Exhibit 8 Manuals - Confidential

Remote Radio Unit Description

RRUS 11 and RRUS 61

Description

111/1551-LZA 701 6001/3 Uen H

Disclaimer

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Contents

1 Introduction

This document describes the Remote Radio Unit multi-Standard (RRUS) 11 and the RRUS 61. In the document, RRUS without a model number means both RRUS 11 and RRUS 61.

Note: Remote Radio Unit (RRU) is often used as a generic expression for a remotely installed Radio Unit (RU). It is also the name of models prior to the RRUS versions described in this document, for example Remote Radio Unit Wideband (RRUW).

1.1 Warranty Seal

The product is equipped with a warranty seal sticker.

Note: Seals that have been implemented by Ericsson must not be broken or removed, as it otherwise voids warranty.

2 Product Overview

The RRUS remotely extends the reach of the RBS by up to 40 km. The RRUS is designed to be located near the antenna. A fiber optic cable connects the RRUS to the RBS main unit or an expanded macro RBS. The RRUSs can be connected in a star or cascade configuration with optical cable links.

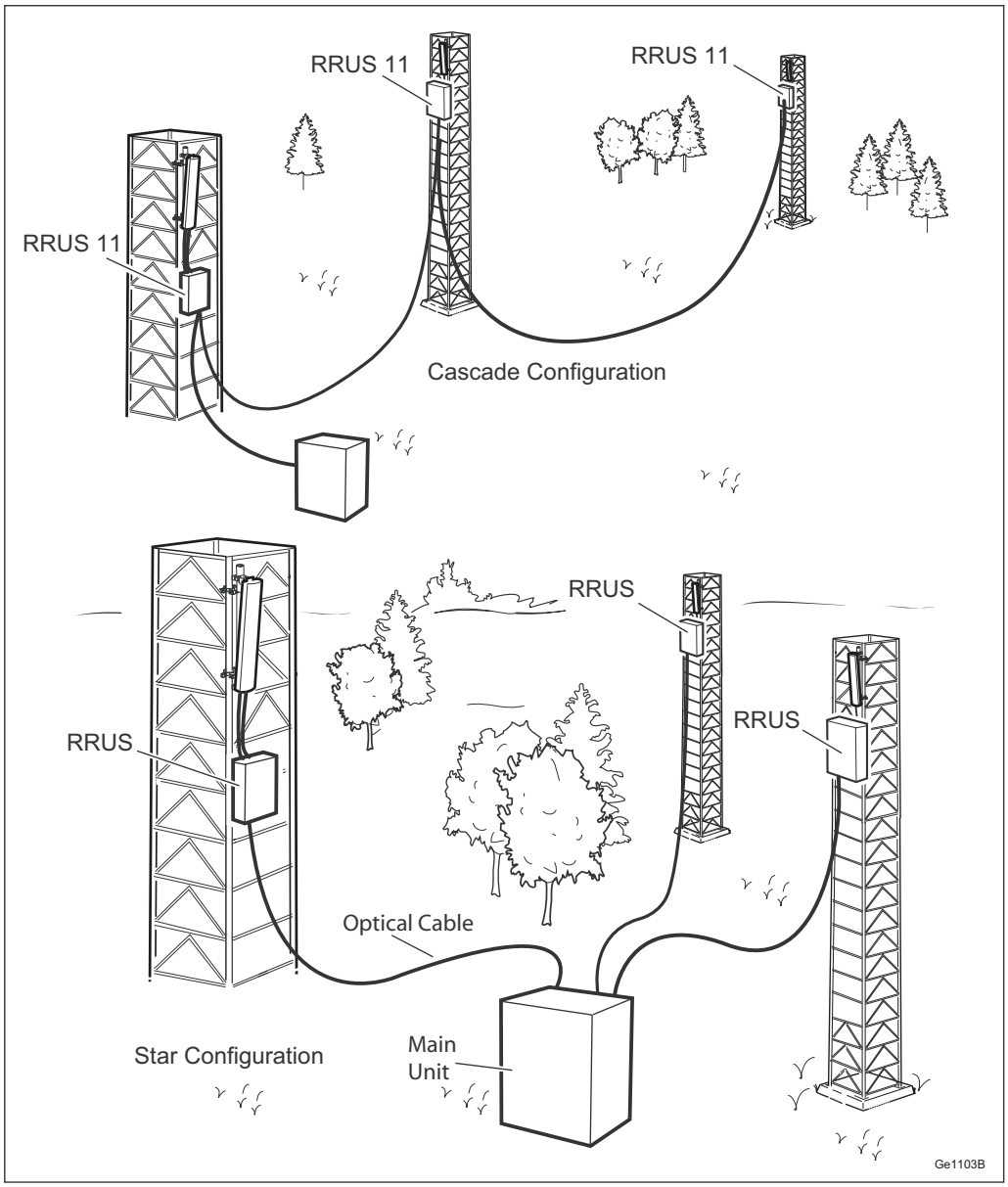


Figure 1 RRUSs in Star and Cascade Configurations

2.1 Main Features

Depending on the software application, the RRUS supports the Antenna Line Devices (ALD), and the Remote Electrical Tilt Unit (RETU). The RETU can be connected either through the ASC or the RET Interface Unit (RIU) over the antenna interface, or directly using the RRUS ALD, or Remote Electrical Tilt (RET) control interface.

For LTE and WCDMA configurations with dual transmitter (TX) RRUSs, redundancy can be achieved by cross-connecting the antenna feeders between the RRUS and the antenna. For more information, refer to *Cross-Sector Antenna Sharing Redundancy* or *Manage Hardware Equipment*.

The RET interface on the RRUS is the link to the antenna communication system. See Table 14 for information about the RRUS connection interface for ALD (RET).

RRUS 11 supports Wideband Code Division Multiple Access (WCDMA), Code Division Multiple Access (CDMA), LTE Frequency Division Duplexing (LTE FDD) and Massive IoT (MI). It has two duplex transmitter/receiver branches (2TX/2RX), and supports cross connection of RX ports with other RRUs.

RRUS 61 supports LTE Time Division Duplexing (LTE TDD). It has two duplex transmitter/receiver branches (2TX/2RX).

RRUS 11 can be used together with an RRUS A2, RRUS A3, or Radio 0208 to provide a four RX branch implementation for Main Remote applications. For more information, refer to *Remote Radio Unit Description* of RRUS A2, *Remote Radio Unit Description* of RRUS A3, or *Radio Description* of Radio 0208.

2.2 Optional Equipment

The optional equipment for the RRUS is the following:

- Wall installation equipment
- Pole installation equipment
- Power Supply Unit (PSU)
- Radio Frequency (RF) monitoring port

3 Technical Data

This section contains information about the physical characteristics, environmental data, and the power supply of the RRU.

3.1 Dimensions

This section contains information about the technical data and dimensions for the RRUS 11, and RRUS 61.

3.1.1 RRUS 11

Table 1 RRUS 11 Technical Data

Description	Value
Maximum nominal output power, subject to license handling.(1) (2)	2×10 W, 2×20 W, 2×30 W, 2×35 W, and 2×40 W(3) Hardware Activation Code (HWAC) is required for total output power over 20 W.
Number of carriers, subject to license handling.(1)	WCDMA: 1 to 4 carriers CDMA: 1 to 4 carriers LTE: 1 to 2 carriers MI, NB-IoT In-band mode: 1 to 2 carriers(4) MI, NB-IoT standalone mode: 1 carrier per port. MI, NB-IoT guardband mode: one Physical Resource Block (PRB) on either side of the LTE carrier, or one PRB on each side of the LTE carrier. Mixed mode: 2 to 4 carriers
Frequency(5)	1920 to 1980 MHz uplink 2110 to 2170 MHz downlink B1 for WCDMA, LTE and MI NB-IoT In-band mode
	1850 to 1910 MHz uplink 1930 to 1990 MHz downlink B2 for WCDMA, LTE, MI NB-IoT In-band mode, MI NB-IoT standalone mode, and MI NB-IoT guardband mode
	1710 to 1755 MHz uplink 2110 to 2155 MHz downlink B4 for CDMA, WCDMA, LTE, MI NB-IoT In-band mode
	824 to 849 MHz uplink 869 to 894 MHz downlink B5 for CDMA, WCDMA, LTE and MI NB-IoT In-band mode (6)
	2500 to 2570 MHz uplink 2620 to 2690 MHz downlink B7 for LTE and MI NB-IoT In-band mode
	699 to 715 MHz uplink 729 to 745 MHz downlink B12 for LTE and MI NB-IoT In-band mode(7)
	777 to 787 MHz uplink 746 to 756 MHz downlink B13 for LTE, MI NB-IoT In-band mode

Description	Value
	832 to 862 MHz uplink 791 to 821 MHz downlink B20 for LTE and MI NB-IoT In-band mode
	1850 to 1915 MHz uplink 1930 to 1995 MHz downlink B25 for LTE and MI NB-IoT In-band mode
	1850 to 1910 MHz uplink 1930 to 1990 MHz downlink B25 for CDMA and MI NB-IoT In-band mode
	817 MHz to 824 MHz uplink 862 MHz to 869 MHz downlink B26A for CDMA, LTE and MI NB-IoT In-band mode
	814 MHz to 824 MHz uplink 859 MHz to 869 MHz downlink B26B for LTE and MI NB-IoT In-band mode
	821 MHz to 835 MHz uplink 866 MHz to 880 MHz downlink B26C for LTE and MI NB-IoT In-band mode
Dimensions with Solar Shield and Handle	
Height	500 mm
Width	431 mm
Depth	182 mm
Weight with solar shield, handle and accessories	
RRUS 11 B1, B5, B26C	23 kg
RRUS 11 B2, B4, B7, B13, B25	24 kg
RRUS 11 B12, B26A, B26B	25 kg
RRUS 11 B20	22 kg
Color	
Gray	

(1) Detailed information about licenses and hardware activations codes (HWAC) can be found in:

GSM: User Description, RAN handling of software licenses and hardware activation codes and MCPA Guideline in the GSM RAN CPI library.

WCDMA: Licenses and Hardware Activation Codes in the WCDMA RAN CPI library.

LTE: Manage Licenses and Hardware Activation Codes in the Radio Node libraries.

(2) Detailed information about output power can be found in the applicable Output Power feature description.

(3) For RRUS 11 B7, 2×30W is guaranteed for operating ambient temperatures < +50 °C. For higher temperatures, 2×20W is guaranteed. For RRUS 11 B26B, maximum output power is 2×35 W for LTE two carrier configuration. For RRUS 11 B26C single carrier, maximum output power is 2×40 W, and for multi-carriers, it is back off 0.5 dB.

(4) One NB-IoT carrier per configured LTE carrier

(5) Information about Instantaneous Bandwidth (IBW) can be found in RBS Configurations.

(6) For CDMA RRUS 11 B5 supports frequency from 869.88 MHz to 893.10 MHz.

(7) RRUS 11 for B12 has a bandwidth that is 2 MHz narrower than 3GPP. The supported frequency corresponds to EARFCN (Channel Numbers) of 5010-5169 in downlink and 23010-23169 in uplink.

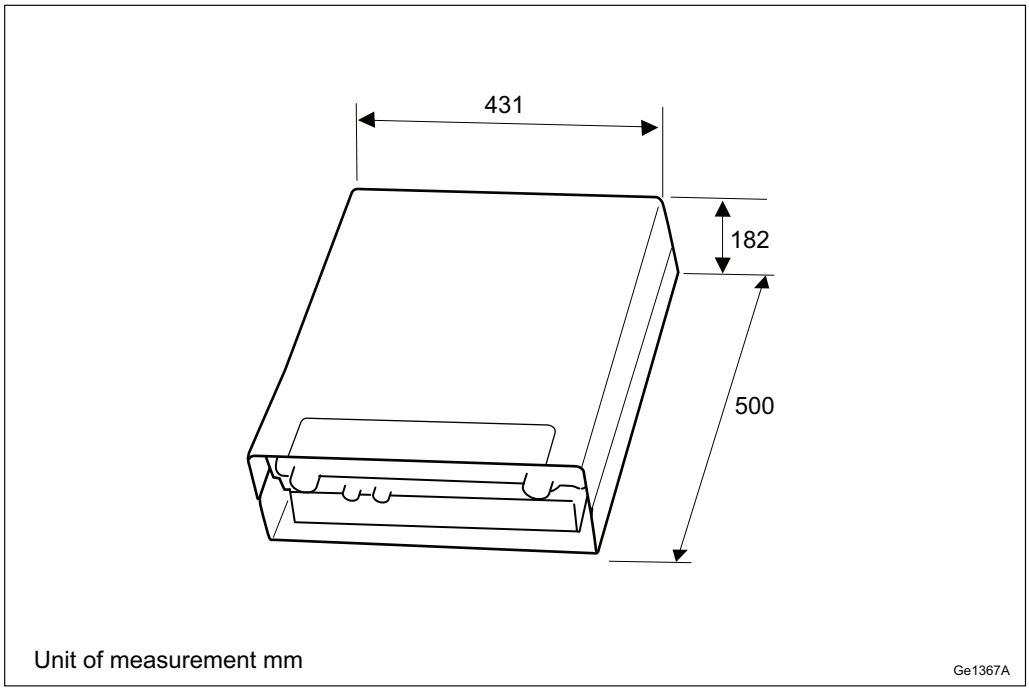


Figure 2 RRUS 11 Height, Width, and Depth with Solar Shield

3.1.2 RRUS 61

Table 2 RRUS 61 Technical Data

Description	Value
Maximum nominal output power, subject to license handling.(1) (2)	B38, B39, B40, B41A, B41C: 2x10 W, 2x20 W , 2x30 W, and 2x40 W. B40B, B40C, B40D: 2x10 W, 2x20 W, and 2x30 W. Hardware Activation Code (HWAC) is required for total output power over 20 W.
Number of carriers, subject to license handling.(1)	1 carrier.
Frequency(3)	2575 to 2615 MHz uplink and downlink B38 for LTE
	1880 to 1915 MHz uplink and downlink B39 for LTE

Description	Value
	2302.5 to 2322.5 MHz uplink and downlink B40B for LTE
	2305 to 2325 MHz uplink and downlink B40C for LTE
	2320 to 2340 MHz uplink and downlink B40D for LTE
	2300 to 2382 MHz uplink and downlink B40 for LTE
	2496 to 2658 MHz uplink and downlink B41A for LTE
	2535 to 2655 MHz uplink and downlink B41C for LTE
Dimensions without Solar Shield and Handle	
Height	406 mm
Width	416 mm
Depth	128 mm
Dimensions with Solar Shield and Handle	
Height	500 mm
Width	431 mm
Depth	182 mm
Weight	
RRUS 61	21.6 kg
Color	
Gray	

(1) Detailed information about licenses and hardware activations codes (HWAC) can be found in:

GSM: User Description, RAN handling of software licenses and hardware activation codes and MCPA Guideline in the GSM RAN CPI library.

WCDMA: Licenses and Hardware Activation Codes in the WCDMA RAN CPI library.

LTE: Manage Licenses and Hardware Activation Codes in the Radio Nodes libraries.
(2) Detailed information about output power can be found in the Output Power user guides.
(3) Information about IBW can be found in RBS Configurations.

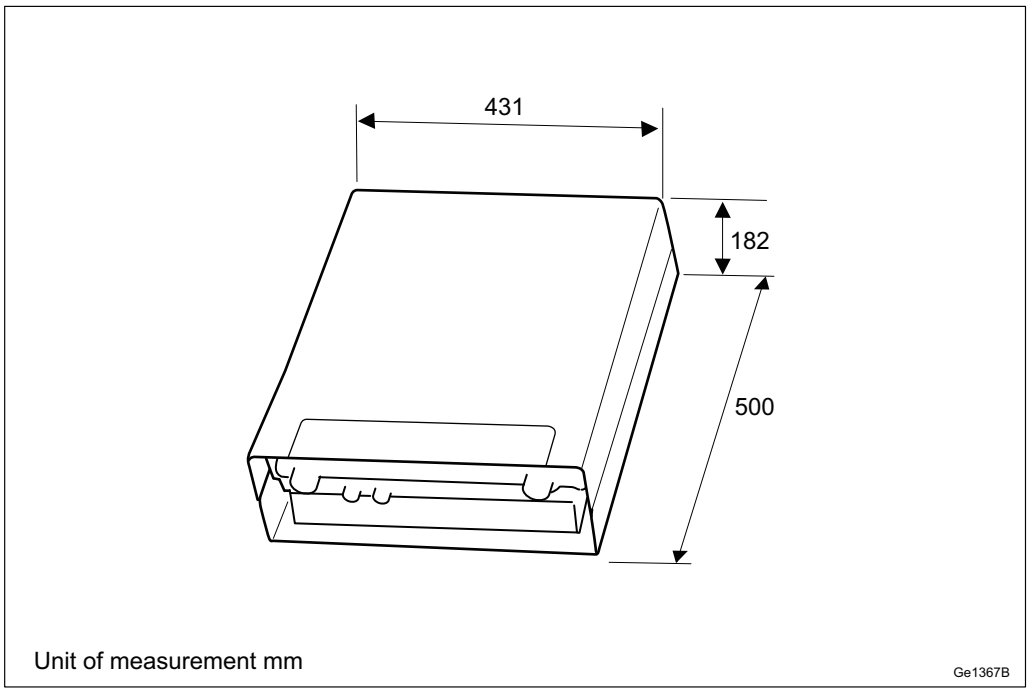


Figure 3 RRUS 61 Height, Width, and Depth with Solar Shield

3.2 Installation Recommendations

To achieve reliable operation, and maximum performance, an appropriate installation location must be chosen.

3.2.1 Indoor Installation Environments to Avoid

Although the unit is designed for outdoor use, it can be used indoors. For indoor locations Ericsson recommends to operate according to ETSI 300 019-1-3 class 3.1 and 3.3. This does not cover installation with heat traps or installation in lofts, where air ventilation does not exist. To ensure smooth performance of the product, it is recommended to ensure that the planned installation site for the unit is not a potential microclimate location. This typically occurs in places such as unventilated lofts, sites with heat traps, or sites where the product is exposed to direct sunlight through windows. Avoid installing the equipment under glass covers or skylight windows without proper ventilation.

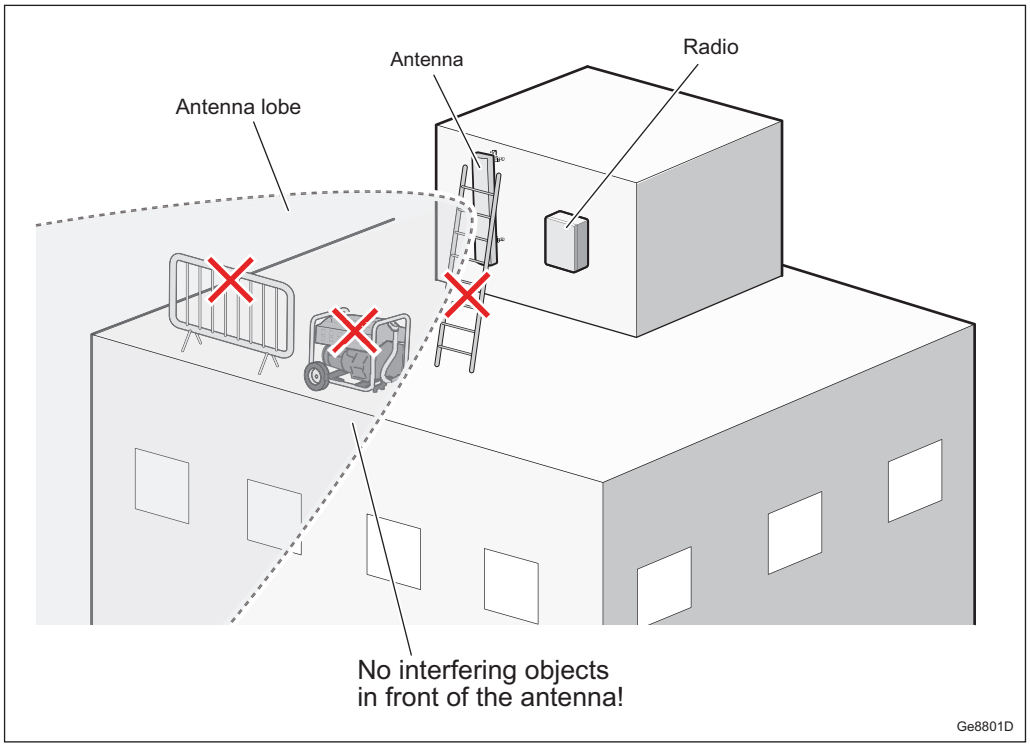
3.2.2 Outdoor Installation Environments to Avoid

The RRU is designed for outdoor use but to ensure optimal operation avoid the following:

- Hot microclimates caused, for example, by heat radiated or reflected from dark or metallic walls or floors
- Chimney mouths or ventilation system outlets
- Large glass or concrete surfaces

Avoid radio interference by keeping the area directly in front of the antenna clear of the following:

- Metal surfaces or objects such as railings, ladders or chains
- Equipment generating electromagnetic fields, such as electric motors in air conditioners or diesel generators
- RBS equipment



3.2.3 Painting Limitations

Ericsson does not recommend painting the RRU as it may affect radio performance of the unit.

Ericsson will apply limitations to the warranty and service contract if the RRU is painted.

3.2.3.1 Technical Limitations

If the RRU is painted, be aware of the technical limitations below:

- Sunlight on dark paint may increase the temperature of the RRU causing it to shut down.
- The plastic surfaces and the plastic covers are suited for painting with normal, commercially available one- or two-component paints.
- Never use metallic paint or paint containing metallic particles.
- Ensure that ventilation and drainage holes are free from paint.
- Ensure proper adhesion of the paint.

3.2.3.2 Commercial Limitations

If the RRU is painted, the commercial limitations below apply:

- Failure modes directly related to overheating due to painting are not valid for repair within the scope of the warranty or standard service contract.
- Product failures related to paint contamination of components of the unit are not valid for repair within the scope of warranty or standard service contract.
- When a painted unit is repaired, it will be restored to the standard color before being returned to the market. It is not possible to guarantee the same unit being sent back to the same place. This is also valid for units repaired under a service contract.
- For repairs within the warranty period or a standard service contract, the customer will be charged the additional costs for replacing all painted parts of the unit or the complete unit.

3.3 Space Requirements

This section describes the space requirements for installing the RRUS.

The RRUS with cable connections running downwards can be installed as follows:

- On a wall
- On a pole or mast

Both wall and pole installations can be indoors or outdoors.

Pole installations can be on monopoles, masts, or towers. Figure 4 shows sample pole installations.

3.3.1 Generic Requirements

The RRUS is installed with the cable connections facing downwards.

Allow a minimum of 1 m free space in front of the RRUS to ensure sufficient working space.

Note: If no other possibilities are available, under exceptional conditions, the RRUS may be installed horizontally with the front downwards. This installation alternative limits the power supply options and the maximum output power. Details regarding optional actions can be found in *Install Remote Radio Units*.

It is recommended that the RRUS is installed below the antenna. The minimum distance between the RRU and the antenna, and between two RRUs are shown in Figure 5, Figure 6, and Figure 7.

Note: The distance between the antenna and the RRU needs to be increased if the antenna azimuth is in the direction of the RRU.

3.3.2 Pole Installation

Figure 4 shows example pole installations (left to right: single unit on a monopole, two units on a tower on different struts, and three units on a monopole).

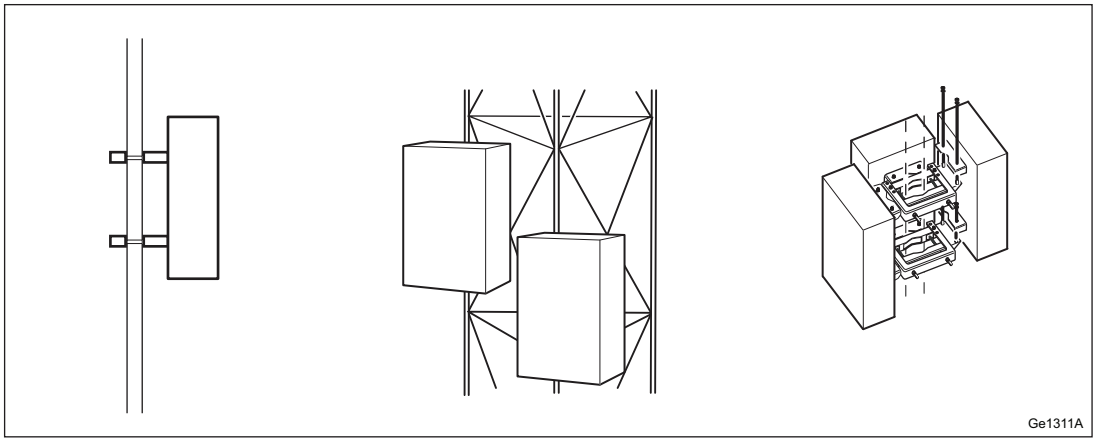


Figure 4 Sample Site Layout for Pole Installation

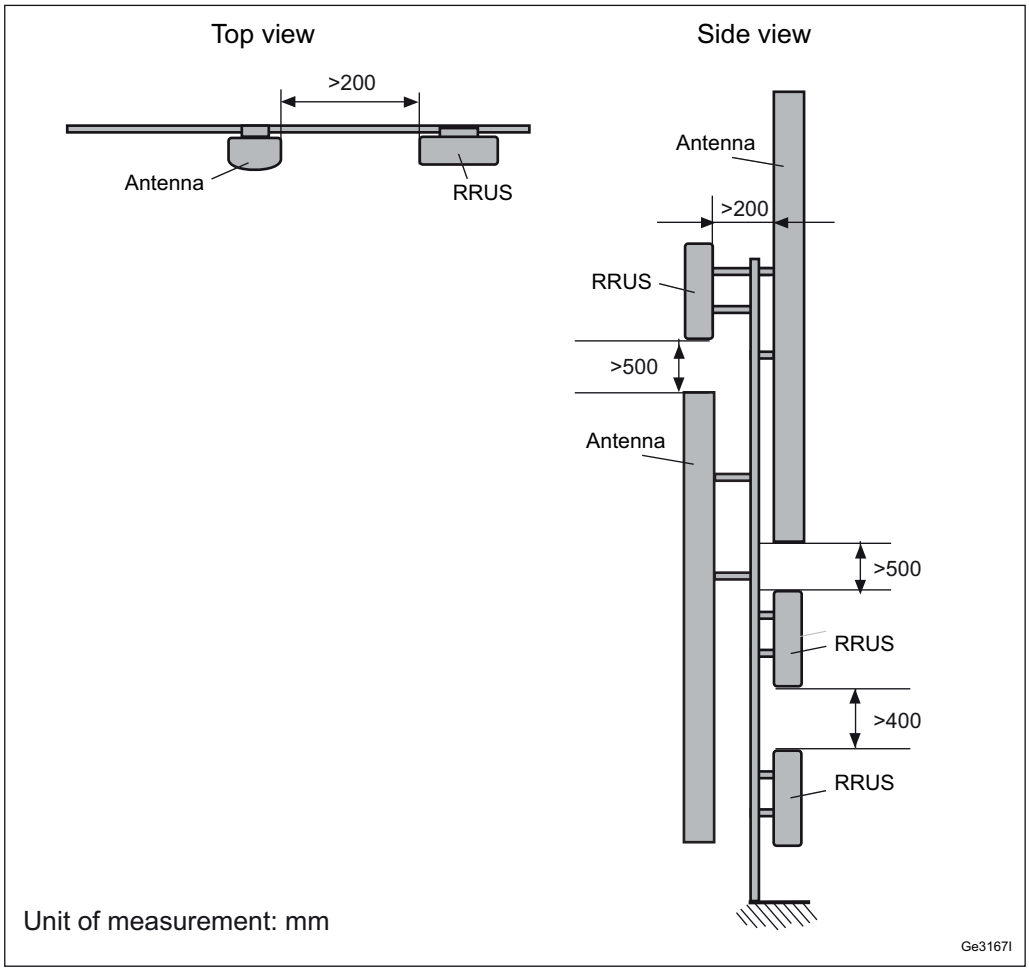


Figure 5 RRU Pole Installation Requirements

To ensure adequate airflow between the units, allow a minimum of 400 mm free space between RRUSs installed vertically on a pole. Allow a minimum vertical distance of 500 mm between RRUS and antenna, if installed above or below an antenna. Allow a minimum of 200 mm free space between RRUSs installed side by side. The minimum distance from the bottom of the RRUS to the floor is 300 mm.

Note: An RRU cannot be installed in the uppermost top position of a pole or mast.

For an RRUS with AC power supply, the mounting bracket supports only two RRUS units.

Table 3 Pole Diameters

Mounting Equipment	Pole Diameter	Supported RRUSs
Single fixture	60 – 120 mm	All types

Mounting Equipment	Pole Diameter	Supported RRUSs
Mounting bracket	35 – 155 mm	All types

3.3.3 Wall Installation

This section describes the installation requirements when installing the RRU on a wall.

3.3.3.1 RRU Installation on Outdoor Wall

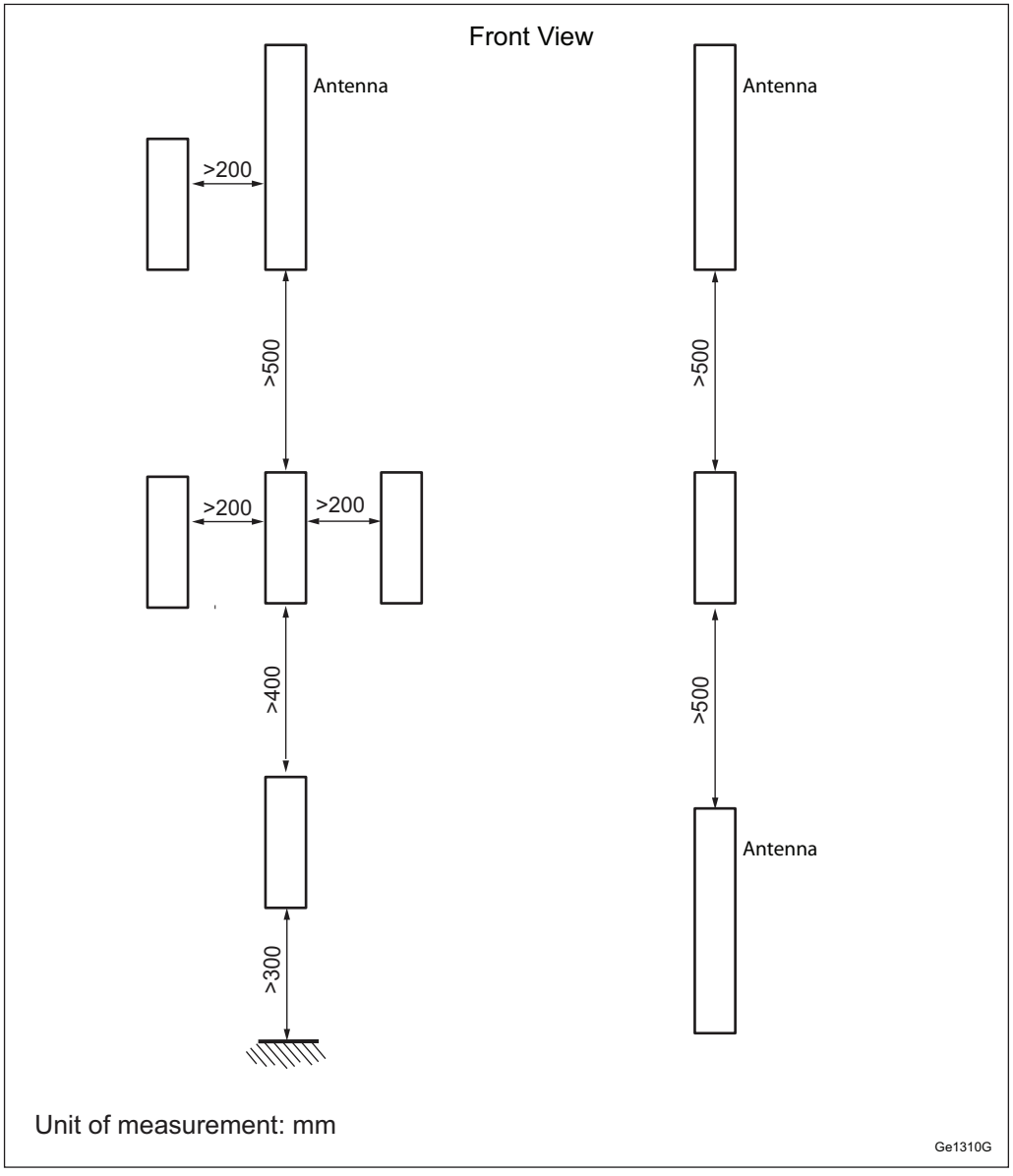


Figure 6 RRU Outdoor Wall Installation Requirements

To ensure adequate airflow between the units, allow a minimum of 400 mm free space between RRUSs installed vertically on a wall. Allow a minimum vertical distance of 500 mm between RRUS and antenna, if installed above or below an antenna. Allow a minimum of 200 mm free space between RRUSs installed side by side. The minimum distance from the bottom of the RRUS to the floor is 300 mm.

Note: An RRU cannot be installed in the uppermost top position on a wall.

3.3.3.2 RRU Installation on Indoor Wall

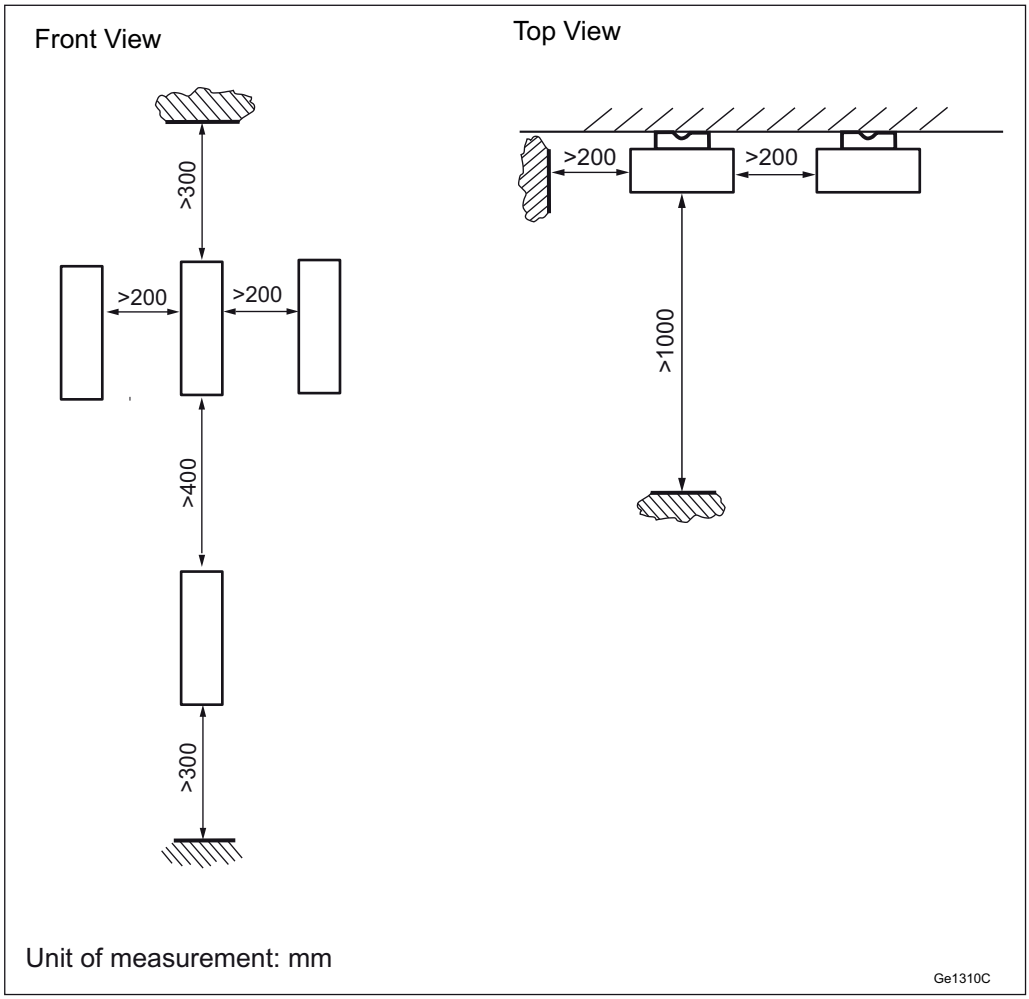


Figure 7 RRU Indoor Wall Installation Requirements

To ensure adequate airflow between the units, allow a minimum of 400 mm free space between RRUSs installed vertically on a wall. Allow a minimum of 200 mm free space between RRUSs installed side by side. The minimum distance from the bottom of the RRUS to the floor is 300 mm.

3.4 Acoustic Noise

The RRUS does not generate acoustic noise.

3.5 Environmental Characteristics

This section contains RRUS operating environment data.

3.5.1 Operating Environment

The following is a list of values for the RRUS normal operating environment:

Temperature	-40 to +55 °C -40 to +45 °C (RRUS 11 B1, B2, B4, B20; in high load scenario: 2x40 W) -40 to +50 °C (RRUS 11 B5, RRUS 61 B40; in high load scenario: 2x40 W)
Solar radiation	≤ 1,120 W/m²
Relative humidity	5 to 100%
Absolute humidity	0.26 to 40 g/m^3
Maximum temperature change	1.0°C/min
Maximum wind load at 50 m/s (pole installed single case)	430 N (front)

3.5.2 Heat Dissipation

The RRUS is convection cooled and designed for outdoor installation. The values shown in Table 4 are meant to give an idea of heat dissipation when the unit is installed indoor or around other RRUs.

Avoid indoor installation in a room without adequate ventilation and cooling.

Table 4 RRUS Heat Dissipation

Unit	Output Power	Maximum Heat Dissipation
RRUS 11 B1, B4	2x30 W	0.34 kW
	2x40 W	0.43 kW
RRUS 11 B2	2x30 W	0.35 kW
	2x40 W	0.43 kW

Unit	Output Power	Maximum Heat Dissipation
RRUS 11 B5, B26C	2x30 W	0.26 kW
	2x40 W	0.30 kW
RRUS 11 B7	2x30 W	0.46 kW
RRUS 11 B12	2x30 W	0.32 kW
	2x40 W	0.43 kW
RRUS 11 B13	2x40 W	0.43 kW
RRUS 11 B20	2x30 W	0.32 kW
	2x40 W	0.33 kW
RRUS 11 B25	2x30 W	0.35 kW
	2x40 W	0.43 kW
RRUS 11 B26A	2x40 W (1)	0.33 kW
RRUS 11 B26B	2x40 W	0.43 kW
RRUS 61 B38, B39, B41A, B41C	2x40 W	0.34 kW
RRUS 61 B40	2x40 W	0.34 kW
RRUS 61 B40B, B40C, B40D	2x30 W	0.27 kW

(1) Maximum output power is limited to 2x30 W if using RRUS 11, KRC 161 287/1.

3.5.3 Vibration

This section describes the RRUS tolerance to vibrations. The RRUS operates reliably during seismic activity as specified by test method IEC 60 068-2-57 Ff.

Maximum level of Required Response Spectrum (RRS)	50 m/s^2 within 2-5 Hz for DR=2%
Frequency range	1–35 Hz
Time history signal	Verteq II

The RRUS operates reliably during random vibration as specified by test method IEC 60 068-2-64 Fh method 1

Random vibration, normal operation	0.5 m^2/s^3

The RRUS operates reliably during shock as specified by test method IEC 60 068-2-27 Ea

Peak acceleration	40m/s^2
Duration	22 ms

3.5.4 Materials

All Ericsson products fulfill the legal and market requirements regarding:

- Material declaration
- Materials' fire resistance, components, wires, and cables
- Recycling
- Restricted and banned material use.

3.6 Power Supply Characteristics

This section describes the power supply requirements, power consumption, and fuse and circuit breaker recommendations for the RRUS.

The power for multiple RRUSs can be supplied from different power systems if required.

3.6.1 DC Power Supply Characteristics

The power supply voltage for the RRUS is -48 V DC.

Table 5 RRUS DC Power Supply Requirements

Conditions	Values and Ranges
Nominal voltage	-48 V DC
Operating voltage range	-38.0 to -58.5 V DC
Non-destructive range	0 to -60 V DC

Fuse and Circuit Breaker Recommendations

The recommendations given in this section are based on peak power consumption and give no information on power consumption during normal operation.

The recommended melting fuse type is gG-gL-gD in accordance with IEC 60269-1. Circuit breakers must comply with at least Curve 3 tripping characteristics, in accordance with IEC 609 34.

The RRUS has a built-in Class 1 (Type 1) Surge Protection Device (SPD) to protect the equipment in case of lightning and network transients. The recommended fuse or circuit breaker rating is therefore dimensioned to not trip the fuse or circuit breaker in case of most SPD operations. The minimum fuse

rating could be taken into account only if it is accepted that fuses or circuit breakers trip in such situations.

Table 6 RRUS Fuse or Circuit Breaker Recommendations

Unit (DC powered)	Output Power	Minimum Fuse Rating (1)	Fuse Rating Recommended for Reliable Operation (2)	Maximum Allowed Fuse Rating(3)
RRUS 11 B1, B4	2x10 W	9 A	25 A	32 A
	2x20 W	10 A		
	2x30 W	13 A		
	2x40 W	15 A		
RRUS 11 B2, B5, B12, B13, B20, B25, B26A, B26B, B26C	2x10 W	8 A		
	2x20 W	10 A		
	2x30 W	13 A		
	2x40 W	15 A		
RRUS 11 B7	2x10 W	10 A		
	2x20 W	13 A		
	2x30 W	16 A		
RRUS 61 B38, B39, B41A, B41C	2x40 W	12 A		
RRUS 61 B40	2x40 W	12 A		
RRUS 61 B40B, B40C, B40D	2x10 W	7 A		
	2x20 W	8 A		
	2x30 W	10 A		

(1) These fuse ratings can only be used if it is acceptable that fuses trip due to lightning or network transients.

(2) The recommended fuse rating takes into account the fact that external fuses are not to trip due to lightning or network transients.

(3) The absolute maximum fuse class in accordance with RRUS design restrictions.

Note: If a fuse or circuit breaker rating above minimum fuse rating is selected, cable dimensioning rules in *Position C, -48 V DC Power Supply Interface* on page 29 shall be reconsidered to make sure that the fuse or circuit breaker tripping criteria are met.

3.6.2 AC Power Supply Characteristics

The RRUS AC accepts 100 to 250 V AC if it is used together with the optional PSU.

Table 7 RRUS AC Power Supply Requirements

Normal Voltage Range	Tolerance Range
200 to 250 V	180 to 275 V AC (1)
100 to 127 V	90 to 140 V AC (1)
Connection	Phase-neutral
Frequency range	50 to 60 Hz

Normal Voltage Range	Tolerance Range
Voltage harmonics	< 10% at full load (2)
Shut-off allowance	At undervoltage or overvoltage (3)
Inrush current peak	< 40 A
Inrush current duration	< 10 ms

(1) AC connected through a PSU AC 02

(2) Must comply with IEC 61000-3-2

(3) Alarm raised at 70 ± 5 V, ceased at 80 ± 5 V (phase voltage)

Fuse and Circuit Breaker Recommendations

The recommendations given in this section are based on peak power consumption and give no information on power consumption during normal operation.

The recommended melting fuse type is gG-gL-gD in accordance with IEC 60269-1. Circuit breakers must comply with at least Curve 3 tripping characteristics, in accordance with IEC 609 34.

The PSU AC 02 has a built-in Class 1 (Type 1) SPD to protect the equipment in case of lightning and network transients. The recommended fuse or circuit breaker rating is therefore dimensioned for not tripping the fuse or circuit breaker in case of SPD operation. The minimum fuse rating could be taken into account only if it is accepted that fuses or circuit breakers trip in such situations. The PSU AC 02 is described in *PSU AC 02 (Optional)* on page 24.

Table 8 RRUS Fuse/Circuit Breaker Recommendations

Unit (AC powered)	Output Power	Minimum Fuse Rating (1)	Fuse Rating Recommended for Reliable Operation (2)	Maximum Allowed Fuse Rating (3)
RRUS 11 B1, B4, B5, B12, B13, B20, B25, B26A, B26B, B26C	2x30 W / 2x40 W	• 7 A (100 to 127 V AC) • 4 A (200 to 250 V AC)	32 A	32 A
RRUS 11 B1, B2, B4, B5, B26C	2x40 W	• 8 A (100 to 127 V AC) • 4 A (200 to 250 V AC)		
RRUS 11 B7	2x30 W	• 8 A (100 to 127 V AC) • 4 A (200 to 250 V AC)		
RRUS 61 B38, B39, B41A, B41C	2x40 W	• 7 A (100 to 127 V AC) • 3.5 A (200 to 250 V AC)		
RRUS 61 B40	2x40 W	• 7 A (100 to 127 V AC) • 3.5 A (200 to 250 V AC)		

Unit (AC powered)	Output Power	Minimum Fuse Rating (1)	Fuse Rating Recommended for Reliable Operation (2)	Maximum Allowed Fuse Rating (3)
RRUS 61 B40B, B40C, B40D	2x30 W	• 5 A (100 to 127 V AC) • 2.5 A (200 to 250 V AC)		

(1) These fuse ratings can only be used if it is acceptable that fuses trip due to lightning or network transients.

(2) The recommended fuse rating takes into account the fact that external fuses are not to trip due to lightning or network transients.

(3) The absolute maximum fuse class in accordance with RRUS design restrictions.

3.6.3 Power Consumption

For information on power consumption, refer to *Power Consumption Calculations*.

3.7 System Characteristics

This section describes the system characteristics of the RBS.

3.7.1 RF Electromagnetic Exposure for RBS 6000

General information on RF Electromagnetic Fields (EMF) for RRUSs connected to an RBS from the 6000 family can be found in *Radio Frequency Electromagnetic Fields*.

Information about radio access specific compliance boundaries for electromagnetic exposure can be found in *Radio Frequency Electromagnetic Exposure*.

3.7.2 Software

Information on software dependencies can be found in *Radio Software Support*.

3.7.3 Radio Configurations

Information about available radio configurations can be found in *RBS Configurations*.

4 Hardware Architecture

Note: The supported configurations are described in *RBS Configurations*.

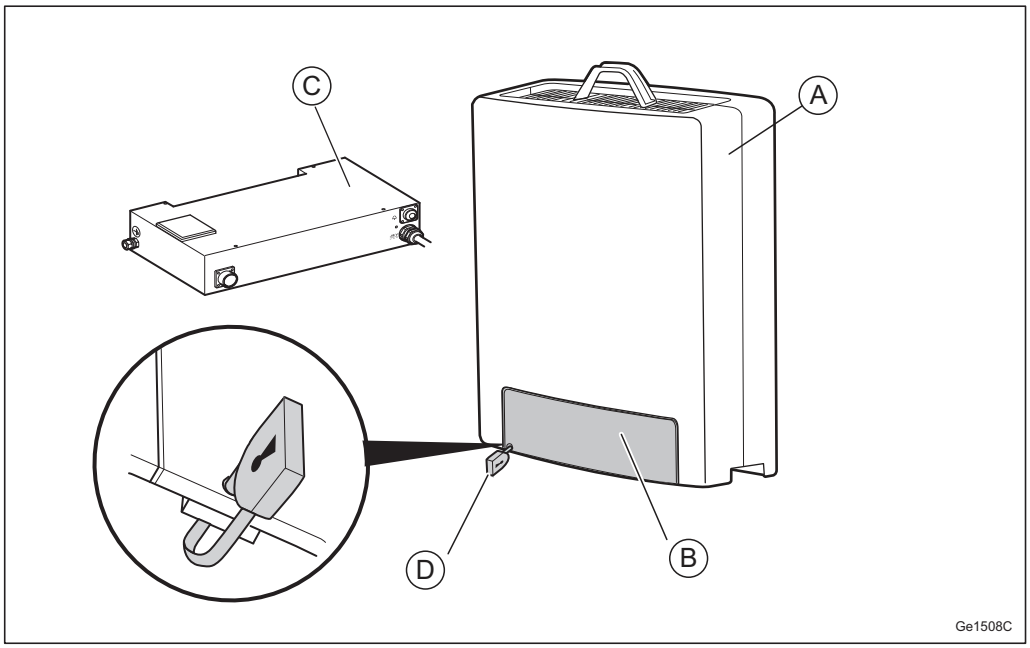


Figure 8 RRUS 11 and RRUS 61 Components

Table 9 Key to RRUS Components

Position	Component
A	Solar shield
B	Slide cover
C	PSU (optional)
D	Hole for padlock (optional, valid in RRUS 11 solar shield variant 2 only)

4.1 RRUS Overview

The RRUS contains most of the radio processing hardware. The following sections describe the component units inside the RRUS.

4.1.1 TRX

The Transmitter and Receiver (TRX) provides the following:

- Analog/Digital (A/D), Digital/Analog (D/A) conversion

- Channel filtering
- Delay and gain adjustment
- Digital predistortion
- RF modulation and demodulation
- Optical cable interface termination
- Two receivers for RX diversity
- RET receiver (the antenna system communication link)

4.1.2 PA

The Power Amplifier (PA) is the linear power amplifier for the RF carrier. RRUS 11 and RRUS 61 have two PAs, one for each branch.

4.1.3 FU

The Filter Unit (FU) consists of band-pass filters and low-noise amplifiers.

In the RRUS, the FU also provides the following:

- Power and supervision for the ASC, the TMA, the TMF, or the RIU
- Voltage Standing Wave Ratio (VSWR) supervision

4.1.4 DC SPD

The DC SPD board protects the DC power input from lightning currents.

4.1.5 ALD (RET) SPD

An SPD provides overvoltage/overcurrent protection for the ALD (RET) port.

4.1.6 External Alarm SPD

An SPD provides overvoltage/overcurrent protection for the external alarm ports.

4.2 Solar Shield

The solar shield protects the RRUS from solar radiation. The solar shield is also part of the cooling design. Figure 8 shows the solar shield.

Note: Always attach the solar shield to the RRUS regardless of whether the RRUS is installed in a shady or in a sunny location.

4.3 Slide Cover

The slide cover hides the optical indicators and the maintenance button.

More information can be found in *Connection Interfaces* on page 27.

4.4 Optical Indicators and Buttons

The RRUS is equipped with optical indicators that show system status. The optical indicators are located on the overlay marking. Table 10 describes how to interpret the optical indicators for RRUS when WCDMA and LTE controlled.

Table 10 RRUS Optical Indicators WCDMA or LTE Controlled

Marking	Indicator	Color	Mode	Indicates
!	Fault	Red	Off	No fault detected in RRUS
			On	Fault detected in RRUS
✔	Operational	Green	Off	RRUS not operational
			On	Power present
			Blink (2 Hz)	Load or testing in progress
			Blink (0.5 Hz)	Dependent resource missing
🔧	Maintenance	Blue (1)	Off	RRUS not in maintenance mode
			On	RRUS in maintenance mode
			Blink (0.5 Hz)	Shutdown in progress
1, 2	Interface	Green	Off	Disconnected
			On	Connected
LMT	–	-	-	Not used
Button:				
🔧	Maintenance	-	-	Switch RRUS mode between Remote and Maintenance

(1) The color can also be yellow. The yellow optical indicator can blink busy.

4.4.1 Maintenance Button Function

See *Indicators, Buttons, and Switches* for information about the maintenance button.

4.5 PSU AC 02 (Optional)

The PSU is required for the AC power input option. The PSU converts RRUS input main power 100 - 250 V AC to -48 V DC and is installed on the back of the RRUS.

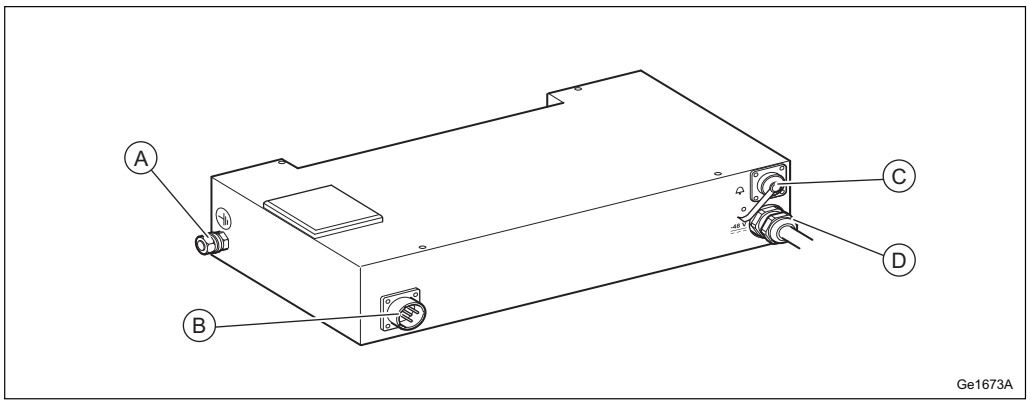


Figure 9 PSU AC 02

Table 11 PSU AC 02 Connection Interfaces

Position	Interface
A	Grounding interface
B	AC power interface
C	Interface for future use
D	DC power interface

For more information about the PSU AC 02, see *PSU Description*.

4.6 PSU 48 02 (Optional)

The PSU 48 02 converts -48 V DC 3-wire to -48 V DC 2-wire.

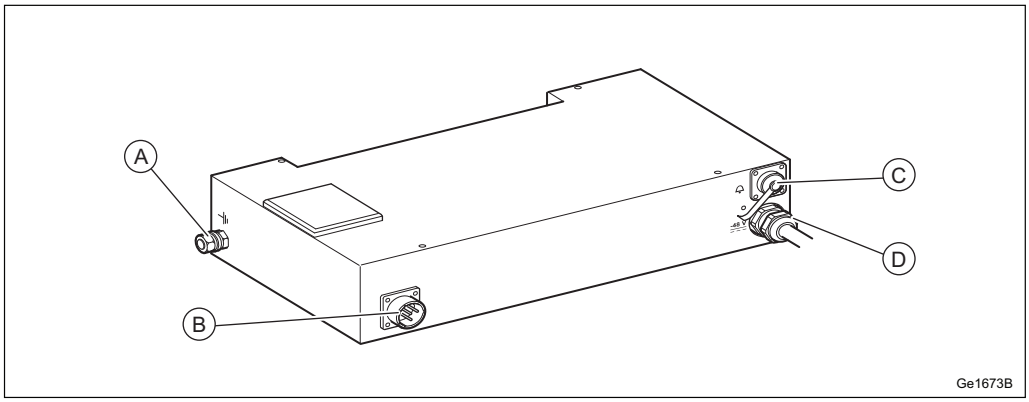


Figure 10 PSU 48 02

Table 12 PSU 48 02 Connection Interfaces

Position	Interface
A	Grounding interface
B	DC power interface (3-Wire)
C	Interface for future use
D	DC power interface (2-Wire)

For more information about PSU 48 02, see *PSU Description*.

4.7 RF Monitoring Port for RRUS 11 (Optional)

The RF monitoring port can be used to monitor the RRUS downlink RF output power without interrupting service.

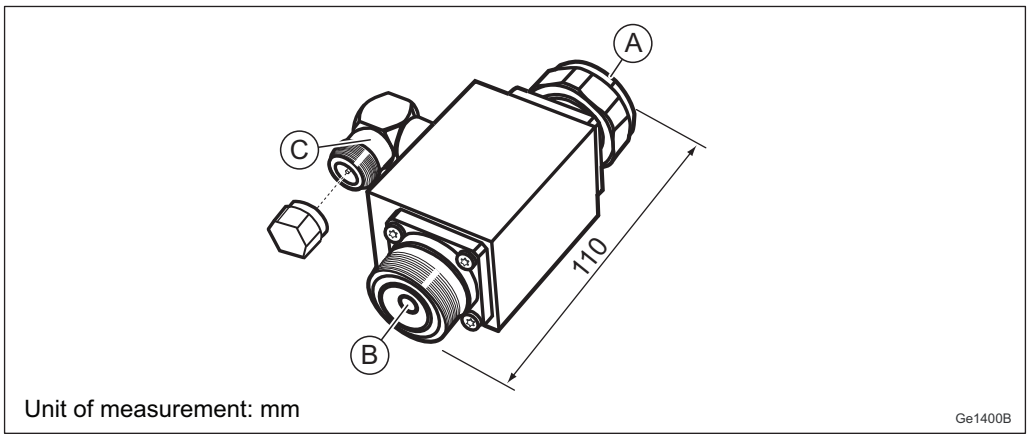


Figure 11 RF Monitoring Port

Table 13 RF Monitoring Port Overview

Position	Interface
A	7/16 RF connector used for connecting to A or B interface
B	7/16 RF connector for connecting the RF cable
C	N-type RF connector for pairing with connector on monitoring equipment (including metal protective cap to be used when the interface is not in use)

The RF monitoring port is connected to the A or B antenna interface on the connection interface panel at the bottom of the RRUS. The A and B interfaces support bidirectional, RX/TX traffic, but only the TX direction can be monitored.

Using the RF monitoring port does not affect RRUS performance. RF leakage due to connecting the antenna cables through the monitoring port does not exceed that of a standard RF cable. Insertion loss between port A and port B is less than 0.2 dB.

5 Connection Interfaces

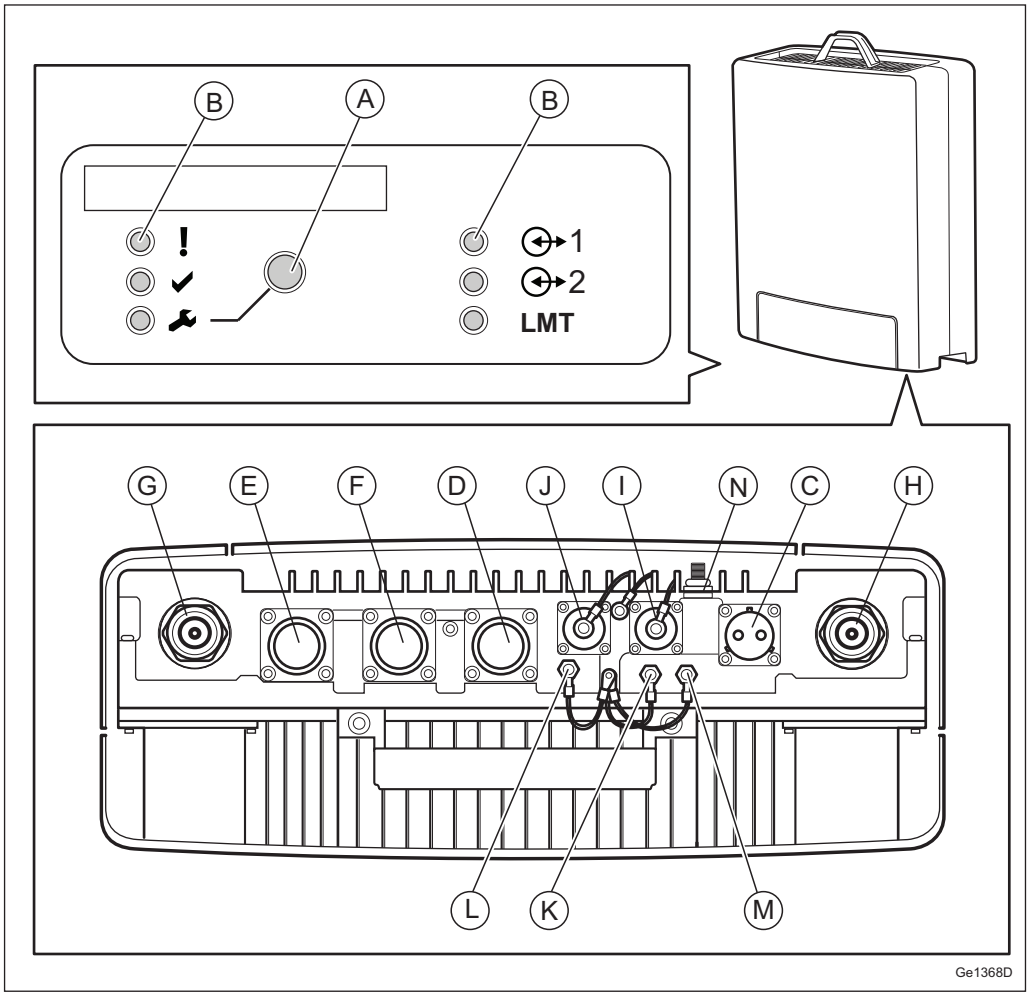
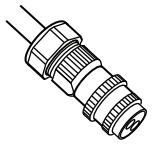
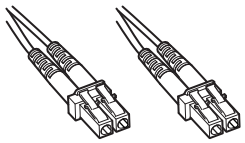
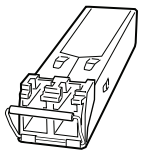
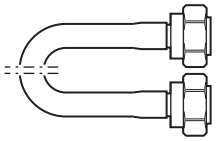
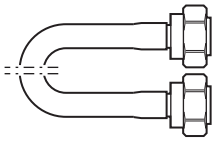
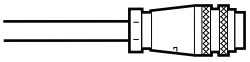
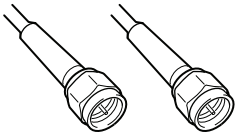


Figure 12 RRUS Connection Interfaces

Table 14 RRUS Connection Interfaces

Position	Description	Marking	Connector Types	Cable Types
A	Maintenance button	🔧	-	-
B	Optical indicators	!, ✔, 🔧 1, 2	-	-

Position	Description	Marking	Connector Types	Cable Types
		LMT		
C	-48 V DC power supply		Screw terminal connector	
D	–	LMT	-	-
E	Optical cable 1	1	LC (On SFP)	 
F	Optical cable 2	2		
G	Antenna 1	A	7/16 connector	
H	Antenna 2	B		
I	ALD (used for a RET unit for example)	ALD	Mini-DIN connector, 8 pin	
J	External alarm		Alarm connector	
K(1)	Cross connect RXA	RXA I/O	SMA connector	
L(1)	RXA co-site	RXA Out		
M(1)	Cross connect RXB	RXB I/O		

Position	Description	Marking	Connector Types	Cable Types
N	Grounding	⏚	M8 bolt	

(1) Applicable for RRUS 11 only.

5.1 Position A, Maintenance Button

The maintenance button is located at the left of the symbol.

Note: Use a pointed object, for instance a screwdriver or a pencil tip, to press the maintenance button.

More information about the maintenance button can be found in *Indicators, Buttons, and Switches*.

5.2 Position B, Optical Indicators

Optical indicators show the system status. More information about the optical indicators can be found in *Indicators, Buttons, and Switches*.

5.3 Position C, -48 V DC Power Supply Interface

The -48 V DC power connector for incoming power accepts cables with various cross-sectional areas, depending on the cable length and the RRU maximum power consumption. For more information on -48 V DC power cable dimensions, see *Main-Remote Installation Products Overview*.

The power cable conductor has a wire for the 0 V DC conductor, and a wire for the -48 V DC conductor. The color codes are market dependent for both wires.

All cables must be shielded. The shielding must be properly connected both to the power connector and to the grounding interface in the power supply equipment, otherwise the RRUS overvoltage and lightning protection does not function properly.

5.4 Position D, LMT

Not used.

5.5 Position E and F, Interface for Optical Cable to Main Unit

The ⊶ 1 and ⊶ 2 interfaces provide connections to optical cables for traffic and timing signals between the RRUS and the main unit. A Small Form-factor Plugable (SFP) is used to connect the optical cable to the RRUS.

Note: The RRUS uses SFP modules for optical transmission and optical radio interfaces on Data 1 (optical cable 1 in) and Data 2 (optical cable 2 out).

Only use SFP modules approved and supplied by Ericsson. These modules fulfill the following:

- Compliance with Class 1 laser product safety requirements defined in standard IEC 60825-1.
- Certification according to general safety requirements defined in standard IEC 60950-1.
- Functional and performance verified to comply with RBS specifications.

Recommended SFP modules are obtained from the product packages for the RBS and the Main Remote Installation products. See *Spare Parts Catalog* and *Main-Remote Installation Products Overview* for more information.

5.6 Position G and H, Antenna Interface

The antenna interfaces provide RRUS connections to antennas. RF cables connect the RRUS to the antenna.

Table 15 RRUS Antenna Connection Interface Characteristics

Connector Type	RF Cable Type	Cable Connector Type	Cable Product Number
7/16 IEC-169-4 insert-receiver type	50 Ω 1/2-inch coaxial	7/16 insert-type on both ends	TSR 951 70

Table 16 RRUS Antenna Cable Connectors

RRUS Connectors	Antenna Connectors
A (Antenna 1)	TX/RX
B (Antenna 2)	TX/RX

5.7 Position I, ALD Ctrl Interface

The ALD control (ALD Ctrl) connects an ALD (RET) cable to the RRUS for antenna system communication.

5.8 Position J, Ext Alarm Interface

Two external alarms can be connected to the RRUS external alarm port.

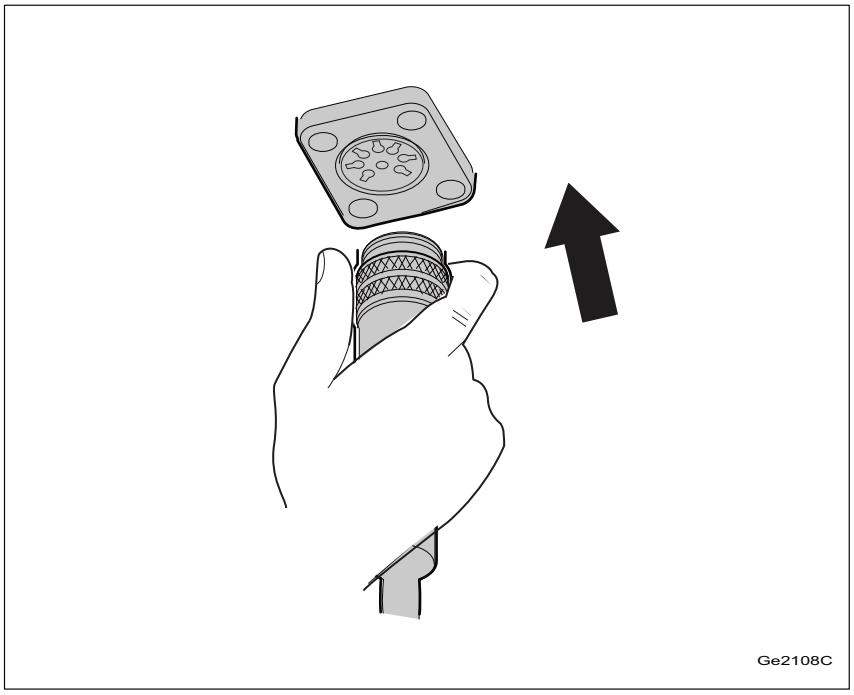


Figure 13 External Alarm Interface

Table 17 External Alarms and Output Characteristics

Alarm Input Port Details	Characteristics
Number of input ports	2
Maximum sensed impedance for a closed loop condition	Closed (less than 1 kΩ)
Minimum sensed impedance for an open loop condition	Open (greater than 33 kΩ)
Maximum current sourced from port interface	1.0 mA
Maximum voltage sourced from port interface	5.5 V

5.9 Position K and M, RXA I/O and RXB I/O Interface (RRUS 11 Only)

The RXA I/O and RXB I/O interface port is used to cross-connect the RRUS 11 for antenna diversity.

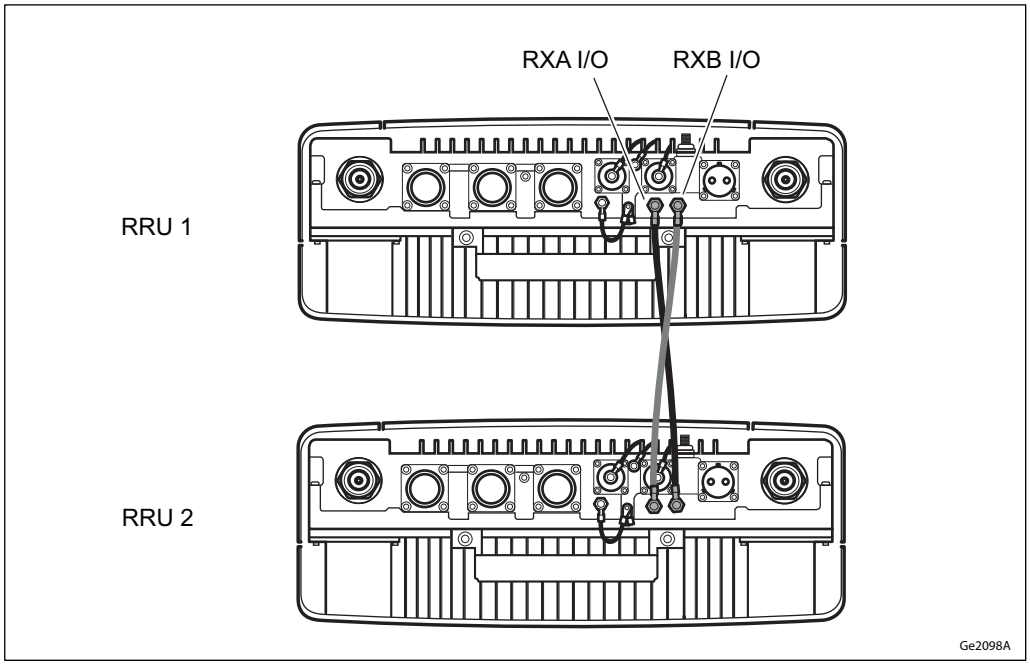


Figure 14 Cross-connecting RRUS 11

5.10 Position L, RXA Out Interface (RRUS 11 Only)

The RXA Out interface port is used to co-site RRUS 11s.

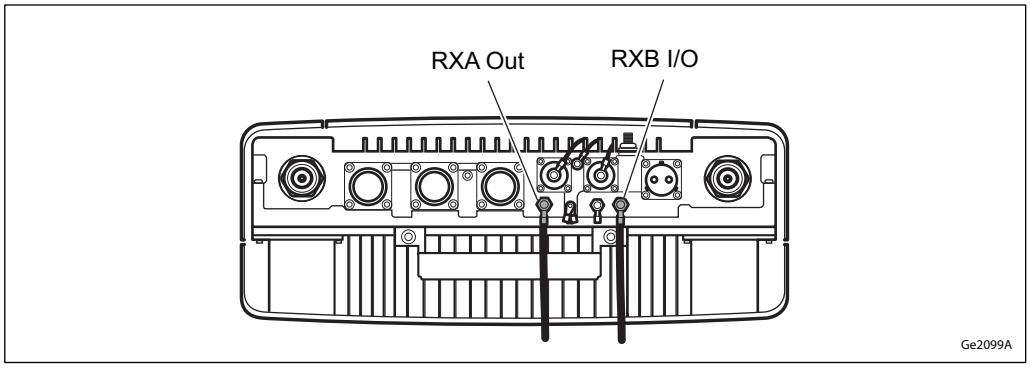


Figure 15 Co-siting RRUS 11

5.11 Position N, Grounding Interface

The RRUS must be grounded to protect it from overvoltage and lightning strikes. The grounding interface on the RRUS accepts a small cable lug on a short, coated cable. Bolt the cable and the loop into place with an M8 bolt.

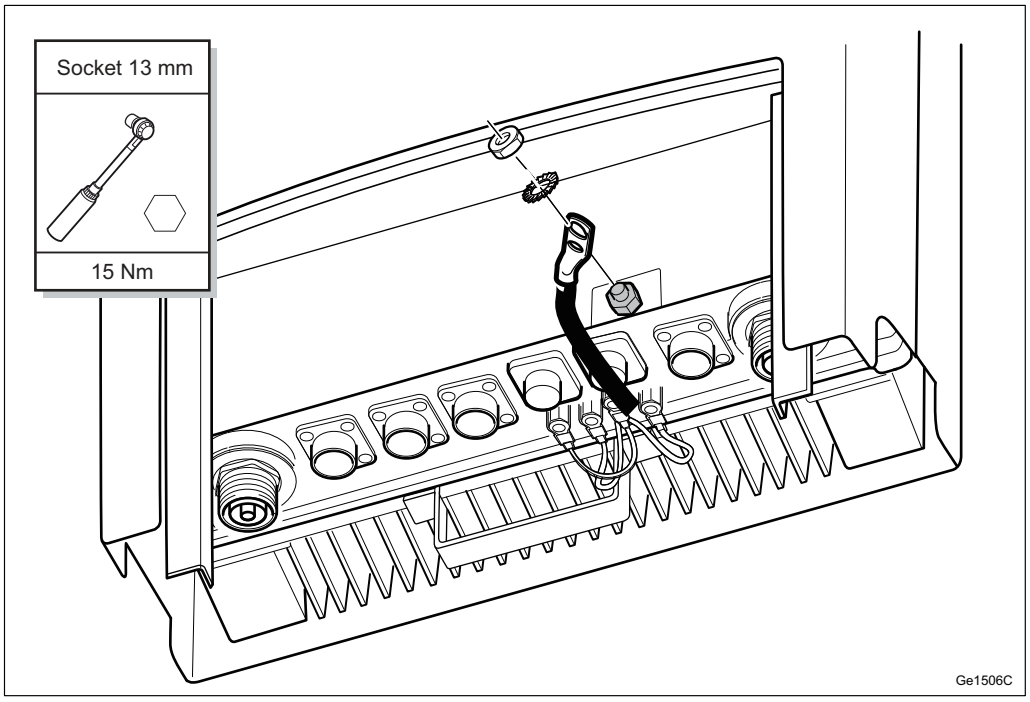


Figure 16 RRUS Grounding Interface

5.12 Optional Equipment Interfaces

The equipment presented in this section is optional and can be ordered separately.

5.12.1 PSU AC (Optional)

The PSU (also called the PSU AC) uses an AC power interface available from Ericsson. The AC cable is connected to the PSU with a contact on the cable. The AC connector comes with the RRUS.

All cables must be shielded. The shielding must be grounded on both the PSU and the power supply equipment side with the site Main Earth Terminal (MET). Each power cable conductor can have a 1.5–4 mm² cross-sectional area.

The PSU is shown in Figure 9.

Note: The wire color code in the external AC power supply cable is market dependent.

5.12.2 PSU 48 02(Optional)

The PSU 48 uses a DC power interface available from Ericsson.

All cables must be shielded. The shielding must be grounded on both the PSU and the power supply equipment side with the site Main Earth Terminal (MET). Each power cable conductor can have a 2.5–10 mm² cross-sectional area.

The PSU is shown in Figure 10.

5.12.3 RF Monitoring Port for RRUS 11 (Optional)

The optional RF monitoring port allows either periodic or continuous downlink RF output power monitoring without interrupting RRUS 11 service. The monitoring interface can be found on the optional RF monitoring port. The RF monitoring port can be placed on each antenna interface that is a transmitter port.

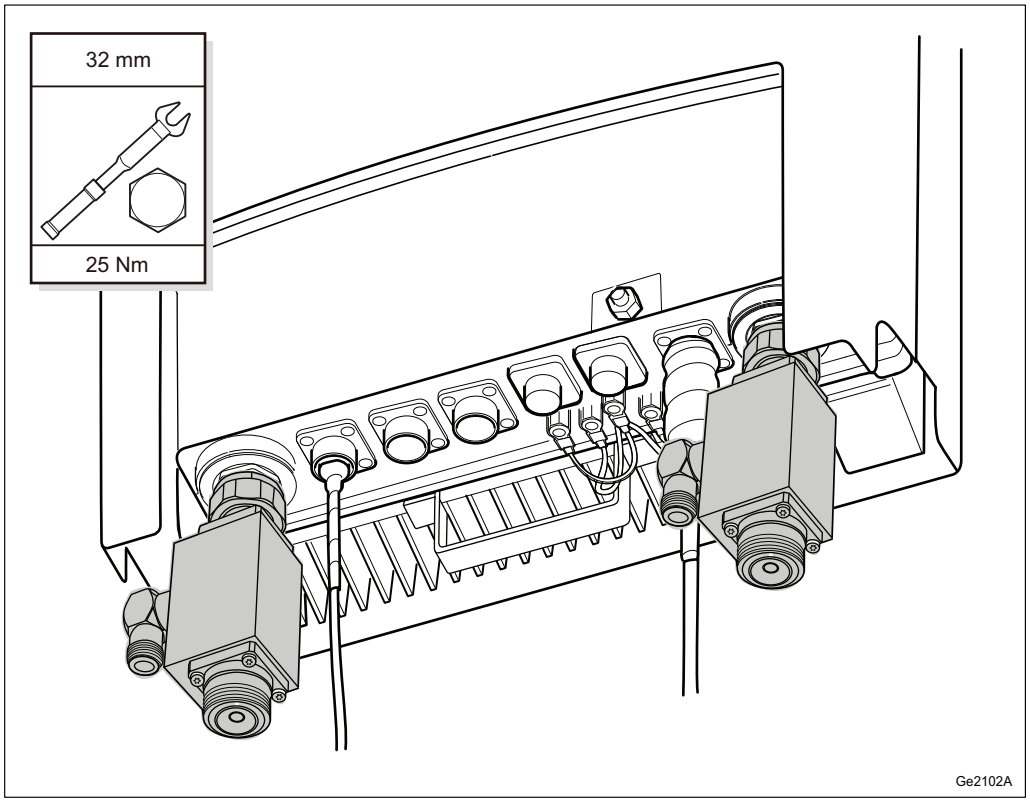


Figure 17 RF Monitoring Interface Connection

6 Standards and Regulations

This section presents a brief overview of standards, regulatory product approval, and declaration of conformity.

Declaration of Conformity

"*Hereby, Ericsson AB, declares that this Product is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU and 2011/65/EU.*"

6.1 Regulatory Approval

The RBS complies with the following market requirement:

- EC (European Community) market requirements, Radio Equipment Directive 2014/53/EU and Directive 2011/65/EU.
- The apparatus may include Radio Transceivers with support for frequency bands not allowed or not harmonized within the European Community (EC).
- Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS) Directive (2011/65/EU).
- North American market requirements.
- Products containing Radio Equipment outside North America and in countries not recognizing the CE-mark may be labeled according to national requirements or standards.

6.1.1 Environmental Standards Compliance

The product complies with the following environmental standard:

Europe

- EN 50581 (RoHS)

6.1.2 Safety Standards Compliance

In accordance with market requirements, the RBS complies with the following product safety standards and directives:

International

- IEC 60 950-1 Ed2 with amendment A1

Europe

- EN 50 385
- EN 60 950-1 Ed2 with amendment A1

North America

- CSA-C22.2 No.60950-1-07 with amendment A1
- FCC CFR 47 Part 1.1310
- Health Canada Safety Code 6
- UL 60950-1

6.1.2.1 Outdoor specific requirements

The RBS complies with the following outdoor specific requirements:

International

- IEC 60 529 (IP55)
- IEC 60 950-22

Europe

- EN 60 529 (IP55)
- EN 60 950-22

North America

- CSA-C22.2 No. 60950-22-07
- UL 60950-22
- UL 50E

6.1.3 EMC Standards Compliance

The RBS complies with the following Electromagnetic Compatibility (EMC) standards:

International

- 3GPP TS25.113
- 3GPP TS36.113
- 3GPP TS37.113

Europe

- ETSI EN 301 489-1
- ETSI EN 301 489-8
- ETSI EN 301 489-23

North America

- FCC CFR 47 Part 15 B
- IC ICES-003 B

6.1.4 Radio Standards Compliance

The RBS complies with the following radio standards:

International

- 3GPP TS25.141
- 3GPP TS36.141
- 3GPP TS37.141
- 3GPP TS51.021

Europe

- ETSI EN 301 502
- ETSI EN 301 908-1

- ETSI EN 301 908-3
- ETSI EN 301 908-14
- ETSI EN 301 908-18

North America

- FCC CFR 47 Part 2 (USA)
- FCC CFR 47 Part 22, 24, 27 and 90 (USA frequency dependent)
- IC RSS-130,132, 133, 139 and 199 (Canada frequency dependent)
- IC RSS-Gen (Canada)

6.1.5 Marking

To show compliance with legal requirements the product is marked with the following labels:

Europe

- CE mark

North America

- FCC CFR 47 Part 15 Statement
- FCC ID (located on RRU)
- IC ICES-003 Statement
- IC ID (located on RRU)
- usETL/cETL

6.2 Other Standards and Regulations

The standards and regulations in this section are not regulatory approved.

6.2.1 Spare Parts

The product adheres to the Ericsson Serviceability and Spare Part Strategy.

6.2.2 Surface Quality

The surface quality of the RRUS is in accordance with Ericsson standard class A3.

6.2.3 Vandal Resistance

Unauthorized access is not possible without damaging the unit.