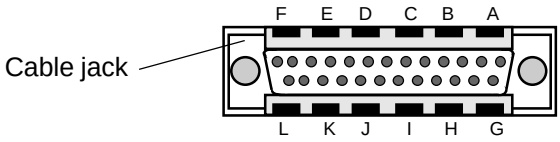


Figure 3-23. Assembling of connector for P1 and P2.

11. Code the jack according to the figure.



Connector	Position on cable jack											
	A	B	C	D	E	F	G	H	I	J	K	L
P1	X					X	X					X
P2		X			X			X			X	

X = Code plug inserted

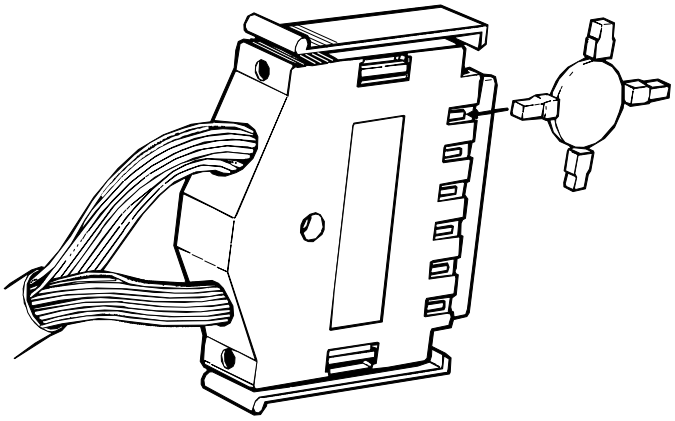


Figure 3-24. Insertion of code plug.

12. Twin the cables and fasten with clamps.

3.7.5 Assembling the Jack for P3 (optional)

The service telephone, the pocket terminal, a computer or a modem can be connected to P3. The table below shows the signals available in P3 and how to assemble the connector jacket. See section 4.11 for further information on how to connect a personal computer. See section 4.12 for further information on how to connect a modem.

The jacket from the pocket terminal is already assembled to fit P3.

Jack for P3			
Pin no	**A**	**B**	**C**
02		RS 232 from radio	0 V
04	Serv in 1 A	RS 232 to radio	Serv in 1 B
06			Modem connect
08	Serv out 1 A	+10 V	Serv out 1 B

1. Strip the cable and the wires.
2. Solder the wires to the soldering tags.
3. Assemble the cover halfs and the cable lock.
4. Fix the label holder to the cable lock according to drawing.

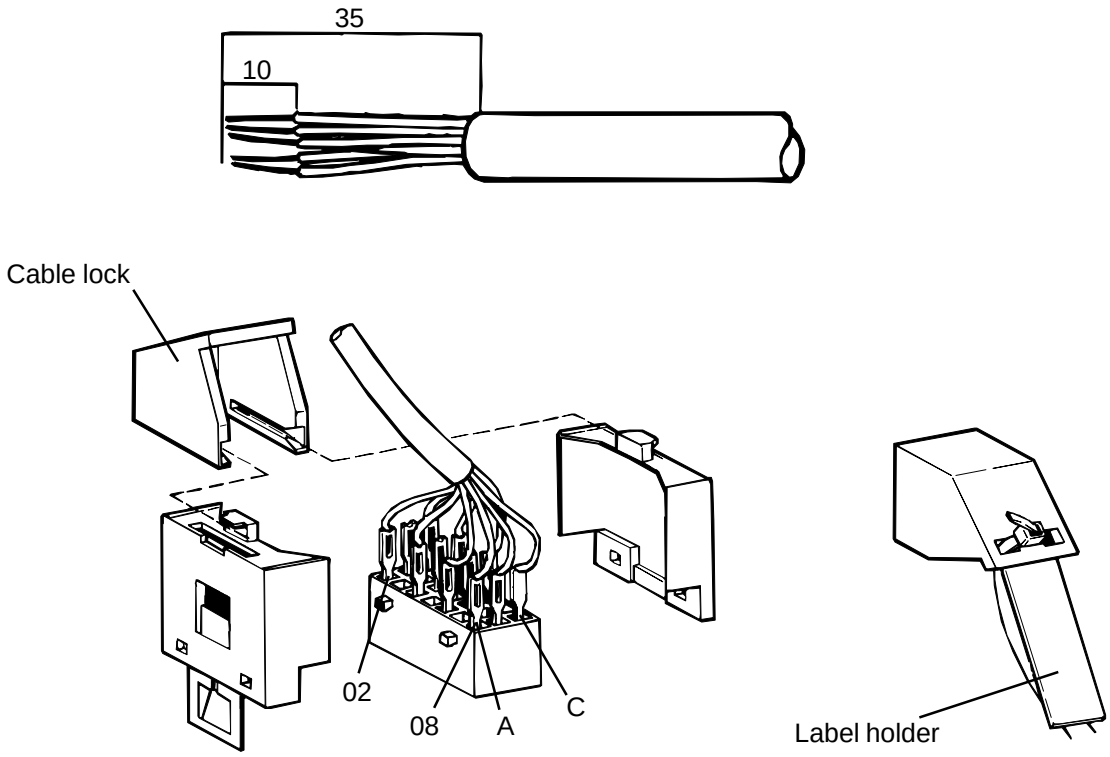


Figure 3-25. Stripping of the cable and the wires and assembling of the BYB multipin connector.

3.8 Mounting

This section describes the procedure when using support SXK 111 0278/1 for mounting of radio module and compact antenna. The radio module and the compact antenna can be mounted integrated or separately. Integrated mounting is described in section 3.8.1 and separate mounting is described in section 3.8.2. For separate mounting a separate mounting kit is required.

For mounting of other antennas than compact antennas, or other support than SXK 111 0278/1, see separate instruction delivered together with the antennas or support.

3.8.1 Integrated Mounting of Radio Module and Antenna Module

The antenna is prepared for **vertical polarization** at delivery.

Follow the instruction below if the antenna should be prepared for horizontal polarization. Note the V and H markings and the position of the polarization plate.

3.8.1.1 Preparation of the Antenna for Horizontal Polarization (integrated mounting)

- Dismount the antenna feeder from the reflector by undoing the four screws using the torx screwdriver TX 20 (M4).

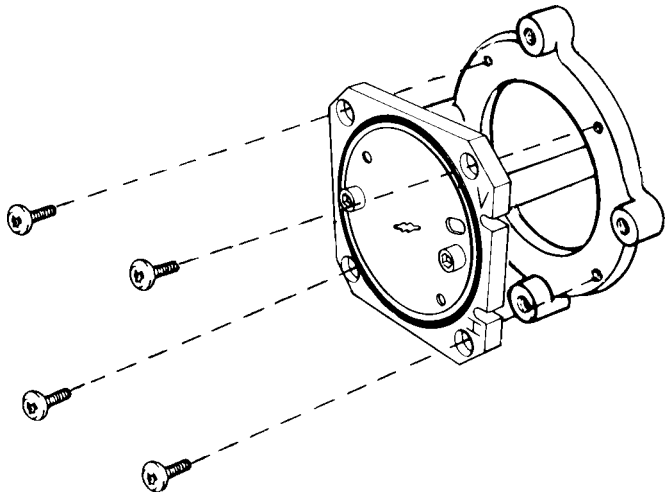


Figure 3-26. Dismounting of antenna feeder from antenna module.

- Undo the two screws at the back of the feeder using the Torx screwdriver TX20 (M4).
- Rotate the polarization plate 45° in accordance with figure below.
- Fasten the two screws and rotate the feeder 90° in accordance with figure below. The right figure shows the feeder when it has been adjusted for horizontal polarization.

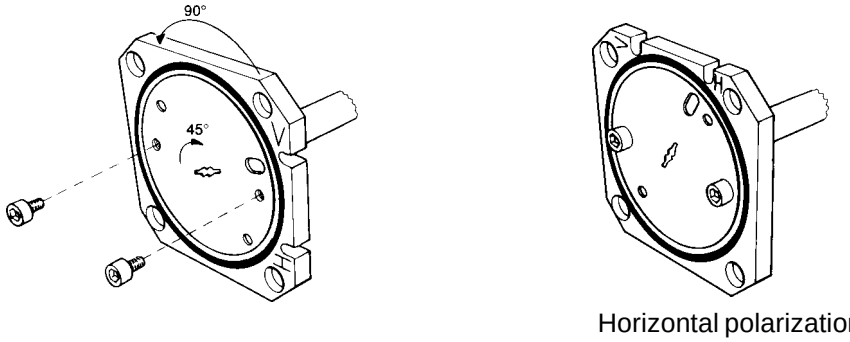


Figure 3-27. Adjusting the feeder for horizontal polarization.

- Fix the antenna feeder to the antenna using its four screws in accordance with figure below.

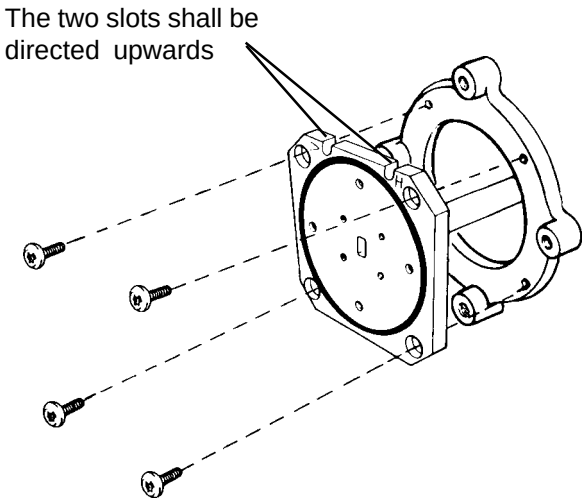


Figure 3-28. Mounting of antenna feeder for horizontal polarisation.

3.8.1.2 Mounting of Antenna Module (Integrated Mounting)

Use the 16 mm ring and open jaw wrench for tightning.

- Lubricate the screws.
- Mount the antenna support to the tube and tighten it using the four screws. Position the mounting equipment so the antenna will point along the radio-link path. For detailed mounting instruction see document 1531-SXK 111 0278 delivered together with the support.

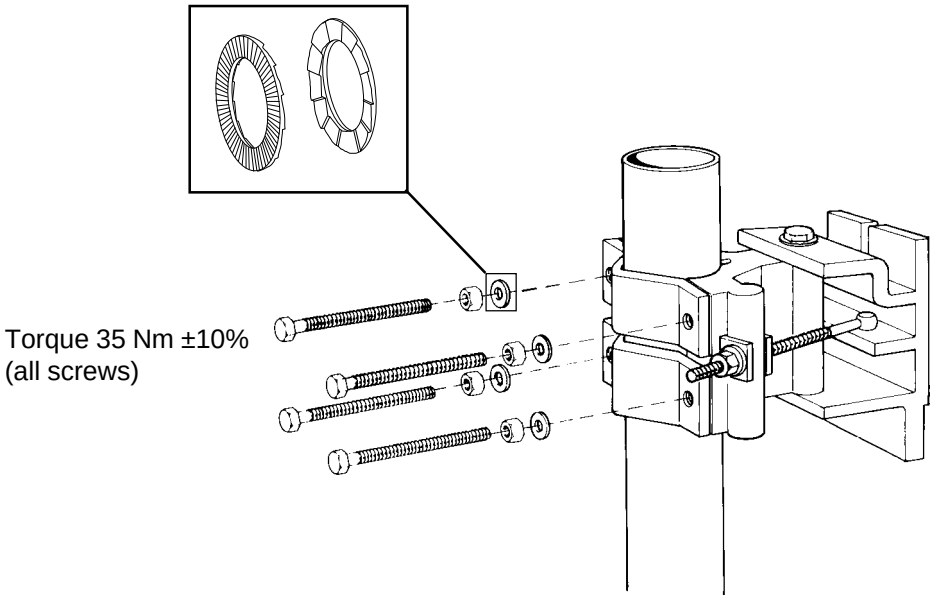


Figure 3-29. Mounting of antenna support.

- Before mounting the antenna, fasten the screw and washer in the upper hole on the side of the antenna module.
- Hoist the antenna to the installation site using the holes for hoisting.
- Position the screw on the antenna in the slot in the mounting equipment.
- Fasten the screw and washer in the lower hole on the side of the antenna.
- Remove the waveguide protection.

The standard mounting equipment fits tubes with a diameter 50-120 mm and L-profiles between 40x40x5 mm and 80x80x8 mm.

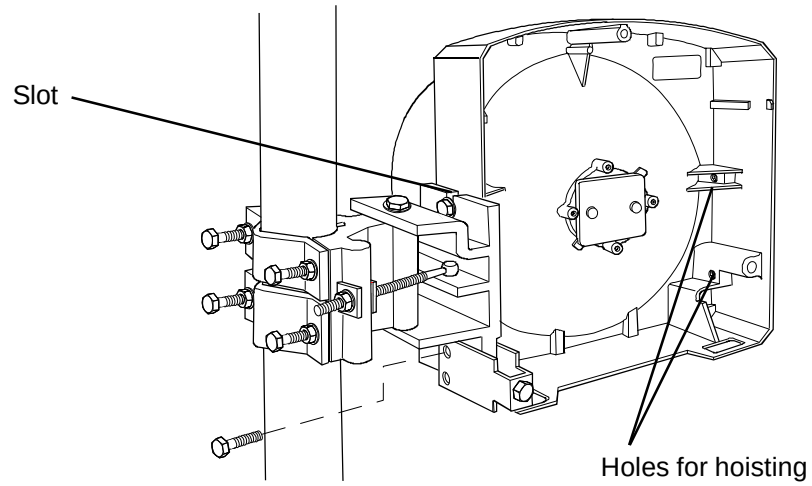


Figure 3-30. Mounting of 0.3 m antenna.

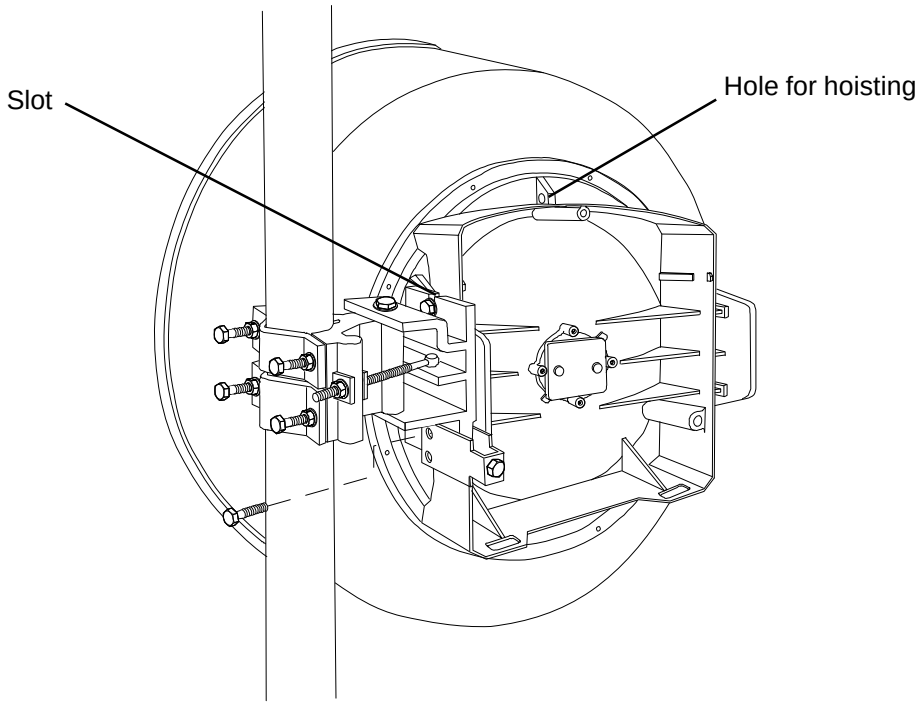


Figure 3-31. Mounting of 0.6 m antenna.

3.8.1.3 Mounting of Radio Module (Integrated Mounting)

Note: The installation is the same for 0.3 m and 0.6 m antenna.

- Before mounting fasten the three screws (included in delivery) on the radio module in accordance with figure below. Use the 5 mm Allen key.
- Remove the waveguide protection.

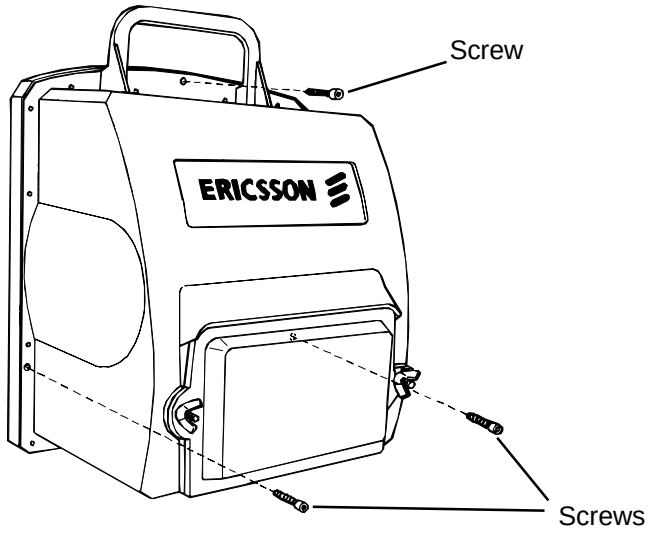


Figure 3-32. Fastening the three screws on the radio module.

- Hoist the radio module using the lifting handle.
- Position the radio module in the corresponding holes at the bottom of the antenna module and lift the radio module over the latches inside the antenna in accordance with figure below.
- Fasten the radio module using the three screws.

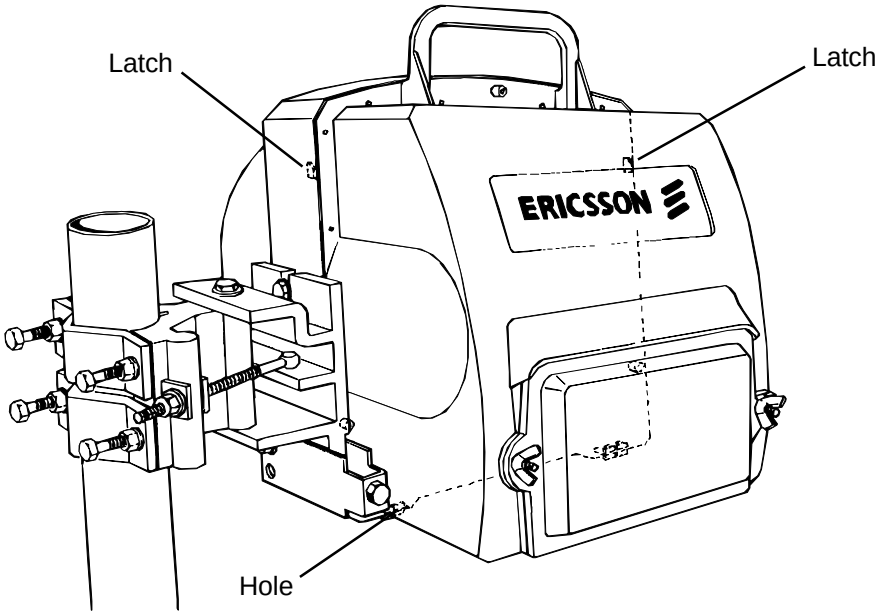


Figure 3-33. Mounting of radio module.

3.8.2 Separate Mounting of Radio Module and Antenna Module (with separate mounting kit)

The separate mounting kit (see chapter 5 for article code) contains the following equipment:

① Mounting support with screws and nuts for mounting of radio module to tubes with diameter 50-120 mm.

② Flexible waveguide with mounting washer, screws and nuts for mounting.

③ Clamp kit for the flexible waveguide, with adjustment screw and hose clamp.

④ Waveguide lock and one screw for mounting of flexible waveguide to radio module and three screws for mounting of radio module to mounting support.

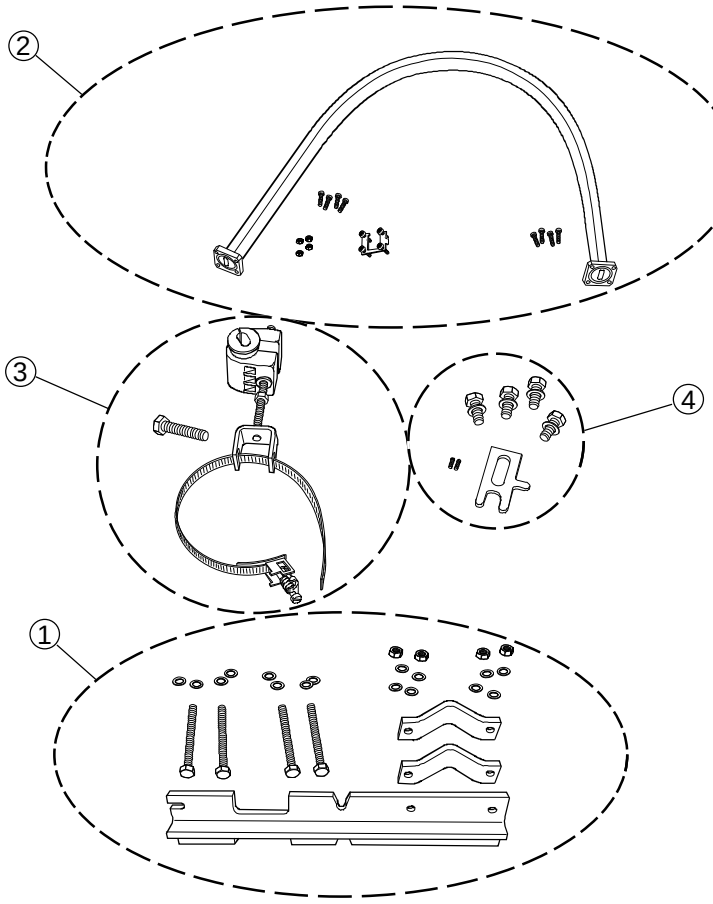


Figure 3-34. The details in the separate mounting kit

3.8.2.1 Mounting of Antenna Feeder (separate mounting)

- Undo the two screws at the back of the feeder using the Torx screwdriver TX20 (M4) and dismount the polarization plate, it shall not be used for this application.

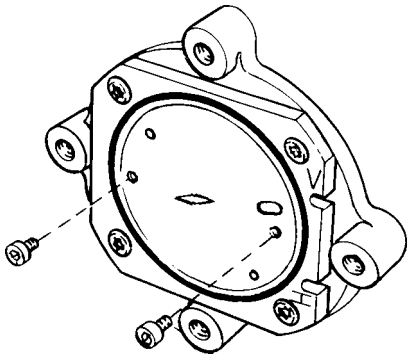


Figure 3-35. Dismounting of the polarization plate.

The antenna is now prepared for **vertical polarization**. Follow the instruction below if the feeder should be adjusted for horizontal polarization. Note the V and H markings and the position of the polarization plate.

Horizontal Polarization

- Undo the 4 screws in the corner of the feeder and rotate the feeder 90°.
- Fasten the feeder using the 4 screws in accordance with figure below.

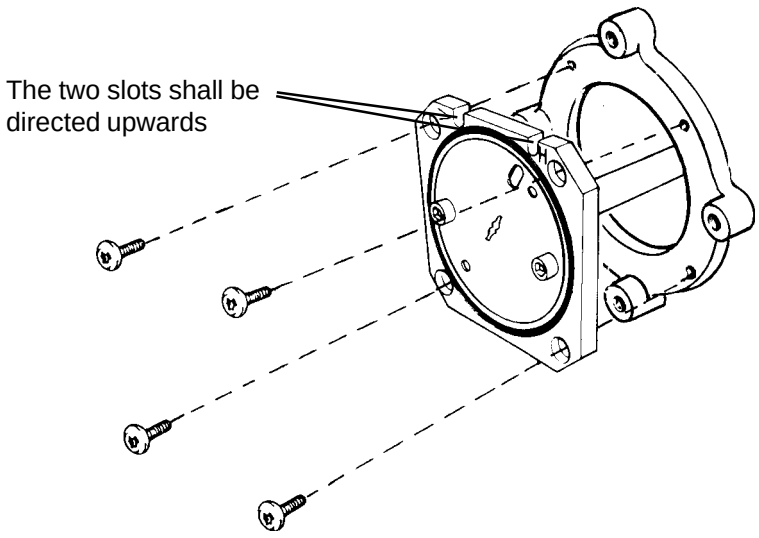


Figure 3-36. Mounting of antenna feeder for horizontal polarization.

3.8.2.2 Mounting of Antenna Module (separate mounting)

Use the 16 mm ring and open jaw wrench for tightening.

- Lubricate all screws.
- Mount the antenna support to the tube and tighten it using the four screws. Position the mounting equipment so the antenna will point along the radio-link path. For detailed mounting instruction see document 1531-SXK 111 0278 delivered together with the support.

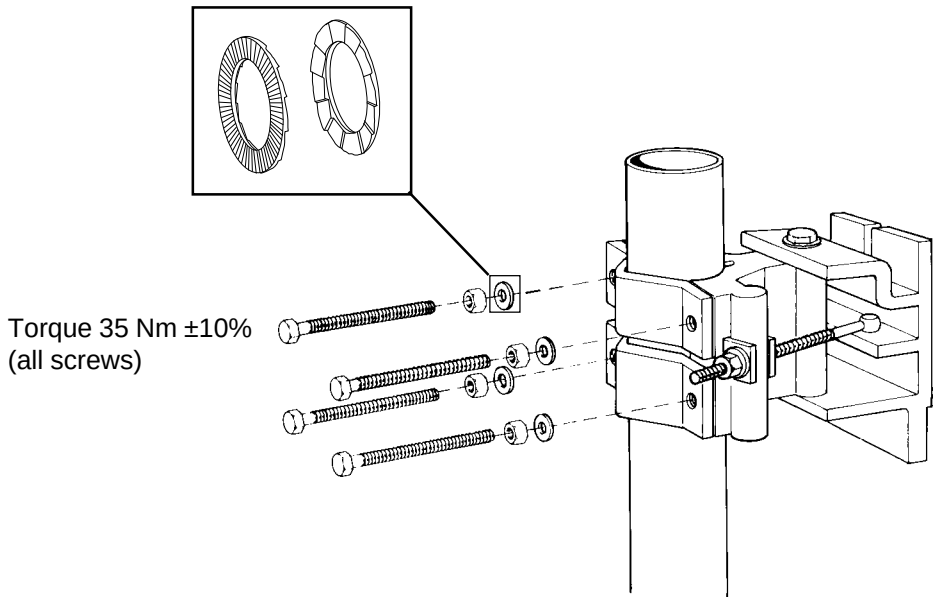


Figure 3-37. Mounting of antenna support.

Continuation on next page ⇨

- Before mounting the antenna, fasten the screw and washer in the upper hole on the side of the antenna module.
- Hoist the antenna to the installation site using the holes for hoisting.
- Position the screw on the antenna in the slot in the support and fasten the screw.
- Fasten the screw and washer in the lower hole on the side of the antenna.

The standard mounting equipment fits tubes with a diameter of 50-120 mm and L-profiles between 40x40x5 mm and 80x80x8 mm.

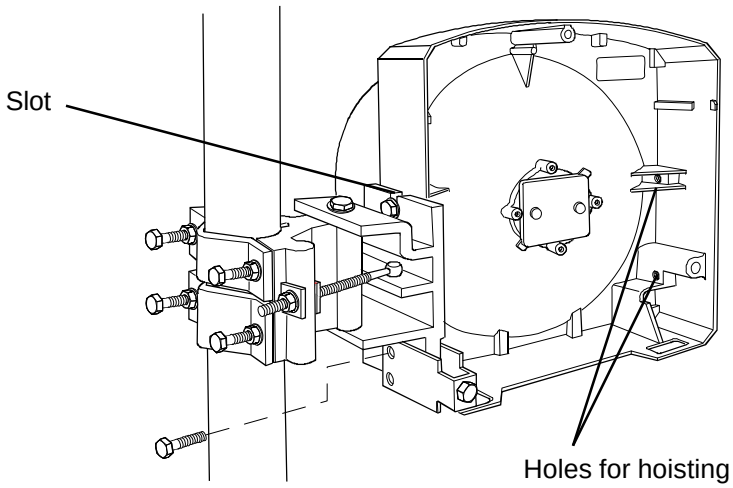


Figure 3-38. Mounting of 0.3 m antenna.

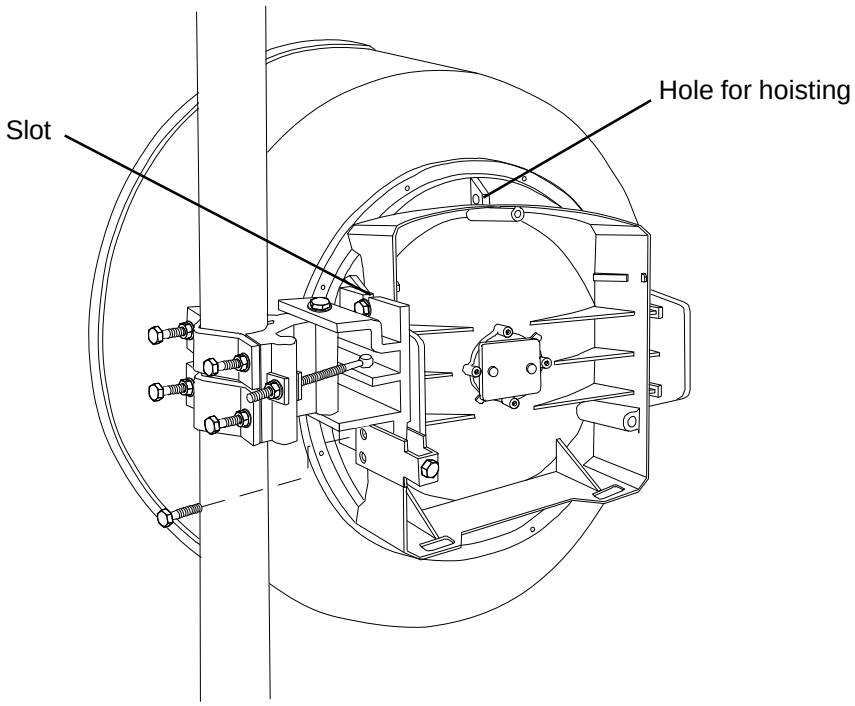


Figure 3-39. Mounting of 0.6 m antenna.

3.8.2.3 Mounting of Waveguide Lock

The waveguide lock shall be mounted before the radio module is hoisted to the mast.

- Remove the waveguide protection.
- Lubricate the screw and the guide pin.
- Mount the waveguide lock to the back of the radio module in accordance with figure below.
- Fasten the two guide pins in the two diagonal holes on the radio module. 2-3 mm of the pins should protrude.

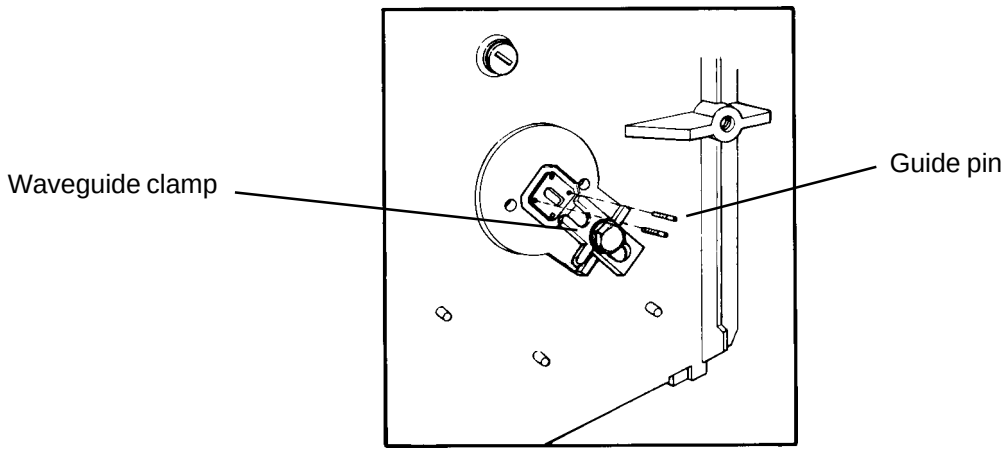


Figure 3-40. Mounting of waveguide lock.

3.8.2.4 Mounting of Radio Module (separate mounting)

- Lubricate all screws.
- Attach the support to the tube, as shown in the figure, and tighten the screws.
- Attach two of the screws at the far end of the radio module, and the third at the nearest end, as shown.
- Hook on the radio to the support.
- Tighten the screws using the 16 mm ring and open jaw wrench.

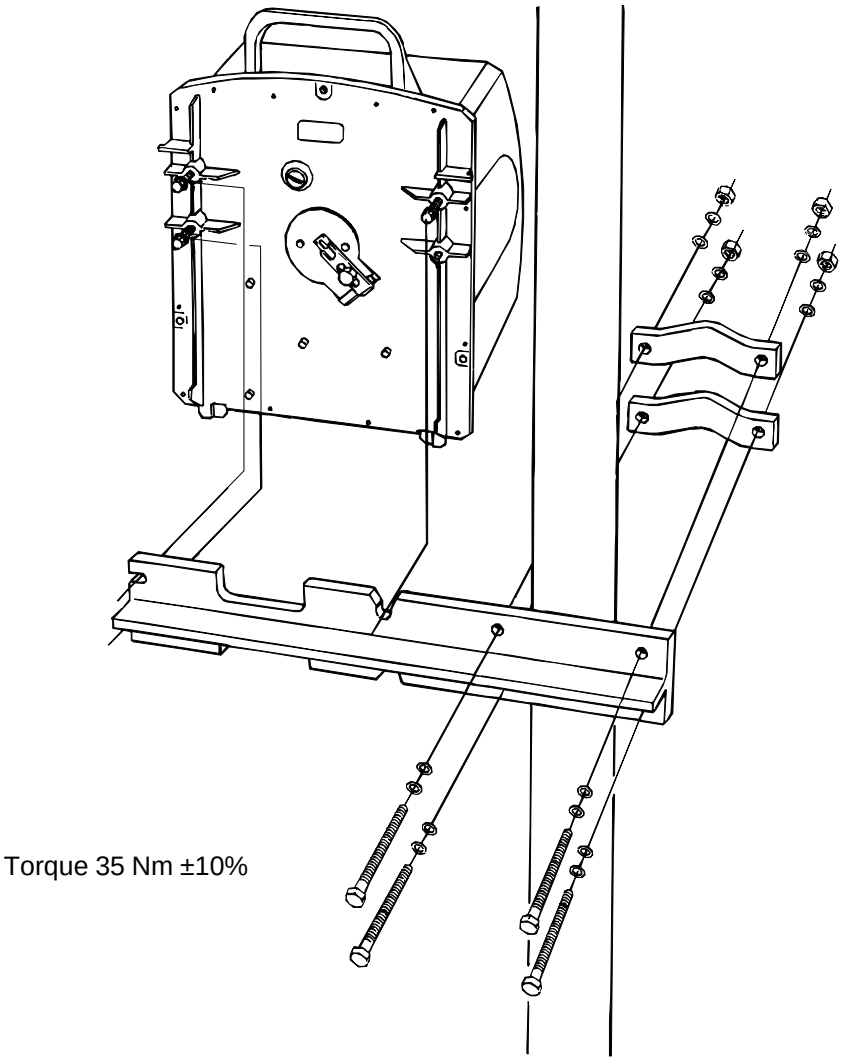


Figure 3-41. Mounting of radio module on separate support.

3.8.2.5 Mounting of Flexible Waveguide

The flexible waveguide shall be handled with care. It must not be used to support any other components and it must not be used as a hand hold.

The flexible waveguide shall be transported in its original packaging until it is installed. The protective end caps shall not be removed until the waveguide flanges are mounted to their mating flanges to prevent the flange faces from being damaged and to keep all dirt and moisture out.

If one end of the flexible waveguide has to be loose it should always be supported close to its final fixing point. It must not be left hanging unsupported with any load attached to it. The minimum bending radius and twisting angle must be adhered to, particularly close to the flanges.

Tools or fittings used on or close to the waveguide must be free from sharp cutting edges that may nick the rubber jacket. It must not pass against or close to screws or sharp edges in such a way that it can chafe against them.

The flexible waveguide shall be installed with a smooth shape ensuring that the jacket to flange joint is not the most stressed area. It must not be stretched or forced to a tight bend at the ends if it is “a little too short”. In such a case try to move or rearrange the equipment. In extreme cases a change to a longer waveguide can be made.

Mounting of Flexible Waveguide to the Antenna Module

For mounting of power splitter, see the next sections.

- Position the mounting washer on the flexible waveguide in accordance with figure.

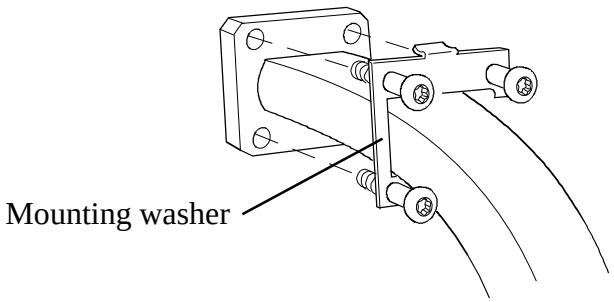


Figure 3-42. Mounting of mounting washer on the flexible waveguide.

- Check that the O-ring is properly located in the waveguide flange groove.
- Remove the waveguide protection from the antenna.
- Fasten the flexible waveguide on the antenna module with the four screws using the Torx screwdriver TX 10 (M3).

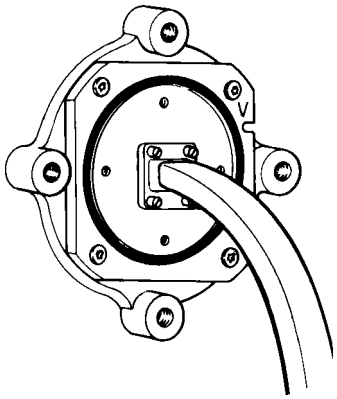


Figure 3-43. Mounting of the flexible waveguide to the antenna module.

Mounting of Power Splitter (option) and Flexible Waveguide to the Antenna Unit

The power spitter is used for 1+1 and 2+0 systems with one single polarized antenna. The power splitter is mounted directly to the 0.3 m and 0.6 m single polarized antennas. There are two versions of the power splitter available:

- Asymmetrical -1.6(radio1)/-7(radio2) dB for 1+1 systems (-1.7/-7 dB for 38-C)
- Symmetrical -3.5/-3.5 dB for 2+0 systems (-3.7/-3.7 dB for 38-C)

Two flexible waveguide kits are required. The power splitter shall be mounted as described below:

- Remove the three waveguide protections from the power splitter.
- Check that the O-ring is properly located in the flange groove at the interface between the power splitter and the feeder.
- Fasten the power splitter to the antenna module with the four screws (1) using a Torx screwdriver TX 10 (M3) (for 15 GHz, use TX 20 (M4)).
- Position the mounting washer (2) on the flexible waveguide in accordance with the figure.
- Check that the O-ring is properly located in the waveguide flange groove.
- Fasten the flexible waveguide on the power splitter with the four screws (3) using the Torx screwdriver TX 10 (M3) (for 15 GHz, use TX 20 (M4)).

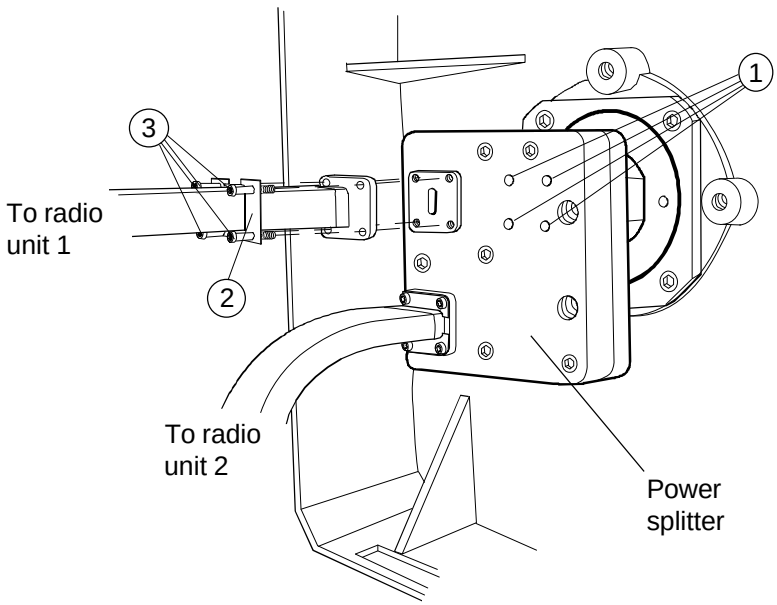


Figure 3-44. Mounting of power splitter.

The power splitter can be mounted to a tube with a diameter of 50-114 mm by using mounting kit SXK 111 0340.

Fitting of the Power Splitter on a Separate Support

In special cases, such as for large antennas, separate mounting of the power splitter is required.

The following accessories are required for mounting of the power splitter on a separate support:

- Mounting kit SXK1110340 for mounting on tubes with diameter 50-114 mm.
- Two kits for separate mounting (include flexible waveguides).
- Flexible waveguide kit.
- Waveguide clamp kit

The power splitter is installed as described below:

- Fit the support to the mast. Tighten the nuts using the 16 mm ring and open jaw wrench.
- Fit the power splitter to the support using the two screws.
- Remove the three waveguide protections from the power splitter.
- Fasten the flexible waveguide (1) to the power splitter. Check that the O-ring is properly located in the flange groove at the interface between the power splitter and the flexible waveguide.
- Fasten the other end of the flexible waveguide to the antenna.
- Position the washer on the flexible waveguide in accordance with the figure.
- Fasten the flexible waveguides from radio 1 and 2 on the power splitter with four screws using the Torx screwdriver TX 10 (M3). Check that the O-rings are properly located in the waveguide flange grooves.

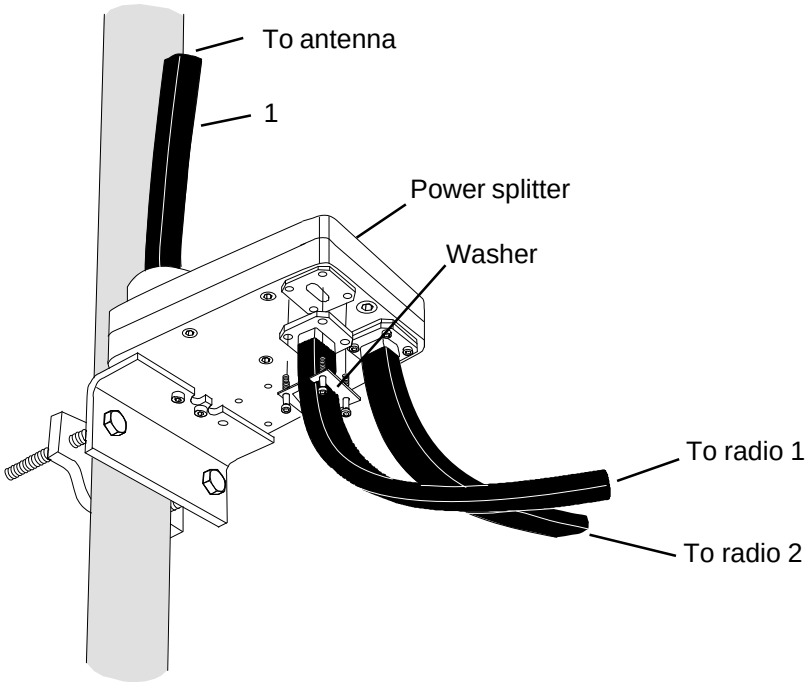


Figure 4-45. Mounting the power splitter using a separate support.

Mounting of Flexible Waveguide to the Radio Module

- Check that the O-ring is properly located in the waveguide flange groove.
- Remove the waveguide protection.
- Mount the flexible waveguide on the radio module using the waveguide lock.
- Fix the waveguide by tightening the waveguide lock with the 16 mm ring wrench.

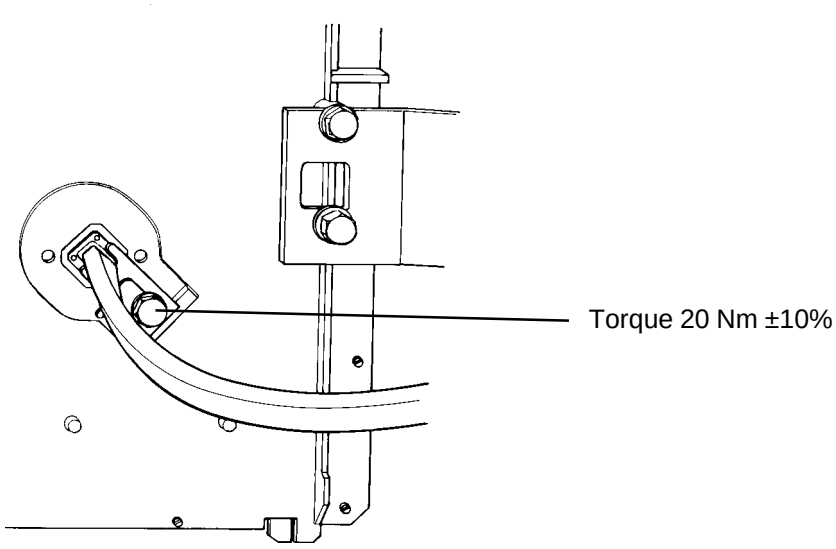


Figure 3-46. Mounting of the flexible waveguide to the radio module.

3.8.2.6 Mounting of Supporting Arm for Flexible Waveguide

The supporting arm must be used to ensure that the flexible waveguide is not damaged.

- Fasten the hose clamp around the tube as shown in the figures below. Use the screw (shown in step 4) to tighten the hose clamp.

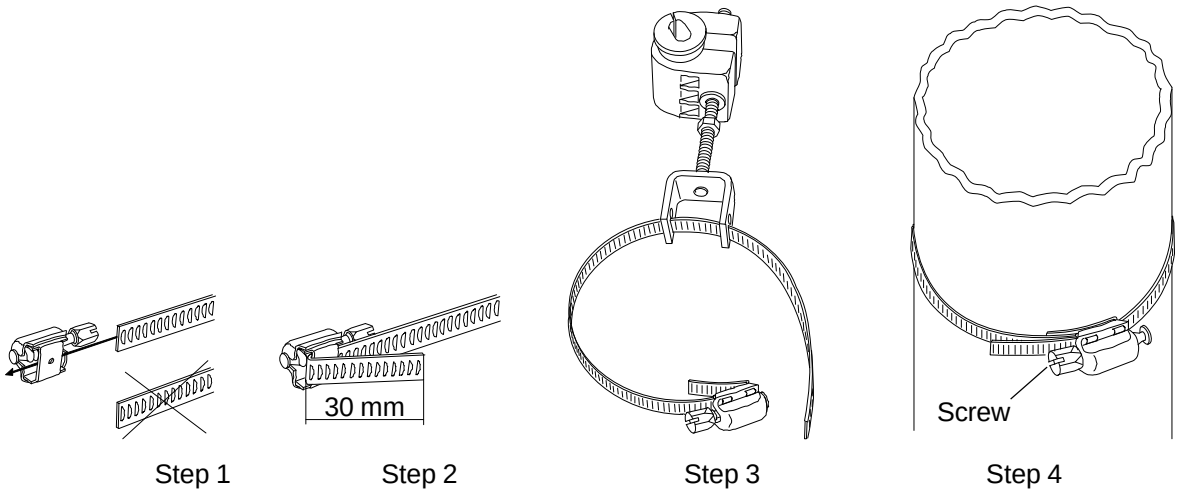


Figure 3-47. Mounting the hose clamp.

- Fasten the flexible waveguide in the clamp in accordance with the figure. For MINI-LINK 38-C, use the rubber bushing with the small hole. For MINI-LINK 23-C and 26-C, use the rubber bushing with the big hole. MINI-LINK 15-C does not require a rubber bushing.

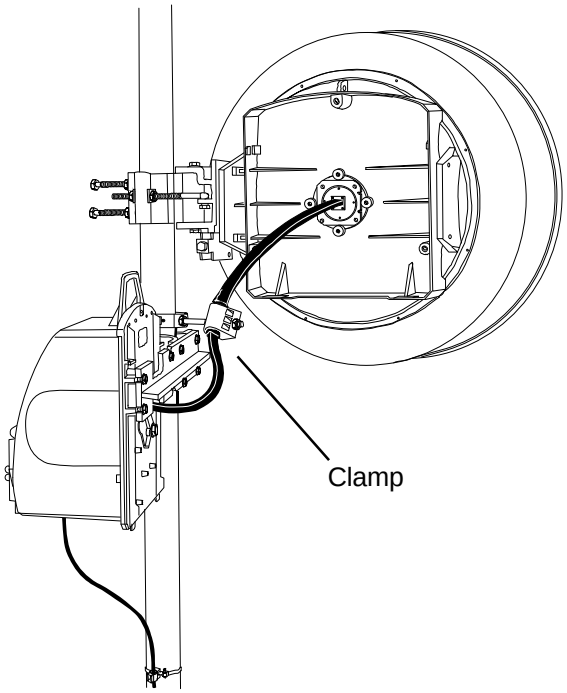


Figure 3-48. The supporting arm fit to a flexible waveguide in a separate installation of the radio unit and the antenna.

3.8.3 Lightning Protection

All input/output ports are provided with a secondary protection consisting of varistors, zeners, etc. These protections are normally fully sufficient as transient and lightning protection. For extraordinary protection a separate primary lightning arrestor board (ROA 115 2234) is available using gas discharge tubes. Four screws for fastening of the connector plugs are included in the delivery.

The lightning arrestor is mounted at the connector field in the radio according to the figure below.

- Place the lightning arrestor at the connector field.
- Press the lightning arrestor in position so that the jacks on the rear come in contact with the plugs on the radio.
- Fasten the lightning arrestor using the three screws.
- Mount the screws to the connector plugs.
- Connect the plugs to the proper positions in accordance with figure and fix them with the screws.

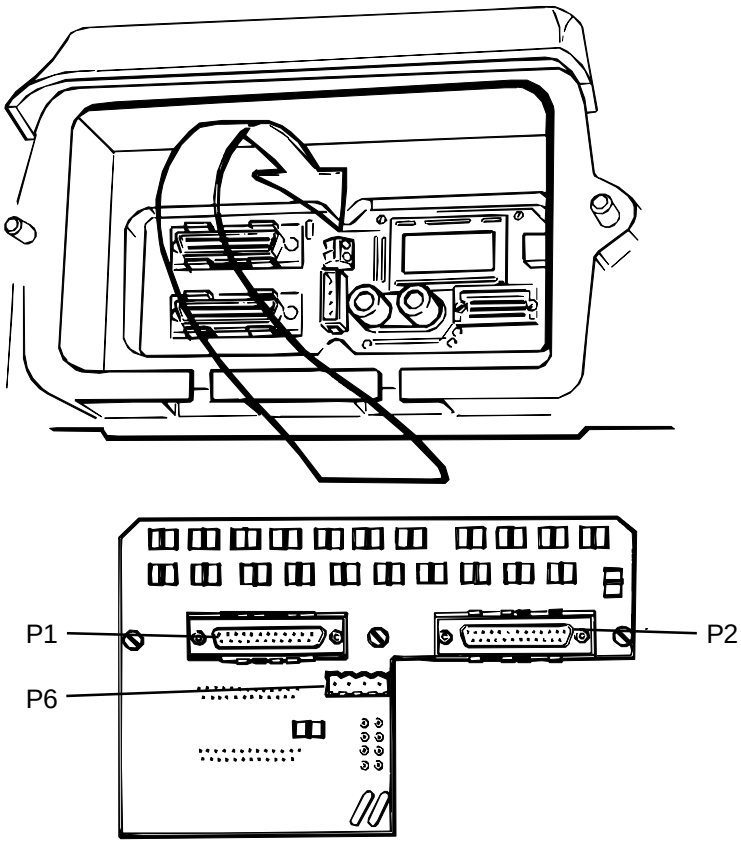


Figure 3-49. Mounting the lightning protection in the radio module.

3.8.4 Connection of Cables

⚠ WARNING - Depending on DC supply, hazardous voltage (>60 V) may exist in the connector field near the connector for the power supply (P6).

- Hoist the assembled cable (cables).
- Open the lid on the radio module.
- Place the cable(s) with the cable bushing(s) in the slotted hole(s) on the radio module.
- Fit the dust protection plate (optional) as shown in the figure.

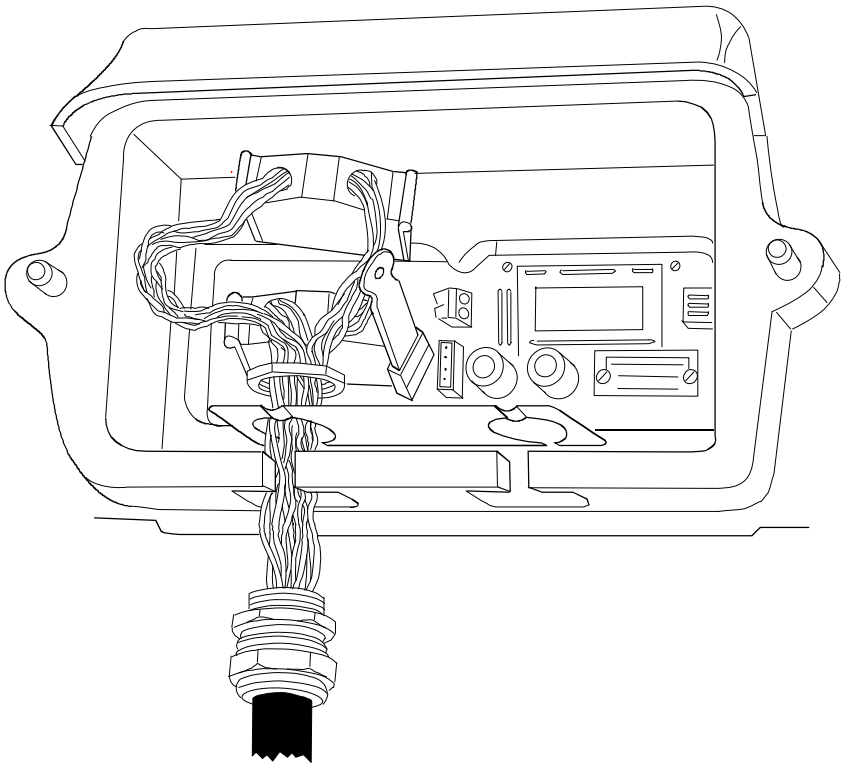


Figure 3-50. Fitting the dust protection plate.

- Fasten the cable(s) with the nut(s) using the 26/27 mm open jaw wrench (included in the connector kit).
- Connect the plugs to their right positions according to the figure.

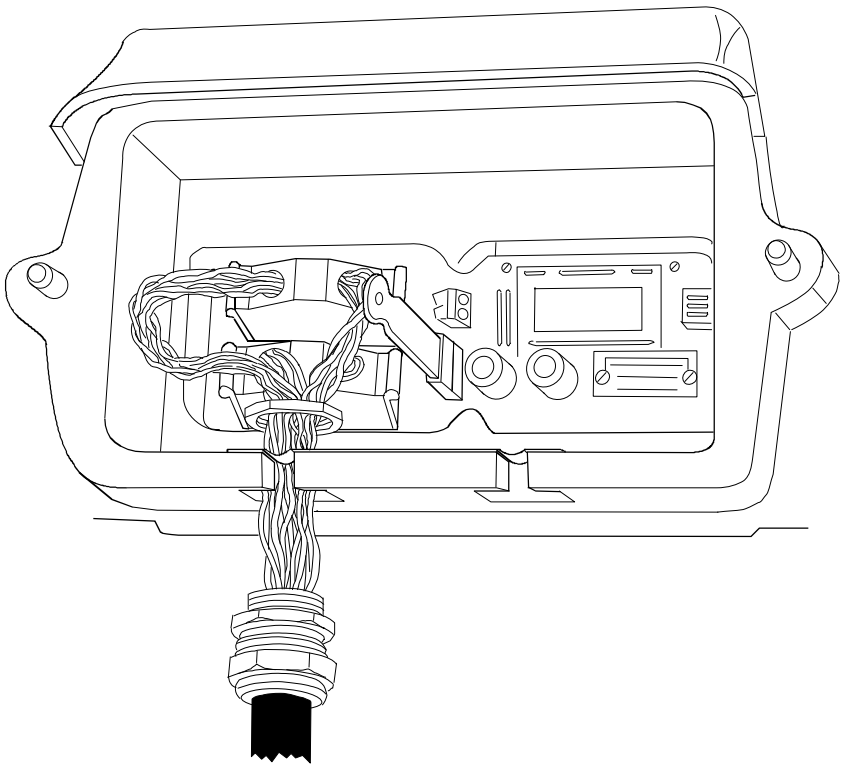


Figure 3-51. Connecting the plugs.

- If only one cable is used, cover the hole for the second cable, by mounting the not used cable bushing with its cover plate inside.

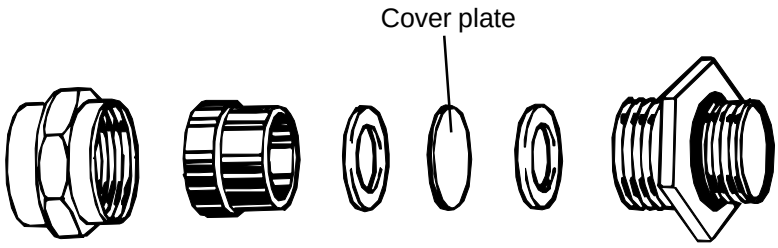


Figure 3-52. Mounting of cable bushing with cover plate.

- Close the lid on the radio module.
- Use the sting to tie the jaw wrench to a place near the radio module.
- Switch on the power supply equipment.

3.8.5 Connection of Radio Earthing Kit

If only one cable is connected to the radio, radio earthing kit SXK 111 0349 can be connected in the second hole on the radio module.

- Fit the earthing cable to the earthing screw and secure it with a nut. The nut shall be mounted with the plastic part facing downwards.
- Fasten the radio earthing kit in the hole on the radio module with the locking nut included in the connector kit SXA 107 6268/1, using the 26/27 mm open jaw wrench.
- Connect the other end of the earting cable to mast earth, see section 3.6.4.

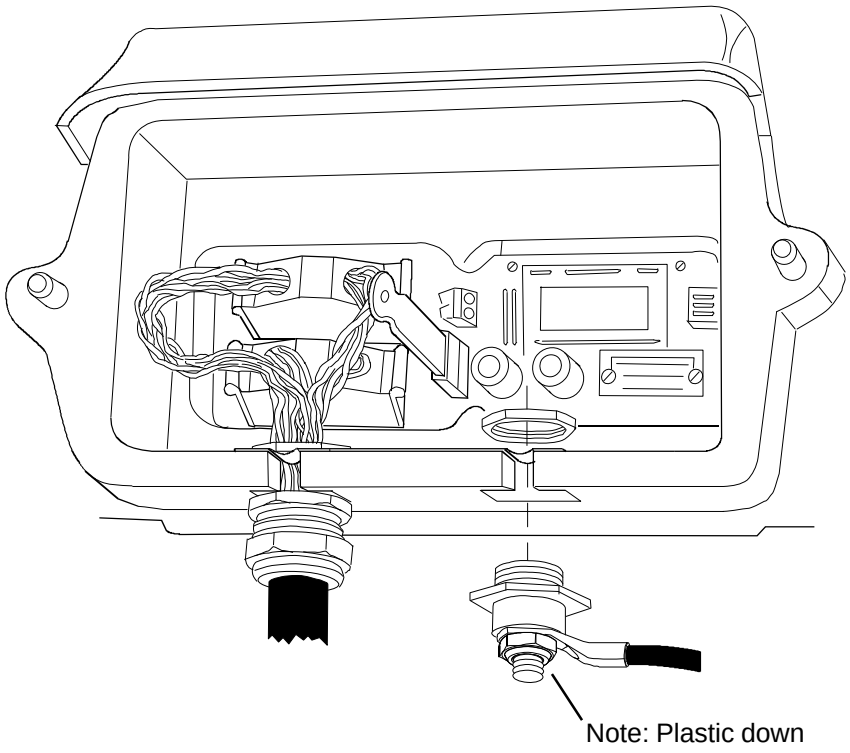


Figure 3-53. Connection of radio earthing kit to radio module.

3.8.6 Clamping of Cable to Mast

To fasten the cable to the mast, use the pliers LSD 349 20 and the cable clamp kit SXK 111 0315/1 (for diameters ≤ 90 mm) or SXK 111 0315/2 (for diameters ≤ 180 mm).

- Loop the clamp around the mast and the cable. Insert the tip through the head and hand tighten.
- Place the pliers on the clamp as shown in figure.

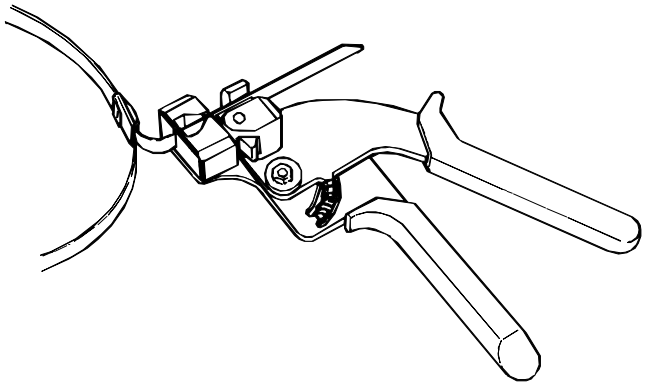


Figure 3-54. Placing of pliers on clamp.

- Squeeze the handles as many times as necessary to tighten the cable to the mast, without damaging the cable.
- When the cable is tightened to the mast, after final handle pressure, rotate the pliers 1/4 - 1/2 turn to cut the excess tail off.
- Place the clamps at recommended distance from each other, see figure.

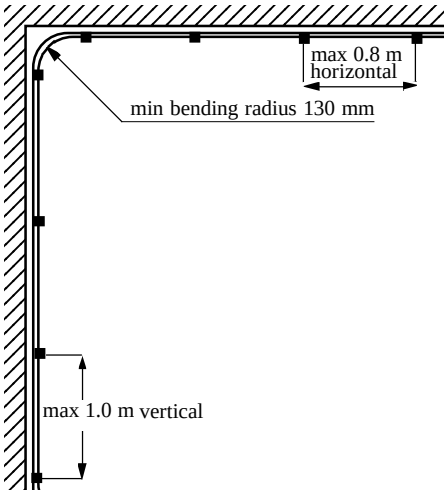


Figure 3-55. Recommendations concerning bending radius of cable and distance between cable clamps.

3.8.7 Connection of Cable Earthing Kits

For lightning protection of radio cable TFR 463 13 and TFR 463 11, cable earthing kit SXK 111 0248/1 can be connected.

It is recommended to mount one cable earthing kit per 50 meters cable for severe conditions. With each earthing kit goes a detailed description of how to mount it on the multicable.

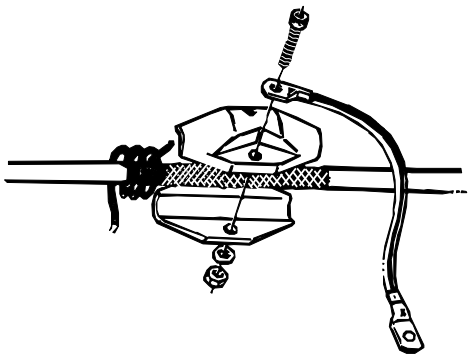


Figure 3-56. Mounting of cable earthing kit on multicable.

3.9 Frequency Setting

3.9.1 Introduction

The frequency channel number can be set in two ways.

- Frequency setting by using the toggle switch in the radio module.
- Frequency setting by using a pocket terminal or a personal computer.

Before any frequency setting can be done the frequency channel number has to be calculated from a formula. Each MINI-LINK has a frequency index. You need this index to calculate the channel number. The index is shown when the toggle switch on the connector field is pressed down (see section 3.9.2). Use one of the formulas below to calculate the frequency channel number. Which formula to use depends on the index number of your MINI-LINK.

MINI-LINK 15-C

Index	Formula	
11	$n = \frac{f - 14504.50}{1.75}$	n = between 1 and 58
18	$n = \frac{f - 15239.50}{1.75}$	n = between 1 and 58
12	$n = \frac{f - 14609.50}{1.75}$	n = between 1 and 58
15	$n = \frac{f - 14924.50}{1.75}$	n = between 1 and 58
13	$n = \frac{f - 14714.50}{1.75}$	n = between 1 and 58
16	$n = \frac{f - 15029.50}{1.75}$	n = between 1 and 58
14	$n = \frac{f - 14819.50}{1.75}$	n = between 1 and 58
17	$n = \frac{f - 15134.5}{1.75}$	n = between 1 and 58
21	$n = \frac{f - 14501.00}{1.75}$	n = between 1 and 64
25	$n = \frac{f - 14921.00}{1.75}$	n = between 1 and 64
22	$n = \frac{f - 14613.00}{1.75}$	n = between 1 and 64
26	$n = \frac{f - 15033.00}{1.75}$	n = between 1 and 64

n = frequency channel number **f** = transmitting frequency

MINI-LINK 15-C

Index	Formula	
23	$n = \frac{f - 14725.00}{1.75}$	n = between 1 and 56
27	$n = \frac{f - 15145.00}{1.75}$	n = between 1 and 56
24	$n = \frac{f - 14823.00}{1.75}$	n = between 1 and 56
28	$n = \frac{f - 15243.00}{1.75}$	n = between 1 and 56
41	$n = \frac{f - 14501.00}{1.75}$	n = between 1 and 54
47	$n = \frac{f - 15145.00}{1.75}$	n = between 1 and 54
42	$n = \frac{f - 14599.00}{1.75}$	n = between 1 and 54
48	$n = \frac{f - 15243.00}{1.75}$	n = between 1 and 54
61	$n = \frac{f - 14501.00}{1.75}$	n = between 1 and 64
68	$n = \frac{f - 15229.00}{1.75}$	n = between 1 and 64
62	$n = \frac{f - 14620.00}{1.75}$	n = between 1 and 62
65	$n = \frac{f - 14928.00}{1.75}$	n = between 1 and 62
63	$n = \frac{f - 14704.00}{1.75}$	n = between 1 and 62
66	$n = \frac{f - 15012.00}{1.75}$	n = between 1 and 62
64	$n = \frac{f - 14816.00}{1.75}$	n = between 1 and 62
67	$n = \frac{f - 15124.00}{1.75}$	n = between 1 and 62
71	$n = \frac{f - 14511.50}{1.75}$	n = between 1 and 58
78	$n = \frac{f - 15225.50}{1.75}$	n = between 1 and 58

n = frequency channel number **f** = transmitting frequency

MINI-LINK 15-C

Index	Formula	
80	$n = \frac{f - 14403.00}{1.75}$	n = between 1 and 64
85	$n = \frac{f - 14893.00}{1.75}$	n = between 1 and 64
81	$n = \frac{f - 14403.00}{1.75}$	n = between 49 and 112
86	$n = \frac{f - 14893.00}{1.75}$	n = between 49 and 112
82	$n = \frac{f - 14403.00}{1.75}$	n = between 97 and 160
87	$n = \frac{f - 14893.00}{1.75}$	n = between 97 and 160
83	$n = \frac{f - 14403.00}{1.75}$	n = between 145 and 208
88	$n = \frac{f - 14893.00}{1.75}$	n = between 145 and 208
84	$n = \frac{f - 14403.00}{1.75}$	n = between 193 and 256
89	$n = \frac{f - 14893.00}{1.75}$	n = between 193 and 256

n = frequency channel number **f** = transmitting frequency

MINI-LINK 23-C

Index	Formula	
12	$n = \frac{f - 21950.25}{1.75}$	n = between 1 and 312
14	$n = \frac{f - 23000.25}{1.75}$	n = between 1 and 312
22	$n = \frac{f - 21784.00}{1.75}$	n = between 1 and 320
24	$n = \frac{f - 23016.00}{1.75}$	n = between 1 and 320
31	$n = \frac{f - 21651.00}{1.75}$	n = between 1 and 212
33	$n = \frac{f - 22925.00}{1.75}$	n = between 1 and 212
32	$n = \frac{f - 21651.00}{1.75}$	n = between 172 and 383
34	$n = \frac{f - 22925.00}{1.75}$	n = between 172 and 383
42	$n = \frac{f - 21797.50}{2.50}$	n = between 1 and 231
44	$n = \frac{f - 22997.50}{2.50}$	n = between 1 and 231
46	$n = \frac{f - 21796.25}{1.75}$	n = between 1 and 330
48	$n = \frac{f - 22996.25}{1.75}$	n = between 1 and 330
52	$n = \frac{f - 22008.00}{1.75}$	n = between 1 and 288
54	$n = \frac{f - 23016.00}{1.75}$	n = between 1 and 288
56	$n = \frac{f - 22002.75}{1.75}$	n = between 1 and 291
58	$n = \frac{f - 23010.75}{1.75}$	n = between 1 and 291
57	$n = \frac{f - 22002.75}{1.75}$	n = between 45 and 335
59	$n = \frac{f - 23010.75}{1.75}$	n = between 45 and 335

n = frequency channel number **f** = transmitting frequency

MINI-LINK 26-C

Index	Formula	
12	$n = \frac{f - 25560.50}{1.75}$	n = between 1 and 282
17	$n = \frac{f - 26684.00}{1.75}$	n = between 1 and 282
23	$n = \frac{f - 24549.00}{1.75}$	n = between 469 and 511
28	$n = \frac{f - 25557.00}{1.75}$	n = between 469 and 511
24	$n = \frac{f - 24549.00}{1.75}$	n = between 256 and 511
29	$n = \frac{f - 25557.00}{1.75}$	n = between 256 and 511

MINI-LINK 38-C

Index	Formula	
11	$n = \frac{f - 37058.00}{1.75}$	n = between 1 and 160
15	$n = \frac{f - 38318.00}{1.75}$	n = between 1 and 160
12	$n = \frac{f - 37338.00}{1.75}$	n = between 1 and 160
16	$n = \frac{f - 38598.00}{1.75}$	n = between 1 and 160
13	$n = \frac{f - 37618.00}{1.75}$	n = between 1 and 160
17	$n = \frac{f - 38878.00}{1.75}$	n = between 1 and 160
14	$n = \frac{f - 37898.00}{1.75}$	n = between 1 and 160
18	$n = \frac{f - 39158.00}{1.75}$	n = between 1 and 160
23	$n = \frac{f - 37758.00}{1.75}$	n = between 1 and 160
27	$n = \frac{f - 39018.00}{1.75}$	n = between 1 and 160

n = frequency channel number **f** = transmitting frequency

Note! Frequency setting by using personal computer or pocket terminal is described in separate manuals.

3.9.2 Frequency Setting using Toggle Switch on Radio Module

⚠ WARNING - When the lid is open, voltage from power supply exists in the connector field.

Reading Channel Number

The current channel number is stored in a non-volatile memory. The current channel number can be read on the alphanumeric display, situated on the connector field. Under normal conditions the display shows a number that indicates the frequency band in which the equipment operates.

Error code “Err XXXX” indicates an abnormal condition, see the table on the following page.

When you press the toggle switch DOWN, five digits are displayed. These digits are described in the figure below.

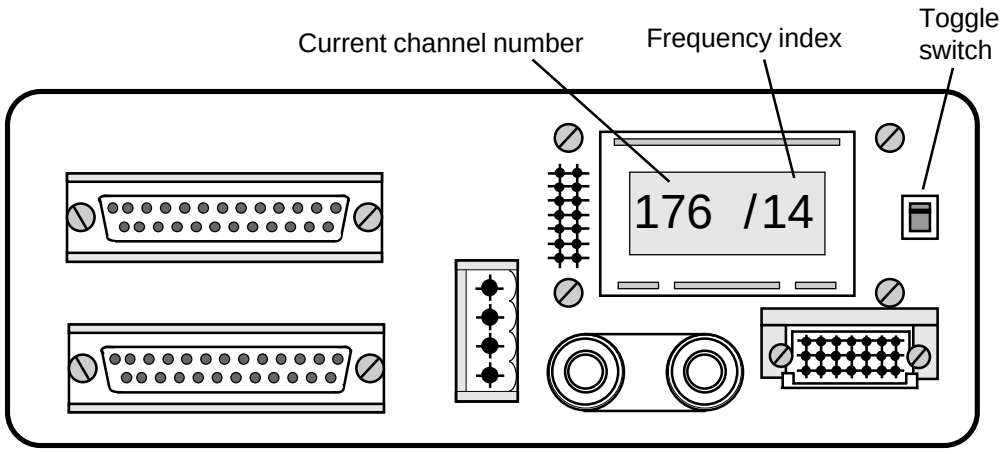


Figure 3-57. The digits on the display, situated on the connector field.

After about five seconds the display returns to idle mode.

Setting Channel Number

A new channel is selected by entering the channel number with the toggle switch. Press the toggle switch DOWN and then UP to enter the channel number slow-step mode.

Increase channel number by pressing the toggle switch UP once. Decrease channel number by pressing the toggle switch DOWN once.

Enter the fast-step mode by holding the toggle switch in UP or DOWN position. The channel number is then changed in steps of ten. You leave the fast-step mode and return to the slow-step mode as soon as you release the toggle switch.

You leave the slow-step mode five seconds after the last touch of the toggle switch. Then the RF module is set to the new RF channel and the new channel number is stored.

Error Codes

Error code “Err XXXX” indicates an abnormal condition. The table below explains the different error codes that might appear when setting the frequency channel.

Error codes	Error definitions	Measures
Err-0001	No Microwave unit connected.	Check internal cabling.
Err-0002	Non-valid sub-band code.	Check cables and settings on Microwave unit. See 4.10.3
Err-0003	A valid channel is not selected yet. At delivery the channel number is set to 0 to make the transmitter stay turned off.	This error code will disappear when a channel is selected.

Figure 3-58. Error codes.

3.10 Alignment

3.10.1 Introduction

The MINI-LINK radios should be installed on both sites and the frequency channels should be set before the alignment starts.

Traffic or a pattern generator should be connected to the traffic input. If a PC or pocket terminal is available, perform an RF loop test (only MINI-LINK 15-C and 23-C) on each MINI-LINK before starting the alignment procedure.

If possible arrange for speech communication between the sites, to co-ordinate alignment actions.

3.10.2 Alignment Procedure

WARNING - Depending on DC supply, hazardous voltage (>60 V) may exist in the connector field near the connector for power supply (P6).

1. Fill in the name of the site, local configuration and polarization in the line-up record (see chapter "8. Appendices").
2. Align both antennas toward each other coarsely, but as accurately as possible using a compass.

   Note! If the mast is made of steel, the compass can mislead.
3. Open the lid of the radio module and connect the voltmeter to the AGC level testport in the connector field.

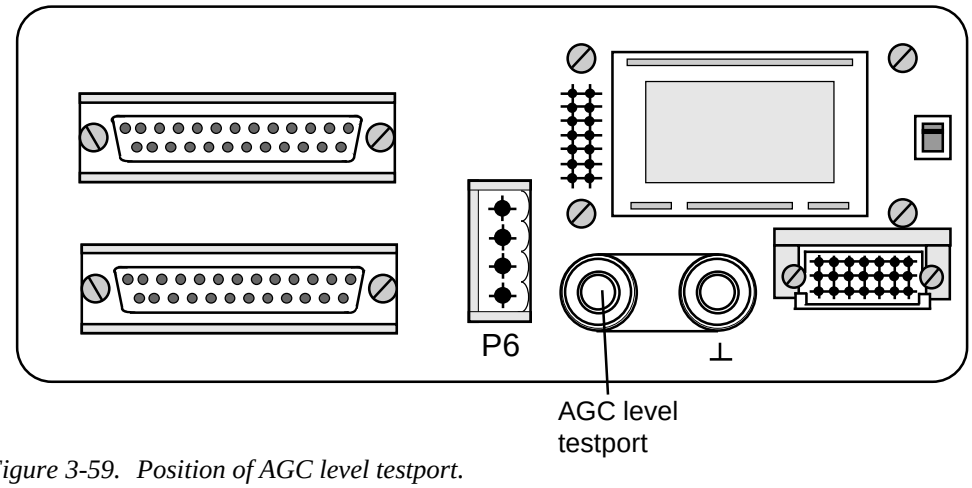


Figure 3-59. Position of AGC level testport.

4. Rotate the antenna by hand to achieve maximum reading of the AGC level.

5. For fine adjustment use the azimuth and elevation screws. Before adjustment of elevation undo the locking screw. **Note:** The adjustment procedure is the same for 0.3 m and 0.6 m antenna.

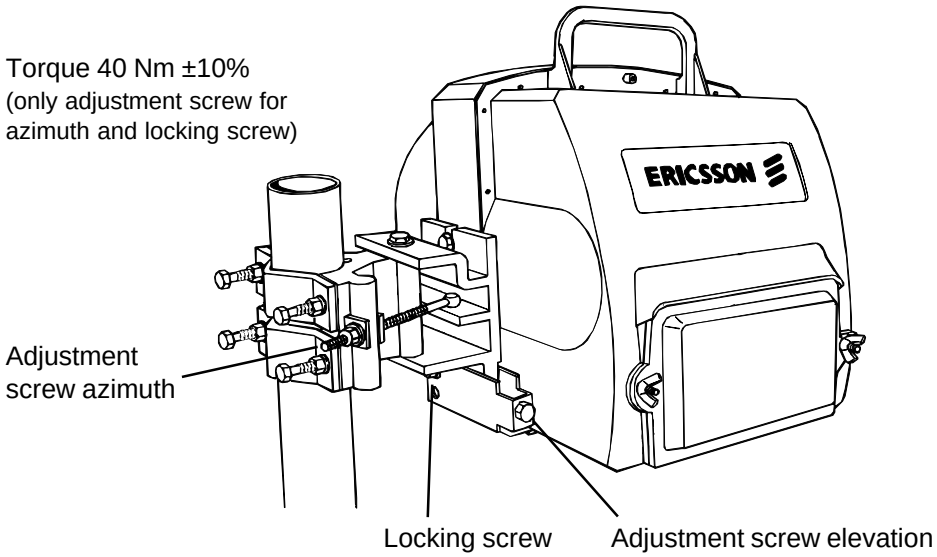


Figure 3-60. Adjustment screws.

6. Secure the position by tightening the locknut on the azimuth screw and the locking screw for elevation. Use the 16 mm ring wrench.
   Note: Once the alignment has been made, the azimuth screw, the elevation locking screw and the clamp screws must **not** be touched. Exchanging radio module or antenna does not affect these screws.
7. Measure the AGC level and record the value in the line-up record.
8. Transform AGC level in volts to RF level in dBm using the curve below.

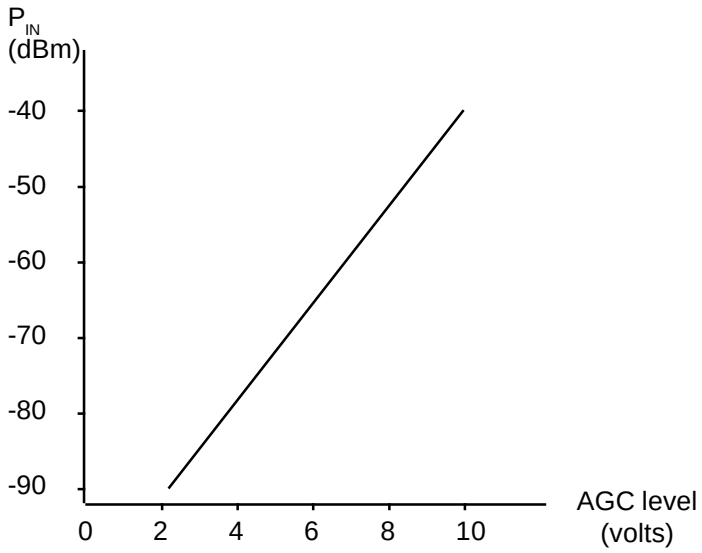


Figure 3-61. RF in level as a function of AGC level.

9. Compare the RF level given in the curve with that calculated for the system during path calculation (made when planning the network).

3.11 Software Settings (option)

For single hop applications no further settings or adjustments are required. However in some applications further settings are required to take full advantage of the facilities:

- when using only one traffic port for dual traffic versions.
- when the radio is part of a MINI-LINK supervisory network.
- when the radio operates in a 1+1 or 2+1 configuration.
- when the RF input level generating AGC Alarm shall differ from the default value -70 dBm.
- if User Alarm is set in Special Mode (see section 4.8.1 for further information).

The settings are performed using a PC or a pocket terminal.

For information on how to set the software see separate manuals when using a computer or a pocket terminal with MNM.

3.12 Functional Check

3.12.1 Preparations

The MINI-LINK radios should be installed on both sides before making the tests.

If possible, traffic should be connected to the radios. A pattern generator and a BER detector can be used if traffic is not available.

⚠ **WARNING - Depending on DC supply, hazardous voltage (>60 V) may exist in the connector field near the connector for power supply (P6).**

3.12.2 Functional Test using MNM

- Connect the computer to one MINI-LINK.
- Start the MNM.
- Check that both radio terminals are OK.

3.12.3 Functional Test using Pocket Terminal

- Connect the pocket terminal to one MINI-LINK.
- Select TRMA.
- Check that there are no alarms on TRMA (a “b” in any position is acceptable).
- Select TRMB.
- Check that there are no alarms on TRMB (a “b” in any position is acceptable).
- Record the result of the functional test in the line-up record (see chapter 8).

3.12.4 Functional Test using Ohmmeter

- Connect the ohmmeter to RADIO ALARM (P2:7) and 0 V (P2:6).
- Check that the impedance is close to 220 Ω.
- Record the result of the functional test in the line-up record (see chapter 8).
- Close the lid on the radio module.

3.12.5 Service Channel Test

If the service channel shall be used, perform the following test:

- Initiate the service channel test tone via the computer or pocket terminal.
- Listen in the service telephone, or measure 0.5-5V AC at the output ports. Duration of test tone: 10 seconds.

3.13 In Case of Problem

- Check the setup in all terminals on site.
- Check the cables.
- See section “4.9 Fault Localization in Field” for further information.

3.14 Starting Up the System

Valid for users of the MINI-LINK supervisory system.

After installation, clear the alarm buffer and wake up signals and reset performance monitoring using the computer or pocket terminal.

- Connect the computer or pocket terminal to MINI-LINK.
- Reset performance monitoring and restore CSS at Near Radio (TRMA).
- Reset performance monitoring and restore CSS at Far Radio (TRMB).
- Close the lid on radio module.

For the user of MNM for PC:

- Delete all alarm and performance log files.

Contents

4. Operation and Maintenance

⚠WARNING - Due to DC supply, hazardous voltage (>60 V) may exist in the connector field near the connector for power supply (P6).

4.1 Introduction

Because the MINI-LINK Control and Supervision System (CSS) is a very powerful device, it may require some effort to grasp its full potential. This document is designed to ensure that you encounter a minimum of difficulty as we guide you through the system.

To make a single hop system operational, all you have to do is connect cables, enter the RF channel number and perform alignment as described in chapter "3. Installation". No special tools or instruments are required, and no setting of software is needed, the default settings will be sufficient in most cases.

Systems with multiple hops, protected hops or other systems of a more complex structure could of course be treated as a number of single hops, but that is not recommended. Instead, the Control and Supervision Systems of each MINI-LINK radio should be connected and set to form an operation and maintenance network. In this network all MINI-LINK equipment can be supervised from the same operation and maintenance centre, as shown in figure below.

The service engineer can at the same time access the MINI-LINK equipment from his PC (laptop) or pocket terminal.

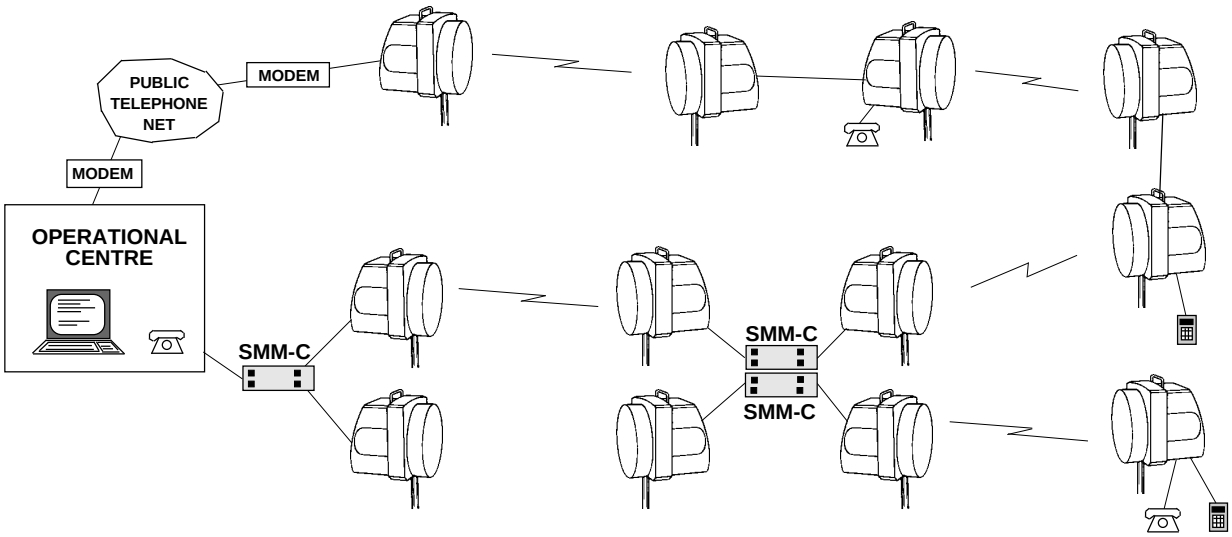


Figure 4-1. Operation and maintenance network.

Terminal Port

MINI-LINK radio and access module are provided with a communication port, the terminal port, which gives access to the full range of CSS utilities. With a computer (or pocket terminal) connected to this port you can read any alarm and status signal known by the CSS in any MINI-LINK radio. It is also possible to set RF channel number, command loops, turn transmitter on/off, read performance data, activate special functions, etc.

Internal and External Alarm Channels

Radio terminals exchange CSS information via the Internal and External Alarm Channels.

The Internal Alarm Channel (IAC) is a data link across the hop for exchange of CSS information between the two radio terminals at each end.

The External Alarm Channel (EAC) is used for building operation and maintenance networks. It is a data bus for exchange of CSS information between terminals at the same site.

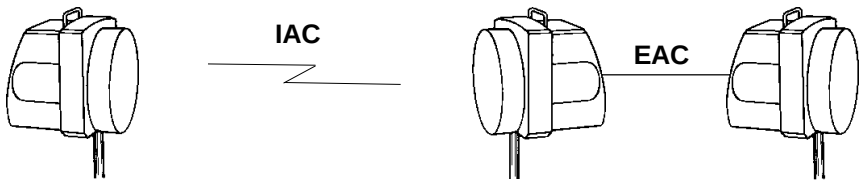


Figure 4-2. Internal and external alarm channels.

Alarm Collection

All locally generated alarms are collected and evaluated in CSS. Alarms are concentrated to summary alarms that activate local parallel outputs. All alarms may also be read on a PC or a pocket terminal connected to a terminal port at the MINI-LINK radio or access module. Furthermore, the alarm signals are transmitted along with the traffic data over the radio channel, and may be supervised from any MINI-LINK site, or transferred via the PSTN (Public Subscribed Telephone Network) to an operation and maintenance central.

Control

CSS handles certain functions, such as Transmitter Off, loop-back etc. These functions can be controlled from any radio site within the system. Transmitter Off may also be controlled from a local hardware input.

Performance monitoring

CSS monitors transmission performance, according to CCIR Rec 613-4 (and CCITT G.821), by checking bit errors in MINI-LINK frames. Current performance data are available from any radio site within the system.

MINI-LINK Network Manager (MNM)

The MINI-LINK Network Manager is a computer software package for the MINI-LINK control and supervision system. It can be used for network status presentation, detailed alarm and status presentation, performance monitoring, alarm log file generation, command handling, automatic status polling, network audit etc.

The MINI-LINK Network Manager is designed both for centralized unattended supervision of MINI-LINK products connected to a MINI-LINK control and supervision network and for installation, configuration, operation and fault location in the field.

Pocket Terminal

The MINI-LINK Control and Supervision System comes with a terminal driver adapted for Pocket Terminal. See separate manual for a description of how to use the pocket terminal.

Frequency Setting

The operating transmit and receive frequency (frequency channel number) in the microwave unit is selected via CSS.

Software Setup

In a MINI-LINK operation and maintenance network, each radio (and SMM) must have its own unique identity. This identity, the identity for remote radio and the identities for other radios (and SMMs) on the site are stored in an EE-PROM. RF-channel number, threshold for AGC alarm, etc are also stored in this EE-PROM.

4.2 Local Supervision

4.2.1 Radio Frequency Channel Setting

The CSS handles setting of the microwave unit for transmission and reception on the required channel frequencies. The current channel number is stored in a non-volatile memory. The current channel number can be read on the alphanumeric display and a new channel selected by entering its number with the toggle switch on the connector field.

Reading channel number

Under normal conditions the display shows a number, that indicates the frequency band in which the equipment operates. Error code “Err xxxx” indicates an abnormal condition.

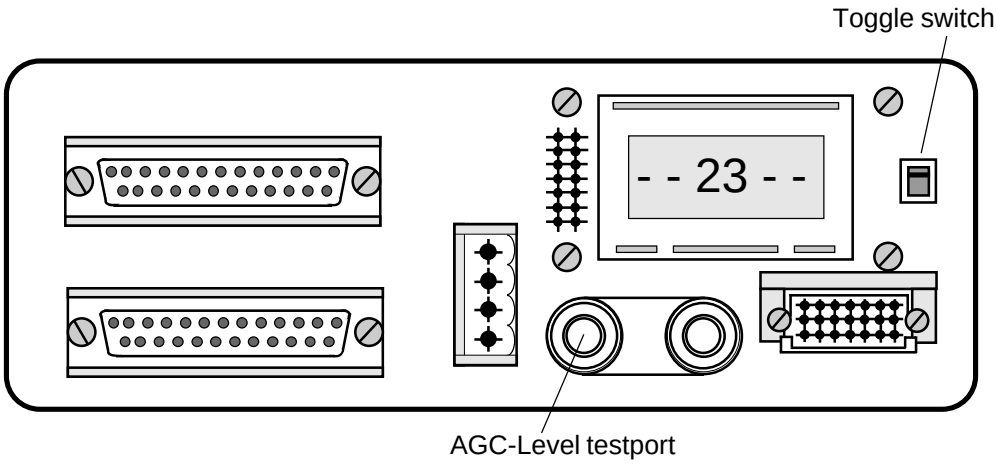


Figure 4-3. Connection field.

When you press the toggle switch DOWN, five digits are displayed. The first three digits indicate the current channel number. The two following digits show the frequency index.

After about five seconds the display returns to idle mode.

Setting channel number

Press the toggle switch DOWN and then UP to enter the channel number slow-step mode.

Increment channel number by pressing the toggle switch UP once, decrement channel number by pressing the toggle switch DOWN once.

Hold the toggle switch in UP or DOWN position get to the fast-step mode where the channel number is changed in steps of ten. The fast-step mode is left for the slow step mode as soon as the toggle switch is released.

The slow-step mode is left five seconds after the last touch of the toggle switch. Then the radio module is set to the new RF channel, and the new channel number is stored in non-volatile memory.

Error codes

If CSS is unable to set RF channel frequencies, an error code is displayed.

Error codes	Error definitions	Measures
Err-0001	No Microwave unit connected.	Check internal cabling.
Err-0002	Non-valid subband code.	Check cables and settings on Microwave unit. See 4.10.3.
Err-0003	A valid channel is not selected yet. At delivery the channel number is set to 0 to make the transmitter stay turned off.	This error code will disappear when a channel is selected.

Figure 4-4. Error codes.

4.2.2 AGC-Level Testport

The AGC-level corresponding to the RF input level can be measured by a voltmeter. For further information see section “3.10.2 Alignments Procedure”.

4.2.3 Wake Up Received

An open drain hardware output is provided which purpose is to activate some kind of alert mechanism. The output is activated when a new alarm has been detected and is deactivated when the alarm information is read via a computer or pocket terminal or after 15 minutes.

4.2.4 Alarm Outputs

The CSS continuously monitors a number of internal test points to detect any abnormal condition like loss of incoming traffic, loss of frame sync, transmitter frequency unlocked, low received RF level, high BER, etc and sets the corresponding alarm signal.

The alarm signals are concentrated into four summary alarms:

Alarm Signal	Description
Radio Alarm	Suggests a faulty radio module.
TX Alarm	Indicates that a failure has been detected on transmit side.
RX Alarm	Indicates that a failure has been detected on receive side.
AGC Level Alarm	Generated when the RF input level falls below the alarm threshold. At delivery the threshold level is set to -70 dBm, but can be changed via the terminal port.

Figure 4-5. Description of summary alarms.

These summary alarms are available in parallel form at the connector field. They are used to control switches in a protected hop and for external supervision, that is connection to user's own supervision system.

See section “4.5 Alarms” for a full list of alarm signals and the corresponding conditions.

Loss of DC Power

When the supply voltages, either to the SMM or between the SMM and the radio, fall below the point where the equipment is working properly, both Radio Alarm, TX Alarm, RX Alarm and AGC Level Alarm go active.

4.2.5 User In/Out (NORMAL mode)

Note! The information, in this section, about User Input/Output is only valid when User Mode is set to NORMAL, which is the default setting. User Mode is changed from the Setup Menu, see section 4.8.1 for other options.

Two user inputs (User In 1 and User In 2) are provided for distributing of environmental alarm signals to two corresponding user outputs (User Out 1 and User Out 2) at the remote radio terminal. Two user outputs are provided for receiving the same type of alarm signals from two corresponding user inputs at the remote radio terminal.

4.2.6 Insertion of AIS

An AIS (Alarm Indicating Signal) consisting of only "1"s is generated at the traffic output when any of the following alarm signals is active or any of the following loops is commanded:

- BER Alarm
- Radio ID Alarm
- Radio Frame 1
- Radio Frame 2
- Baseband Receive Loop 1
- Baseband Receive Loop 2

- Remote MINI-LINK, Input traffic 1
- Remote MINI-LINK, Input traffic 2
- Remote MINI-LINK, Baseband transmit loop
- Remote MINI-LINK, RF loop

For description of the alarm signals and loops see section “4.5 Alarms” and ”4.6 Controls” respectively.

4.3 Network Supervision

The Control and Supervision System (CSS) in the MINI-LINK radios (and SMMs) support building of network for operation and maintenance.

When configuring a network site:

- All MINI-LINK equipment on the same site must be connected via EAC, see section “3.6.2 EAC Cabling”.
- Each radio must be given an unique identity. This identity, identity for remote radio and identities for other radios (and SMMs) on the site are stored in an EE PROM together with RF channel number, threshold for AGC alarm etc, see section “4.4 Software Setup”.

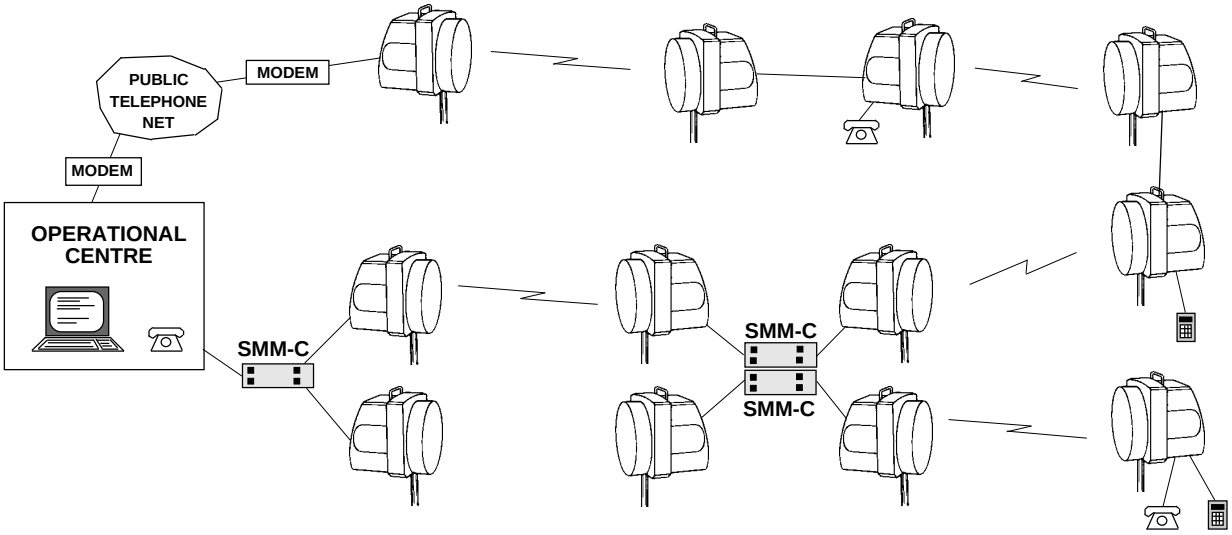


Figure 4-6. Operation and maintenance network.

4.4 Software Setup

For a radio in a MINI-LINK operation and maintenance network, the EE-PROM in the baseband unit has to be set up before the system can work as desired.

Software Setup	Description
Standby Mode	When Hot Standby is set to OFF the radio terminal is initiated for operation in unprotected mode or Working Standby mode. When Hot Standby is set to ON the radio terminal is initiated for operation in Hot Standby mode. Default=OFF.
Near Radio ID	Identity of the near end radio terminal, see 4.4.1 for description.
Far Radio ID	Identity of the far end radio terminal, see 4.4.1 for description.
Near Standby Radio ID	Only valid when Hot Standby=ON. Identity of the other near end radio terminal in a protected pair, see 4.4.3 for description.
Far Standby Radio ID	Only valid when Hot Standby=ON. Identity of the other far end radio terminal in a protected pair, see 4.4.3 for description.
AGC Alarm Threshold	The AGC threshold value as the RF input level in dBm. Valid range is -99 dBm to -30 dBm. Default=-70 dBm.
Bitrate (Mbit/s)	Fixed from hardware, can not be changed.
Traffic Channel 1	Only valid for bitrate 2x2 and 2x8 Mbps. Traffic channel 1 should be set to ON if channel 1 is used. When channel 1 is set to OFF the alarms signal Traffic 1 which indicates loss of traffic on traffic channel 1 is disabled. Default=ON.
Traffic Channel 2	Same as traffic channel 1 but for traffic channel 2. Default=ON.
Radio ID Check	When Radio ID Check is set to ON the identity on the received bitstream is checked, see 4.4.4 for description. When it is set to OFF no identity is checked. Default=OFF.
RF Output Power	Adjustment of transmitter output power for MINI-LINK 15-C, 23-C and 26-C High Power. (This function is not available with MNM LZY 202 307 version < 1.4)
User 1 Mode	When User 1 Mode is set to NORMAL, User Output 1 is controlled from User Input 1 at the remote radio terminal. When User 1 Mode is set to SPECIAL the output can be toggled via the computer or pocket terminal. Default=Normal.
User 2 Mode	Same as User 1 Mode but for User Output 2. Default=Normal.
Frequency Channel Number	Channel number for operating frequency, see chapter 3.9 for calculation.
Frequency Index	Fixed from hardware, can not be changed.
EAC identities	Identities to all other radio or SMM equipment connected to the EAC bus at the same site, see 4.4.1 for description.

Figure 4-7. Description of software setup for MINI-LINK radio.

4.4.1 Standby Mode

Radio terminals are instructed to work in either Hot Standby mode or Working Standby mode.

Hot Standby Mode is used in:

- 1+1 protected hops with only one transmitter active.

Working Standby Mode is used in all other systems, that is:

- non protected hops
- 1+1 protected hops with frequency diversity
- 2+1 protected hops.

When a protected hop works in Hot Standby mode, the two radio terminals which are not active cannot communicate via IAC. Instead they exchange alarm and control information via EAC and the active radio terminals. This requires entering of identities for the two additional radio terminals in the protected hop.

4.4.2 Identities

Every terminal in the MINI-LINK network must have an unique identity . It must also know the identity of the remote terminal (on the other side of the hop) and the identities to other members connected to the External Alarm Channel (EAC). An identity has four digits or letters.

The radio terminal itself is referred to as Near Radio, and the remote radio terminal is referred to as Far Radio. Identities of terminals connected to the EAC bus are listed in a table called “EAC ID” table.

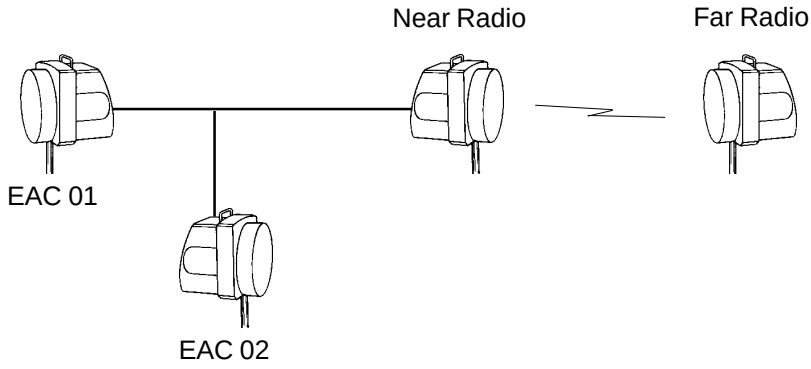


Figure 4-8. Network identities.

Restricted Identities

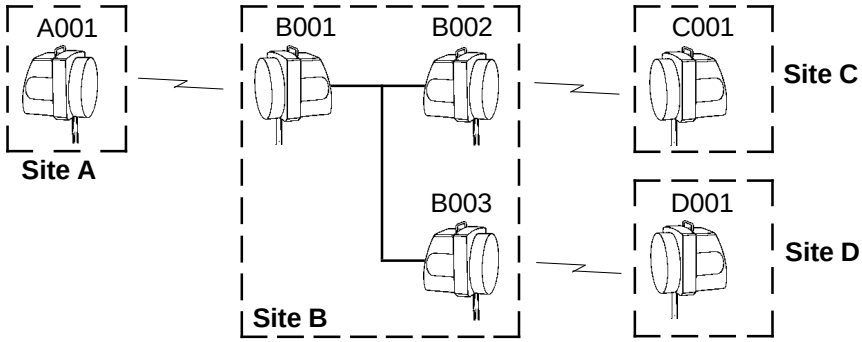
AAAA, TRMA, TRMB, SMMA and SMMB must not be used as identities. BBBB is reserved for nonexisting equipment.

4.4.3 Example of Identities for a Network

Identities of the radio terminals is selected as shown in the figure below. The first letter in the identity is selected to be the same for all radio terminals at the same site.

The example below is valid for a network using ICM, ICM-C, RJB or ICU. When using SMM or SMM-C see separate manual. A separate manual for building of networks is also available.

Connect the computer or pocket terminal to each radio terminal in the network and set the identity for the radio terminals as listed in table.



Terminal	Near Radio ID	Far Radio ID	Num of TRMs on EAC*	EAC ID 01	EAC ID 02
A001	A001	B001	00	-	-
B001	B001	A001	02	B002	B003
B002	B002	C001	02	B001	B003
B003	B003	D001	02	B001	B002
C001	C001	B002	00	-	-
D001	D001	B003	00	-	-

*Only for pocket terminal.

Figure 4-9. An example of identities for radio terminals in a network.

See SMM-C user's manual for more examples (with access modules).

4.4.4 Radio ID Check

The purpose of the Radio ID option is to eliminate reception of traffic from any other radio but the correct remote radio.

When Radio ID is set to ON, the identity of the received bitstream is checked. If the identity differs from the ”Far Radio ID” in EE-PROM, a Radio ID Alarm signal is generated and AIS is inserted in the received traffic channel.

4.4.5 Change of Software Setup

All setup, except for "Near SMM ID" and "Near Radio ID", can be made when the computer or pocket terminal is connected to any SMM or radio in the supervision net. The "Near SMM ID" can only be changed from the SMM to which the computer or pocket terminal is connected, not to loose supervision contact by mistake. In the same way, to change "Near Radio ID" the computer or pocket terminal must be connected to that radio or to its SMM.

4.5 Alarms

A number of different alarm signals are generated in the radio.

Alarm	Description
RF Input	Received RF input signal level drops below about -90 dBm (data rate dependent).
RX Frequency	The receiver frequency synthesizers loop is unlocked.
AGC Lev. XX dBm	AGC level below threshold (default: -70 dBm). XX dBm shows current RF input level (in the range -99 to -30 dBm).
BER	The bit error rate on the received signal exceeds 10^{-3}. BER is estimated by measuring the actual BER on frame bits in the composite bit stream.
Radio Frame 1	The MINI-LINK fails to synchronize to frames on the received composite bit stream.
Radio Frame 2	The MINI-LINK fails to synchronize to frames on the received composite bit stream. Only valid for configurations 2x2 and 2x8 Mbit/s.
Radio ID	Received traffic comes from a radio terminal with an identity not matching the remote identity as entered from the Setup menu. This alarm can only be active if the Radio ID is set to ON.
AIS Inserted	AIS inserted is activated when the processor has inserted an AIS, that is when BER or Radio ID alarm is detected or when RF or Baseband transmit loop is set in remote radio. AIS is also inserted for an error in frequency setting. Note: AIS inserted via the hardware, that is for Radio frame , Baseband receive loop and remote Input traffic is not indicated by this alarm.
Output Traffic 1	Outgoing traffic (to MUX) is faulty or lost on traffic channel 1.
Output Traffic 2	Outgoing traffic (to MUX) is faulty or lost on traffic channel 2. Only valid for 2x2 and 2x8 Mbit/s.
Input Traffic 1	Incoming traffic (from MUX) is faulty or lost on traffic channel 1.
Input Traffic 2	Incoming traffic (from MUX) is faulty or lost on traffic channel 2. Only valid for 2x2 and 2x8 Mbit/s.
TX Frequency	The transmitter frequency synthesizer loop is unlocked. Generated alarm activates transmitter OFF.
RF Output	Transmitter output power failure.
BUS	Fault is detected in the internal or external alarm channels or terminal interface RS 232.
Processor	A fault is found in the processor including program memory, non-volatile memory or random access memory.
Summary	Concentrated alarms, detailed information is given below.

Figure 4-10.Alarm signals.

The computer or pocket terminal displays current alarm status of the radio.

Active alarms are indicated on the display by an asterisk “*”. Alarms that have been but are no longer active are stored in an alarm buffer until you read them. These alarms are indicated by a “b” for a short time (depending on pollrate) and stored in alarm log files.

Summary Alarm

Alarm Signal	Description
Radio Alarm	Radio Alarm suggests a faulty radio module. It is generated when any of the following alarms is active: - Transmitter Frequency Alarm - RF Output Alarm - RF Input Alarm - Receiver Frequency Alarm - Radio Frame 1 and 2 - Output Traffic 1 and 2 - BER Alarm
TX Alarm	Indicates that a failure has been detected on transmit side. It is generated when any of the following alarm signals is active: - Input Traffic 1 and 2 - Transmitter Frequency Alarm - RF Output Alarm
RX Alarm	Indicates that a failure has been detected on receive side. It is generated when any of the following alarm signals is active: - RF Input Alarm - Receiver Frequency Alarm - Radio Frame 1 and 2 - Radio ID Alarm - Output Traffic 1 and 2 - BER Alarm - Remote MINI-LINK Input Traffic 1 and 2.
AGC Level Alarm	AGC Level Alarm is generated when the RF input level falls below the alarm threshold. At delivery the threshold level is set to -70 dBm, but can be changed via the terminal port.

Figure 4-11.Description of summary alarms.

4.5.1 Alarm Notification

When a new alarm has been detected anywhere in the MINI-LINK network a notification message is sent to all radio modules and SMMs in the network through the alarm channel.

When a PC is connected to the network, the alarm notification is displayed on the screen. The alarm information is also stored in separate files for each terminal.

An open drain hardware output is also provided. Its purpose is to activate some kind of alert mechanism. The output is activated by the notification message and is deactivated when the alarm information is read by a computer or pocket terminal or after 15 minutes.

4.6 Control

The following functions can be controlled via the computer from the control menu:

Control	Description
P-marking	When P-marking is activated, all alarm signals are generated and can be read as normal, but wake-up signals and radio alarm output are inhibited.
Transmitter	Turns the RF output power ON/OFF.
RF Loop	When Radio Frequency Loop is activated, a sample of the transmitted RF signal is shifted in frequency and fed back into the receiver.
BB TX Loop	Baseband Transmit Loop loops back the transmit side composte bit stream(s) to the receive side.
BB RX Loop	Baseband Receive Loop 1 and 2 loop back received traffic signals after regeneration and line decoding to the transmit side of the remote radio terminal.

Figure 4-12.Control functions.

4.6.1 P-marking

A valuable facility during fault location is P-marking which inhibits wake-up signals and summary alarm signals.

When P-marking is activated, all alarm signals are generated and can be read as normal, but wake-up signals and radio alarm output are inhibited.

Note: The P-marking has to be activated at both near end and far end radio terminals.

4.6.2 Transmitter

Transmitter (ON/OFF) turns the RF output power ON or OFF.

TX OFF can be controlled from the Control menu, or from the TX OFF hardware input.

Note! A transmitter turned OFF from the TX OFF hardware input can not be turned on from the pocket terminal or computer.

4.6.3 RF Loop

Note: Only available for MINI-LINK 15-C and 23-C.

When RF Loop is activated, a sample of the transmitted RF Loop signal is shifted in frequency and fed back into the receiver.

Note! Turn OFF the transmitter of the remote radio terminal before activating RF Loop. Nothing will break but the measurement may be of limited value since the received RF signal will interfere with the looped signal.

RF Loop cannot be activated through IAC, i.e. from the remote radio terminal, since looping breaks the IAC connection and would make it impossible to deactivate RF Loop.

When RF Loop is activated, the remote radio terminal will insert AIS on its outgoing traffic.

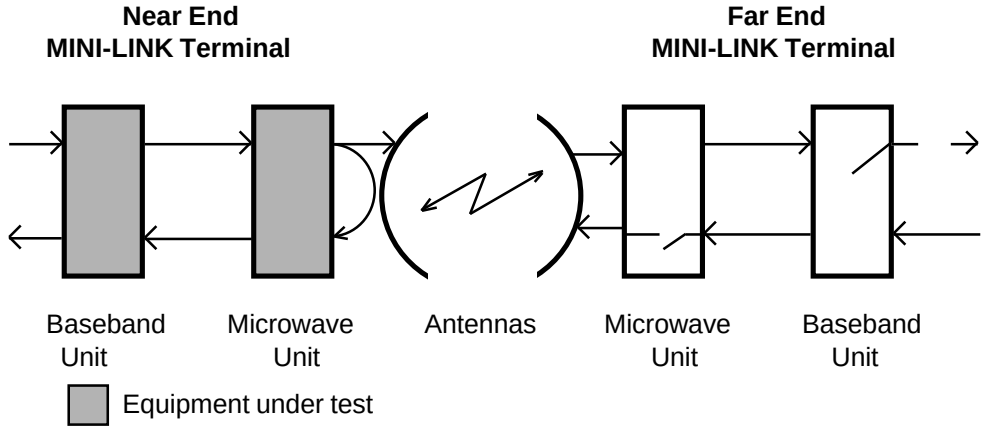


Figure 4-13. RF Loop.

4.6.4 BB TX Loop

Baseband Transmit Loop loops back the transmit side composite bit stream(s) to the receive side.

Baseband Transmit Loop cannot be activated through IAC, i.e. from the remote radio terminal, since looping breaks the IAC connection and would make it impossible to deactivate Baseband Transmit Loop.

When Baseband Transmit Loop is activated, the remote radio terminal will insert AIS on its outgoing traffic.

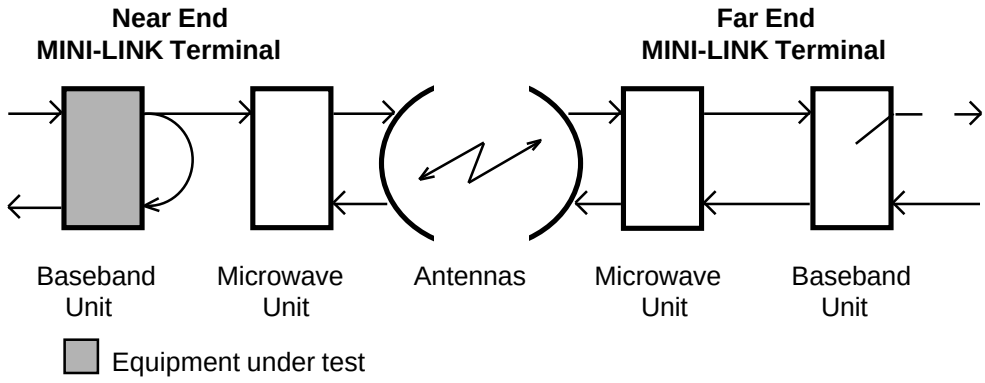


Figure 4-14. Baseband Transmit Loop.

4.6.5 BB RX Loops

Baseband Receive Loop 1 and 2 loop back received traffic signals after regeneration and line decoding to the transmit side of the remote radio terminal. There is no Baseband Receive Loop 2 in equipment with only one traffic channel. Both loops can be activated individually.

When a BB RX loop is activated, the remote radio terminal will insert AIS on its outgoing traffic.

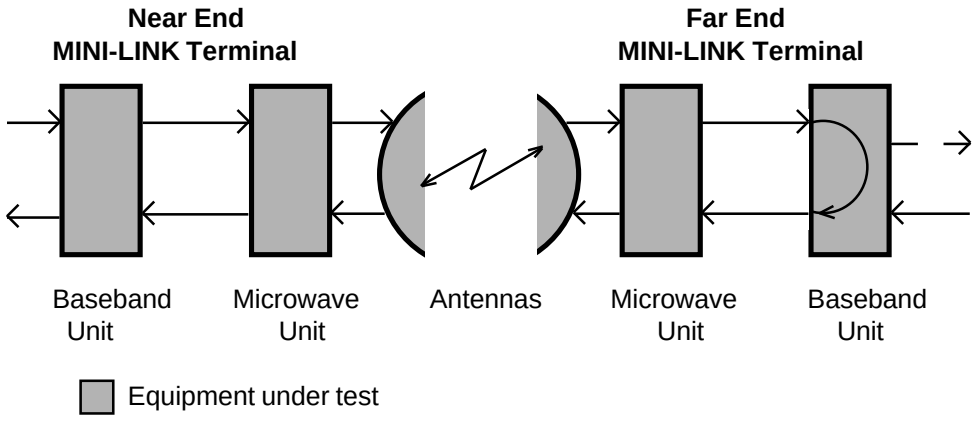


Figure 4-15. Baseband Receive Loops.

4.7 Performance Monitoring

CSS monitors transmission performance, according to CCIR Rep 613-4 (and ITU-T G.821), on the receiver side by checking for bit errors in MINI-LINK frames. Current performance data are available from any radio terminal within the system.

The following data are displayed on the computer:

Performance values	Description	Maximum values
Total seconds	Seconds since last reset.	67108863 sec (777 days)
UAS - Unavailable seconds	BER >10^{-3} for more than 10 consecutive seconds.	524287 sec (6 days)
SES - Severely Errored Seconds	Seconds with BER >10^{-3} (excluding UAS).	524287 sec (6 days)
DM - Degraded Minutes	Minutes with BER >10^{-6} (excluding UAS).	8191 min (6 days)
ES - Errored Seconds	Seconds with any error (excluding UAS and SES).	524287 sec (6 days)

Figure 4-16. Description of performance values.

Percentage values can be calculated manually from the displayed values.

Accumulated data are saved in non-volatile memory once a day. Should the power supply be interrupted, loss of performance data is limited to at most the last 18 hours.

Under normal conditions performance data of more than one year of continuous operation can be accumulated. However, if one counter overflows, all counters are stopped and no more data can be accumulated. This overflow condition is indicated on the PC or pocket terminal.

All performance counters can be cleared by the command Reset.

4.8 Miscellaneous Functions

4.8.1 User In/Out (SPECIAL mode)

Note! The information, in this section, about User Input/Output is only valid when User Mode is set to SPECIAL. See section 4.2.5 for other options.

It is possible to collect user's environmental alarms into the PC or pocket terminal, for example a fire alarm or power supply alarm. It is also possible to control user's functions via a PC and pocket terminal, for example starting air condition equipment.

Two user inputs (User In 1 and User In 2) and two user outputs (User Out 1 and User Out 2) are available at each MINI-LINK radio (and SMM).

When the user output shall be used to control user's functions via PC or pocket terminal, the User Mode option must be setup to SPECIAL. Special mode option may be assigned to one or both outputs. User mode is changed from the Setup menu.

The status of User In can be read from Alarm menu in both special and normal mode.

4.8.2 Service Channel Test

A Service Channel Test tone can be activated from the Misc menu. This test tone is sent on all service channels for about fifteen seconds.

4.8.3 Restore Terminal

The Restore Terminal facility is useful after installation and service. It clears the alarm buffer and the wake up list. It also deactivates all loops and Tx off. (Tx off commanded from the parallel input is not affected.)

Restore Terminal is initiated from the Misc menu.

Traffic is not interrupted or disturbed by Restore Terminal.

4.8.4 Call In/Call Out

A Call In signal from the service telephone equipment can be sent from the MINI-LINK radio to the Call Out ports on all other SMMs and radio terminals in the MINI-LINK network. The signals are available in the TERM/SC plugs on the front of the SMMs and ICMs.

4.9 Fault Localization in Field

4.9.1 Introduction

The aim of the fault location in the field is to locate the defective module. The defective module shall then be replaced and sent to the local repair center or to Ericsson. The fault shall be located to one of the following items:

1. The external equipment, connected to the MINI-LINK.

2. Radio module (on either side).

3. Path items, i.e. waveguide, feeder, alignment of antenna or obstructions in the path.

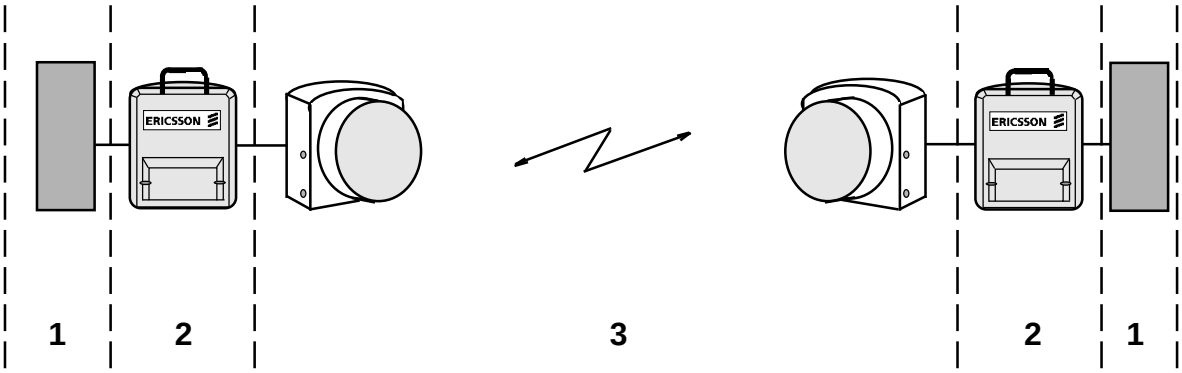


Figure 4-17. Figure showing different areas when locating faults in the field.

A majority of the possible faults is covered by the fault location procedure below. Faults in alarm detection and some dual faults are not covered.

When a radio module has been replaced, the software has to be set again. This can be done in field with a pocket terminal or a PC, or at the repair center. Setting at the repair center requires connection of power.

4.9.2 Fault Location Procedure using MNM for PC

- In main window, check if any terminal has STATUS=WARNING. If so, reset all loops and set transmitter to ON for this terminal.
- Check the terminal window for terminals with STATUS=critical or not OK.
- Follow the instructions in the table below.

<table>
<tr><th>Alarm</th><th colspan="2">Action</th></tr>
<tr><td>RF Input</td><td colspan="2">- Action 1, see description below.</td></tr>
<tr><td>RX Frequency</td><td colspan="2">- Replace the radio module.</td></tr>
<tr><td>AGC</td><td colspan="2">- Action 1, see description below.</td></tr>
<tr><td>BER</td><td colspan="2">- Action 1, see description below.</td></tr>
<tr><td>Radio Frame 1 or 2</td><td colspan="2">- Action 1, see description below.</td></tr>
<tr><td>Radio ID</td><td colspan="2">- Action 1, see description below.</td></tr>
<tr><td>Output Traffic 1 or 2</td><td colspan="2">- Replace the radio module.</td></tr>
<tr><td>Input Traffic 1 or 2</td><td colspan="2">- Check the traffic cables at the remote radio and the external equipment connected to the traffic input.
- Check the cable between radio and access module.</td></tr>
<tr><td>TX Frequency</td><td colspan="2">- Replace the radio module.</td></tr>
<tr><td>RF Output</td><td colspan="2">- Replace the radio module.</td></tr>
<tr><td rowspan="6">Bus</td><td colspan="2">- Check the Bus alarm window.</td></tr>
<tr><td colspan="2">- Follow the instruction below.</td></tr>
<tr><td>Alarm</td><td>Action</td></tr>
<tr><td>RS232</td><td>- Check cable to computer or pocket terminal.</td></tr>
<tr><td>EAC</td><td>- Check EAC cables and twisting of wires.
- Check that the identities are properly set in all terminals on site.
- Contact Ericsson.</td></tr>
<tr><td>IAC</td><td>- Check other alarms on near and far radios.
- Check that the identities are properly set in all terminals on site.
- Contact Ericsson.</td></tr>
<tr><td>Processor</td><td colspan="2">Replace the radio module.</td></tr>
</table>

Action 1

Check the AGC-level and alarms at the remote MINI-LINK radio.

a) If the AGC-level is low at both sides, check path items and path calculations.

b) If the remote radio has TX-frequency alarm, replace the remote radio module.

c) If the remote radio has no alarms and the AGC-level is alright, replace the near end radio module.

4.10 Fault Localization at Repair Center

WARNING - Be careful when the cover is off. Due to DC supply, hazardous voltage (>60 V) may exist on the boards.

To avoid Microwave radiation:
Do not leave the Waveguide and RF port on the Microwave Unit open when the power supply is on.

4.10.1 Fault Location Procedure

The text below describes the fault location procedures at the repair center. The aim is to locate a fault to a subunit in the radio module, i.e. baseband or microwave unit.

The following instruments are required:

- Power supply.
- Signal generator for traffic signal.
- PC or pocket terminal.
- BER-detector, for checking after replacement.

For replacement of unit the following tool is required:

- Torx screwdriver TX 15.

Fault Location Instructions

- Connect the signal generator and BER detector to the traffic port.
- Check the radio alarms using the computer or pocket terminal and compare the alarm status with the list below. This will show which unit that is most probably causing the fault.
- Replace the unit which is causing the fault and check again.
- If the radio module still fails then replace the other unit and check again.
- If it still fails, after both units have been replaced, send it to Ericsson.

RFOUT	TXFR	RFIN	RXFR	ITRF1 and ITFR2	BER	OTRF1 and OTRF2	RFF1 and RFF2	PROC	BUS	AGC	Baseband unit	Microwave unit
-	-	-	-	-	-	-	-	-	-	-	X	
+	+	+	+	●	+	+	+	+	+	+	X	
●	+	+	+	+	+	+	+	+	+	+		X
+	●	+	+	+	+	+	+	+	+	+		X
+	+	+	●	+	+	+	+	+	+	+		X
+	+	+	+	+	+	+	+	●	+	+	X	
+	+	+	+	+	+	+	+	+	●	+	X	
+	+	+	+	+	+	+	●	+	+	+		X
+	+	+	+	+	+	●	+	+	+	+	X	
Service channel fault											X	
Other combinations												X

- no alarm ● alarm + any status

4.10.2 Replacement of faulty Unit

Baseband Unit

- Undo the 14 screws ① using the torx screwdriver TX 20 (M4) and dismount the vertical frame from the radio module.
- Unplug the ribbon cable ② from the baseband unit.
- Unplug the 2 cables ③ from the microwave unit and undo the cable clamp ④.
- Undo and remove the 9 screws ⑤ using the torx screwdriver TX 20 (M4) from the baseband unit.
- Replace the faulty baseband unit with the new one.
- Fasten the 9 screws ⑤ on the unit.
- Connect the 2 cables ③ to the unit as before and fasten the cable clamp ④.
- Connect the ribbon cable ② to the baseband unit.
- Place the vertical frame on the radio module and fasten the screws ①.
- Set the software, see section 4.4. The software setting can be done at the repair center, which requires connection of power, or in field using a pocket terminal or a PC.

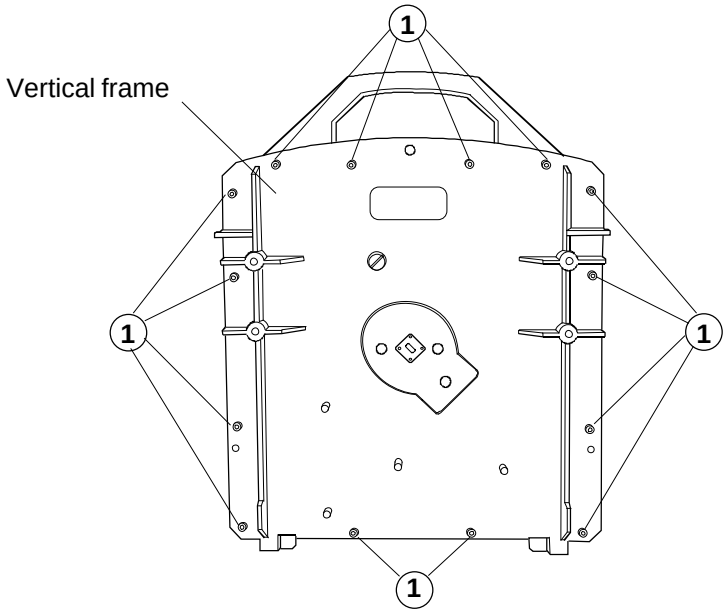


Figure 4-18. Radio module.

Baseband Unit with Software Revision < 3.1

The software revision can be read on the PROM label ⑥. A baseband unit with software revision < 3.1 can **not** be used in a 15, 26 or 38 GHz radio.

- If a baseband unit with PROM revision < 3.1 shall be used in a 23 GHz radio, connect position S1 on the microwave unit (see section 4.10.3).

Note: The baseband unit does not include cover, while the microwave unit includes the vertical frame.

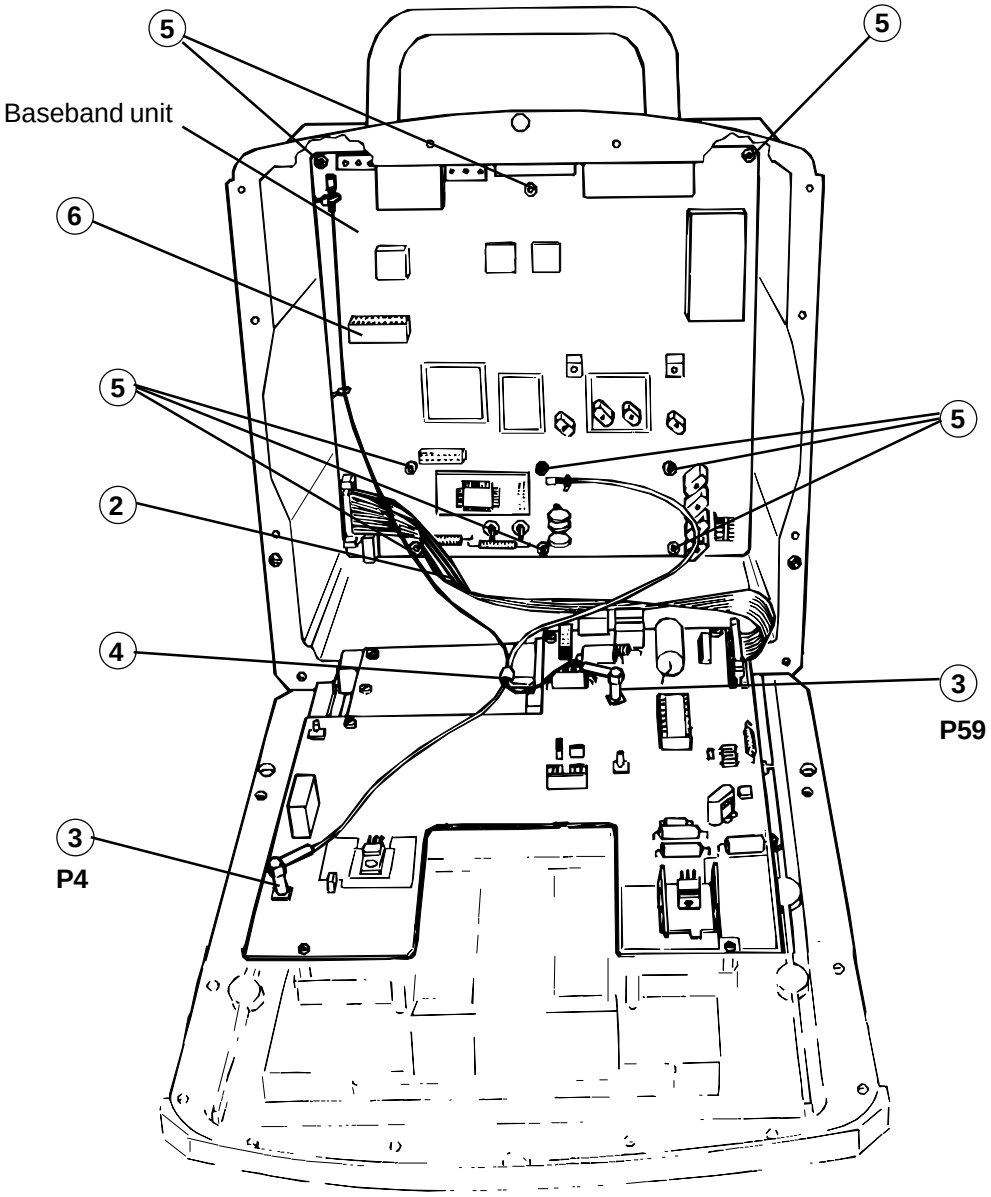


Figure 4-19. Baseband unit and microwave unit in radio module.

When the faulty unit is replaced send it to Ericsson together with a failure report (see Appendices). Please use the original package for safe shipping.

Mail
Ericsson Microwave Systems AB
P.O Box 22150
S-500 02 BORÅS
SWEDEN

Goods Address
Ericsson Microwave Systems AB
Sandlidsgatan 3
S-500 02 BORÅS
SWEDEN

Telephone Switchboard: +46 33 179600

Telefax: +46 33 133270

Microwave Unit

- Undo the 14 screws ① using the torx screwdriver TX 20 (M4) and dismount the vertical frame from the radio module.
- Unplug the ribbon cable ② .
- Unplug the 2 cables ③ from the microwave unit and undo the cable clamp ④ .
- Replace the faulty microwave unit with a new one.
- Connect the 2 cables ③ to the unit as before and fasten the cable clamp ④ .
- Connect the ribbon ② cable to the microwave unit.
- Place the vertical frame on the radio module and fasten the screws ① .

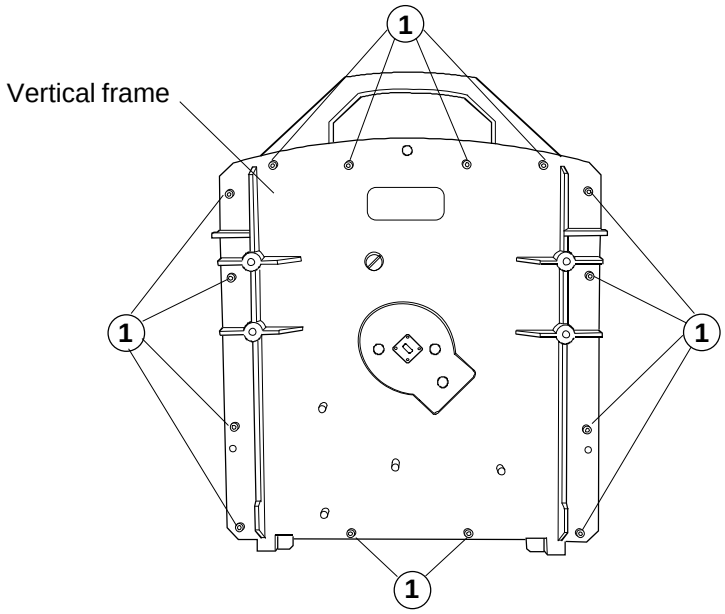


Figure 4-20. Radio module.

Note: The baseband unit does not include cover, while the microwave unit includes the vertical frame.

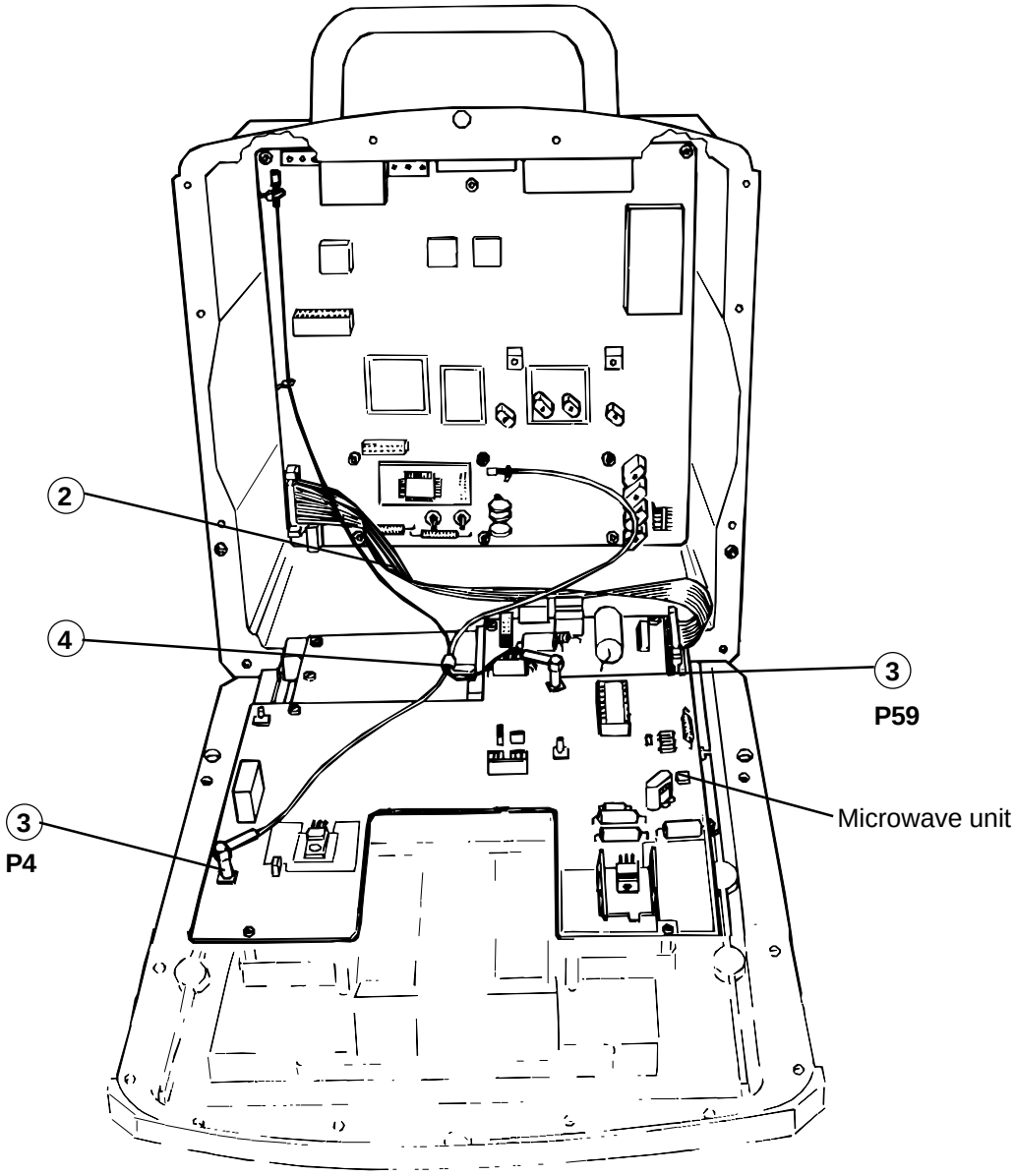


Figure 4-21. Baseband unit and microwave unit in radio module.

When the faulty unit is replaced send it to Ericsson together with a failure report (see Appendices). Please use the original package for safe shipping.

Mail

Ericsson Microwave Systems AB
P.O Box 22150
S-500 02 BORÅS
SWEDEN

Goods Address

Ericsson Microwave Systems AB
Sandlidsgatan 3
S-500 02 BORÅS
SWEDEN

Telephone Switchboard: +46 33 179600

Telefax: +46 33 133270

4.10.3 Microwave Unit Setting

The position S1 on the microwave unit shall **not** be connected. (S1 is only connected if a baseband unit with software revision < 3.1 is used.)

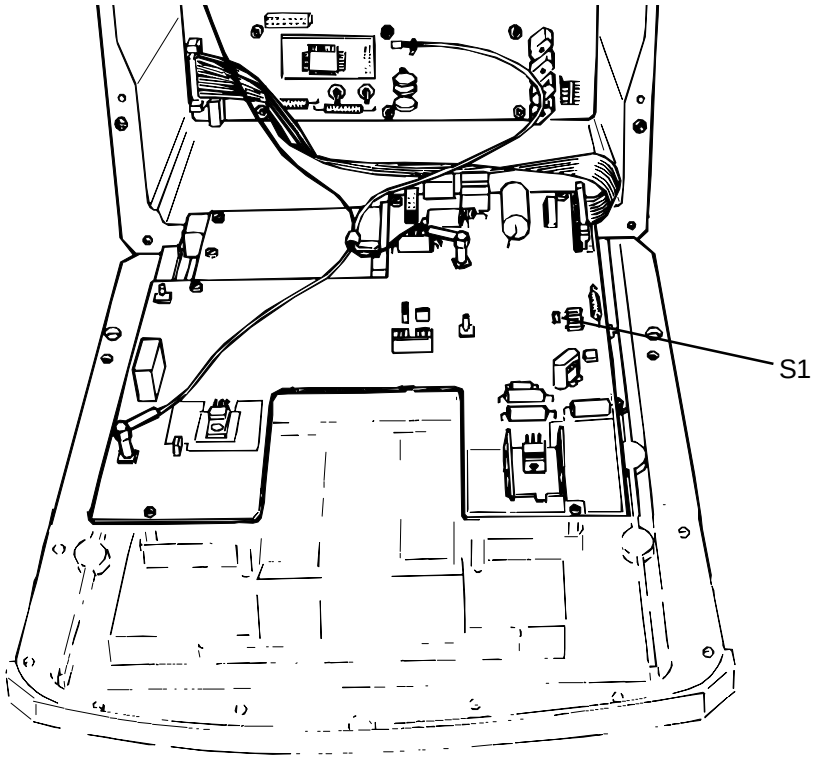


Figure 4-22. Position of S1 on the microwave unit.

4.11 Connection of PC

Connect the MINI-LINK Terminal Port to one of your PC's COM ports, as shown in table below. Consult section "3.7 Trimming the Cables and Assembling" for assembling of jacks.

Connection of RS-232 (or V.24) at PC				Connection to MINI-LINK	
9-Pin	**25-Pin**	**Name**	**Note**	**Name**	**Connector: pin no**
3	2	TD, Transmit Data	From PC	RS 232 to radio	P1:18 or P3:B04
2	3	RD, Receive Data	To PC	RS 232 from radio	P1:5 or P3:B02
5	7	SG, Signal Ground		0 V	P2:6 or P3:C02

The MINI-LINK PC Cable TSR 753 2002/3000, TSR 758 2001/600 or TSR 758 2002/600 can be connected to P3.

4.12 Connection of Modem

Short-haul modems or modems for connection to the public telephone network (PSTN) can be connected to the Terminal Port.

The table below gives information on how to connect the modem. The information should be used as a guideline. For exact instructions consult the manual for the modem.

Connection of 25-pin RS-232 (or V.24) connector			**Connection to MINI-LINK**	
Pin	**Name**	**Note**	**Name**	**Connector: pin no**
2	TD, Transmit Data	To modem	RS 232 from radio	P1:5 or P3:B02
3	RD, Receive Data	From modem	RS 232 to radio	P1:18 or P3:B04
7	SG, Signal Ground		0 V	P2:6 or P3:C02
20	Connect Data Set to Line	To modem	Modem Connect, see below	P1:6 or P3:C06 (optional)

An output for +10 Volt DC at P6 and P3:B08 is provided for powering a short-haul modem.

4.12.1 Modem Connect

A Modem Connect signal is provided for dial-up modems with automatic calling facilities. The signal goes low for 0.6 seconds when an alarm occurs in the MINI-LINK network.

4.12.2 How to Set Up a Modem

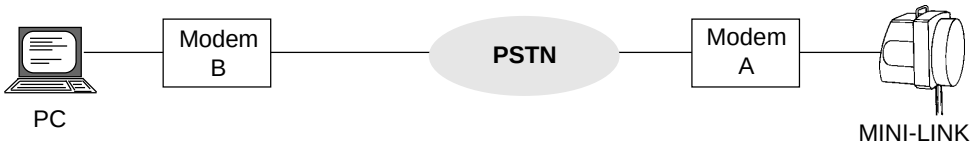


Figure 4-23. MINI-LINK supervision via modems

The PC shall be connected to the modem via the serial COM port, and the modem shall be connected to the MINI-LINK equipment in accordance with the table on the previous page.

The calling and modem configurations shall be done outside MNM, preferably with Microsoft windows Terminal program. Use 1200 baud, 8 bit and no parity.

The modem shall be set to 1200 bps serial port speed and not use any speed control.

The AT commands below apply when using Ericsson V.34DT ZATR 809 1401/020 modem.

The DTR calling (108.1 / 108.2) can differ between modems, please consult the manual modem.

Calling from MNM to MINI-LINK

Modem A - MINI-LINK

AT&F0	Load factory default values from ROM.
ATS0=2	Automatic answer after two signals.
AT&D0	Ignore DTR to be able to exit the Terminal program without disconnecting.
AT&E3	No modem initiated flow control.
AT$SB1200	Set serial port baud rate to 1200 bps.
ATQ1	Suppress result codes.
AT&W0	Save configuration.

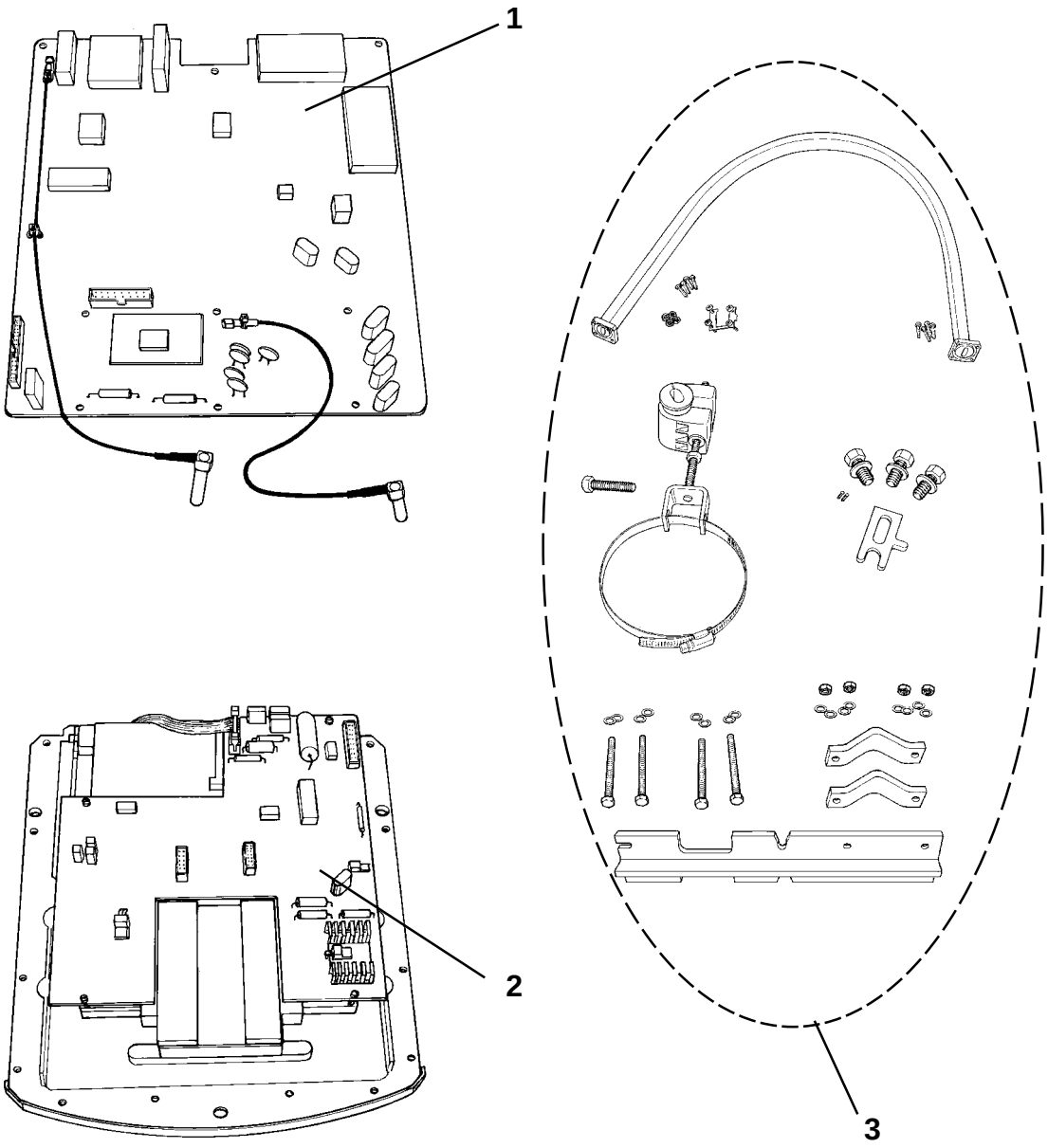
Modem B - MNM

AT&F0	Load factory default values from ROM.
AT&D0	Ignore DTR to be able to exit the Terminal program without disconnecting.
AT&E3	No modem initiated flow control.
AT$SB1200	Set serial port baud rate to 1200 bps.
AT&W0	Save configuration.

5. Spare Parts List

This chapter contains codes for radio, radio spare parts, antenna and antenna spare parts.

Ordering Code for Radio		
M L 2 T U 7 X Y Z / CD		
Letter	**Code**	**Description**
T	3	MINI-LINK 15-C
	5	MINI-LINK 23-C
	6	MINI-LINK 26-C
	8	MINI-LINK 38-C
U	0	Without variable attenuator (previous version)
	2	Variable attenuator
	3	High Power with variable attenuator
XY	02	2 Mbps traffic, high deviation
	04	8 Mbps traffic, high deviation
	12	2x2 Mbps traffic, high deviation
	14	2x8 Mbps traffic, high deviation
	54	2x8 Mbps traffic, low deviation
	62	2x2 Mbps traffic, low deviation
	64	8 Mbps traffic, low deviation
Z	1	Standard
	4	Extended lightning protection
CD	Frequency index, see section 7.11	


1
2
3

Radio Spare Parts		
Item	**Article Code**	**Description**
1	ROA 119 4600/2	Baseband Unit, 2 Mbit/s
	ROA 119 4642/2	Baseband Unit, 2x2 Mbit/s, high deviation
	ROA 119 4642/21	Baseband Unit, 2x2 Mbit/s, low deviation
	ROA 119 4600/1	Baseband Unit, 8 Mbit/s, high deviation
	ROA 119 4600/11	Baseband Unit, 8 Mbit/s, low deviation
	ROA 119 4584/1	Baseband Unit, 2x8 Mbit/s, high deviation
	ROA 119 4584/11	Baseband Unit, 2x8 Mbit/s, low deviation
2	UKM 110 40/CD	Microwave Unit for MINI-LINK 15-C *
	UKM 110 47/CD	Microwave Unit for MINI-LINK 15-C High Power *
	UKM 110 44/CD	Microwave Unit for MINI-LINK 23-C *
	UKM 110 45/CD	Microwave Unit for MINI-LINK 26-C *
	UKM 110 46/CD	Microwave Unit for MINI-LINK 26-C High Power *
	UKM 110 42/CD	Microwave Unit for MINI-LINK 38-C *
-	SXA 107 6268/1	Connector kit (includes all the necessary material for cable connection at radio end).
Accessory		
3	SXK 111 0401/1	Kit for separate mounting, MINI-LINK 15-C
	SXK 111 0402/1	Kit for separate mounting, MINI-LINK 23-C
	SXK 111 0403/1	Kit for separate mounting, MINI-LINK 26-C
	SXK 111 0404/1	Kit for separate mounting, MINI-LINK 38-C

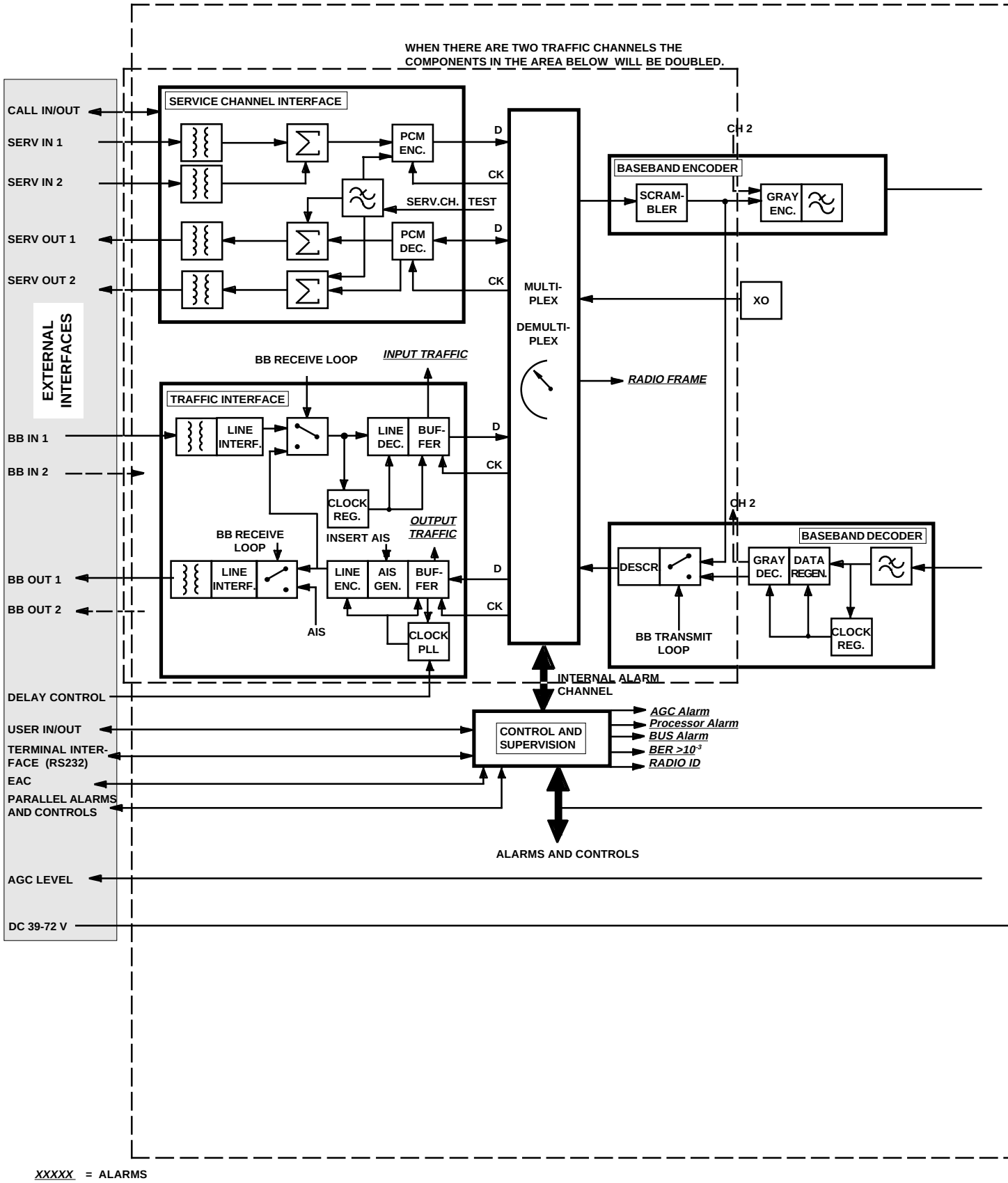
* Frames are included in all microwave units.

Article Code for Compact Antenna	
Article Code	**Description**
UKY 210 15/SC31	0.6 m, MINI-LINK 15-C standard
UKY 210 15/SC21	0.6 m, MINI-LINK 15-C standard with radome
UKY 210 15/SC11	0.6 m, MINI-LINK 15-C high performance
UKY 210 06/SC31	0.6 m, MINI-LINK 23-C standard
UKY 210 06/SC21	0.6 m, MINI-LINK 23-C standard with radome
UKY 210 06/SC11	0.6 m, MINI-LINK 23-C high performance
UKY 210 11/SC31	0.6 m, MINI-LINK 26-C standard
UKY 210 11/SC21	0.6 m, MINI-LINK 26-C standard with radome
UKY 210 11/SC11	0.6 m, MINI-LINK 26-C high performance
UKY 210 09/SC21	0.6 m, MINI-LINK 38-C standard with radome
UKY 210 09/SC11	0.6 m, MINI-LINK 38-C high performance
UKY 210 05/SC11	0.3 m, MINI-LINK 23-C high performance
UKY 210 10/SC11	0.3 m, MINI-LINK 26-C high performance
UKY 210 08/SC11	0.3 m, MINI-LINK 38-C high performance

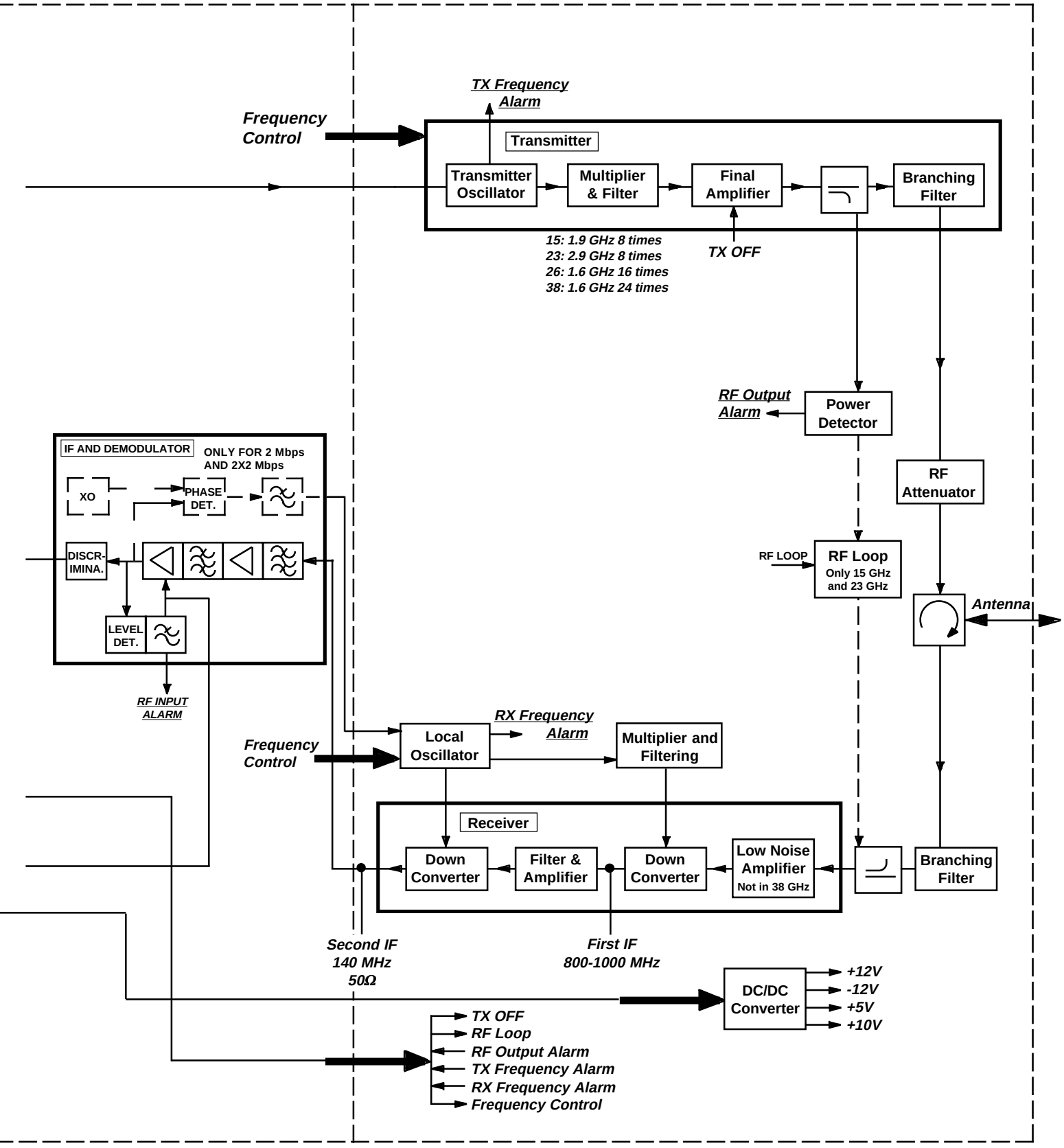
Antenna Spare Parts	
Article Code	**Description**
SXK 111 0317/1	Radome kit for 0.6 m compact antenna
SXK 111 0264	Feeder for 0.3 m compact antenna 23-C
SXK 111 0265	Feeder for 0.3 m compact antenna 26-C
SXK 111 0267	Feeder for 0.3 m compact antenna 38-C
URY 102 15	Feeder for 0.6 m compact antenna 15-C
URY 102 16	Feeder for 0.6 m compact antenna 23-C
URY 102 17	Feeder for 0.6 m compact antenna 26-C
URY 102 18	Feeder for 0.6 m compact antenna 38-C
SXK 111 0278/1	Mounting support for tubes with diameter 50-120 mm

6. Block Diagram

Baseband Unit



Microwave Unit



Contents

7. Technical Data

7. Technical Data

7.1 Environmental Requirements

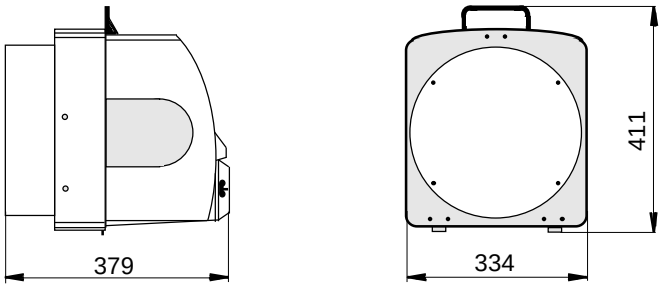
Operation ambient temperature: -40°C to +55°C (including the effect of 1120 W/m^2 solar radiation)

Relative humidity: 8-100%

7.2 Mechanical Data

Integrated mounting with 0.3 m antenna

Dimensions(HxWxD): 411x334x379 mm
Weight: 12 kg



Integrated mounting with 0.6 m antenna

Dimensions(HxWxD): 660x660x549mm
Weight: 17 kg

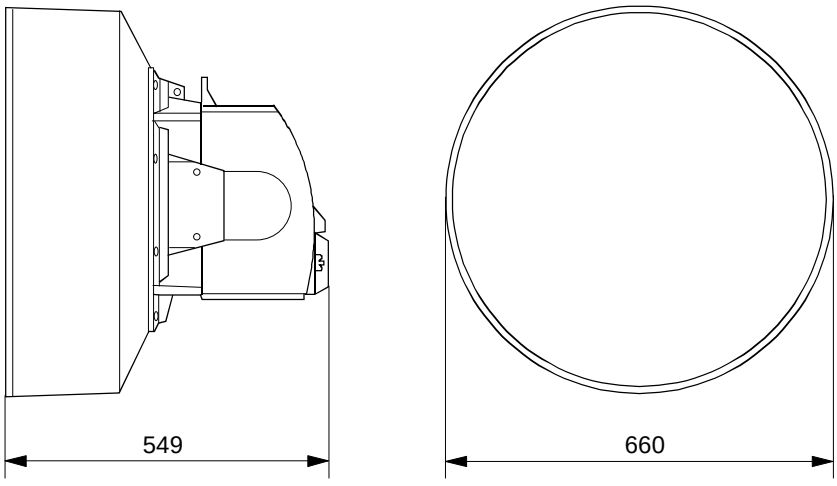


Figure 7-1. Dimensions of antenna and radio module for integrated mounting.

Antenna module 0.3 m

Dim.(HxWxD): 360x334x183 mm
Weight: 4 kg

Antenna module 0.6 m

Dim.(HxWxD): 634x634x402 mm
Weight: 9 kg

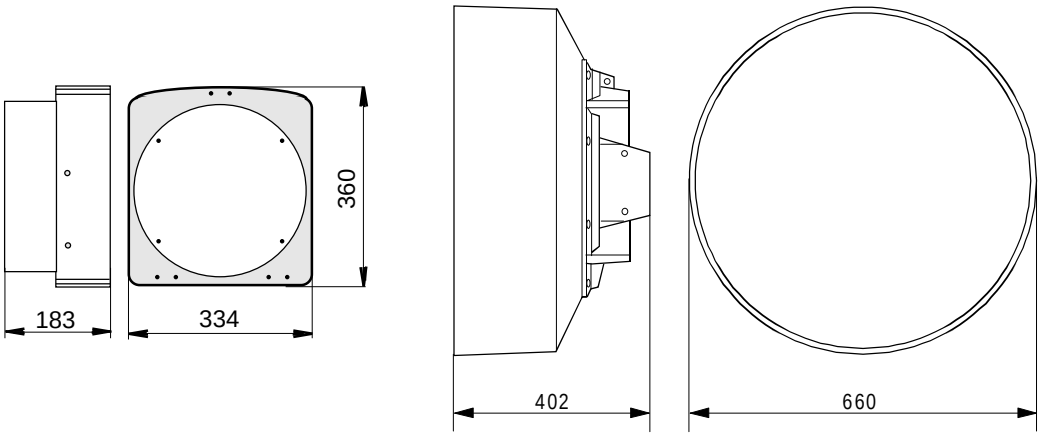


Figure 7-2. Dimensions of 0.3 m and 0.6 m antenna.

Radio module

Dim.(HxWxD): 411x326x224 mm
Weight: 8 kg

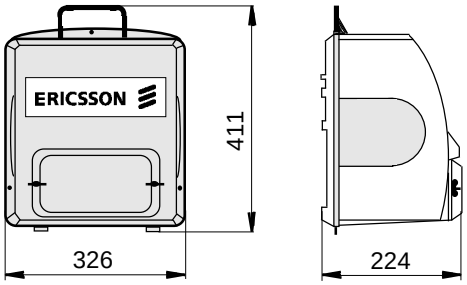
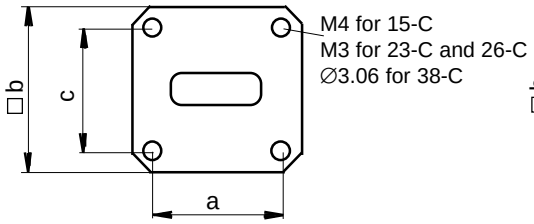


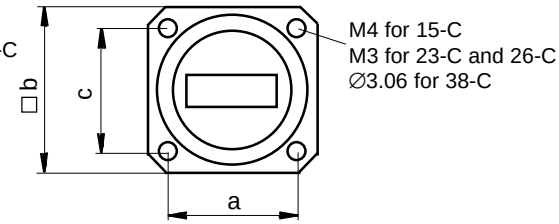
Figure 7-3. Dimensions of radio module.

Waveguide Interface

At radio module



At flexible waveguide



MINI-LINK radio	Measures (mm)			Waveguide Interface	
	a	b	c	At radio module	At flexible waveguide
MINI-LINK 15-C	25.25	33.3	24.28	154 IEC-UBR 140	154 IEC-PBR 140
MINI-LINK 23-C	16.26	22.4	17.02	154 IEC-UBR 220	154 IEC-PBR 220
MINI-LINK 26-C	15.0	22.9	15.8	154 IEC-UBR 260	154 IEC-PBR 260
MINI-LINK 38-C	12.7	19.1	13.46	154 IEC-UBR 320	154 IEC-PBR 320

Figure 7-4. Dimensions of waveguide interface.

Antenna Support

Weight (including the bracket, two clamps, screws and nuts): < 4.5 kg

Radio Mounting Support (separate mounting only)

Dim.(HxWxD): 100x535x50 mm
Weight (including the bracket, two clamps, screws and nuts): 3.5 kg

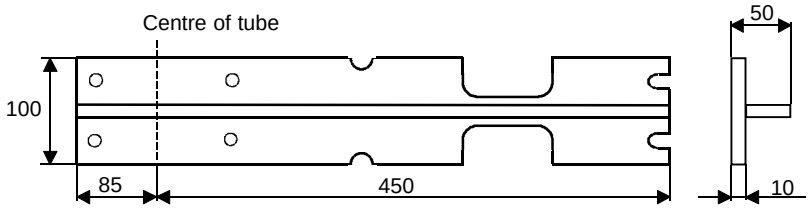


Figure 7-5. Dimensions of radio mounting support.

7.3 Power Supply

Input voltage: 39-72V

Power consumption:

MINI-LINK 15-C, 23-C and 26-C	< 30W
MINI-LINK 38-C	< 34W

7.4 Baseband Interfaces

According to CCITT G.703.

2 and 8 Mbps: balanced 120 ohm

7.5 Service Channel Interface

Frequency range: 0.3 - 3.4 kHz

Impedance: 600 ohm

Input signal level: -11 dBr

Output signal level:

Telephone interface: +4 dBr
Branching interface: -11 dBr

7.6 Terminal Interface

Type: RS 232C V.24 / V.28

Format for pocket terminal: 7 bit ASCII, odd parity.

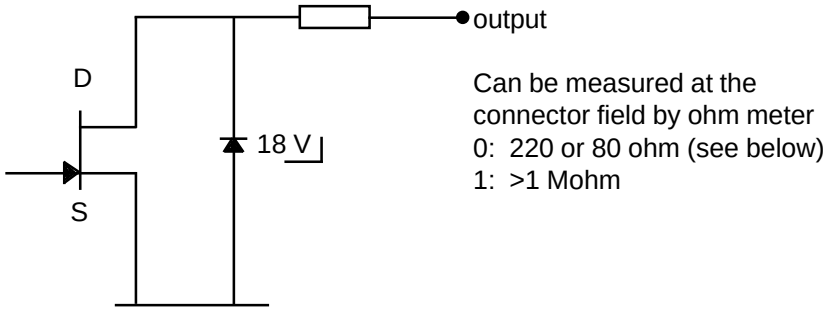
Format for direct access mode: 8 bit, no parity.

Bit rate: 1200 bps

7.7 Alarm Outputs

Applicable to the following interfaces at connector P1 and P2:

- Radio Alarm
- Transmitter Alarm
- Receiver Alarm
- AGC Alarm
- Wake-up Received
- Call Out
- User Out 1
- User Out 2

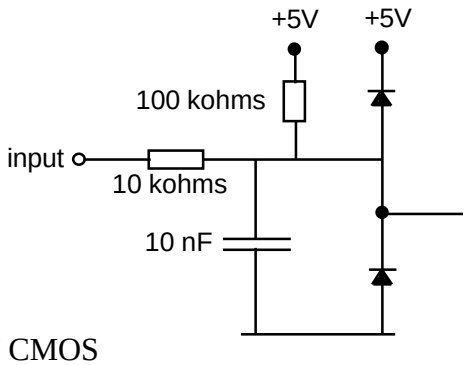


Type:	open drain
Max voltage:	15 V
Max current:	20 mA
On resistance -	
for Wake up and Call out:	80 ohm
for other outputs:	220 ohm
Alarm State -	
for Wake up and Call out:	closed
for Alarms:	open

7.8 Control Inputs

Applicable to the following interfaces at connector P1 and P2:

- Tx off
- Call In
- User In 1
- User In 2



Type: 5V CMOS

Max voltage: 15V

Logical zero: < 1.0V

Logical one: > 3.5V

User input toggle rate can be up to 1 Hz.

7.9 Antenna Data

Typical values:

	MINI-LINK 15-C	MINI-LINK 23-C	MINI-LINK 26-C	MINI-LINK 38-C
Antenna gain (0.3 m antenna)	-	35 dBi	35 dBi	39 dBi
Antenna gain (0.6 m antenna)	37 dBi	40 dBi	41 dBi	45 dBi
Interface	154 IEC-UBR 140	154 IEC-UBR 220	154 IEC-UBR 260	154 IEC-UBR 320

7.10 AGC Curve

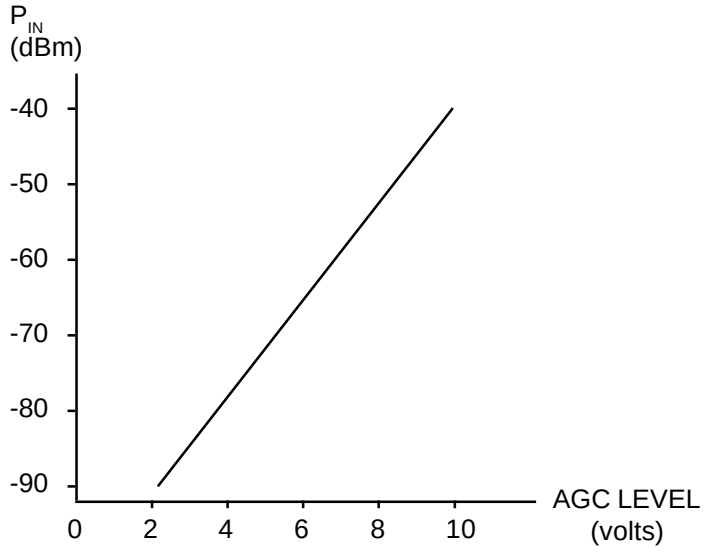


Figure 7-5. RF in level as a function of the AGC level.

7.11 Technical Performance

7.11.1 MINI-LINK 15-C

Typical values unless otherwise stated.

Output power at the MINI-LINK port: 18 dBm (High Power 25 dBm)

Switching time TX on/off: 10 ms

Receiver input levels: -30 to -90 dBm (+15 dBm without damage)

Nominal frequencies for the MINI-LINK radios are given in a table below.

Traffic rate (Mbps)	Receiver sensitivity (dBm) typical value	
	BER 10^{-3}	BER 10^{-6}
2	-93	-89
2x2	-87(-90)	-83(-86)
8	-84(-87)	-80(-83)
2x8	-81(-84)	-77(-80)

High deviation in brackets.

	Nominal Frequencies		
Index	**Transmitter frequency (MHz)**	**Receiver frequency (MHz)**	**n**
11	14504.50 + n x 1.75	15239.50 + n x 1.75	1-58
18	15239.50 + n x 1.75	14504.50 + n x 1.75	1-58
12	14609.50 + n x 1.75	14924.50 + n x 1.75	1-58
15	14924.50 + n x 1.75	14609.50 + n x 1.75	1-58
13	14714.50 + n x 1.75	15029.50 + n x 1.75	1-58
16	15029.50 + n x 1.75	14714.50 + n x 1.75	1-58
14	14819.50 + n x 1.75	15134.50 + n x 1.75	1-58
17	15134.50 + n x 1.75	14819.50 + n x 1.75	1-58
21	14501.00 + n x 1.75	14921.00 + n x 1.75	1-64
25	14921.00 + n x 1.75	14501.00 + n x 1.75	1-64
22	14613.00 + n x 1.75	15033.00 + n x 1.75	1-64
26	15033.00 + n x 1.75	14613.00 + n x 1.75	1-64

continuation ⇨

	Nominal Frequencies		
Index	**Transmitter frequency (MHz)**	**Receiver frequency (MHz)**	**n**
23	14725.00 + n x 1.75	15145.00 + n x 1.75	1-56
27	15145.00 + n x 1.75	14725.00 + n x 1.75	1-56
24	14823.00 + n x 1.75	15243.00 + n x 1.75	1-56
28	15243.00 + n x 1.75	14823.00 + n x 1.75	1-56
41	14501.00 + n x 1.75	15145.00 + n x 1.75	1-54
47	15145.00 + n x 1.75	14501.00 + n x 1.75	1-54
42	14599.00 + n x 1.75	15243.00 + n x 1.75	1-54
48	15243.00 + n x 1.75	14599.00 + n x 1.75	1-54
61	14501.00 + n x 1.75	15229.00 + n x 1.75	1-64
68	15229.00 + n x 1.75	14501.00 + n x 1.75	1-64
62	14620.00 + n x 1.75	14928.00 + n x 1.75	1-62
65	14928.00 + n x 1.75	14620.00 + n x 1.75	1-62
63	14704.00 + n x 1.75	15012.00 + n x 1.75	1-62
66	15012.00 + n x 1.75	14704.00 + n x 1.75	1-62
64	14816.00 + n x 1.75	15124.00 + n x 1.75	1-62
67	15124.00 + n x 1.75	14816.00 + n x 1.75	1-62
71	14511.50 + n x 1.75	15225.50 + n x 1.75	1-58
78	15225.50 + n x 1.75	14511.50 + n x 1.75	1-58
80	14403.00 + n x 1.75	14893.00 + n x 1.75	1-64
85	14893.00 + n x 1.75	14403.00 + n x 1.75	1-64
81	14403.00 + n x 1.75	14893.00 + n x 1.75	49-112
86	14893.00 + n x 1.75	14403.00 + n x 1.75	49-112
82	14403.00 + n x 1.75	14893.00 + n x 1.75	97-160
87	14893.00 + n x 1.75	14403.00 + n x 1.75	97-160
83	14403.00 + n x 1.75	14893.00 + n x 1.75	145-208
88	14893.00 + n x 1.75	14403.00 + n x 1.75	145-208
84	14403.00 + n x 1.75	14893.00 + n x 1.75	193-256
89	14893.00 + n x 1.75	14403.00 + n x 1.75	193-256

7.11.2 MINI-LINK 23-C

Typical values unless otherwise stated.

Output power at the MINI-LINK port: 20 dBm

Switching time TX on/off: 10 ms

Receiver input levels: -30 to -90 dBm (+15 dBm without damage)

Nominal frequencies for the MINI-LINK radios are given in the table below.

	Nominal Frequencies		
Index	**Transmitter frequency (MHz)**	**Receiver frequency (MHz)**	**n**
12	21950.25 + n x 1.75	23000.25 + n x 1.75	1-312
14	23000.25 + n x 1.75	21950.25 + n x 1.75	1-312
22	21784.00 + n x 1.75	23016.00 + n x 1.75	1-320
24	23016.00 + n x 1.75	21784.00 + n x 1.75	1-320
31	21651.00 + n x 1.75	22925.00 + n x 1.75	1-212
33	22925.00 + n x 1.75	21651.00 + n x 1.75	1-212
32	21651.00 + n x 1.75	22925.00 + n x 1.75	172-383
34	22925.00 + n x 1.75	21651.00 + n x 1.75	172-383
42	21797.50 + n x 2.50	22997.50 + n x 2.50	1-231
44	22997.50 + n x 2.50	21797.50 + n x 2.50	1-231
46	21796.25 + n x 1.75	22996.25 + n x 1.75	1-330
48	22996.25 + n x 1.75	21796.25 + n x 1.75	1-330
52	22008.00 + n x 1.75	23016.00 + n x 1.75	1-288
54	23016.00 + n x 1.75	22008.00 + n x 1.75	1-288
56	22002.75 + n x 1.75	23010.75 + n x 1.75	1-291
58	23010.75 + n x 1.75	22002.75 + n x 1.75	1-291
57	22002.75 + n x 1.75	23010.75 + n x 1.75	45-335
59	23010.75 + n x 1.75	22002.75 + n x 1.75	45-335

Traffic rate (Mbps)	**Receiver sensitivity (dBm) typical value**	
	BER 10^{-3}	**BER 10^{-6}**
2	-92	-88
2x2	-86(-89)	-82(-85)
8	-83(-86)	-79(-82)
2x8	-80(-83)	-76(-79)

High deviation in brackets.

7.11.3 MINI-LINK 26-C

Typical values unless otherwise stated.

Output power at the MINI-LINK port: 11 dBm (High Power 18 dBm)

Switching time TX on/off: 10 ms

Receiver input levels: -30 to -90 dBm (+15 dBm without damage)

Nominal frequencies for the MINI-LINK radios are given in the table below.

Index	Nominal Frequencies		n
	Transmitter frequency (MHz)	Receiver frequency (MHz)	
12	25560.50 + n x 1.75	26684.00 + n x 1.75	1-282
17	26684.00 + n x 1.75	25560.50 + n x 1.75	1-282
23	24549.00 + n x 1.75	25557.00 + n x 1.75	469-511
28	25557.00 + n x 1.75	24549.00 + n x 1.75	469-511
24	24549.00 + n x 1.75	25557.00 + n x 1.75	256-511
29	25557.00 + n x 1.75	24549.00 + n x 1.75	256-511

Traffic rate (Mbps)	Receiver sensitivity (dBm) typical value	
	BER 10^{-3}	BER 10^{-6}
2	-91	-87
2x2	-85 (-88)	-81 (-84)
8	-82 (-85)	-78 (-81)
2x8	-79 (-82)	-75 (-77)

High deviation in brackets.

7.11.4 MINI-LINK 38-C

Typical values unless otherwise stated.

Output power at the MINI-LINK port: 15 dBm

Switching time TX on/off: 10 ms

Receiver input levels: -30 to -90 dBm (+15 dBm without damage)

Nominal frequencies for the MINI-LINK radios are given in the table below.

Index	Nominal Frequencies		n
	Transmitter frequency (MHz)	Receiver frequency (MHz)	
11	37058.00 + n x 1.75	38318.00 + n x 1.75	1-160
15	38318.00 + n x 1.75	37058.00 + n x 1.75	1-160
12	37338.00 + n x 1.75	38598.00 + n x 1.75	1-160
16	38598.00 + n x 1.75	37338.00 + n x 1.75	1-160
13	37618.00 + n x 1.75	38878.00 + n x 1.75	1-160
17	38878.00 + n x 1.75	37618.00 + n x 1.75	1-160
14	37898.00 + n x 1.75	39158.00 + n x 1.75	1-160
18	39158.00 + n x 1.75	37898.00 + n x 1.75	1-160
23	37758.00 + n x 1.75	39018.00 + n x 1.75	1-160
27	39018.00 + n x 1.75	37758.00 + n x 1.75	1-160

Traffic rate (Mbps)	Receiver sensitivity (dBm) typical value	
	BER 10^{-3}	BER 10^{-6}
2	-87	-83
2x2	-81(-84)	-77(-80)
8	-78(-81)	-74(-77)
2x8	-75(-78)	-71(-74)

High deviation in brackets.

Contents

8. Appendices

MINI-LINK Failure Report

Date of report: _____

After repair return to:

Goods address	Invoice address

Failure report

Unit name	Part No	Serial No

Cause of failure	Date of failure

Fault Description

Location of failing unit

Site name		
Name of opposite site		
MINI-LINK type no	Transmit frequency (MHz)	Traffic type
Start of operation, date	Latest previous failure on same site, date	

Signature: _____

ERICSSON MICROWAVE SYSTEMS AB

Mail
P.O Box 22150
S-500 02 BORÅS
SWEDEN

Goods address
Sandlidsgatan 3

Telephone
Switchboard
+46 33 179600

Telefax
+46 33 179947

MINI-LINK Line-up Record

This Line-up Record is valid for:

Radio link station _____ (TRMA=Near Radio ID)
Direction towards _____ (TRMB=Far Radio ID)

1. Local Configuration

Ordering code 2 _____/____ Serial No _____
Traffic _____ Mbps Power supply _____ Volts

	Article code	**Serial No**
Baseband Unit	_____	_____
Microwave Unit	_____	_____

Date of commisioning _____
Approved by _____

2. Settings

2.1 Polarization

☐ Vertical ☐ Horizontal

2.2 Frequency setting

Channel number _____ Frequency index _____

2.3 Service channel setting for 2x2 and 2x8 Mbps versions

☐ Two independent channels (factory set) ☐ One channel with branching

2.4 Setting of Options

Program version _____

PROM settings			**Factory settings**
Standby mode	(HSFL)	_____	Working
Near Radio ID	(ADRN)	_____	
Far Radio ID	(ADRF)	_____	
Near Standby Radio ID	(HSN2)	_____	
Far Standby Radio ID	(HSF2)	_____	
AGC Alarm Threshold(dBm)	(AGC Threshold)	_____	-70 dBm
Traffic Channel 1	(CH1)	_____	ON
Traffic Channel 2	(CH2)	_____	ON
Radio ID Check	(IDACT)	_____	OFF
User 1 Mode	(UMOD1)	_____	Normal
User 2 Mode	(UMOD2)	_____	Normal
Frequency Channel number	(RFchno)	_____	000
EAC identities	_____	_____	_____
	_____	_____	_____
	_____	_____	_____

3. Tests

3.1 Analog Measurements

AGC _____ V
AGC according to curve _____ dBm
Calculated RF input value _____ dBm

3.2 Functional Test

☐ OK ☐ Faulty