CME 20 R6.0/CMS 40 R2, CME 20 R6.1/CMS 40 R3

RBS 2301, RBS 2302
Reference Manual

ERICSSON

EN/LZT 123 2697 R5A

Reference Manual

© Ericsson Radio Systems AB — All Rights Reserved —

© Ericsson Radio Systems AB
— All Rights Reserved —

Due to continued progress in methodology, design and manufacturing the contents of this document are subject to revision without notice.

© Ericsson Radio Systems AB
— All Rights Reserved —

Contents

© Ericsson Radio Systems AB
— All Rights Reserved —

© Ericsson Radio Systems AB
— All Rights Reserved —

© Ericsson Radio Systems AB
— All Rights Reserved —

© Ericsson Radio Systems AB
— All Rights Reserved —

© Ericsson Radio Systems AB
— All Rights Reserved —

© Ericsson Radio Systems AB

— All Rights Reserved —

© Ericsson Radio Systems AB
— All Rights Reserved —

© Ericsson Radio Systems AB
— All Rights Reserved —

1 Preface

This manual is valid for CME 20 R6.0/ CMS 40 R2 and CME 20 R6.1/ CMS 40 R3.

1.1 Objectives

The manual is intended as an overview of the Ericsson micro base stations for the GSM 900 MHz, GSM 1800 MHz and GSM 1900 MHz.

The manual is divided into:

- General Information:

  Preface

- Supported Configurations:

  The chapters gives an overview of supported site configurations including earthing principles, battery backup times etc. and radio configurations with characteristics and capacity for each configuration

- Specifications for the basestations and complementary products:

  The chapters describes the architecture and specifies the characteristics and performance of each product.

- Function Specifications:

  Provides detailed information about the basestations from a functional point of view. The Function Specifications are customer-adapted and give a deeper understanding of the behavior of the basestations.

- BTS Parameter Limitations:

  States configurable BTS parameters for RBS 2000. BTS parameters with limitations compared with the parameter ranges in the Abis O&M IWD are stated in this section.

- Glossary:

  List of Abbreviations.

© Ericsson Radio Systems AB
— All Rights Reserved —

1.2 Audience

Customer and Ericsson personnel involved in radio base station activities.

1.3 Customer Documentation Library

The user documentation for RBS 2301, RBS 2302 and MAXITE™ consists of customer manuals and procedures divided up to suit different process events. The *Library Overview* contains the following information for each manual:

- Short description
- Recommendation of appropriate target group
- Product number

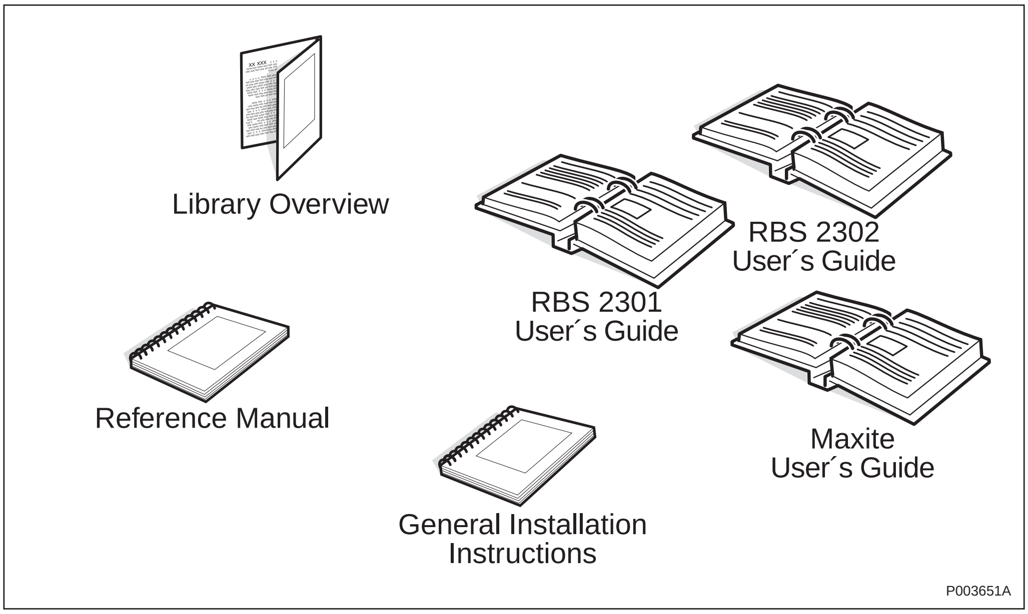

Figure 1 The Customer documentation library

© Ericsson Radio Systems AB
— All Rights Reserved —

1.4 Release History

Except editorial changes such as correction of spelling, grammar and layout, this manual has been revised as follows:

1.4.1 R4A to R5A

Table 1

Chapter	Chapter heading	Revised sections and sub-sections	Description
1	Preface	1.1 1.4.1	Objectives and figure "The Customer Documentation Library" updated. Release History for R3A to R4A deleted and exchanged for R4A to R5A.
2	Site Configurations, RBS 2000 Micro		A new chapter added
3	General Specification for RBS 2000 Micro Configurations		Renamed to Radio Configurations, RBS 2000 Micro. Technical data concerning the RBS 2302 added.
5	Product Specification for RBS 2302		A new chapter added
6	Product Specification for Power and Battery Cabinet		A new chapter added
12	Encryption	12.2.3	Section "Encryption Mode Change at Mode Modify" added
20	Radio Transmission	20.3.4	TX Diversity: "Transmitter diversity..." rewritten
29	External Alarms	29.3.2	RBS 2302, External alarms, maximum: 8 added
31	Climate Protection	31.2.1	Natural Convection renamed to Convection
39	EMC Capabilities		Chapter renamed from "EMC Capabilities" to "EMC Capabilities for RBS 2301"
40	EMC Capabilities for RBS 2302		A new chapter added
41	Environmental Capabiblities		"RBS 2301" was removed from the title

Note: Chapters not listed in the table are unchanged.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

2 Site Configurations, RBS 2000 Micro

2.1 Terminology

AC box	The AC box splits the incoming mains to the site to different AC users in the site. This is external equipment that is delivered by the local support organization in each country or region.
Interfaces	There are a number of interfaces in the system: AC mains, DC 24 V, DC –48 V, External alarms, Alarms, Data, Transmission, T,X,L-bus, RF Feeders
N/A	Not Applicable
Mini Link E-micro	Mini Link E-micro is a transmission unit that sends transmission via the radio interface.
MLPU	Mini Link Lightning Protection Unit
PBC	Power Battery Cabinet The PBC converts AC mains to 24 V and –48 V. It includes battery backup for RBS and AAU.
R1P1A1RL1PL1AL1/M1	Configuration with: 1 RBS, 1 PBC, 1 AAU, 1 RLPU, 1 PLPU, 1 ALPU and optional 1 Mini Link
RBS 2302	RBS 2302 is a radiobasestation based on the RBS 2301. It is developed for 6 TRX functionality and prepared for MAXITE™ installations.

t_{ext} means External temperature

2.2 System Overview

2.2.1 Site Configurations Overview

The tables below describe the different site configurations for RBS 2302 products.

Fan units and Mini Link configurations are considered to be optional and therefore marked with a “slash” (/), for example “/RF1” or ”/M1”).

Table 2 RBS 2302 Site Configurations

Short no.	Slogan	RBS 2302	P B C	Fan Unit	Mini Link
		(R)	(P)	(RF,PF)	(M)
R1	2 TRX	1		/RF1	
R2	4 TRX	2		/RF2	

© Ericsson Radio Systems AB
— All Rights Reserved —

R3	6 TRX	3		/RF3	
R1P1	2 TRX external backup	1	1	/RF1	/M1
R2P2	4 TRX external backup	2	2	/RF2	/M1
R3P3	6 TRX external backup	3	3	/RF3	/M1

Note: Not all configurations are described with a figure.

2.3 Configuration

2.3.1 Site Configurations

RBS 2302 Configurations

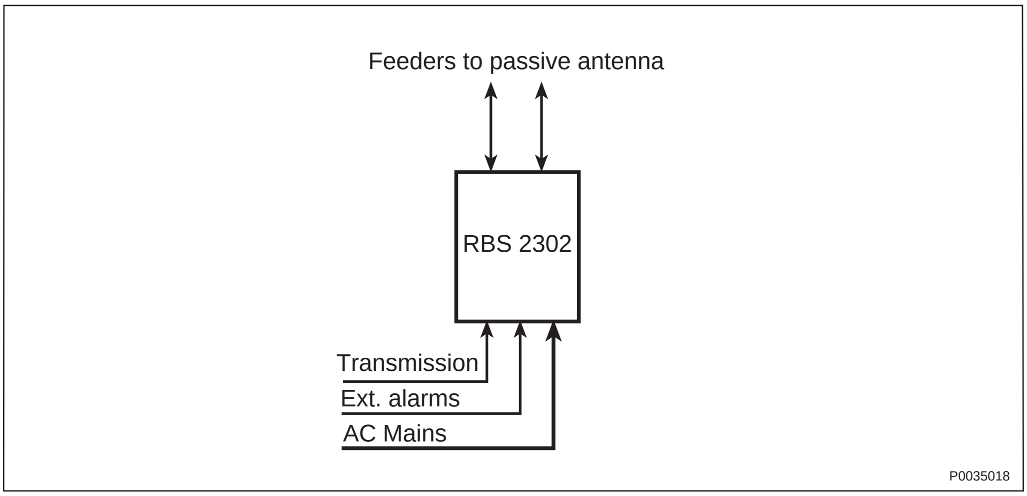

Figure 2 2 TRX (R1)

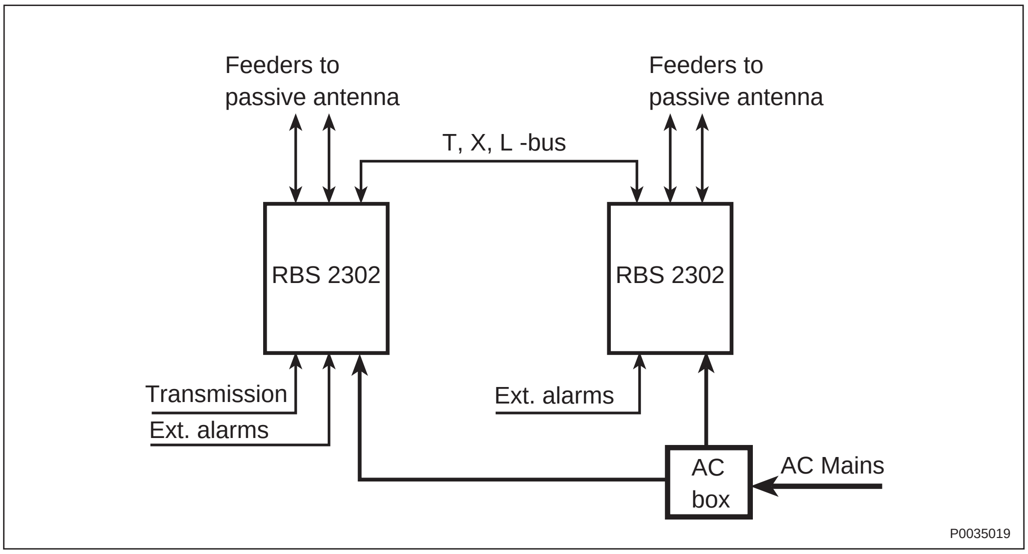

Figure 3 4 TRX (R2)

© Ericsson Radio Systems AB
— All Rights Reserved —

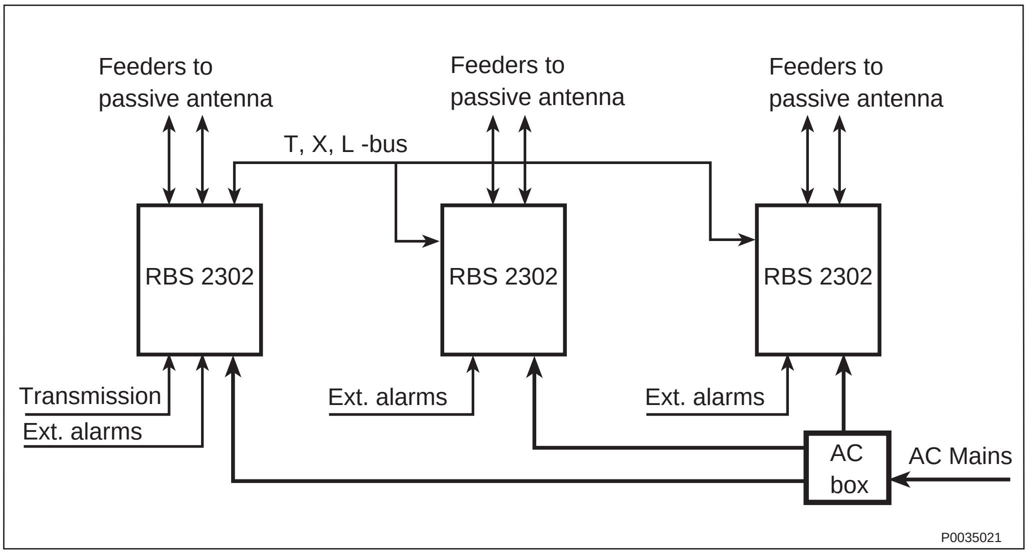

Figure 4 6 TRX (R3)

RBS 2302 Configurations with backup

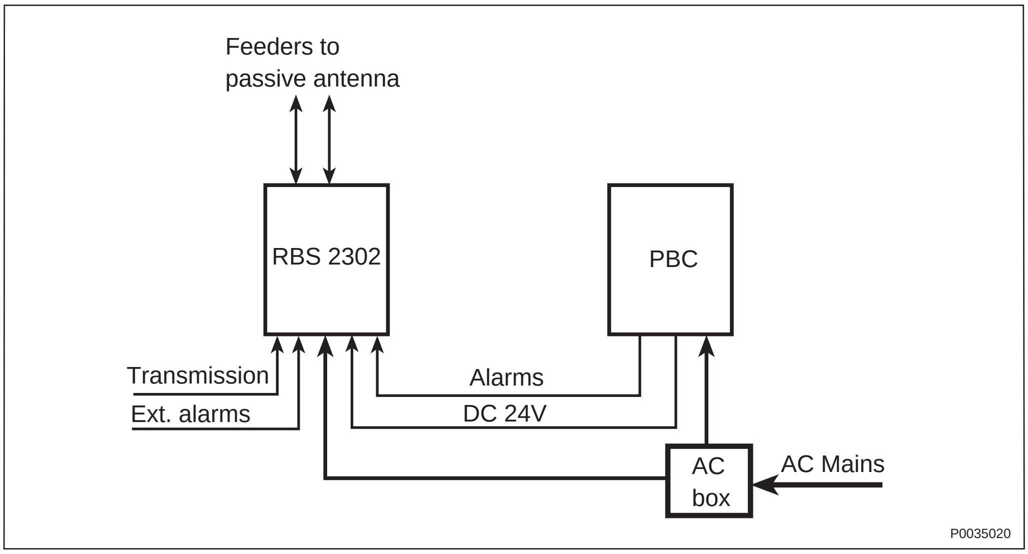

Figure 5 Extended backup, 2 TRX (R1P1)

© Ericsson Radio Systems AB
— All Rights Reserved —

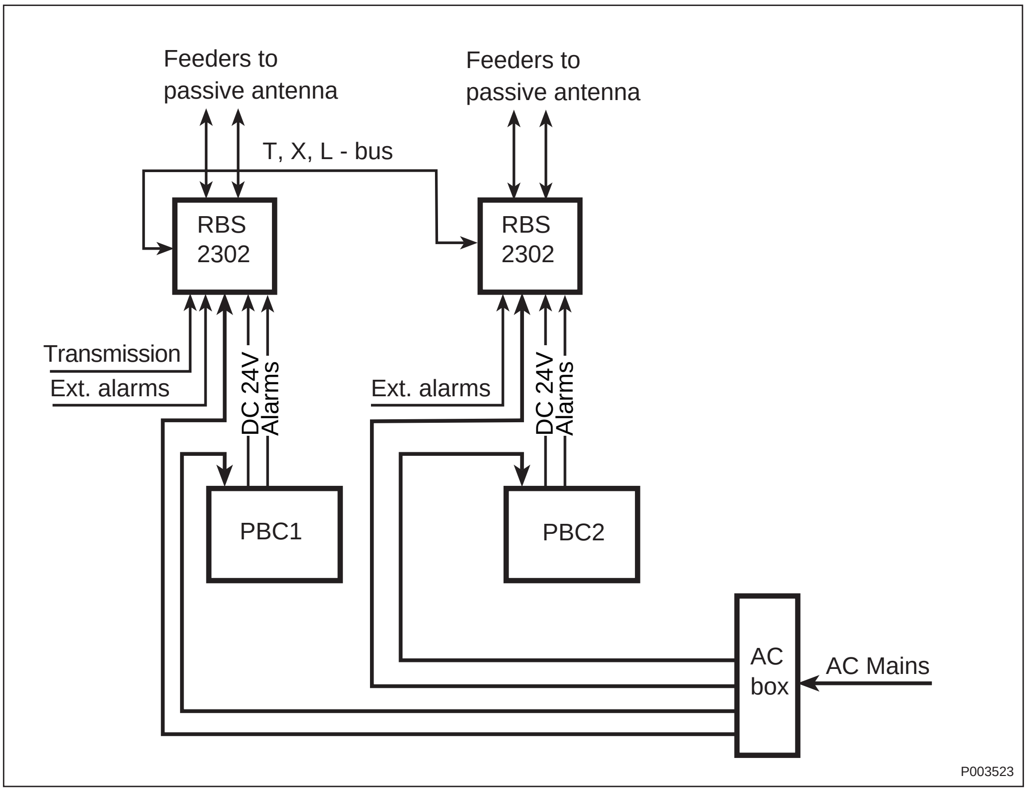

Figure 6 Extended backup, 4 TRX (R2P2)

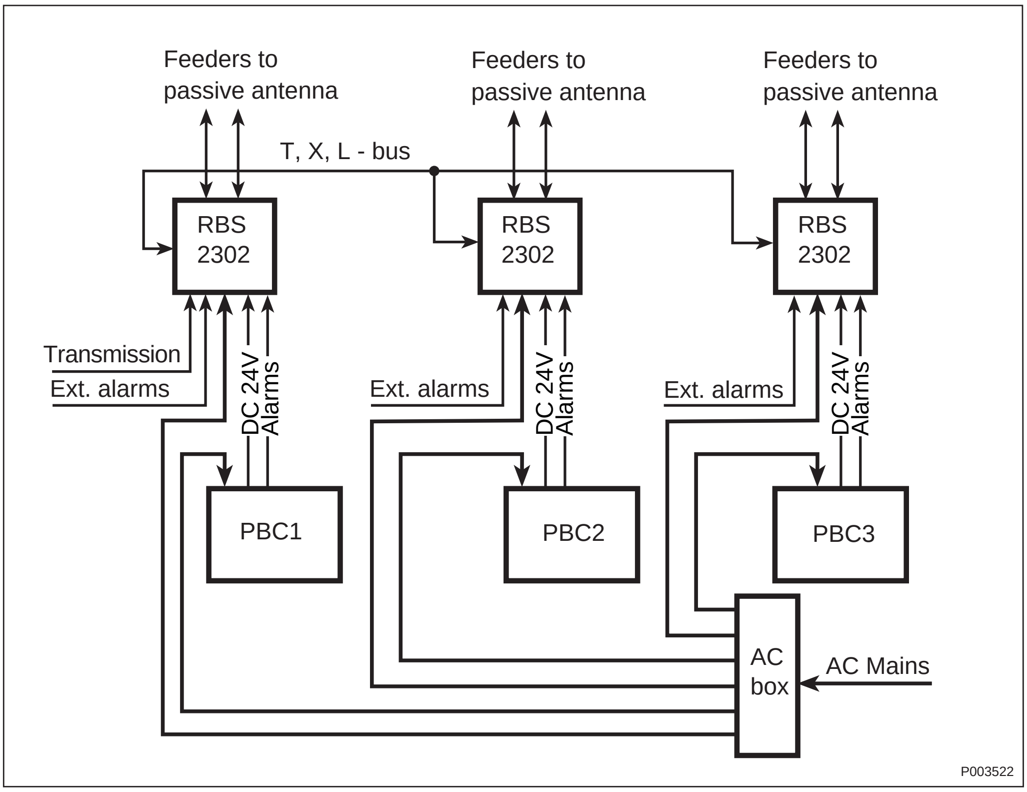

Figure 7 Extended backup, 6 TRX (R3P3)

© Ericsson Radio Systems AB
— All Rights Reserved —

+55°C Configurations

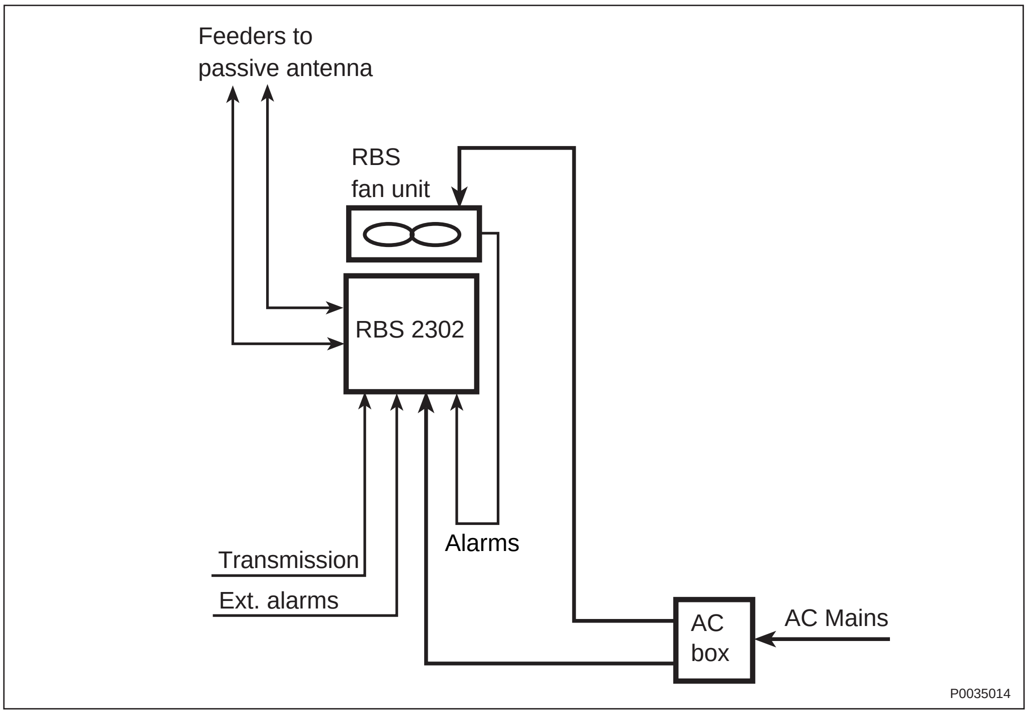

Figure 8 2 TRX, +55°C (R1/RF1)

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

3 Radio Configurations, RBS 2000 Micro

This chapter describes the RBS 2000 Micro Radio Configurations and their associated performances.

3.1 References

/GSM:05.05/	GSM 05.05 (phase 2) version 4.13.0
/PCS/	The references /PCS:1-8/ are chapters in the document: Volume 1, PCS 1900 Physical Layer 1 Specification marked: JTC(AIR)94.08.01-231R3

3.2 Terminology

3.2.1 The Mobile Telephone System

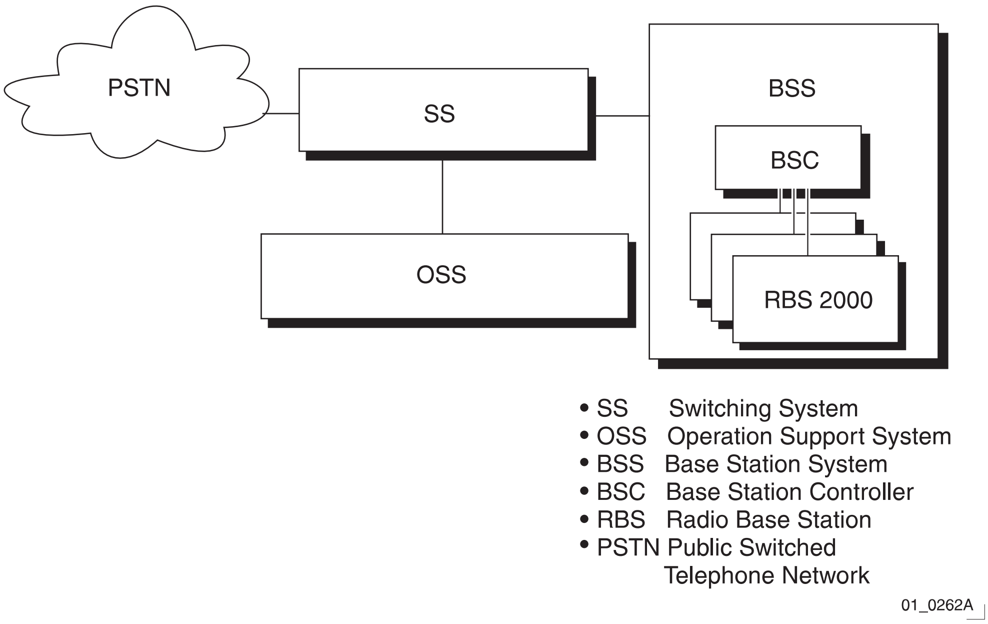

Figure 9 RBS 2000 in Ericsson's GSM System

The BSS (Base Station System) contains two functional entities:

- The BSC (Base Station Controller) handles the radio-related functions such as hand over, management of the radio network resources, and cell configuration data. It also controls radio frequency power levels in base stations and mobile stations.
- The BTS (Base Transceiver Station) is the radio equipment needed to serve one cell. It consists of the antenna system, the radio frequency power amplifiers and all the digital signal processing equipment. RBS 2000 contains equipment for 1 – 3 BTSs.

© Ericsson Radio Systems AB
— All Rights Reserved —

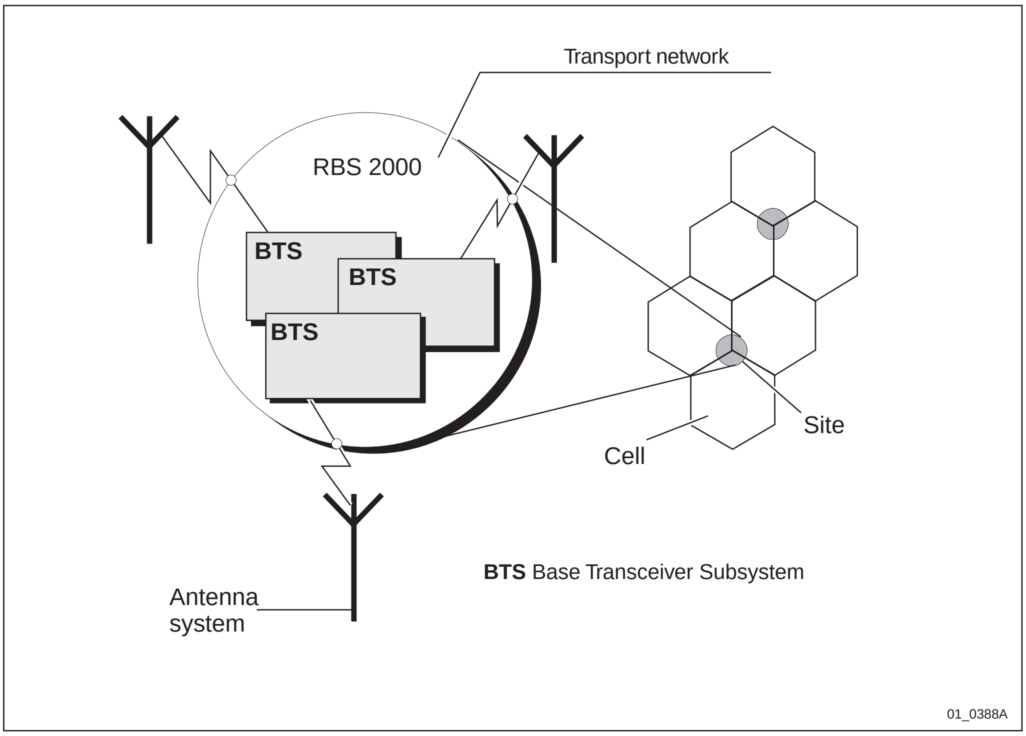

Figure 10 An RBS 2000 site with three cells

3.2.2 Antenna System

Is constituted by all RF transmission and reception antennas, directed to cover the same area or multicasting configuration.

Antenna Reference Point (ARP)

Two ARP are defined in this document; the RBS ARP and the AAU V[(1)]-ARP.

The RBS ARP is the feeder connector on the RBS.

The AAU V-ARP is the test connector after the network that connects the outputs from different PAM:s. This network is used for test purposes only.

[(1)]V=Virtual

3.2.3 Basic Configuration

A maximum of two transceivers can be combined and connected to one antenna system.

The basic configuration may be multiplied or used in combination with other basic configurations to build the needed site equipment.

3.2.4 Definition

The definition of the basic configuration type thus refers to CDU_type.

<Basic_Config>::=<X><F>d_<A>.<T>\<N>

© Ericsson Radio Systems AB
— All Rights Reserved —

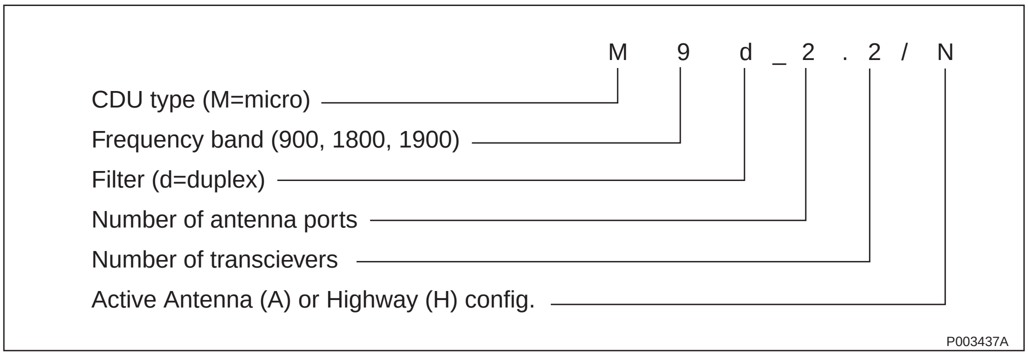

Figure 11 Type definition example

Type definitions:

<N> ::= <Variant> ::= A, H

A	=	Active Antenna
H	=	Active Antenna Highway Congifuration

<X> ::= <Basic CDU-type> ::=M

M	=	Microbase RBS

<F> ::= <Frequency Band> ::=9/18/19

9	=	900 MHz
18	=	1800 MHz
19	=	1900 MHz

<option>::=d

d:	=	Duplexer included in CDU

<A> ::= <No of Antenna Ports>

<T> ::= <No of Transceivers>

3.3 Frequency Bands

GSM 900	Uplink	890 - 915 MHz
	Downlink	935 - 960 MHz
GSM 1800	Uplink	1710 - 1785 MHz
	Downlink	1805 - 1880 MHz
GSM 1900	Uplink	1850 - 1910 MHz
	Downlink	1930 - 1990 MHz

© Ericsson Radio Systems AB
— All Rights Reserved —

3.4 General

RBS Configurations is the designated expression for the RF parts integrated in the BTS.

The functionality is:

- The output signal from one or more transmitters are combined into the same antenna system, which can be utilized as a TX/RX antenna.
- The received signal from the receive antenna system, which can be utilized as a TX/RX antenna, is distributed to receivers belonging to one RBS.

3.5 Configurations

3.5.1 TX Output Power

The value given for the RBS output power for the different configurations below is the minimum RBS output power when the transmitter is set for maximum nominal power (P0).

The RBS output power is measured at the TX reference point, and it is dependent on the TX combining and filtering parts.

The tolerance for the RBS output power at the different settings is in compliance with /GSM:05.05:4.1.2/ for GSM 900 and GSM 1800, and /PCS:5.3.3/ for GSM 1900.

When two or more transmitters are combined to one antenna, the transmitters must be operated with a minimum of 400 kHz separation between the centre frequency of adjacent carriers. This limitation is not caused by the combiner but the RBS itself.

With TX diversity configured both transmitters use the same ARFCN.

The maximum nominal power, P0, measured on the cabinet output RF connector (which in this case corresponds to the TX Reference Point) is minimum +32 dBm. This output power level is valid for all frequency bands.

With TX diversity configured the output power is minimum +32 dBm at each ARP.

Nominal A-bis configuration power parameters for the Micro Base Station RBS 2301:

900 MHz	21 - 33 (dec)
1800 MHz	21 - 33 (dec)
1900 MHz	21 - 33 (dec)

Note: Only steps by 2 is configureable (from the highest value).

TX diversity configuration power parameters for the Micro Base Station RBS 2301:

© Ericsson Radio Systems AB
— All Rights Reserved —

1800 MHz:	36 (dec)
1900 MHz:	36 (dec)

3.5.2 RX Description

The receiver system performance is dependent on the configuration.

Actual sensitivity level

Is defined in and complying with the level where RBS meets the reference sensitivity performance defined in:

- /GSM:05.05:6.2 / for GSM 900 and GSM 1800
- /PCS:4/ and /PCS:5.1.1/ for GSM 1900.

Radio reception

The receiver sensitivity is reduced when a third order intermodulation product, generated by the radio transmitters in the RBS, is received at the same RCFN as the useful signal.

This occurs when the distance in frequency between two simultaneous transmitters is chosen in a way that a third order intermodulation product is generated at the same frequency as the operating frequency of one of the receivers in the RBS.

Note: In RBS 2301 the receiver sensitivity will be decreased by 1 dB when a third order transmitter intermodulation product coincides in frequency with an active frequency used by the receiver.

3.5.3 Isolation values

The isolation requirements between two antennas belonging to the same RBS is reduced and shall at least be:

- for GSM 900:	15 dB
- for DCS 1800 MHz and PCS 1900 MHz:	20 dB
- for Maxite, GSM 1800 and GSM 1900:	30 dB

3.5.4 Omnidirectional Antenna

GSM 900

Beamwidth:	For omnidirectional antennas, specification on beamwidth is replaced by the specification on gain.
Space Diversity Separation:	The two antennas has a horizontal separation of at least 0.5 wavelength c/c or a vertical separation of 1.0 wavelength c/c.
Power Handling:	The Antenna is able to handle a continuous output of 10 W.

© Ericsson Radio Systems AB
— All Rights Reserved —

GSM 1800/ GSM 1900

Beamwidth:	For omnidirectional antennas, specification on beamwidth is replaced by the specification on gain.
Space diversity separation:	The two antennas has a horizontal separation of at least 0.5 wavelengths c/c or a vertical separation of 1.0 wavelengths c/c.
Power Handling:	The antenna is able to handle a continuous output power of 10 W.

3.5.5 Sector Antenna

GSM 900

For sector antennas, the beamwidth is specified both as the traditional –3 dB beamwidth and also as a beamwidth at the 0 dBi (isotropic) level:

Horizontal:	Min. 80° at the –3 dB point
	Min. 180° at the -10 dB level
Vertical:	Max. 75° at the –3 dB point

The antenna is able to handle a continuous output power of 10 W.

GSM 1800/ GSM 1900

For sector antennas, the beamwidth is specified both as the traditional –3 dB beamwidth and also as a beamwidth at the 0 dBi (isotropic) level:

Horizontal:	Min. 60° at the -3 dB point
	Min. 120° at the -10 dB level
Vertical:	Max. 50° at the -3 dB point

The antenna is able to handle a continuous output power of 10 W.

3.5.6 Supported Basic Configurations

RBS 2301

The following Basic Configurations are supported:

Table 3 RBS 2301 Supported Configurations

No. Cab.	Config/band	GSM 900	GSM 1800	GSM 1900
1	M9d_2.2 (1)	x		
1	M9d_2.2	x		
1	M9d_1.2	x		
1	M18d_2.2 (1)		x	

© Ericsson Radio Systems AB
— All Rights Reserved —

1	M18d_2.2		x	
1	M18d_1.2		x	
1	M19d_2.2[1]			x
1	M19d_2.2			x
1	M19d_1.2			x

Note: [1] 1 TRX only

RBS 2302

The following Basic Configurations are supported:

Table 4 RBS 2302 Supported Configurations

No. Cab.	Config/band	GSM 900	GSM 1800	GSM 1900
1	M9d_2.2	x		
2	M9d_4.4	x		
3	M9d_6.6	x		
1	M9d_1.2	x		
1	M18d_2.2		x	
2	M18d_4.4		x	
3	M18d_6.6		x	
1	M18d_1.2		x	
1	M19d_2.2			x
2	M19d_4.4			x
3	M19d_6.6			x
1	M19d_1.2			x

© Ericsson Radio Systems AB
— All Rights Reserved —

3.6 Basic Configuration GSM 900 MHz, M9d_2.2

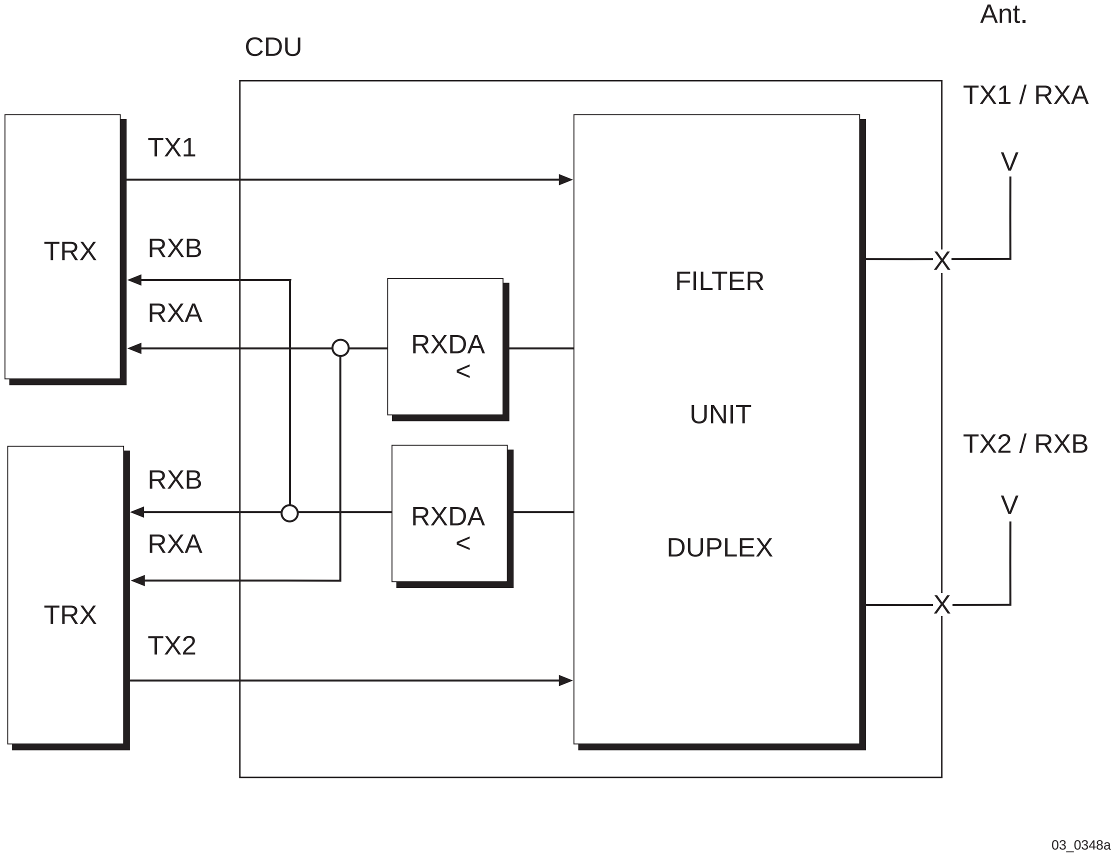

Figure 12 Basic Configuration M9d_2.2

3.6.1 Characteristics M9d_2.2

Max. no. of TRXs	2
No. of feeders	2
No. of antennas	2
Antenna configuration	TX/RX + TX/RX

3.6.2 Capacity M9d_2.2

The capacity is defined at the Tx and Rx reference points marked with X.

Capacity Radio Transmission: The output power with 1 TX to one TX/RX output is minimum +32 dBm.

The equivalent output power with TX diversity configured is minimum +35 dBm.

Capacity Radio Reception: The actual sensitivity level is –104 dBm, or better.

© Ericsson Radio Systems AB
— All Rights Reserved —

3.6.3 Capacity M9d_2.2 with Integrated Omnidirectional Antenna

The typical antenna gain for the omnidirectional antenna is -1 dBi for the GSM band.

Capacity Radio Transmission: The output power with 1 TX to one TX/RX output is minimum +32 dBm.

The minimum corresponding Effective Isotropic Radiated Power is thus +31 dBm EIRP for the above antenna.

Capacity Radio Reception: The actual sensitivity level is –104 dBm or better.

The corresponding sensitivity level with Omnidirectional antenna is –103 dBm, or better.

3.6.4 Capacity M9d_2.2 with Integrated Sector Antenna

The typical antenna gain for the sector antenna is 6 dBi for the GSM 900 band.

Capacity Radio Transmission: The output power with 1 TX to one TX/RX output is minimum +32 dBm.

The maximum corresponding Effective Isotropic Radiated Power is thus +38 dBm EIRP for the above antenna.

Capacity Radio Reception: The actual sensitivity level is –104 dBm, or better.

The corresponding sensitivity level with Sector antenna is –110 dBm or better.

© Ericsson Radio Systems AB
— All Rights Reserved —

3.7 Basic Configuration GSM 900 MHz, M9d_1.2

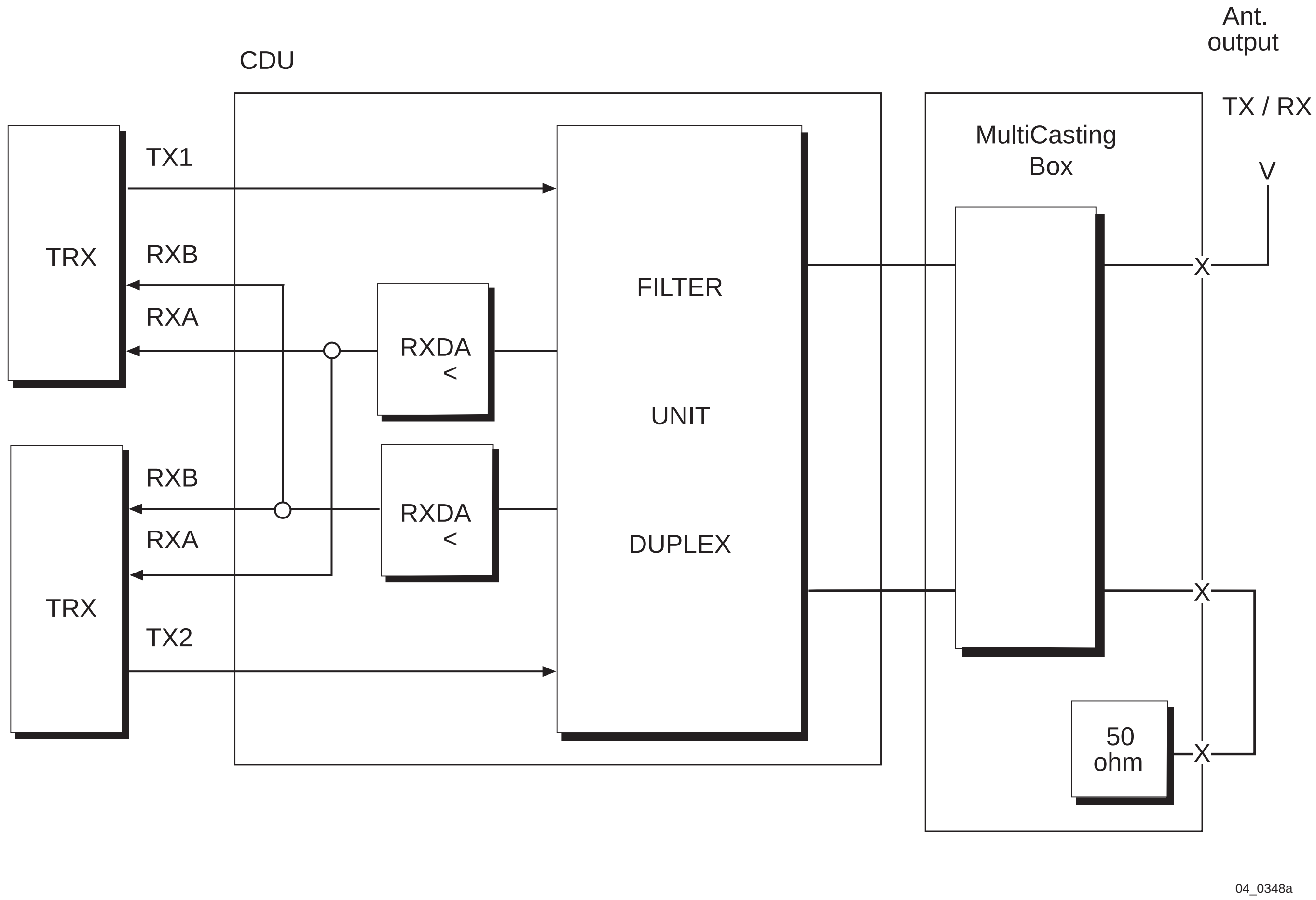

Figure 13 Basic Configuration M9d_1.2

3.7.1 Characteristics M9d_1.2

Max. no. of TRXs	2
No. of feeders	1
No. of antennas	1
Antenna configuration	TX/RX
Loss TRX-TX Reference point	Max. 4.5 dB in each output/input
Limitations	No RX diversity

3.7.2 Capacity M9d_1.2 (with Multicasting Box)

The capacity is defined at the Tx and Rx reference points marked with X.

Capacity Radio Transmission: The output power from 1 TX to each TX/RX output/input is minimum +27.5 dBm.

Capacity Radio Reception: The actual sensitivity level is –99.5 dBm, or better.

© Ericsson Radio Systems AB
— All Rights Reserved —

3.8 Basic Configuration GSM 1800 MHz, M18d_2.2

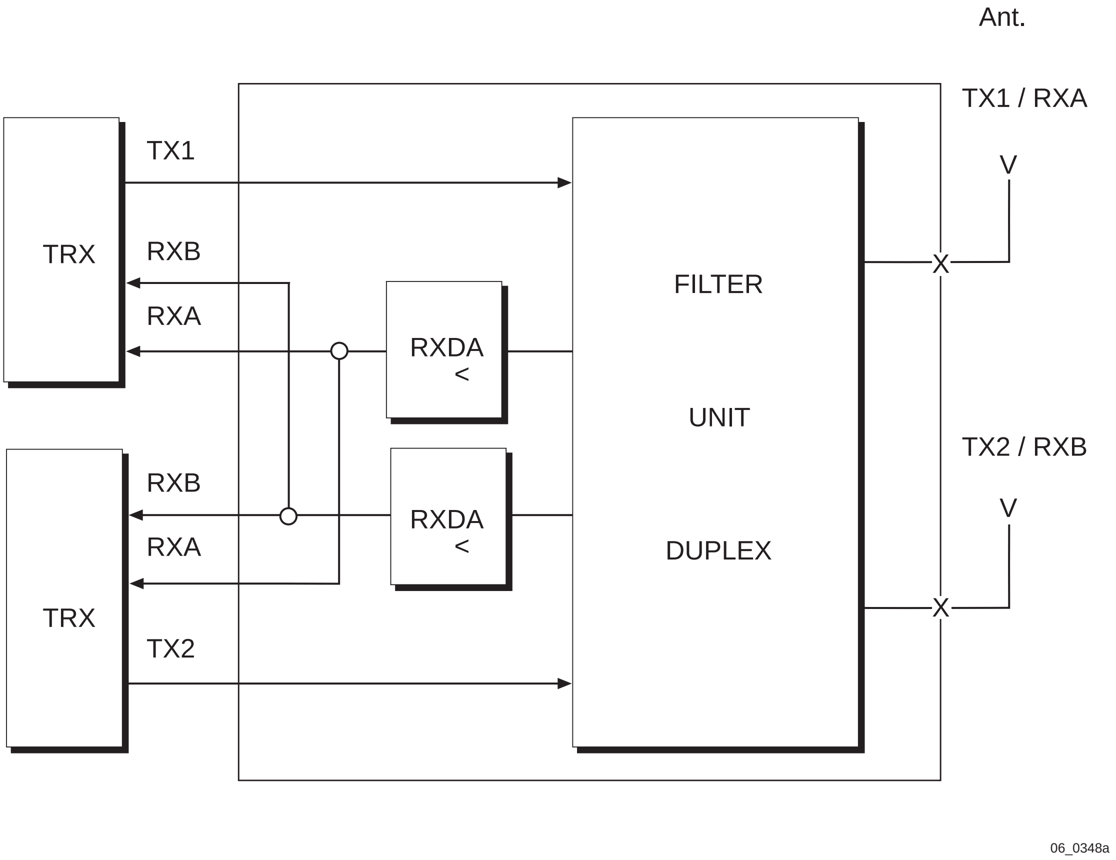

Figure 14 Basic Configuration M18d_2.2

3.8.1 Characteristics M18d_2.2

Max no. of TRXs	2
No. of feeders	2
No. of antennas	2
Antenna configuration	TX/RX + TX/RX

3.8.2 Capacity M18d_2.2

The capacity is defined at the Tx and Rx reference points marked with X.

Capacity Radio Transmission: The output power with 1 TX to one TX/RX output is minimum +32 dBm.

The equivalent output power with TX diversity configured is minimum +35 dBm.

Capacity Radio Reception: The actual sensitivity level is –104 dBm, or better.

© Ericsson Radio Systems AB
— All Rights Reserved —

3.8.3 Capacity M18d_2.2 with Integrated Omnidirectional Antenna

The typical antenna gain for the omnidirectional antenna is +1 dBi for the GSM 1800 band.

Capacity Radio Transmission: The output power with 1 TX to one TX/RX output is minimum +32 dBm.

The maximum corresponding Effective Isotropic Radiated Power is thus minimum +33 dBm EIRP for the above antenna.

Capacity Radio Reception: The actual sensitivity level is –104 dBm or better.

The corresponding sensitivity level with Omnidirectional antenna is –105 dBm, or better.

3.8.4 Capacity M18d_2.2 with Integrated Sector Antenna

The typical antenna gain for the sector antenna is +8.5 dBi for the GSM 1800 band.

Capacity Radio Transmission: The output power with 1 TX to one TX/RX output is minimum +32 dBm.

The maximum corresponding Effective Isotropic Radiated Power is thus minimum +40.5. dBm EIRP for the above antenna.

Capacity Radio Reception: The actual sensitivity level is –104 dBm or better.

The corresponding sensitivity level with Sector antenna is –112.5. dBm, or better.

© Ericsson Radio Systems AB
— All Rights Reserved —

3.9 Basic Configuration GSM 1800 MHz, M18d_1.2

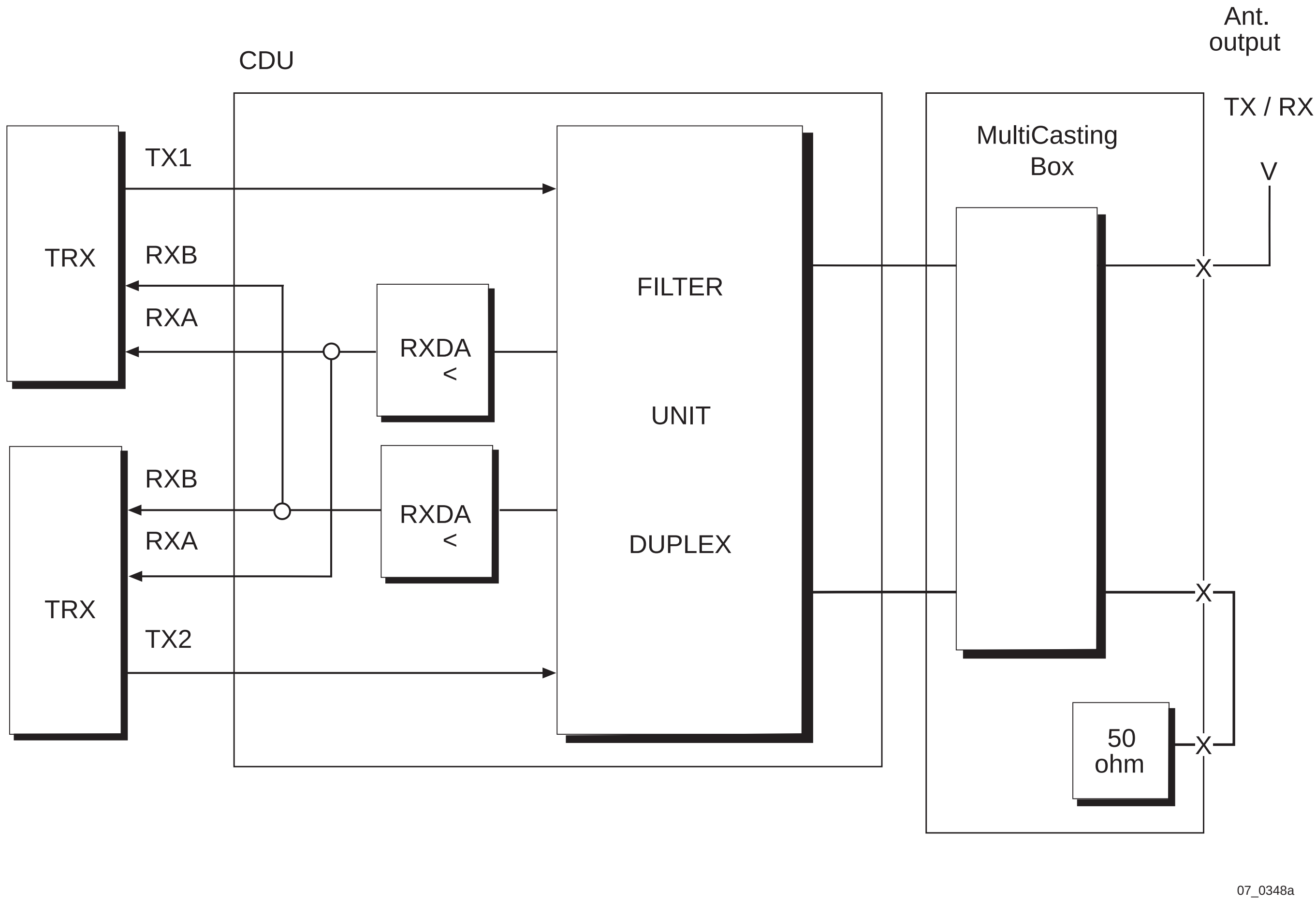

Figure 15 Basic Configuration M18d_1.2

3.9.1 Characteristics M18d_1.2

Max. no. of TRXs	2
No. of feeders	1
No. of antennas	1
Antenna configuration	TX/RX
Loss TRX-TX Reference point	Max. 4.5 dB in each output/input
Limitations	No RX diversity

3.9.2 Capacity M18d_1.2 (with Multicasting Box)

The capacity is defined at the Tx and Rx reference points marked with X.

Capacity Radio Transmission: The output power from 1 TX to each TX/RX output/input is minimum +27.5 dBm.

Capacity Radio Reception: The actual sensitivity level is –99.5 dBm, or better.

© Ericsson Radio Systems AB
— All Rights Reserved —

3.10 Basic Configuration GSM 1900 MHz, M19d_2.2

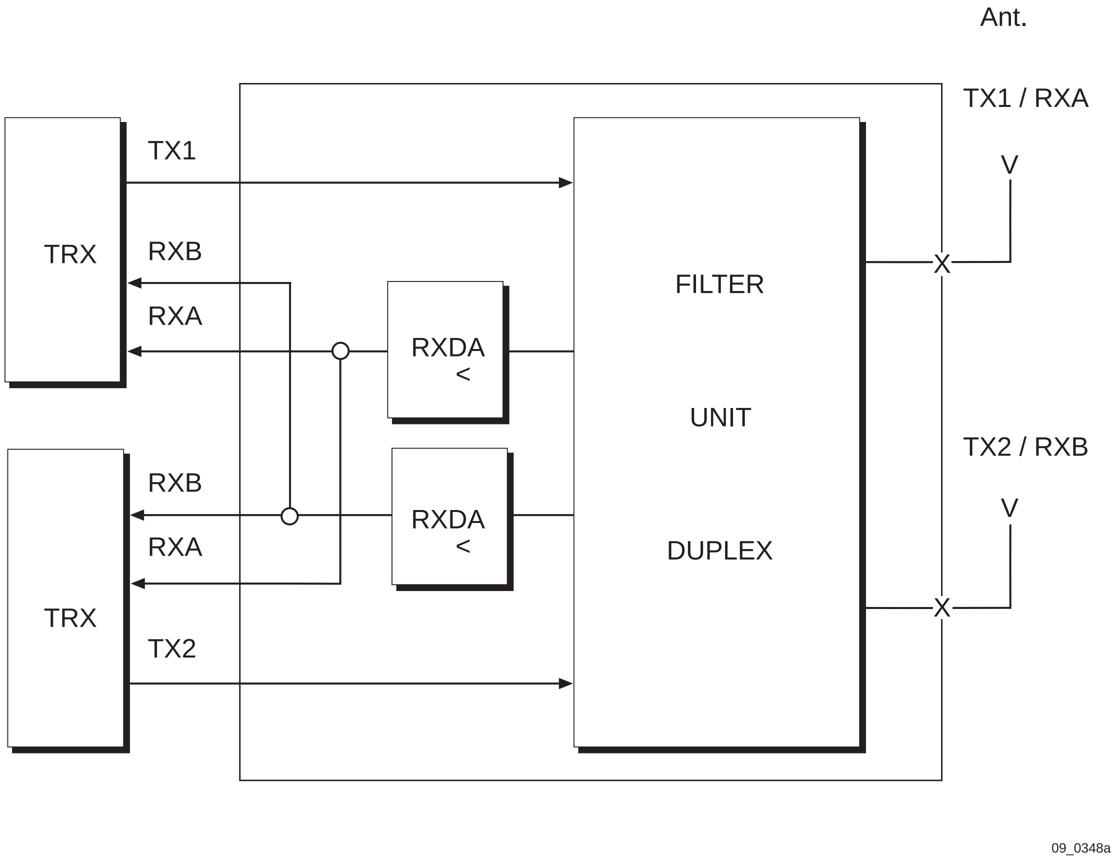

Figure 16 Basic Configuration M19d_2.2

3.10.1 Characteristics M19d_2.2

Max. no. of TRXs	2
No. of feeders	2
No. of antennas	2
Antenna configuration	TX/RX + TX/RX

3.10.2 Capacity M19d_2.2

The capacity is defined at the Tx and Rx reference points marked with X.

Capacity Radio Transmission: The output power with 1 TX to one TX/RX output is minimum +32 dBm.

The equivalent output power with TX diversity configured is minimum +35 dBm.

Capacity Radio Reception: The actual sensitivity level is –104 dBm, or better.

© Ericsson Radio Systems AB
— All Rights Reserved —

3.10.3 Capacity M19d_2.2 with integrated Omnidirectional Antenna

The typical antenna gain for the omnidirectional antenna is 1 dBi for the GSM 1900 band.

Capacity Radio Transmission: The output power with 1 TX to one TX/RX output is minimum +32 dBm.

The maximum corresponding Effective Isotropic Radiated Power is thus minimum +33 dBm EIRP for the above antenna.

Capacity Radio Reception: The actual sensitivity level is –104 dBm or better.

The corresponding sensitivity level with Omnidirectional antenna is –105 dBm, or better.

3.10.4 Capacity M19d_2.2 with integrated Sector Antenna

The typical antenna gain for the sector antenna is 9 dBi for the GSM 1900 band.

Capacity Radio Transmission: The output power with 1 TX to one TX/RX output is minimum +32 dBm.

The maximum corresponding Effective Isotropic Radiated Power is thus minimum +41 dBm EIRP for the above antenna.

Capacity Radio Reception: The actual sensitivity level is –104 dBm or better.

The corresponding sensitivity level with Sector antenna is –113 dBm, or better.

© Ericsson Radio Systems AB
— All Rights Reserved —

3.11 Basic Configuration GSM 1900 MHz, M19d_1.2

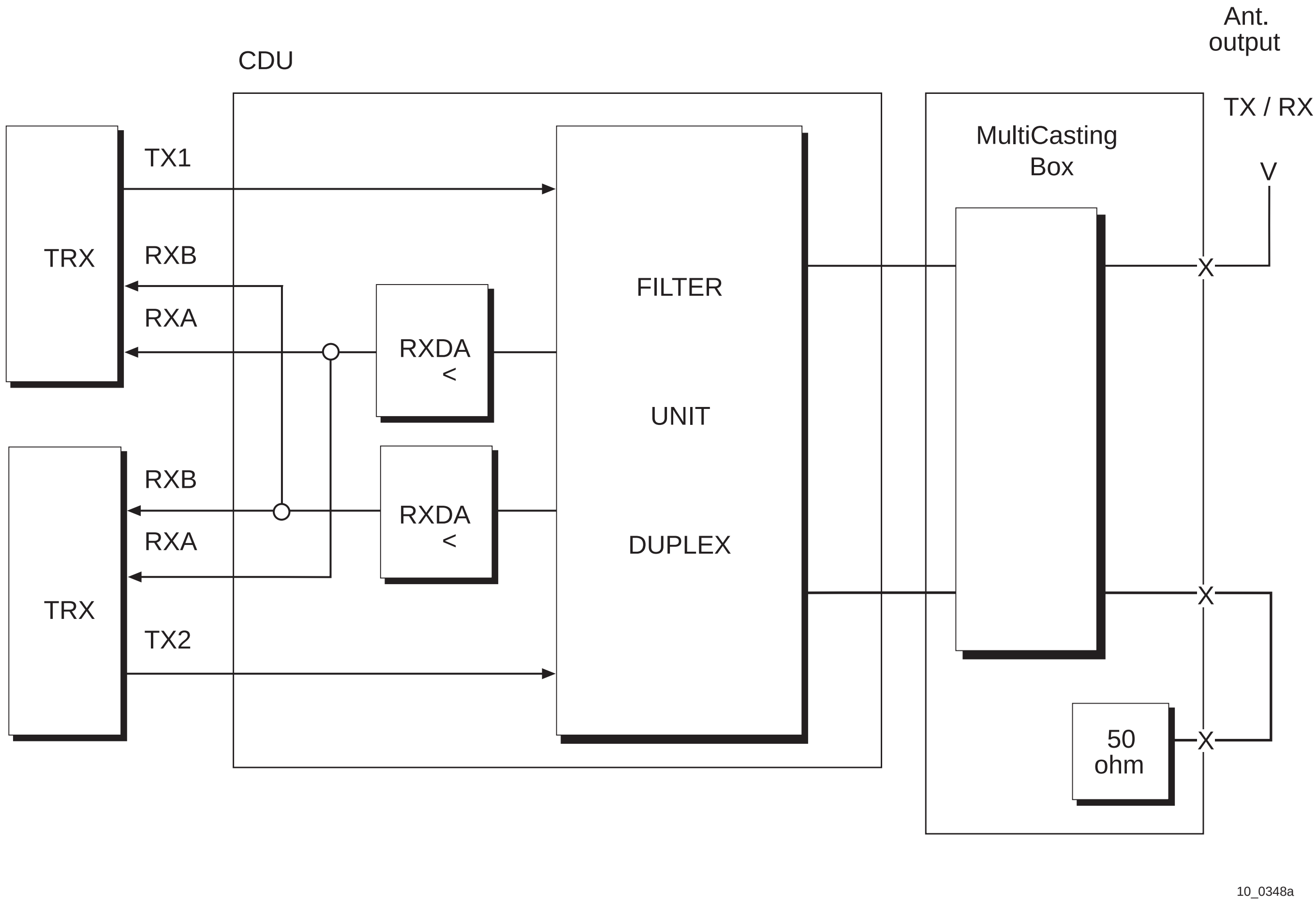

Figure 17 Basic Configuration M19d_1.2

3.11.1 Characteristics M19d_1.2

Max. no. of TRXs	2
No. of feeders	1
No. of antennas	1
Antenna configuration	TX/RX
Loss TRX-TX Reference point	Max. 4.5 dB in each output/input
Limitations	No RX diversity

3.11.2 Capacity M19d_1.2 (with Multicasting Box)

The capacity is defined at the Tx and Rx reference points marked with X.

Capacity Radio Transmission: The output power from 1 TX to each TX/RX output/input is minimum +27.5 dBm.

Capacity Radio Reception: The actual sensitivity level is –99.5 dBm or better.

© Ericsson Radio Systems AB
— All Rights Reserved —

4 Product Specification for RBS 2301

This chapter will describes the architecture, and specifies the characteristics and performance of the RBS 2301.

4.1 General

The RBS 2301 satisfies the need for ’hot spot’ capacity in small areas, such as part of a city centre or a shopping mall, as well as ’fill in’ coverage.

The main focus with this product is to reduce site cost and make it easier for operators to find sites, which will ensure operator profitability of a micro cell network.

To be able to support the idea of a small RBS that can be located almost anywhere, some functional limitations has been made:

- Low output power.
- No antenna supervision (VSWR).
- No RF cable supervision.
- No expansion possibility.

The RBS is designed to fulfil applicable parts of the GSM and JTC specifications.

The weather-proof cabinet and design make it ideal for installation indoor, outdoor, on poles, walls or mast.

Integral antennas can be ordered as omnidirectional or sector antennas, except from this there is always a possibility to connect external antennas.

The base colour of the RBS is Grey (NCS S2502-R), but there is a possibility to order the front sun-shields in different colours, which will make the RBS more discrete.

The RBS is built up by the following main physical units: Mounting Base, Cabinet, Antennas and Sun-shield. This will support a routine of installing the Mounting Base prior to the Cabinet arrival.

© Ericsson Radio Systems AB
— All Rights Reserved —

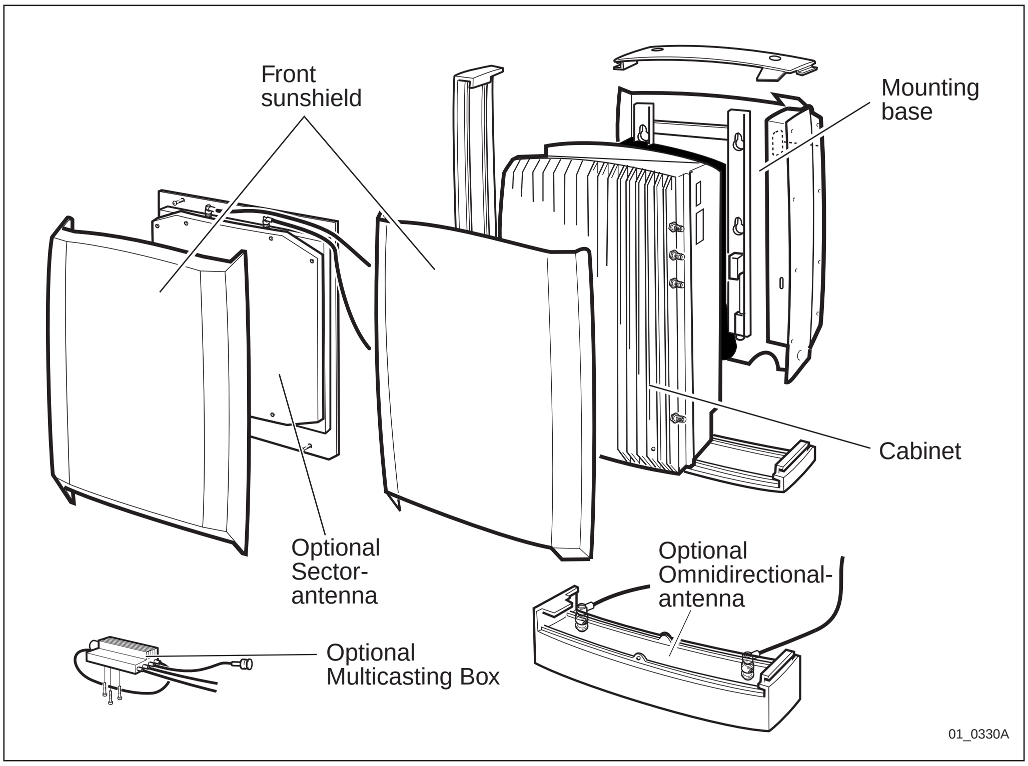

Figure 18 Main physical units

The prime technical concerns have been to implement a RBS that:

- has a small size (volume and weight), and an appearance suitable for a discrete installation ("landlord friendly").
- has high channel capacity, two transceivers giving total of 15 traffic channels if configured to one cell, or 7 + 7 traffic channels if configured to two cells.
- is characterized by low need for preventive maintenance.
- has high MTBF
- has versions for the different system standards GSM 900, GSM 1800 and GSM 1900.
- includes all functions needed for a complete installation of a radio base station, including standard interface G703 E1 or T1 (DS1) to transmission network, AC mains power, battery backup and antennas.
- support Linear Cascade connection on the transmission interface.
- is possible to install by one person.
- can be installed by ordinary skilled installation personnel.

© Ericsson Radio Systems AB
— All Rights Reserved —

4.2 Product Architecture

4.2.1 Hardware units

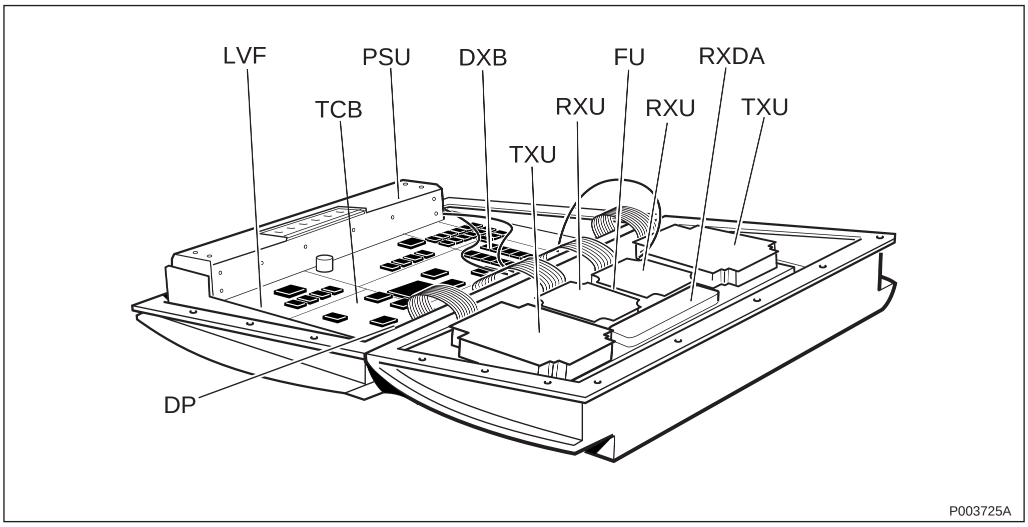

Figure 19 Hardware units in cabinet

DXB	Distribution Switching Board
	The DXB (1 per RBS) is the central control unit for the RBS and supports the transmission interface.
OMT	Operation and Maintenance Terminal
	The OMT is a PC based terminal used during installation and maintenance.
TCB	Transceiver Control Board
	The TCB (2 per RBS) includes equipment related to signal processing for up to two radio carriers.
TXU	Transmitter Unit
	The TXU (2 per RBS) contains equipment for transmission on one radio carrier.
RXU	Receiver Unit
	The RXU (2 per RBS) contains equipment for reception on one radio carrier.
RXDA	Receiver Divider Amplifier
	The RXDA (1 per RBS) contains equipment for low noise amplification of the received radio carrier(s) and dividing each incoming RX into two output carriers.
FU	Filtering Unit

© Ericsson Radio Systems AB
— All Rights Reserved —

	The FU (1 per RBS) is the interface between the transmitters, receivers and the antenna system.
LVF	Low Voltage Filter The LVF contains components for voltage filtering
PSU	Power Supply Unit The PSU (1 per RBS), which rectifies the incoming AC mains to regulated DC voltages, controls and supervises the battery and supervises the temperatures inside the cabinet.
Climate Equipment	Heater to heat the RBS at low temperature.
Battery	The battery is an internal entity and is replaceable without disturbing traffic handling
Connection Unit	The connection unit contains components for lightning and EMC protection. It also includes fuses, AC mains and battery switch as well as plinths for the external interfaces except for antenna feeders.
Distribution Plane	The distribution plane interfaces the DXB, the TCB, the TXUs, the RXUs and the PSU. It also contains the buttons and indicators for the RBS.

© Ericsson Radio Systems AB
— All Rights Reserved —

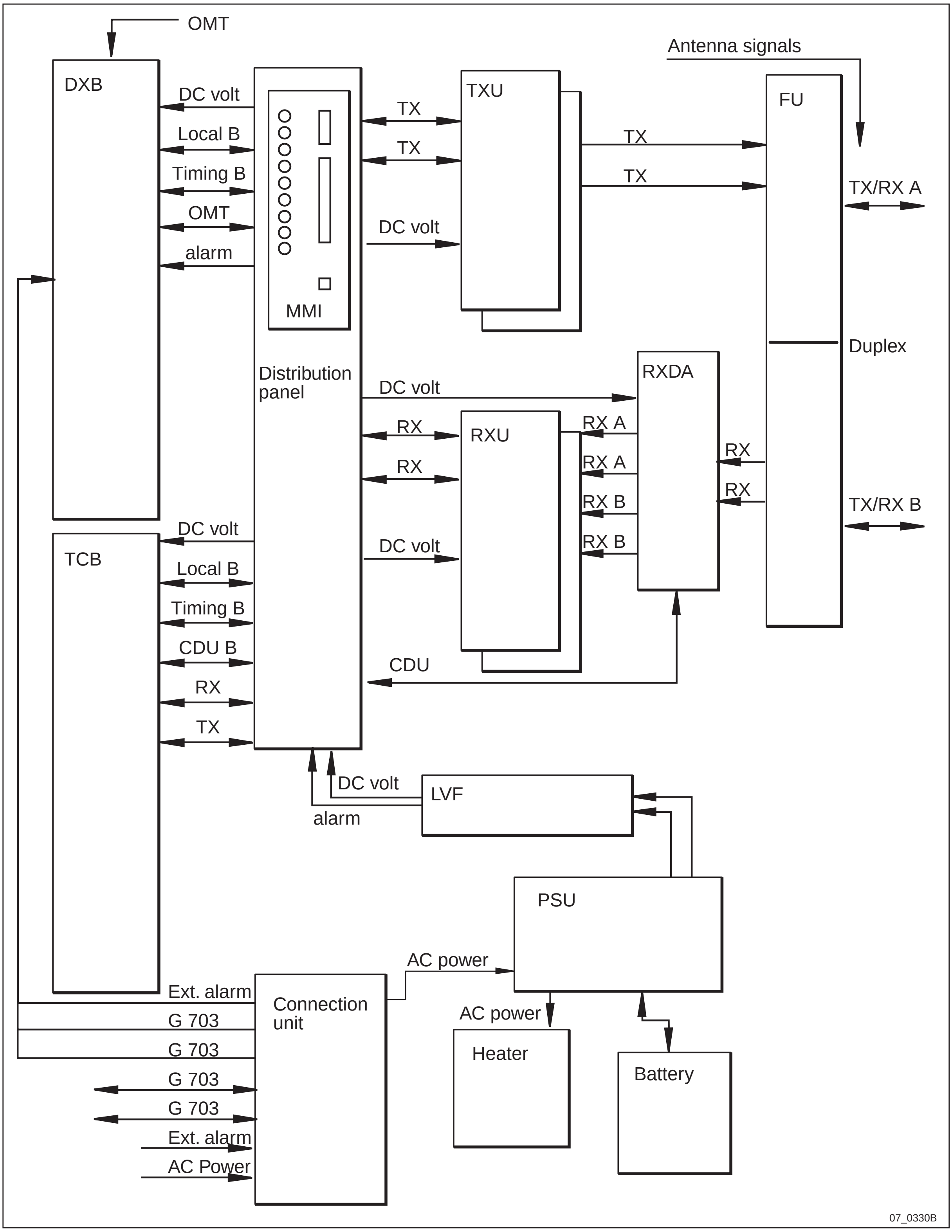

Figure 20 Overview

© Ericsson Radio Systems AB
— All Rights Reserved —

4.3 Configuration

4.3.1 Options

The RBS is a flexible product which can be ordered according to different customer needs.

The following options are available:

- Mast mounting fixture
- Internal high precision oscillator
- Integral antennas
- Multicasting box

Multicasting functionality: One feeder system which can be used for a distributed antenna system.

Sun-shield

The following optional colours are available for the front sun-shield.

NCS S3010-G80Y	(Olive green)
NCS S2020-R70B	(Sky blue)
NCS S2030-Y40R	(Brick red)
NCS S2040-Y20R	(Ochre)
NCS S1010-Y20R	(Light yellow)

According to NCS standard.

4.3.2 Variants

Configurations

The RBS will support the following basic configuration alternatives:

Table 5

GSM 900	GSM 1800	GSM 1900
M9d_1.2	M18d_1.2	M19d_1.2
M9d_2.2	M18d_2.2	M19d_2.2

The performance for each configuration is described in ref. /GS-Config/.

© Ericsson Radio Systems AB
— All Rights Reserved —

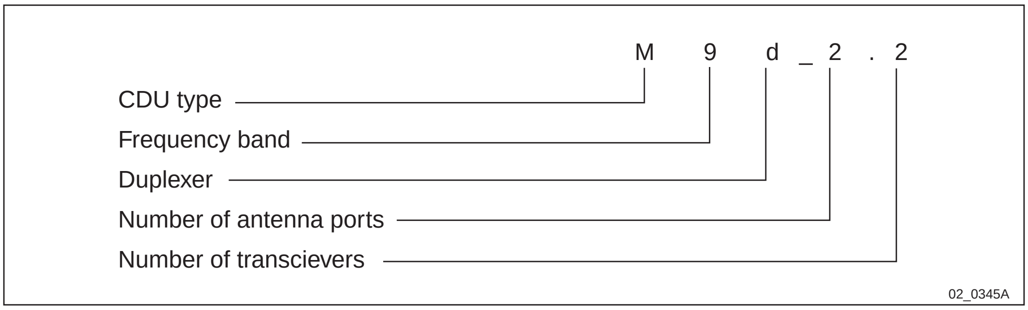

Figure 21 How to read the code

Table 6

Object	**RBS Variants**
Traffical capacity	2 TRX
Encryption	A5/1, A5/2
Transport Network Interface	1.5 Mbit/s, 100 Ohm 2.0 Mbit/s, 75 Ohm 2.0 Mbit/s, 120 Ohm
Filter	Duplex

Integral Antennas

The following selection are available: Omnidirectional or Sector.

4.4 Combinations

Possible combinations are described in Ordering Information.

© Ericsson Radio Systems AB
— All Rights Reserved —

4.5 Transmission Modes

The RBS 2301 can be configured for linear cascade mode and stand alone mode. The configuration is performed by means of the OMT.

When used as stand alone, PCM port A shall be connected towards the BSC. In this mode, PCM port B cannot be used.

When used in linear cascade mode (multidrop), the RBSs are connected so that each RBS uses its port A towards the BSC and port B towards the next RBS. That RBS is connected in the same way with port A towards the previous RBS (and indirectly the BSC) and port B towards the next RBS etc.

Only RBSs that support multidrop can be included in the multidrop chain. Figure 22 on page 44 shows a multidrop chain with three RBSs.

The multidrop function handles 64 kbit/s timeslots only. All RBSs have dedicated timeslots.

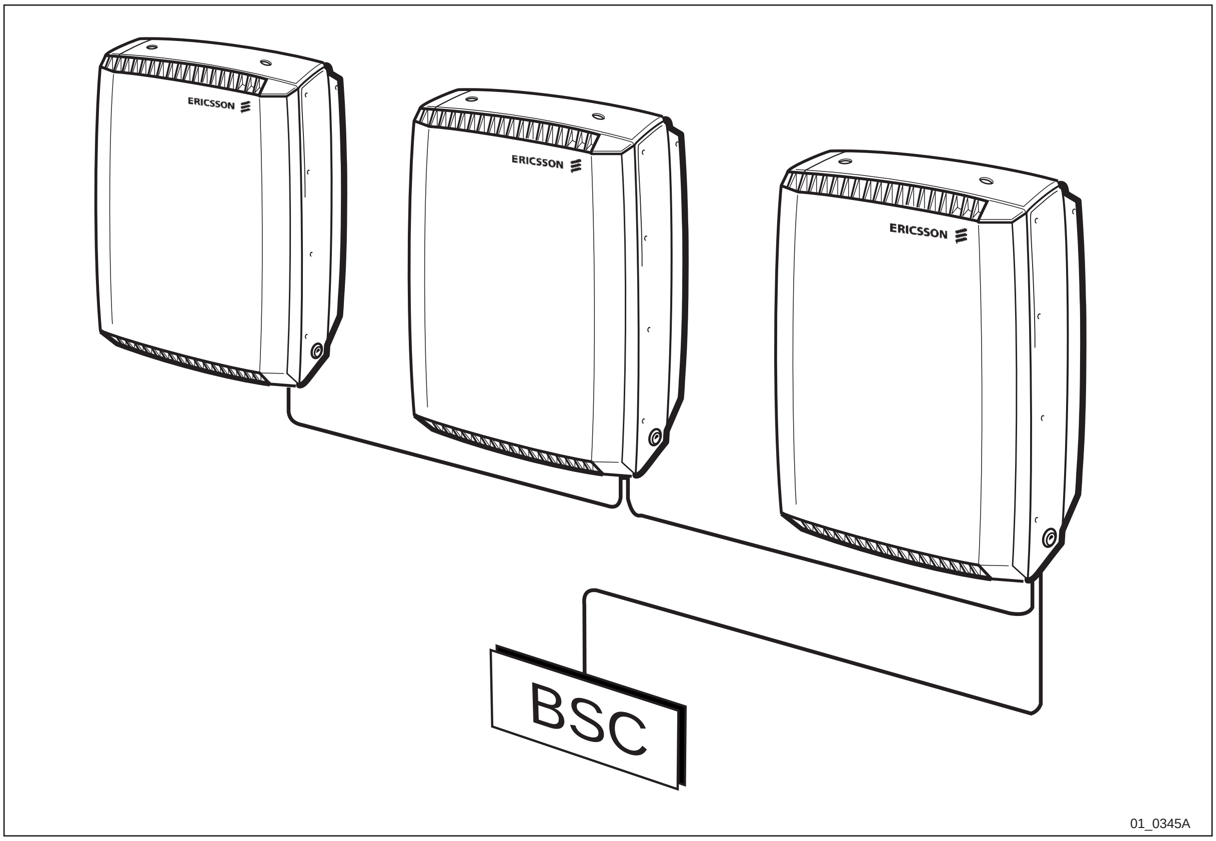

Figure 22 Multidrop chain

© Ericsson Radio Systems AB
— All Rights Reserved —

4.6 Interface and Connection

4.6.1 External Connections

AC Mains

Type of connections:	Screw terminal for 4 X max.2.5 mm²
Cable gland capacity:	1 times Ø 14 mm

External Alarms

Type of connections:	Screw terminal for 8 X max. 1.5 mm²
Cable gland capacity:	1 times Ø 10 mm
Number of alarms:	4

Antenna Connectors

Type of connectors:	TNC (receptacle) female.

Note: When using integral antennas, Cables and connectors are included, these connection are placed on the cabinet.

Transmission

Type of connections: alternative	1. Coax Cable 75 Ohm
	2. 100/120 Ohm

Earthing

Central earth terminal point M8 thread.

4.6.2 Internal Connections

OMT

Type of connections:	9 pin D-sub (receptacle) female.

4.6.3 Test Interface

The RBS is equipped with test ports for connection of external instruments. The following signal are available at test ports:

13 MHz Reference

Type of connectors:	SMB connector (receptacle) male.

© Ericsson Radio Systems AB
— All Rights Reserved —

4.6.4 Operator Interface

When opening the Mounting Base there is an MMI area available containing the operational interface which includes the LED’s and buttons listed below.

Indicators (LEDs)

Fault	One or more faults, equals BS fault.
Operational	At least one TRX operational.
Local mode	RBS in local mode.
Reduced capacity	One of two TRX’s operational.
Test TRX1	Result from TRX1 test operation.
Test TRX2	Result from TRX2 test operation.
AC Power on	AC Power is switched on to RBS.
Battery fault	Lowbattery DC voltage, battery absent.
External alarm	One or more external alarm active.

Buttons

CPU reset

Local/remote mode

Test Operation initiation

Switches

Battery

AC Mains

Barcodes Signs

The bar code sign for product identification is readable without disturbing the RBS function.

4.7 Product Requirements

4.7.1 Appearance

Ericsson products are designed to appear as one physical unit, inconspicuous, pleasant and good-looking. The standard colour of the RBS is Grey.

The front cover of the RBS which is designed as a sun-shield may be ordered in different colours to make the RBS even more inconspicuous.

There is an optional integrated antenna system which will support the idea that the RBS and antenna site are the same.

© Ericsson Radio Systems AB
— All Rights Reserved —

4.7.2 Mechanical Structure

Replaceable Units

The RBS consists of the following replaceable units:

- Cabinet
- Mounting base
- Integral antennas
- Sun-shield
- Batteries
- Connection unit
- Wall fixture
- Mast/pole fixture

Labels

All signs are placed to fulfil the requirements behind the purpose and reason for the signs. And all signs that are needed for identification of the product and its compliance are readable without disturbing the RBS function.

4.7.3 Dimension and Weight

Volume

The total volume of a complete RBS site without cabling, 33 l.

Size

(HxWxD): 535x408x160 mm. (without integral antennas).

(HxWxD): 535x408x210 mm. (with Sector Antenna).

(HxWxD): 607x408x160 mm. (with Omnidirectional Antenna).

Weight

The total weight is the sum of the following handling units:

Cabinet	18 kg (incl. internal battery)
Mounting Base	6.5 kg (incl. Sun-shield)
Wall bracket	3 kg
Omni Antenna	0.5 kg
Sector Antenna	2 kg
Total Weight	30 kg

(A temporary lifting device can be attached during installation.)

© Ericsson Radio Systems AB
— All Rights Reserved —

4.7.4 Hardware Characteristics

Acoustical Noise

The RBS will not contribute to the acoustical noise in the surroundings.

Vandal Resistance

The RBS will appear as vandal resistant and unauthorized intrusion will not be possible without damaging the unit.

Package Material

The package material is recyclable.

Handling Robustness

The RBS main cabinet is designed to accept intermediate placing on the ground during installation and maintenance work.

4.7.5 Environment

Operation

The RBS is designed to endure the requirement for “outdoor mast mounted equipment”.

Temperature range:	-33°- +45°C
For details see:	Section "Environmental Capabilities RBS 2301"

Solar Radiation

The RBS is designed to withstand the additional heat from solar radiation in it’s specified environment.

Transport

The RBS is designed to endure the requirement for transport.

Temperature range:	-40°C - +70°C
For details see:	Section "Environmental Capabilities RBS 2301"

Storage

The RBS is designed to endure the requirement for storage.

Temperature range:	-25°C - +55°C
For details see:	Section "Environmental Capabilities RBS 2301"

© Ericsson Radio Systems AB
— All Rights Reserved —

Handling

The RBS is designed to endure the requirement for Handling. Handling of RBS parts during installation and maintenance.

Temperature range:	-40°C - +70°C
For details see:	Section "Environmental Capabilities RBS 2301"

In addition to this requirement the RBS 2301 will endure topple. Minor damages of the cabinet i.e. a broken corner of a cooling fin at topple will not disturb the function of the RBS.

4.7.6 Climate Protection

Climate Protection Principle

The climate protection maintains the internal temperature within allowed range for the units in the RBS.

The climate protection of the RBS is handled by a combination of:

- Natural convection with the help of cooling fins
- Conductional heating

Heating Capacity

The system have the capacity to heat the RBS from:

- –33 °C to starting conditions within 30 minutes
- –15 °C to starting conditions within 15 minutes

If the environmental conditions are: no wind or accumulated ice or snow on the RBS.

Ingression

The RBS fulfil the IP-55 requirements according to the standard IEC 529.

4.7.7 Power Supply

Supply Voltage

The RBS can be connected to mains supply voltage with Nominal:

200 - 250 VAC	±10 %	50 Hz ±10 %
100 - 127 VAC	±10 %	60 Hz ± 8 %
200/100 - 240/120	±10 %	60 Hz ± 8 %

The RBS will support installation with:

Single-phase (two-wire; earthed end of phase).

Single-phase (three-wire; earthed mid point).

© Ericsson Radio Systems AB
— All Rights Reserved —

Single-phase (three-wire; separate PE and N conductor).

According to TN, TT and IT power system.

Power Consumption

Normal operation, both TRX’s transmitting on full output power. (at 230 V nominal mains supply)	150 VA
Maximum power consumption:	500 VA (only with activated heater).

Battery Backup

The RBS will survive interruptions on mains supply during at least 3 minutes. The RBS will maintain full performance during the backup time if the battery is fully charged. The battery will be recharged to at least 80% of its capacity within 15 hours.

For longer backup time an external UPS may be used.

4.7.8 Type Approval

Type Approval Standard

The product fulfils the required type approvals from: GSM 11.20 or GSM 11.21 standard JTC standard FCC rules and regulations. According to requirements in Section Product Safety Requirements RBS 2000.

4.7.9 Dependability

Preventive Maintenance

These preventive maintenance conditions must be fulfilled to guarantee the availability of the RBS.

Action	Interval
Change of battery	< 5 years
Change of lightning protection equipment	<10 years
Calibration of "optional" synchronisation oscillator	< 3 years

© Ericsson Radio Systems AB
— All Rights Reserved —

4.7.10 Installation

A quick and easy installation procedure is provided. If the installation preconditions are met, the RBS can be installed in less than 30 minutes. A minimum of tools and instruments are required when installing an RBS.

Preconditions

- The initiation of the BSC is prepared
- The transport network available[1)] at the site
- Mains power available at site
- Preinstalled antennas and feeders are available[1)]
- Wall fixture preinstalled
- Friendly geographic location and environment (means higher than -10 °C, no precipitation and easy access to the site)

[1)]"available" means: accessible and with specified function.

Installation Scenario

To support the idea of a quick and smooth installation scenario, the RBS installation work can be divided in to two steps:

- Preinstallation. Installation of the Mounting Base, antennas and all necessary cabling (AC mains, transmission and alarms).
- Installation and Commissioning. Installation of the Cabinet including all parts according to customer ordering.

However the installation is possible to carry out in one site visit.

The manual operations at installation are few and easy, this is valid also when connecting external cables.

There is no need for an OMT on site, during installation work.

Site Installation Requirement

When installing more than one RBS at the same site, the RBS’s must be separated. The separation is necessary because of antenna isolation requirements and to provide sufficient working space.

© Ericsson Radio Systems AB
— All Rights Reserved —

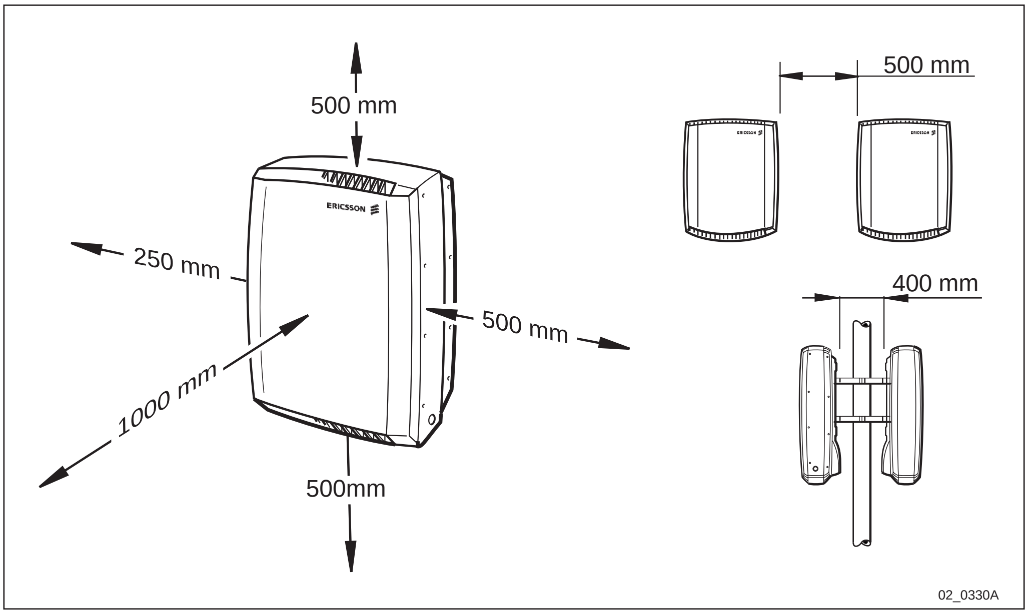

Figure 23 Required separation between RBSs

- Min separation 0.5 m side by side
- Min separation 0.5 m above/below
- Min separation 0.4 m back to back

Free space is required around the RBS for installation and maintenance. For a simple installation, following distances are recommended:

- Front: 1.0 m
- Side: 0.25 m
- Top: 0.5 m
- Bottom: 0.5 m

4.7.11 Production

The concept for the RBS supports production according to customer choice from the ordering information plan.

© Ericsson Radio Systems AB
— All Rights Reserved —

4.8 Future Expansion

4.8.1 Future Expansion Possibilities

- Datacommunication, i.e. 14.4 kbit/s and GPRS CS-2.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

5 Product Specification for RBS 2302

This chapter describes the architecture of the RBS 2302 and specifies its the characteristics and performance.

5.1 Terminology

TN Power System	TN Power System is a power distribution system having one point directly earthed. The exposed conductive parts of the installation are connected to that point by protective earth connectors.
TT Power System	TT Power System is a power distribution system having one point directly earthed. The exposed conductive parts of the installation are connected to earth electrodes electrically independent of the earth electrodes of the power system.
IT Power System	IT Power System is a power distribution system having no direct connection to earth. The exposed conductive parts of the electrical installation are earthed.

5.2 General

The RBS 2302 satisfies the need for ’hot spot’ capacity in small areas, such as part of a city centre or a shopping mall, as well as ’fill in’ coverage.

The main focus with this product is to reduce site cost and make it easier for operators to find sites, which will ensure operator profitability of a micro cell network.

The RBS 2302 can be expanded with up to six transceivers by adding extra RBS 2302 cabinet to a site.

To be able to support the idea of a small RBS that can be located almost anywhere, some functional limitations has been made:

- No antenna supervision.
- No RF cable supervision.

The weather-proof cabinet and design make it ideal for installation indoor, outdoor, on poles, walls or masts.

Integral antennas can be ordered as omni or sector antennas. Apart from this there is always a possibility to connect external antennas.

A multicasting box is provided to make it possible to combine the antenna signals from two TRXs into one antenna feeder.

For sites located in places with extreme heat an active cooling device may be provided as an option.

An extended OMT port (a permanent cable from the RBS to a more convenient place) is provided as an option.

© Ericsson Radio Systems AB
— All Rights Reserved —

The base colour of the RBS is Grey (NCS S2502-R), but it is possible to order the front sun-shields in different colours, which can make the RBS more discrete depending on the environmental surroundings.

The RBS consists of the following main physical units: Mounting Base, Cabinet, Antennas and Sun-shield. This will support a routine of installing the Mounting Base prior to the Cabinet arrival.

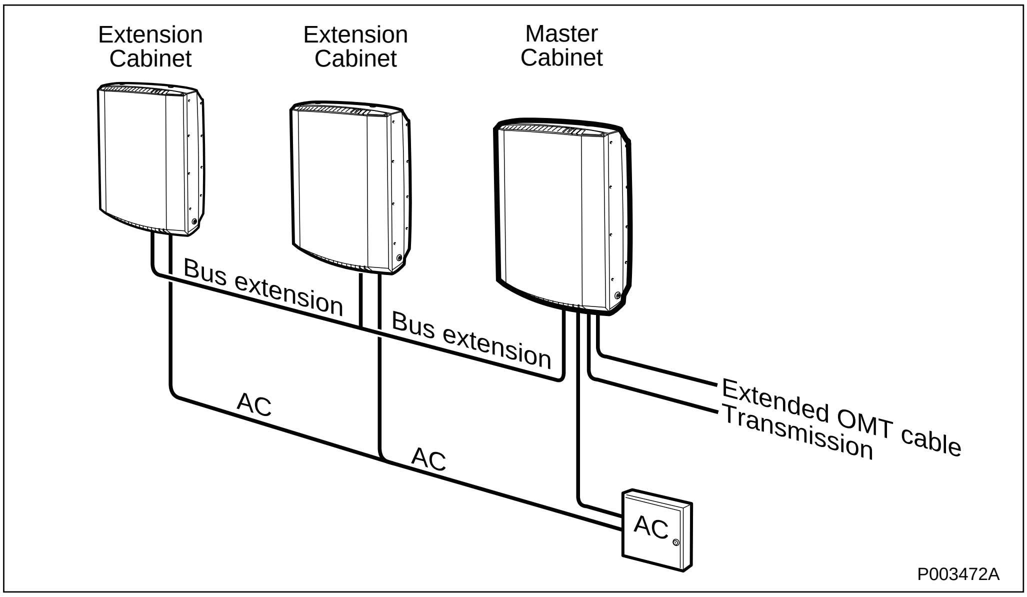

Figure 24 Six TRX site

The prime technical concerns have been to implement a RBS that:

- has a small size (volume and weight), and an appearance suitable for a discrete installation ("landlord friendly").
- has high channel capacity, two transceivers giving total of 15 traffic channels if configured to one cell. The RBS 2302 may be configured with up to six transceivers in one cell by adding extra RBS 2302 as extension cabinets.
- is characterized by low need for preventive maintenance.
- has high MTBF
- has versions for the different system standards GSM 900, GSM 1800 and GSM 1900.
- includes all functions needed for a complete installation of a radio base station, including standard interface G703 2048 kbit/s or DS1 1544 kbit/s to transmission network, AC mains power, battery backup and a choice of internal or external antennas.
- supports Linear Cascade connection on the transmission interface.
- has an extended OMT-port that makes it possible for connection of the OMT at ground level if the RBS 2302 is mounted high on a wall or a pole.
- includes an optional fan-unit which extends the upper temperature limit to +55 C°.

© Ericsson Radio Systems AB
— All Rights Reserved —

- has space for a transmission module to support other transmission protocols than G703 or DS1.
- can be installed by one person.

5.3 Product Architecture

5.3.1 Main Physical Units

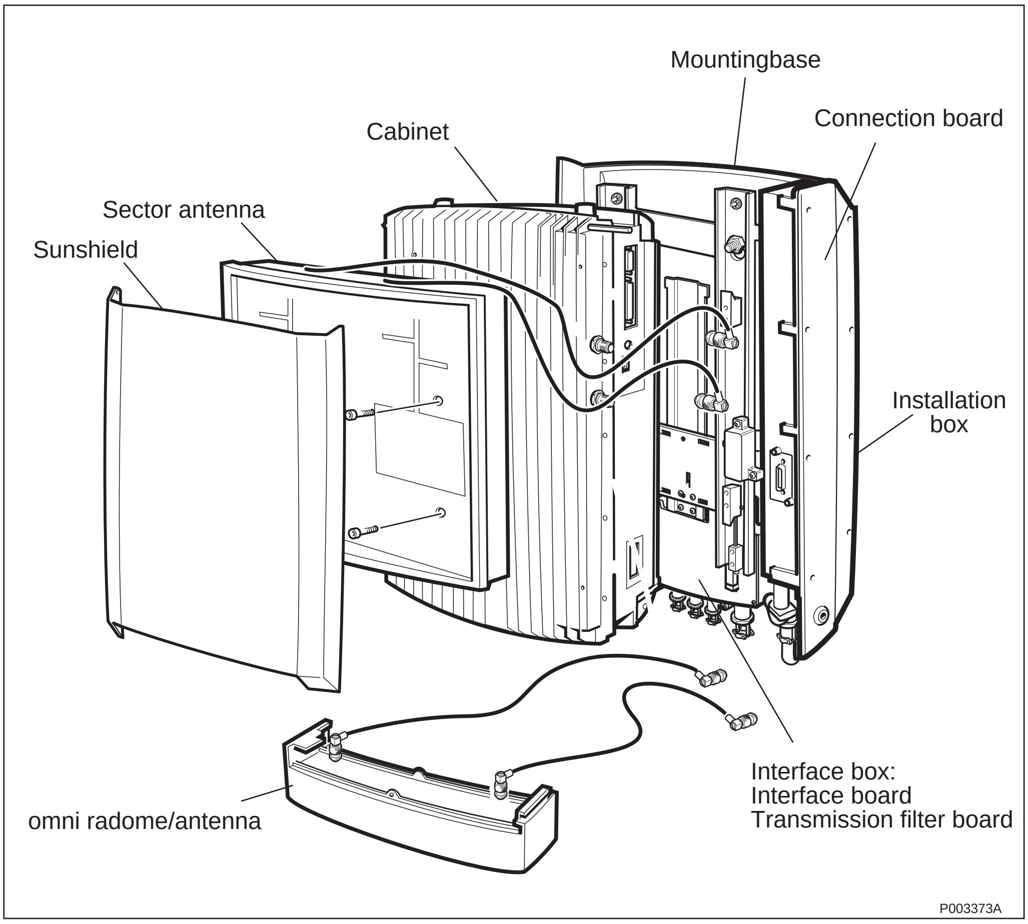

Figure 25 Main Physical Units

© Ericsson Radio Systems AB
— All Rights Reserved —

5.3.2 Hardware units

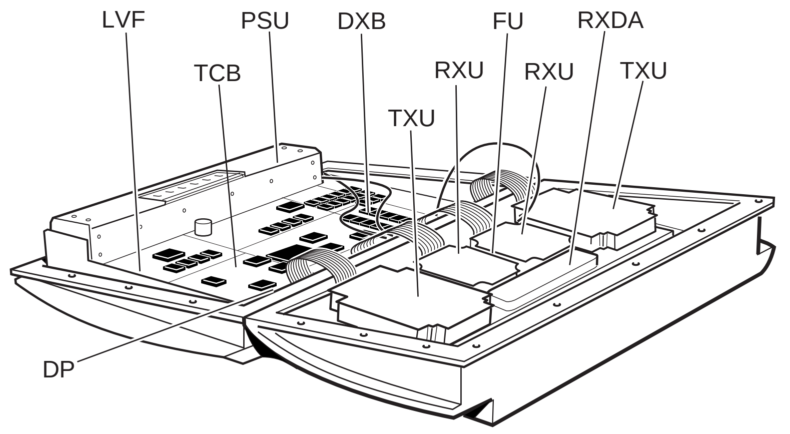

Figure 26 Hardware Units in the Cabinet

DXB	Distribution Switching Board The DXB (1 per RBS) is the central control unit for the RBS and supports the transmission interface.
OMT	Operation and Maintenance Terminal The OMT is a PC based terminal used during installation and maintenance.
TCB	Transceiver Control Board The TCB (2 per RBS) includes equipment related to signal processing for up to two radio carriers.
TXU	Transmitter Unit The TXU (2 per RBS) contains equipment for transmission on one radio carrier.
RXU	Receiver Unit The RXU (2 per RBS) contains equipment for reception on one radio carrier.
RXDA	Receiver Divider Amplifier The RXDA (1 per RBS) contains equipment for low noise amplification of the received radio carrier(s) and dividing each incoming RX into two output carriers.
FU	Filtering Unit

© Ericsson Radio Systems AB
— All Rights Reserved —

	The FU (1 per RBS) is the interface between the transmitters, receivers and the antenna system.
LVF	Low Voltage Filter The LVF contains components for voltage filtering.
PSU	Power Supply Unit The PSU (1 per RBS), which rectifies the incoming AC mains to regulated DC voltages, controls and supervises the battery and supervises the temperatures inside the cabinet.
Climate Equipment	Heater to heat the RBS at a low temperature.
Battery	The battery is an internal entity and is replaceable without disturbing traffic handling.
Connection Unit	The connection unit contains components for lightning and EMC protection. It also includes fuses, AC mains and battery switch as well as plinths for the external interfaces except for antenna feeders.
Distribution Plane	The distribution plane interfaces the DXB, the TCB, the TXUs, the RXUs and the PSU. It also contains the buttons and indicators for the RBS.

5.4 Configurations

5.4.1 Options

Options are configurations that require additional hardware.

Appearance

The following optional colours are available for the front sun-shield besides the standard colour.

NCS S2010-B70G	(Olive green)
NCS S1020-R70B	(Sky blue)
NCS S1020-Y90R	(Brick red)
NCS S1020-Y50R	(Brown)
NCS S1020-Y10R	(Yellow)

According to NCS standard.

© Ericsson Radio Systems AB
— All Rights Reserved —

5.4.2 Variants

Radio Configurations

The RBS will support the following basic configuration alternatives:

Table 7

GSM 900	**GSM 1800**	**GSM 1900**
M9d_2.2	M18d_2.2	M19d_2.2

The performance for each configuration is described in chapter Radio Configurations, RBS 2000 Micro.

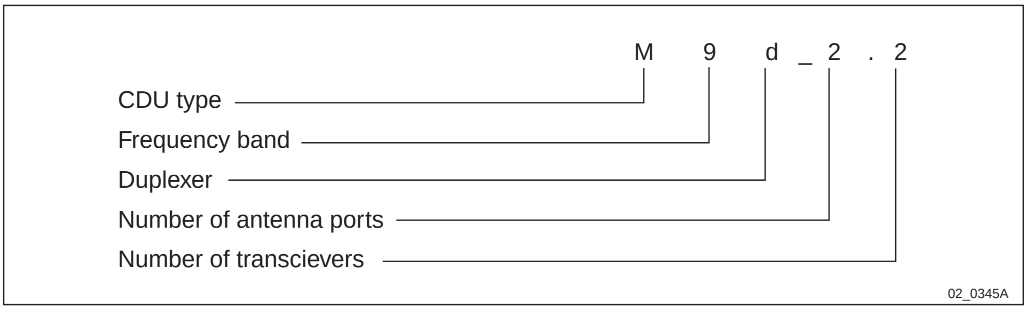

Figure 27 How to read the code

Table 8

Object	**RBS Variants**
Traffic capacity	2 TRX
Encryption	A5/1, A5/2
Transport Network Interface	1.5 Mbit/s, 100 Ohm 2.0 Mbit/s, 75 Ohm 2.0 Mbit/s, 120 Ohm
Filter	Duplex

It is possible to equip the RBS with either external antennas, integral antennas or an active antenna system (MAXITE™).

Using the active antenna, the RBS supports a “highway configuration”, where two TRXs cover two directions as one cell, as specified below.

It is also possible to extend one cabinet with up to two other cabinets to form a 4 or 6 TRX site.

The RBS supports a multicasting box, as specified below.

The RBS 2302 will support the following basic configuration alternatives:

© Ericsson Radio Systems AB
— All Rights Reserved —

Table 9

GSM 900	GSM 1800	GSM 1900
M9d_1.2	M18d_1.2	M19d_1.2
	M18d_2.2\H	M19d_2.2\H
	M18d_2.2\A	M19d_2.2\A
M9d_4.4	M18d_4.4	M19d_4.4
	M18d_4.4\A	M19d_4.4\A
M9d_6.6	M18d_6.6	M19d_6.6
	M18d_6.6\A	M19d_6.6\A

Integral Antennas

The following sections are available: Omni Antenna or Sector Antenna.

External Passive Antennas

The RBS supports the use of customer specific external antennas.

Multicasting box

It is possible to connect a multicasting box to the antenna connectors that combine the antenna signals from each TRX to one antenna feeder. The multicasting box is only supported for 2 TRX configurations.

Transmission

It is possible to change the door on the installation box to a wider door with a modem to support HDSL, ISDN or some other protocol.

Extended temperature range

It is possible to extend the temperature range by +10 C$^{\circ}$ using a fan unit, placed on top of the RBS.

Extended OMT interfaces

The RBS supports a permanent extension of the OMT-port. The extension cable length may be up to 50 m. The PC end of the extension is designed for outdoor weather protected locations.

External battery backup

The RBS supports an external battery backup (the PBC) source using an adapter, mounted in the battery compartment of the RBS. The backup voltage requirements are further specified in chapter Product Specification for Power and Battery Cabinet.

© Ericsson Radio Systems AB
— All Rights Reserved —

5.4.3 Variants

Enhanced Lightning Protection

To protect the RBS 2302 from lightening it is possible to order an Enhanced Lightning Protection.

5.4.4 On Site Configurable Options and Variants

On site configurable options and variants are configurations that do not require different or additional hardware, see chapter RBS 2000 Micro, Site Configurations for more details.

5.5 Combinations

Possible combinations are described in *Ordering Information*.

5.6 Transmission Modes

Transmission

The RBS 2302 can be configured for linear cascade mode and stand alone mode. The configuration is performed by means of the OMT.

When used in stand alone mode, PCM port A is connected to the BSC. In this mode, PCM port B cannot be used.

When used in linear cascade mode (multidrop), the RBSs are connected so that the first RBS uses its port A towards the BSC and port B towards the second RBS. The consecutive RBSs are connected in the same way with port A towards the previous RBS (and indirectly the BSC) and port B towards the next RBS etc.

The transmission functionality is further specified in relevant function specifications, see chapter Transmission and Interface Handling G.703 2048 kbit/s and Transmission and Interface Handling DS1 1544 kbit/s.

© Ericsson Radio Systems AB
— All Rights Reserved —

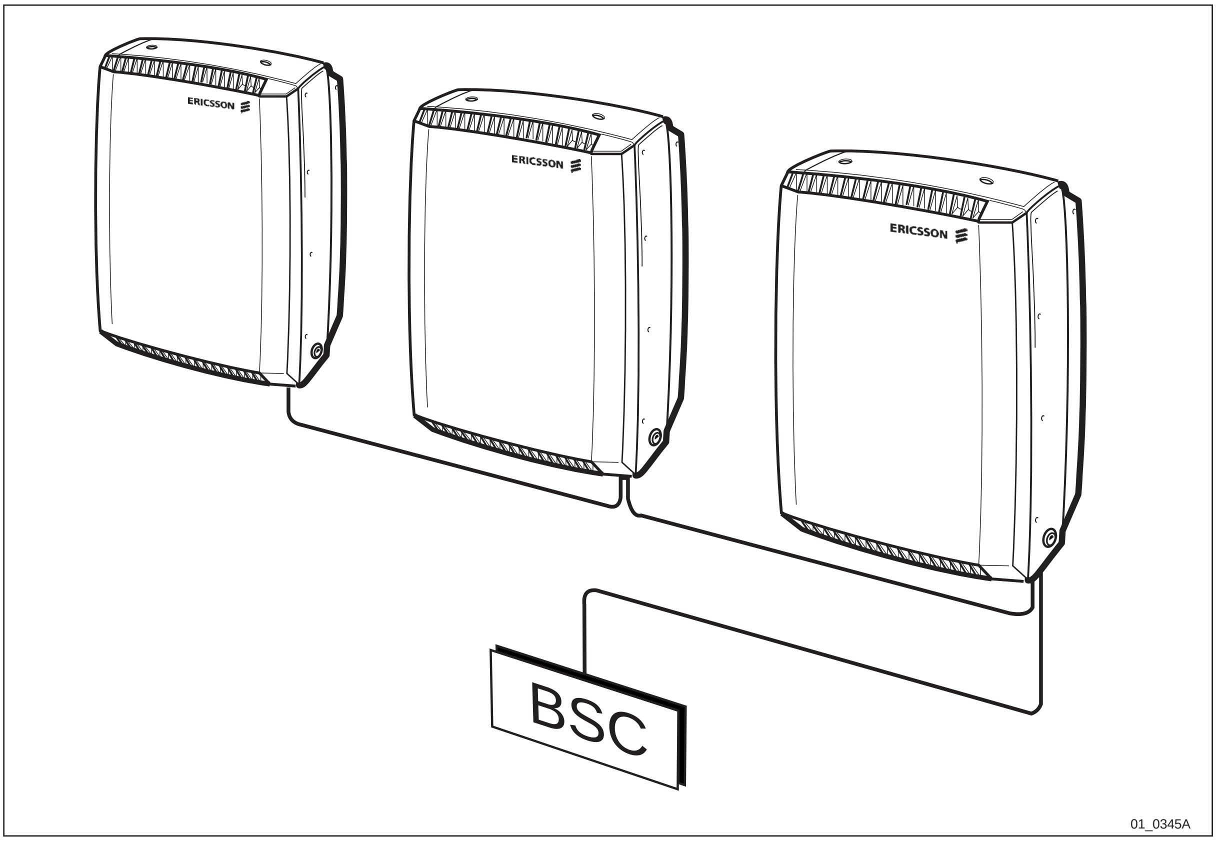

Figure 28 Multidrop chain

5.7 Interface and Connection

5.7.1 External Connections

AC Mains

Type of connections:	Screw terminal for 4 X max.2.5 mm²
Cable gland capacity:	1 times Ø8-19mm

External Battery Backup

Type of connections:	The adapter must fit the battery compartment of the RBS.

External Alarms

Type of connections:	Screw terminal for 16 x max. 1.5 mm²
Cable gland capacity:	2 x Ø5-9 mm
Number of alarms:	8

Antenna Connectors

Type of connectors:	2 x TNC (receptacle) female.

© Ericsson Radio Systems AB
— All Rights Reserved —

Note: When using integral antennas, cables and connectors are included. These connection are placed on the cabinet.

Transmission

Twisted pair:

Type of connections:	Screw terminal for 12 x max. 1.5 mm^2
Cable gland capacity:	2 x Ø7-15 mm

Coaxial:

Type of connection:	4 x TNC (receptacle) female
Grounding:	The transmit wire screen is grounded. It is possible to ground the receive wire screen.

Earthing

Type of connectors:	Central earth terminal point M8 thread

5.7.2 Internal Connections

OMT

Type of connections:	9 pin D-sub (receptacle) female.

Extended OMT-port

Type of connections:	9 pin D-sub female.
Maximum cable length:	50 m
Cable gland capacity:	1 x Ø5-9 mm

5.7.3 Test Interface

The RBS is equipped with test ports for connection of external instruments. The following signals are available at test ports:

13 MHz Reference

Type of connectors:	SMB connector (receptacle) male.

RTS-PLS Test Port

Type of connectors:	No requirements

5.7.4 Operator Interface

The operator interface is located in the Mounting Base. The interface includes indicators and buttons, switches and barcode signs. For exact specification of button and indicator functionality see chapter Operation & Maintenance Support.

© Ericsson Radio Systems AB
— All Rights Reserved —

Indicators (LEDs)

Fault	One or more faults, equals BS fault.
Operational	At least one TRX operational.
Local mode	RBS in local mode.
Reduced capacity	One of two TRXs operational.
Test TRX1	Result from TRX1 test operation.
Test TRX2	Result from TRX2 test operation.
AC Power on	AC Power is switched on to RBS.
Battery fault	Lowbattery DC voltage, battery absent.
External alarm	One or more external alarm active.

Buttons

CPU reset

Local/remote mode

Test Operation initiation

Switches

Battery	connected/not connected
AC Mains	connected/not connected

Barcode Sign

The barcode sign for product identification is readable without disturbing the RBS function.

5.8 Product Requirements

5.8.1 Appearance

Ericsson products are designed to appear as one physical unit, inconspicuous, pleasant and good-looking. The standard colour of the RBS is Grey.

The front cover of the RBS which is designed as a sun-shield is available in different colours to make the RBS even more inconspicuous.

There is an optional integrated antenna system which supports the idea of the RBS and the antenna site as one unit.

5.8.2 Mechanical Structure

Replaceable Units

The RBS consists of the following replaceable units:

- Cabinet

© Ericsson Radio Systems AB
— All Rights Reserved —

- Mounting base
- Installation box door
- Integral antennas
- Sun-shield
- Batteries
- AC-filter board (including overvoltage protection)
- Transmission filter board (including overvoltage protection)
- Wall bracket
- Mast/pole fixture
- Connection board

Labels

All signs are placed to fulfil the requirements behind the purpose and reason for the signs. And all signs that are needed for identification of the product and its compliance are readable without disturbing the RBS function.

Locks

The installation box door is equipped with a lock which can be exchanged if neccesary.

5.8.3 Dimension and Weight

Volume

The total volume of a complete RBS site without cabling, is less than 35 l.

Size

(HxWxD): 535x408x160 mm. (without integral antennas).

(HxWxD): 535x408x210 mm. (with Sector Antenna).

(HxWxD): 607x408x160 mm. (with Omnidirectional Antenna).

Weight

The total weight is the sum of the following units:

Cabinet	18 kg (incl. Internal battery)
Mounting Base	8 kg (incl. Sun-shield)
Wall bracket	5 kg (incl. Pole fixture)
Total weight	31 kg

© Ericsson Radio Systems AB
— All Rights Reserved —

5.8.4 Hardware Characteristics

Acoustical Noise

The RBS will not contribute to the acoustic noise in the surroundings.

The optional fan-unit contributes with less than 5.5 Bel at temperatures below +30 C° and less than 6.5 at all other temperature.

Vandal Resistance

The RBS is designed as vandal resistant and unauthorized intrusion will not be possible without damaging the unit.

Package Material

The package material is recyclable.

Handling Robustness

The RBS main cabinet is designed to be placed on the ground during installation and maintenance work.

5.8.5 Environment

Operation

The RBS meets the following requirement for “outdoor mast mounted equipment”.

Temperature range:	-33° to +45°C
	-33° to +55°C (with fan-unit)

Solar Radiation

The RBS is designed to withstand the additional heat from solar radiation in its specified environment.

Transport

The RBS meets the following transport requirements.

Temperature range:	-40°C to +70°C

Storage

The RBS is designed to endure the requirement for storage.

Temperature range:	-25°C to +55°C

Handling

The RBS is designed to endure the requirement for Handling.

© Ericsson Radio Systems AB
— All Rights Reserved —

Temperature range: -40°C to +70°C

In addition to this requirement the RBS 2302 can be toppled without damage. Minor damage to the cabinet that is a broken corner of a cooling fin after a topple will not disturb the function of the RBS.

5.8.6 Climate Protection

Climate Protection Principle

The climate protection maintains the internal temperature within the allowed range for the units in the RBS.

The climate protection of the RBS is handled by a combination of:

- Natural convection with the help of cooling fins
- Conductional heating

The fan-unit increases the air flow over the cooling fins.

Heating Capacity

The system has the capacity to heat the RBS from:

- –33 °C to starting conditions within 30 minutes
- –15 °C to starting conditions within 15 minutes

The above only applies if the environmental conditions are: no wind or accumulated ice or snow on the RBS.

Ingression

The RBS fulfils the IP-55 requirements according to the standard IEC 529 and type 3R according to UL50.

5.8.7 Power Supply

Supply Voltage

The RBS can be connected to mains supply voltage with Nominal:

200 - 250 VAC	±10 %	50 Hz ±10 %
100 - 127 VAC	±10 %	60 Hz ± 8 %
200/100 - 240/120	±10 %	60 Hz ± 8 %

The RBS will support installation with:

Single-phase (two-wire; earthed end of phase).

Single-phase (three-wire; earthed mid point).

Single-phase (three-wire; separate PE and N conductor).

According to TN, TT and IT power system.

The AC supply is fused.

© Ericsson Radio Systems AB
— All Rights Reserved —

Power Consumption

Normal operation, both TRXs transmitting on full output power (at 230 V nominal mains supply):	<140 VA
Maximum power consumption:	<500 VA (only with activated heater).
The optional fan-unit (at 230 V nominal mains supply):	<15 VA

Battery Backup

The RBS will survive interruptions on mains supply for at least 3 minutes. The RBS will maintain full performance during the backup time if the battery is fully charged. The battery will be recharged to at least 80% of its capacity within 15 hours.

For longer backup time an external UPS or PBC may be used.

Battery Backup (PBC)

The Battery Backup Time is further specified in chapter Site Configuration, RBS 2000 Micro.

5.8.8 Type Approval

Type Approval Standard

The RBS 2302 fulfils the required type approvals from: GSM 11.20 or GSM 11.21 standard JTC standard FCC rules and regulations. According to requirements in Section Product Safety Requirements RBS 2000.

Product Safety

The RBS 2302, 1900 MHz is listed by the National Recognized Testing Laboratory (NRTL).

EMC

The RBS complies with the European Community market requirements regarding EMC for Base station equipment. The product has the CE sign to show this compliance.

The RBS complies with the US market requirement regarding EMC for Base station equipment. The product has the FCC sign to show this compliance.

The RBS fulfils the electromagnetic requirements for Base station Radio meeting Phase 2 GSM requirements according to ETS 300 342–3.

© Ericsson Radio Systems AB
— All Rights Reserved —

5.8.9 Dependability

Technical Lifetime

The RBS is designed for a technical lifetime of 20 years (24 hours operation).

Preventive Maintenance

The RBS has the following availability performance.

Action	Interval
Mean repair time (MRT)	< 60 minutes
Mean time between failures (MTBF)	<8.5 years
Mean accumulated down time (MADT)	<6 minutes/year (time to reach the site is not included)

These preventive maintenance conditions must be fulfilled to guarantee the availability figures above.

Action	Interval
Change of battery	< 5 years
Change of lightning protection equipment	<10 years
Calibration of "optional" synchronisation oscillator	< 3 years

5.8.10 Installation

A quick and easy installation procedure is provided. If the installation preconditions are met, the RBS can be installed in less than 30 minutes. A minimum of tools and instruments are required when installing an RBS.

Preconditions

- It is possible to adjust the RBS in vertical direction ± 10°.
- Wall mounting with no visible cables is supported.
- The initiation of the BSC is prepared.
- The transport network is available[1)] at the site
- Mains power is available at site
- Preinstalled antennas and feeders are available[1)]
- Wall fixture is preinstalled
- Favourable geographic location and environment (means higher than -10 °C, no precipitation and easy access to the site)

[1)]"available" means: accessible and with specified function.

© Ericsson Radio Systems AB
— All Rights Reserved —

Installation Scenario

To support the concept of a quick and smooth installation scenario, the RBS installation work can be divided in to two steps:

- Preinstallation. Installation of the Mounting Base, antennas and all necessary cabling (AC mains, transmission and alarms).
- Installation and Commissioning. Installation of the Cabinet including all parts according to customer ordering.

However, the installation can be performed in one site visit.

The manual operations at installation are few and easy, this is valid also when connecting external cables.

Site Installation Requirement

Free space is required around the RBS for installation and maintenance. For a simple installation, the following distances are recommended:

- Front: 1.0 m
- Side: 0.25 m
- Top: 0.5 m
- Bottom: 0.5 m

For 4 and 6 TRX, the maximum distance between the cabinets is 5 m, which is the length of the cable.

If external battery backup is used, the following distances are required:

- Top: 0.7 m
- Bottom: 0.7 m

5.8.11 Production

The concept for the RBS supports production according to customer choice from the ordering information plan.

5.9 Future Expansion

5.9.1 Future Expansion Possibilities

- The hardware of the RBS is prepared for the expansion of up to 4 and 6 TRX.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

6 Product Specification for Power and Battery Cabinet

This chapter describes the architecture of the Power and Battery Cabinet (PBC), and specifies its characteristics and performance.

6.1 Terminology

TN Power System	TN Power System is a power distribution system having one point directly earthed . The exposed conductive parts of the installation are connected to that point by protective earth connectors.
TT Power System	TT Power System is a power distribution system having one point directly earthed . The exposed conductive parts of the installation are connected to earth electrodes electrically independent of the earth electrodes of the power system.
IT Power System	IT Power System is a power distribution system having no direct connection to earth. The exposed conductive parts of the electrical installation are earthed.
Link Equipment	Link Equipment is used to establish contact with the BSC if there is no fixed network between the RBS and the BSC.
Second PBC	A second PBC is used in configurations which require two AAUs connected to one RBS.
Replaceable Unit	In this document Replaceable Unit refers to units that are replaceable on site.

6.2 General

The PBC serves as a common base for battery back-up and power supply to the Active Antenna, the micro RBS and optional transmission equipment (link equipment). The PBC is also an interface for alarms from the Active Antenna and the RBS.

After a complete discharge of the battery the recharging time is less than 24 hours.

In order to reuse already developed parts the mechanical outline is similar to Ericssons micro basestation family. The units are based on modular, standardized assembly structure.

Easy access of the batteries for maintenance without disturbing the traffic.

The weather-proof cabinet and design make it ideal for installation indoor, outdoor, on poles, walls or masts.

© Ericsson Radio Systems AB
— All Rights Reserved —

The base colour of the PBC is Grey, but it is possible to order the front sun-shields in different colours, which can make the PBC more discrete depending on the environmental surroundings.

The PBC is built up by the following main physical units: Battery Cabinet, Sun-shields, Lid and Mounting Base where Installation Box and Interface Box are included. This will support a routine of installing the Mounting Base prior to the Cabinet arrival.

The PBC has the same width and length as the micro RBS but the rear sun-shield is modified to achieve the additional volume needed to fit the batteries.

6.3 Product Architecture

6.3.1 Main Physical Units

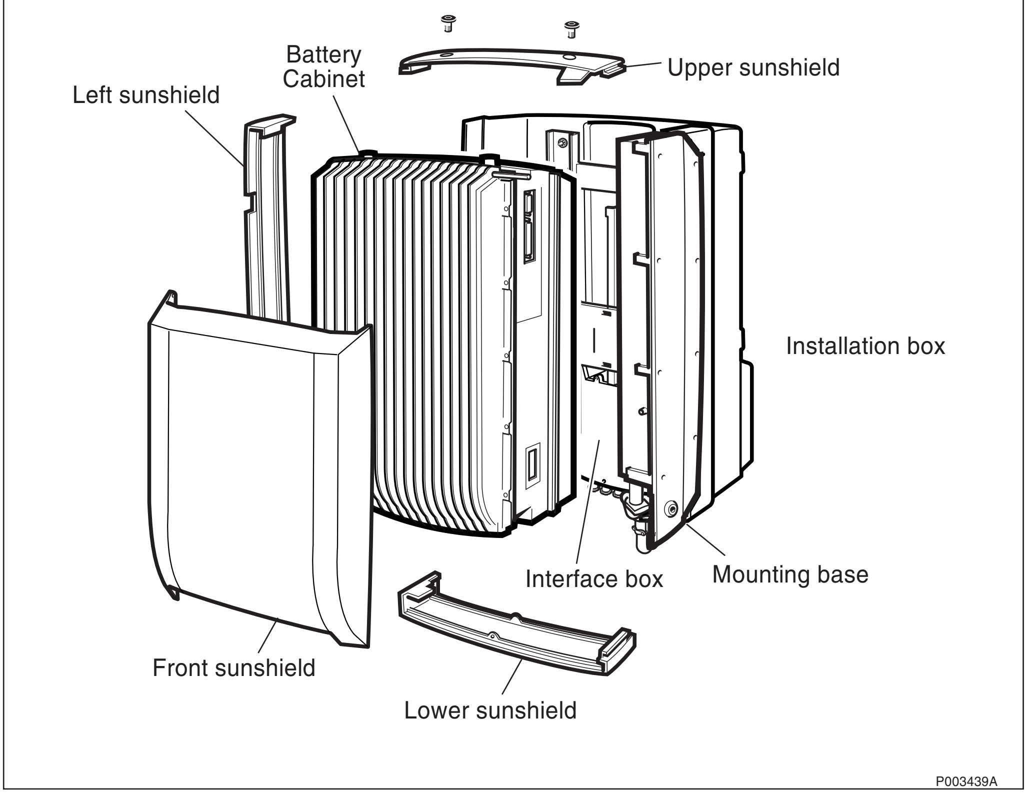

Figure 29 Main Physical Units

BC	Battery Cabinet The BC contains a AC/DC converter and batteries for DC-backup. The batteries are replaceable without disturbing traffic handling.
Installation Box	The Installation Box contains the MMI-area.
Interface Box	The Interface Box contains all ports to external equipment as follows:

© Ericsson Radio Systems AB
— All Rights Reserved —

	AC Mains to PBC
	–48 V to link equipment
	–48 V and Data to AAU in the same port
	two ports 24 V to RBS
	alarm port from second PBC
	binary alarms to the RBS
	The Interface Box also contains surge protection devices on all external terminals. The internal interface is designed so that it is possible to remove the surge protection devices and install an optional reinforced surge device.
Mounting Base	The Mounting Base serves as a base for the Battery Cabinet.
Sun-shield	The Sun-shields protect the PBC from sun, wind, rain and snow.

6.4 Configurations

6.4.1 Options

Options are configurations that require additional hardware.

Appearance

The following optional colours are available for the sun-shields besides the standard colour.

NCS S2010-B70G	(Olive green)
NCS S1020-R70B	(Sky blue)
NCS S1020-Y90R	(Brick red)
NCS S1020-Y50R	(Brown)
NCS S1020-Y10R	(Yellow)

According to NCS standard.

6.4.2 Variants

Enhanced Lightning Protection

To protect the PBC from lightening it is possible to order an Enhanced Lightning Protection.

© Ericsson Radio Systems AB
— All Rights Reserved —

6.4.3 On Site Configurable Options and Variants

On site configurable options and variants are configurations that do not require different or additional hardware, see chapter RBS 2000 Micro, Site Configurations for more details.

6.5 Combinations

Possible combinations are described in *Ordering Information*.

6.6 Interface and Connection

6.6.1 External Connections

AC Mains

Type of connections:	Screw terminal for 3 x max.2.5 mm²
Cable gland capacity:	1 times Ø 10.5-14 mm

Data/DC port

Type of connections:	Data and -48 V
Cable gland capacity:	1 times ∅ 14-16 mm

Data

Type of connections:	Screw terminal for 2 x max. 0.6 mm²
Cable gland capacity:	See Data/DC port

Earthing

Type of connectors:	Central earth terminal point M8 thread

Binary Alarms

The PBC has eight alarm terminals. Four of them are used to connect the RBS. The remaining four terminals are used to connect the external alarms from the second PBC.

© Ericsson Radio Systems AB
— All Rights Reserved —

PBC Alarms to RBS

Type of connections:	Screw terminal for 4 x 2x max.1.5 mm²
Cable gland capacity:	1 times Ø 7.5-9.5 mm
Number of alarms:	4

PBC Alarms from second PBC

Type of connections:	Screw terminal for 4 x 2x max.1.5 mm²
Cable gland capacity:	1 times Ø 7.5-9.5 mm
Number of alarms:	4

+24 Volt DC

The PBC supplies two regulated DC voltages with +24 V. The two voltages are fused separately.

Each voltage supplies the RBS with DC power. The voltages are galvanically isolated from -48 V and from Cassie/ground.

+24 V, RBS 1

Type of connections:	Screw terminal for 2x max.1.5 mm²
Cable gland capacity:	1 times Ø 7.5-9.5 mm

+24 V, RBS 2

Type of connections:	Screw terminal for 2x max.1.5 mm²
Cable gland capacity:	1 times Ø 7.5-9.5 mm

–48 Volt DC

The PBC supplies two regulated DC voltages with -48 V. The two voltages are fused separately. One voltage supplies the AAU and the other voltage supplies the Link equipment.

The two voltages are positive grounded, that is the terminal with the highest potential is connected to Cassie/ground. The voltages are not galvanically isolated from each other.

-48 V, AAU

Type of connections:	Screw terminal for 2x max. 6 mm²
Cable gland capacity:	See Data/DC port

-48 V, Link Equipment

Type of connections:	Screw terminal for 2x max. 2.5 mm²
Cable gland capacity:	1 times ∅ 7.5-9.5 mm

© Ericsson Radio Systems AB
— All Rights Reserved —

6.6.2 Operator Interface

When opening the Lid to the Installation Box there is an MMI area available containing the operational interface which includes two LEDs, three 7–segment indicators and a number of buttons, see fig below.

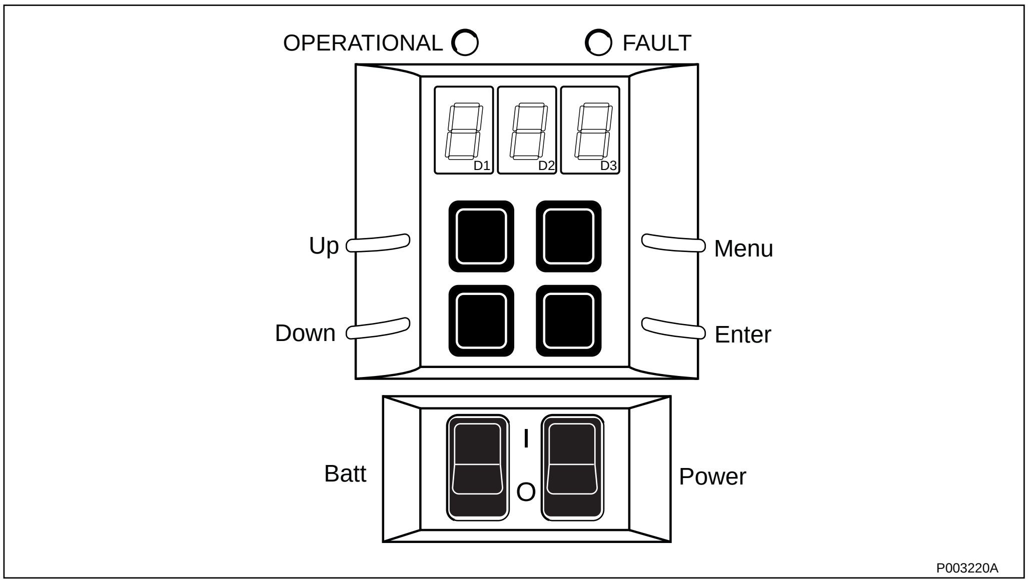

Figure 30 MMI Interface

Indicators (LEDs)

Colours

-Green	Operational
-Green and red	Warning
-Red	Fault

Display

Display 1	Unit number
Display 2	Alarm severity
Display 3	Error code

Buttons

Up	Step numbers up on the display
Down	Step numbers down on the display
Menu	Select between display elements
Enter	Transfers commands to AAU

Barcode Sign

The barcode sign for product identification is readable without disturbing the PBC function.

© Ericsson Radio Systems AB
— All Rights Reserved —

6.7 Product Requirements

6.7.1 Functional Requirements

MMI Handling

The PBC MMI functions provides the following:

- Supervision of the Antenna alarm signals
- Communication link between the AAU and the PBC
- Supervision of the PBC alarm signals
- Alarm signalling to the RBS
- User interface for installation settings and alarm presentation

Codes on display

Display 1 (D1) shows the unit number as follows:

0 = PBC

1 = Antenna part 1

2 = Antenna part 2

3 = Antenna part 3

4 =

5 = Feeder A

6 = Feeder B

7 = Installation faults

Antenna part 2 and 3 are used if the antenna consists of more than one unit.

Display 2 (D2) shows the severity of an alarm as follows:

0 = Not Classified

1 = Severe

2= Warning

The messages for the feeder values also use this element, see below.

Display 3 (D3) shows which type of error has occured or the command that is transmitted to the AAU as follows:

0 = AC fault

1 = AC/DC fault

2 = DC/DC overload

3 = DC/DC fault

4 = Battery fault

© Ericsson Radio Systems AB
— All Rights Reserved —

5 = Battery disconnected

6 = Low battery voltage

7 = Overtemp, active

8 = Overtemp, historical

9 = Mode fault in PBC

AAU:

0 = Transmission fail

1 = DC fault

2 = TXA fault

3 = TXB fault

4 = RXA fault

5 = RXB fault

6 = Overtemp, active

7 = Overtemp, historical

P = Output power off

H = FDU attenuators set to max

Feeder:

0-12= Cable attenuation value

The attenuation value is allowed to be between 0 and 12, presented in one dB-steps (integers only).

Installation:

1 = Feeder A, installation fault

2 = Feeder B, installation fault

Note: The alarms Installation fault, Output power off, and FDU attenuators set to max are only used during installation.

Operator Control Buttons

The buttons are used together with the display to initiate the feeder cable attenuation setting and to step through the error codes.

If an alarm error code is received it is immediately shown on the display. If there are several errors, the operator is able to step through the error codes with the UP/DOWN buttons.

All errors displayed are current alarms, that is no history is displayed on the MMI. The temperature alarms are however handled in another way because they are differentiated as active or historical.

© Ericsson Radio Systems AB
— All Rights Reserved —

6.7.2 Alarm Description

Internal Alarm in the PBC

AC fault

Raise condition:	Activated if AC mains is below 85 V
Cease condition:	Activated if AC mains is more than 88 V
Alarm severity:	Warning
Action:	None

AC/DC fault

Raise condition:	Activated if output voltage from PSU is less than 45 V
Cease condition:	The normal voltage has returned
Alarm severity:	Warning
Action:	None

DC/DC overload

Raise condition:	Activated if one of the two 24 V outputs are overloaded, for example, the current is outside specified value.
Cease condition:	The load must be disconnected and the current must be within specified values.
Alarm severity:	Warning
Action:	None

DC/DC fault

Raise condition:	Activated with low output voltage or high temprature in DC/DC & Supervisor.
Cease condition:	The normal voltage and the temperature has returned.
Alarm severity:	Warning
Action:	None

Battery fault

Raise condition:	Activated if the battery is faulty or if charging is not operating normally.
Cease condition:	Correct battery or normal charging has returned.

© Ericsson Radio Systems AB
— All Rights Reserved —

Alarm severity:	Warning
Action:	None

Battery disconnected

Raise condition:	Activated if the battery is not connected to the battery switches.
Cease condition:	The battery is connected.
Alarm severity:	Warning
Action:	Connect the battery switches.

Low battery voltage

Raise condition:	Activated if the battery voltage is less than 43.5 V.
Cease condition:	When the battery voltage is more than 43.5 V.
Alarm severity:	Warning
Action:	None

Overtemperature, active

Raise condition:	OvertempErature in the PSU, the battery unit or the DC/DC supervisor.
Cease condition:	When the internal tempErature has returned.
Alarm severity:	Warning
Action:	None

Overtemperature, historical

Raise condition:	Overtemperature in the PSU, the battery unit or the DC/DC supervisor.
Cease condition:	Manual reset
Alarm severity:	Warning
Action:	None

The PBC internal alarms are mapped to the following binary alarms:

SEVERE_A	AAU, carrier A, severe
SEVERE_B	AAU, carrier B, severe
WARNING	AAU, carrier A or B, warning
POWER	PBC, any error, warning

© Ericsson Radio Systems AB
— All Rights Reserved —

6.7.3 Appearance

Ericsson products are designed to appear as one physical unit, inconspicuous, pleasant and good-looking. The standard colour of the RBS is Grey.

The front cover of the PBC which is designed as a sun-shield may be ordered in different colours to make the PBC even more discrete.

6.7.4 Mechanical Structure

Replaceable Units

The PBC consists of the following replaceable units:

- Battery Cabinet
- Mounting base
- Installation box cover
- Interface box
- Sun-shields
- Batteries
- Mounting plate
- Mast/pole fixture
- Lightning protection unit
- Protection Cover

Labels

All signs are placed to fulfil the requirements behind the purpose and reason for the signs. All signs that are needed for identification of the product and its compliance are readable without disturbing the PBC function.

6.7.5 Dimension and Weight

Volume

The total volume of a complete PBC site without cabling, is less than 56 l.

Size

(HxWxD): 535 x 408 x 330 mm.

© Ericsson Radio Systems AB
— All Rights Reserved —

Weight

Battery Cabinet	23 kg
Batteries	21 kg
Mounting Base	9.5 kg
Mounting Plate	3.0 kg
Sunshields	1.5 kg
Total weight	58 kg

6.7.6 Hardware Characteristics

Acoustic Noise

The PBC will not contribute to the acoustic noise in the surroundings.

Vandal Resistance

The PBC is designed to be vandal resistant and unauthorized intrusion will not be possible without damaging the unit.

Package Material

The package material is recyclable.

Handling Robustness

The PBC main cabinet is designed to accept intermediate placing on the ground during installation and maintenance work.

6.7.7 Environment

Operation

The PBC is designed to endure the requirement for Outdoor Mast Mounted Equipment.

Temperature range:	-33°- +45°C
Operating at battery backup:	-10°- +45°C

Solar Radiation

The PBC is designed to withstand the additional heat from solar radiation in its specified environment.

Transport

The PBC meets the following transport requirement.

© Ericsson Radio Systems AB
— All Rights Reserved —

Temperature range: -40°C - +70°C

Storage

The PBC meets the following storage requirement.

Temperature range: -25°C - +55°C

Handling

Temperature range: -40°C - +70°C

The PBC is designed to be placed on the ground.

In addition to this requirement the PBC will endure a topple. Minor damages to the cabinet, for example a broken corner of a cooling fin after a topple, will not disturb the function of the PBC.

6.7.8 Climate Protection

Climate Protection Principle

The climate protection maintains the internal temperature within allowed range for the units in the PBC.

The climate protection of the PBC is handled by a combination of:

- Natural convection using cooling fins
- Conductional heating

Battery Heating Capacity

The system delivers DC to the external users independent of temperature.

The system has the capacity to heat the batteries from –33 °C to start charging within 30 minutes (15 minutes from –15 °C) if the environmental conditions are no wind.

The above applies if the environmental conditions are: no wind or accumulated ice or snow on the PBC.

During back-up mode the heater is not operational.

Ingression

The PBC fulfils the IP-55 requirements according to the standard IEC 529 and type 3R according to UL50.

6.7.9 Power Supply

Input Supply Voltage

The PBC can be connected to mains supply voltage with Nominal:

© Ericsson Radio Systems AB
— All Rights Reserved —

200 - 250 VAC	±10 %	50 Hz ±10 %
100 - 127 VAC	±10 %	60 Hz ± 8 %
200/100 - 240/120	±10 %	60 Hz ± 8 %

The PBC will support installation with:

Single-phase (two-wire; earthed end of phase).

Single-phase (three-wire; earthed mid point).

Single-phase (three-wire; separate PE and N conductor).

according to TN, TT and IT power system

Output Supply Voltage

The PBC delivers the following output voltages:

RBS		
Nominal	+ 24 V	range 21.5-28 V
Nominal load current	5.2 A	
AAU		
Nominal	-54.1 V	range -42.8- -60V
Nominal load current	4.0 A	
Link		
Nominal	-54.1 V	range -42.8- -60V
Nominal load current	0.6 A	

Power Consumption

Regarding Power Consumption figures see chapter General Specification for RBS 2000 Micro Site Configuration.

Battery Backup

The PBC battery backup time is between 1.5–3 hours depending on which configuration is used. The battery will be recharged within 24 hours.

For longer backup time an external UPS may be used.

6.7.10 Type Approval

Type Approval Standard

The PBC fulfils the required type approvals from: GSM 11.20 or GSM 11.21 standard JTC standard FCC rules and regulations. According to requirements in Section Product Safety Requirements RBS 2000.

© Ericsson Radio Systems AB
— All Rights Reserved —

Product Safety

The PBC is listed by the National Recognized Testing Laboratory (NRTL).

EMC

The PBC complies with the European Community market requirements regarding EMC for Base station equipment. The product has the CE sign to show this compliance.

The PBC complies with the US market requirement regarding EMC for Base station equipment. The product has the FCC sign to show this compliance.

The PBC fulfils the electromagnetic requirements for Base station Radio meeting Phase 2 GSM requirements according to ETS 300 342–3.

6.7.11 Dependability

Technical Lifetime

The PBC is designed for a technical lifetime of 20 years (24 hours operation).

Preventive Maintenance

The PBC has the following availability performance.

Action	Interval
Mean repair time (MRT)	< 30 minutes
Mean time between failures (MTBF)	<28 years
Mean accumulated down time (MADT)	<1 minutes/year (time to reach the site is not included)

These preventive maintenance conditions must be fulfilled to guarantee the availability figures above.

Action	Interval
Change of battery	< 10 years (with an annual temperature of +20°C)
Surge protection equipment	<10 years

© Ericsson Radio Systems AB
— All Rights Reserved —

Fault Localization

In the PBC all active subunits are identified and the address of faulty subunit is stored in a flash memory. This makes it possible for the repair center to perform a fast and accurate repair on the PBC without any calibration.

6.7.12 Installation

A quick and easy installation procedure is provided. If the installation preconditions are met, the PBC can be installed in less than 30 minutes. A minimum of tools and instruments are required when installing a PBC.

Installation Scenario

To support the concept of a quick and smooth installation scenario, the PBC installation work can be divided in to two steps:

- Preinstallation. Installation of the Mounting Base, antennas and all necessary cabling (AC mains and alarms).
- Installation and Commissioning. Installation of the Cabinet including all parts according to customer ordering.

However, it is possible to perform the installation in one site visit.

The manual operations at installation are few and easy. This is valid also when connecting external cables.

Site Installation Requirement

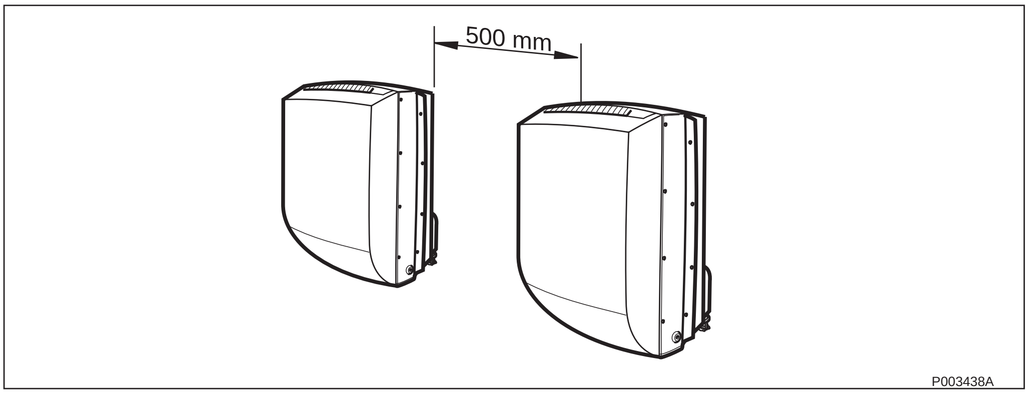

Figure 31 Wall Mounting side by side

Free space is required around the PBC for installation and maintenance. For a simple installation, the following distances are recommended:

- Front: 1.0 m
- Side: 0.5 m
- Top: 0.5 m
- Bottom: 0.5 m

© Ericsson Radio Systems AB
— All Rights Reserved —

6.7.13 Production

The concept for the PBC supports production according to customer choice from the ordering information plan.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

7 Broadcast

“Broadcast” denotes the RBS resources used for transmission of Synchronisation Information and System Information.

The RBS supports:

- Broadcast of Synchronisation Information on SCH and FCCH
- Broadcast of System Information 1, 2, 2bis, 2ter, 3 and 4 on BCCH
- Broadcast of System Information 5, 5bis, 5ter and 6 on SACCH
- Broadcast of System Information 7 and 8 on BCCH Extended

Short message service cell broadcast is covered within the context of Short Message Service.

7.1 References

/GSM:04.06/	GSM 04.06 (phase2) version 4.4.0
/GSM:04.08/	GSM 04.08 (phase2) version 4.10.1 and Amendment Request A015r5
/GSM:05.02/	GSM 05.02 (phase2) version 4.4.2
/GSM:05.03/	GSM 05.03 (phase2) version 4.2.0
/GSM:05.10/	GSM 05.10 (phase2) version 4.5.0
/GSM:08.58/	GSM 08.58 (phase2) version 4.7.0 and Amendment Request A006r1

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

7.2 Concepts

BCCH Extended	Paging, Immediate Assign and System Information 7 and 8 may share the same TDMA frame mapping, see /GSM:05.02:6.5.1/ and /GSM:05.02:7: table 3 of 5/

7.3 Functions

7.3.1 Broadcast of Synchronisation Information

Synchronisation bursts are transmitted on SCH and Frequency Correction bursts are transmitted on FCCH.

The bursts are transmitted regularly, allowing attaching mobiles to synchronise on the TDMA structure and on the timing of the cell.

Supported logical channels /GSM:05.02:3.3.2/:

FCCH	Frequency Correction Channel
SCH	Synchronisation Channel

© Ericsson Radio Systems AB
— All Rights Reserved —

Supported channel combinations /GSM:05.02:6.4/:

- (iv) FCCH+SCH+BCCH+CCCH
- (v) FCCH+SCH+BCCH+CCCH+SDCCH/4(0..3)+SACCH/C4(0..3)

Transmission on FCCH is in accordance with /GSM:05.02:5.2.4./.

Transmission on SCH means transmission of BSIC (Base Station Identity Code) and RFN (Reduced Frame Number) in accordance with /GSM:05.02:5.2.5./, /GSM:05.03:4.7./ and /GSM:04.08:9.1.30./.

The BSIC value is received from the BSC, as a configuration parameter.

7.3.2 Reception of BCCH_INFORMATION from BSC

By means of the BROADCAST INFORMATION MODIFY procedure /GSM:08.58:5.5./, the BSC defines new System Information messages 1, 2, 2bis, 2ter, 3, 4, 7 and 8 to be stored and regularly broadcast by the RBS on the BCCH and BCCH Extended channel.

The RBS supports:

- Interpretation and check of the BCCH_INFORMATION message from BSC
- Storage and update of System Information 1-4 and 7-8

System Information is included in the BCCH_INFORMATION message received from the BSC. New System Information received is used in BCCH transmissions when scheduled.

Transmission of a specific System Information message can be stopped by a BCCH_INFORMATION message /GSM:08.58:8.5.1/ on order from the BSC.

7.3.3 Broadcast of System Information on BCCH

The RBS supports scheduled transmission of System Information on the BCCH channel /GSM:04.08:3.2.2.1/. Reception of System Information from the BSC is described in the section above.

Supported logical channels /GSM:05.02:3.3.2/:

BCCH Broadcast Control Channel

Supported channel combinations /GSM:05.02:6.4/:

- (iv) FCCH+SCH+BCCH+CCCH
- (v) FCCH+SCH+BCCH+CCCH+SDCCH/4(0..3)+SACCH/C4(0..3)

The following table defines the System Information type used depending on TC (Transaction Capabilities) /GSM:05.02:6.3.4/. If a type is not loaded from the BSC, the type within parenthesis is used (if it is loaded).

Table 10 Mapping of BCCH data

TC	No 2bis, no 2ter	2bis, no 2ter	No 2bis, 2ter	2bis, 2ter
0	1 (3)	1 (3)	1 (3)	1 (3)
1	2	2	2	2

© Ericsson Radio Systems AB
— All Rights Reserved —

2	3	3	3	3
3	4 and 8	4 and 8	4 and 8	4 and 8
4	3	3	3	2ter
5	2	2bis	2ter	2bis
6	3	3	3	3
7	4 and 7	4 and 7	4 and 7	4 and 7

Types 7 and 8 are sent on the BCCH Extended channel when they are loaded.

For BCCH blocks, where no System Information (1-4) is defined, "fill frames" /GSM:04.06:5.4.2.3/ are transmitted.

7.3.4 Reception of SACCH_FILLING from BSC

By means of the SACCH FILLING INFORMATION MODIFY procedure /GSM:08.58:6.2/, the BSC sends System Information 5, 5bis and 6 to be used on all SACCHs handled by a TRX (tranceiver).

The RBS supports:

- Interpretation and check of the SACCH_FILLING message from BSC
- Storage and update of System Information 5, 5bis and 6

System Information is included in the SACCH_FILLING used for all SACCHs in one TRX. New System Information received is used in SACCH transmissions when scheduled.

Transmission of a specific System Information message can be stopped by a SACCH_FILLING message /GSM:08.58:8.5.1/ on order from the BSC.

7.3.5 Broadcast of System Information on SACCH

The RBS supports scheduled transmission of System Information on the SACCH channel /GSM:04.08:3.2.2.1/.

Reception of System Information from the BSC for all channel groups within a TRX is described in the section above. Reception of System Information for one particular channel group is described in chapter “Call Control”, see table of contents.

Supported logical channels /GSM:05.02:3.3.4/:

SACCH Slow Associated Control Channel

Supported channel combinations /GSM:05.02:6.4/:

- (i) TCH/F + FACCH/F + SACCH/TF
- (ii) TCH/H(0,1) + FACCH/H(0,1) + SACCH/TH(0,1)
- (v) FCCH+SCH+BCCH+CCCH+SDCCH/4(0..3)+SACCH/C4(0..3)
- (vii) SDCCH/8(0..7) + SACCH/C8(0..7)

LAPDm frames /GSM:04.06:2.1 (format type B)/ are used for transmission of System Information on SACCH.

© Ericsson Radio Systems AB
— All Rights Reserved —

For SACCH blocks, where no System Information is defined, "fill frames" /GSM:04.06:5.4.2.3/ are transmitted.

TRS will change System Information message type for every transmission occasion according to Table 11 on page 94.

Even though the System Information types 5 and 6 are not optional, no checks are performed if they are stored (or deleted). If one of the System Information types 5 or 6 (or both) are missing the TRS shall change System Information message type for every transmission occasion according to Table 12 on page 94.

Table 11 SACCH System Information schedule

Stored System Information				***Transmission order***
5	5bis	5ter	6	
*	*	*	*	5, 5bis, 5ter, 6...
*	*		*	5, 5bis, 6...
*		*	*	5, 5ter, 6...
*			*	5, 5, 6...

Table 12 SACCH System Information schedule

Stored System Information				***Transmission order***
5	***5bis***	***5ter***	***6***	
*	*	*		5, 5bis, 5ter...
	*	*	*	5bis, 5ter, 6...
*	*			5, 5bis...
*		*		5, 5ter...
	*	*		5bis, 5ter...
	*		*	6, 5bis...
		*	*	6, 5ter...
*				5,5...
	*			5bis, 5bis...
		*		5ter, 5ter...
			*	6, 6...

For SACCH blocks, where no System Information is defined, "fill frames" /GSM:04.06:5.4.2.3/ are transmitted.

© Ericsson Radio Systems AB
— All Rights Reserved —

8 Physical Channel Handling

This chapter covers the traffic services provided by the physical layer in the RBS for the air interface.

8.1 References

/GSM:05.02/	GSM 05.02 (phase 2) version 4.3.0
/GSM:05.03/	GSM 05.03 (phase 2) version 4.1.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

8.2 Functions

8.2.1 Supported Burst Types

The following burst types are supported /GSM:05.02:5.2/:

- Normal burst
- Frequency correction burst
- Synchronisation burst
- Dummy burst
- Access burst

8.2.2 Supported Logical Channels

The following logical channels are supported /GSM:05.02:3/:

BCCH	Broadcast Control Channel
CBCH	Cell Broadcast Channel
CCCH	Common Control Channel, comprising: – AGCH Access Grant Channel – PCH Paging Channel – RACH Random Access Channel
FACCH/F	Fast Associated Control Channel, full rate
FACCH/H	Fast Associated Control Channel, half rate
FCCH	Frequency Correction Channel
SACCH/C4	Slow Associated Control Channel, dedicated control/4
SACCH/C8	Slow Associated Control Channel, dedicated control/8
SACCH/TF	Slow Associated Control Channel, full rate traffic

© Ericsson Radio Systems AB
— All Rights Reserved —

SACCH/TH	Slow Associated Control Channel, half rate traffic
SCH	Synchronisation Channel
SDCCH/4	Stand-Alone Dedicated Control Channel/4
SDCCH/8	Stand-Alone Dedicated Control Channel/8
TCH/F	Traffic Channel, full rate
TCH/H	Traffic Channel, half rate

8.2.3 Supported Channel Combinations

The following channel combinations are supported /GSM:05.02:3/:

- (i) TCH/F + FACCH/F + SACCH/TF
- (ii) TCH/H(0,1) + FACCH/H(0,1) + SACCH/TH(0,1)
- (iv) FCCH + SCH + BCCH + CCCH
- (v)
  - a) FCCH + SCH + BCCH + CCCH + SDCCH/4[0..3] + SACCH/C4[0..3]
  - b) FCCH + SCH + BCCH + CCCH + SDCCH/4[0,1,3] + SACCH/C4[0,1,3] + CBCH
- (vii)
  - a) SDCCH/8[0..7] + SACCH/C8[0..7]
  - b) SDCCH/8[0,1,3..7] + SACCH/C8[0,1,3..7] + CBCH

Note: CCCH = PCH + RACH + AGCH.

Note: Channel combinations (v) and (vii) type b, are valid only when SMS Cell Broadcast is configured. In case of Channel combination (vii), CBCH is only allowed for TN (Timeslot Number)=0..3.

Note: Channel combinations (iv) and (v) must be configured for TN=0.

8.2.4 Channel Coding

Channel Coding (downlink) is performed according to:

/GSM:05.03:3/	Traffic Channels
/GSM:05.03:4/	Control Channels

8.2.5 Channel Decoding

Channel Decoding (uplink) is performed according to:

/GSM:05.03:3/	Traffic Channels

© Ericsson Radio Systems AB
— All Rights Reserved —

/GSM:05.03:4/	Control Channels

8.2.6 Interleaving

Interleaving (downlink) is performed according to:

/GSM:05.03:3/	Traffic Channels
/GSM:05.03:4/	Control Channels

8.2.7 De-interleaving

De-interleaving (uplink) is performed according to:

/GSM:05.03:3/	Traffic Channels
/GSM:05.03:4/	Control Channels

8.2.8 Burst Assembly

Burst Assembly is performed according to:

/GSM:05.02:5.2.3/	Normal bursts
/GSM:05.02:5.2.4/	Frequency correction bursts
/GSM:05.02:5.2.5/	Synchronisation bursts
/GSM:05.02:5.2.6/	Dummy bursts
/GSM:05.02:5.2.7/	Access bursts

8.2.9 Multiplexing

Multiplexing of bursts into TDMA frames is performed according to:

/GSM:05.02:7	Table 1/
/GSM:05.02:7	Table 2/
/GSM:05.02:7	Table 3/
/GSM:05.02:7	Table 4/
/GSM:05.02:7	Table 5/

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

9 Base Station Power Control

This document covers power regulation by means of the CHANNEL_ACTIVATION and BS_POWER_CONTROL messages from the BSC.

The "Base Station Power Control" function is implemented to minimise the transmit power required by the RBS TRXs (transceivers), while maintaining the quality of the radio link.

9.1 References

/GSM:05.02/	GSM 05.02 (phase 2) version 4.3.0
/GSM:05.05/	GSM 05.05 (phase 2) version 4.6.0
/GSM:05.08/	GSM 05.08 (phase 2) version 4.6.0
/GSM:08.58/	GSM 08.58 (phase 2) version 4.2.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

9.2 Concepts

Nominal Power	The power level defined during configuration of the RBS TRXs.

9.3 Functions

9.3.1 Base Station Power Control at Channel Activation

By means of the TRANSMISSION POWER CONTROL procedure /GSM:08.58:4.9/, the BSC defines the TRX (transceiver) transmission power level.

The RBS supports:

- Interpretation of the BS Power information element in the CHANNEL ACTIVATION message from BSC
- Storage of BS Power
- Adjustment of BS Power level

Supported Channel Numbers /GSM:08.58:9.3.1/:

- Bm + ACCHs
- Lm + ACCHs
- SDCCH/8 + ACCH
- SDCCH/4 + ACCH

Supported Channel combinations /GSM:05.02:6.4/:

- (i) TCH/F + FACCH/F + SACCH/TF
- (ii) TCH/H(0,1) + FACCH/H(0,1) + SACCH/TH(0,1)

© Ericsson Radio Systems AB
— All Rights Reserved —

- (v) FCCH+SCH+BCCH+CCCH+SDCCH/4(0..3)+SACCH/C4(0..3)
- (vii) SDCCH/8(0..7) + SACCH/C8(0..7)

The nominal power level is used if BS Power is not received at channel activation. The "BS Power" received is stored in the RBS to be used for the requested dedicated channel.

The RBS is able to reduce its BS power level (starting from the nominal power level) in up to 15 steps of 2 dB (nominal value), as defined by the BSC.

If the RBS receives a BS Power which would result in a setting below the lowest level allowed, the BS power level is tuned into the lowest level allowed. The maximum BS power level used for a specific channel never exceeds the nominal BS power level.

The commanded BS Power level is applied on each transmitted burst, except for bursts on a BCCH carrier, where the nominal BS Power level is used on all timeslots. An attempt to change the BS Power level for a channel on a BCCH carrier, is accepted but has no effect.

9.3.2 Base Station Power Control for an Active Channel

By means of the TRANSMISSION POWER CONTROL procedure /GSM:08.58:4.9/ the BSC defines the TRX transmission power level.

The RBS support:

- Interpretation of BS_POWER_CONTROL message from BSC
- Storage of BS Power
- Adjustment of BS power level

Supported channel numbers, channel combinations and handling of the received BS power level are as described in chapter Physical Channel Handling, see table of contents.

The BS power change starts at the first TDMA frame belonging to a SACCH reporting period. When the RBS has received a new BS power level, the BS power is changed within two SACCH reporting periods

9.4 Operational Conditions

The power level setting follows /GSM:05.05:4.1.2/, according to power level step size, maximum output power and tolerances.

© Ericsson Radio Systems AB
— All Rights Reserved —

10 Channel Measurements

The RBS supports:

- Active Channel Measurements, that is. quality and signal strength measurements on active uplink dedicated channels.
- Idle Channel Measurements, that is. signal strength measurements on idle uplink dedicated channels.

10.1 References

/GSM:08.58/	GSM 08.58 (phase 2) version 4.7.0
/GSM:05.08/	GSM 05.08 (phase 2) version 4.12.0
/GSM:05.02/	GSM 05.02 (phase 2) version 4.4.2

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

10.2 Concepts

RX Reference Point	Defined as the point where the RX antenna signal crosses the RBS border, that is the connector for the antenna feeder.
Reporting Period	TDMA frames used for measurements, as defined in /GSM 05.08:8.4/.
RXLEV	Measure of signal strength as defined in /GSM 05.08:8.1.4/.
RXLEV_FULL	RXLEV measured over a whole SACCH multiframe.
RXLEV_SUB	RXLEV measured over a subset of a SACCH multiframe.
RXQUAL	Measure of signal quality as defined in /GSM 05.08:8.2.4/.
RXQUAL_FULL	RXQUAL measured over a whole SACCH multiframe.
RXQUAL_SUB	RXQUAL measured over a subset of a SACCH multiframe.

10.3 Functions

10.3.1 Active Channel Measurements

By means of the basic measurement reporting procedure /GSM:08.58:4.5.1/, the RBS performs quality and signal strength measurements on all active uplink dedicated channels. Measurements on channel combinations, (i), (ii), (v) and (vii) are supported, /GSM:05.02:6.4/.

© Ericsson Radio Systems AB
— All Rights Reserved —

The RBS measures BER (Bit Error Rate) and the signal strength over each active channel per reporting period. All SACCH frames are included in the measurements.

The reporting periods are different for different TNs, and for different channels, and are the same as for the MS, defined in /GSM 05.08:8.4/.

The measurements of signal strength are referred to the RX reference point. An R.M.S. (Root Mean Square) value is created for each burst. Then, the logarithm of this value, expressed in dBm, is averaged over the reporting period. The mapping of this average and RXLEV is as defined in /GSM 05.08:8.1.4/.

The signal quality measurements are sampled per reporting period.

The mapping between BER and RXQUAL is as defined in /GSM 05.08:8.2.4/.

RBS calculates RXLEV_FULL, RXLEV_SUB, RXQUAL_FULL and RXQUAL_SUB as an average of the frames as defined in the following table:

Table 13 Frame calculation

Channel combination	**RXQUAL_FULL, RXLEV_FULL**	**RXQUAL_SUB, RXLEV_SUB**
(i)	All TCH and SACCH frames (96 TCH, 4 SACCH)	8 SID + 4 SACCH
(ii)	All TCH and SACCH frames (48 TCH, 4 SACCH)	TCH/S: 8 SID + 4 SACCH
		TCH/Data: 10 SID + 4 SACCH
(v), (vii)	All SDCCH and SACCH frames (8 SDCCH, 4 SACCH)	Same frames as for RXLEV_FULL and RXQUAL_FULL

The SID frames for the TCH channels are defined in /GSM 05.08:8.3/.

Results from channel measurements are reported by A-bis message MEASUREMENT_RESULT /GSM 08.58:8.4.8/.

10.3.2 Idle Channel Measurements

The RBS can perform signal strength measurements of disturbances on all idle uplink dedicated channels.

The function is set to on or off on full rate or half rate basis when the TS is configured by the BSC.

Measurements of signal strength are made over an averaging period. The averaging period specifies the number of measurement periods from which an average value is to be calculated. The averaging period is specified for each TS by the BSC.

The measurements of signal strength are referred to the RX reference point. An R.M.S. value is formed for each timeslot. The logarithm of this value, expressed in dBm, is coded as defined for RXLEV in /GSM 05.08:8.1.4/. The average value is calculated from the RXLEV value, After Initiation, a first average value is calculated after two completed measurement periods. The second value is calculated when the first averaging period is completed.

© Ericsson Radio Systems AB
— All Rights Reserved —

After this, a new average value is calculated after each new measurement, that is a sliding window principle is used where the oldest value within the averaging period is replaced by the new one.

The average value is classified into one of five Interference Level Bands.

Results from idle channel measurements are reported via the Abis message RF_RESOURCE_INDICATION /GSM 08.58:8.6.1/. This is done when the first value has been calculated and thereafter when the calculated average value is classified into a new Interference Level Band.

10.4 Operational Conditions

The measurements of R.M.S. signal levels fulfil the requirements in /GSM:05.08:8.1.2/. When applicable, exceptions are stated within the context of Radio Reception.

The measurements of RXQUAL fulfil the requirements in /GSM 05.08:8.2/, that is for BER from < 0.2% to > 12.8%.

The MEASUREMENT_RESULT message and the RF_RESOURCE_INDICATION message are sent during the following reporting period.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

11 Discontinuous Transmission

"Discontinuous Transmission" is a mechanism which allows the radio transmitter to be switched off during speech or data (non-transparent) pauses.

The following benefits are achieved:

- Power is saved in the MS uplink
- The overall interference level on the air is reduced
- Reduced RBS power consumption downlink

The RBS supports downlink DTX (Discontinuous Transmission) as well as uplink DTX.

11.1 References

/GSM:04.06/	GSM 04.06 (phase 2) version 4.1.0
/GSM:04.21/	GSM 04.21 (phase 2) version 4.2.1
/GSM:05.02/	GSM 05.02 (phase 2) version 4.3.0
/GSM:05.08/	GSM 05.08 (phase 2) version 4.6.0
/GSM:06.12/	GSM 06.12 (phase 2) version 4.0.1
/GSM:06.22/	GSM 06.22 (phase 2) version 4.0.0
/GSM:06.31/	GSM 06.31 (phase 2) version 4.0.0
/GSM:06.32/	GSM 06.32 (phase 2) version 4.0.1
/GSM:06.41/	GSM 06.41 (phase 2) version 4.0.0
/GSM:06.42/	GSM 06.42 (phase 2) version 4.0.0
/GSM:06.81/	GSM 06.81 (phase 2) (t.b.d)
/GSM:08.20/	GSM 08.20 (phase 2) version 4.1.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

11.2 Functions

11.2.1 DTX Downlink

The DTX function is described in:

/GSM:06.12/	Comfort Noise Aspects
/GSM:06.22/	Comfort Noise Aspects (half rate speech)
/GSM:06.31/	Overall DTX Operation (full rate speech)
/GSM:06.32/	Voice Activity Detection (full rate speech)
/GSM:06.41/	Overall DTX Operation (half rate speech)

© Ericsson Radio Systems AB
— All Rights Reserved —

/GSM:06.42/	Voice Activity Detection (half rate speech)
/GSM:06.81/	Overall DTX Operation (enhanced full rate speech)

The downlink DTX function is supported for channel modes:

- TCH speech, full rate
- TCH speech, half rate
- TCH data, full rate, 9.6 kbit/s, non-transparent
- TCH data, half rate, 4.8 kbit/s, non-transparent

Channel combinations supported /GSM:05.02:6.4/:

- (i) TCH/F + FACCH/F + SACCH/TF
- (ii) TCH/H(0,1) + FACCH/H(0,1) + SACCH/TH(0,1)

The downlink DTX function is enabled when a CHANNEL_ACTIVATION message, or a MODE_MODIFY message with the DTX downlink indicator set, is received from the BSC.

The downlink DTX function for speech is initiated when a speech frame containing comfort noise parameters, is received from the RTC (Remote Transcoder).

The downlink DTX function for non-transparent data is initiated when a complete RLP (Radio Link Protocol) frame, with all E1-bits / GSM:04.21/ set to 1, is received from the RTC.

DTX handling speech

The usage of downlink DTX (on/off) is indicated in the speech frames and in the idle speech frames to the RTC. To detect if a speech frame received from the RTC contains speech or comfort noise parameters / GSM:06.32 / or /GSM:06.42/, the RBS analyses the SID code word / GSM:06.12:2.2/ or /GSM:06.22:2.2/.

SID frames (including comfort noise parameters) are scheduled in TDMA frames according to /GSM:05:08:8.3/. When a SID frame is stolen for signalling (FACCH) purposes, the scheduling in TDMA frames is carried out according to /GSM:06.31:2.1.2/GSM:06.41:2.1.2/ or /GSM:06.81:2.1.2/ instead.

The output power is turned off during periods of silence, except in the following cases:

- Transmission of SID frames (comfort noise parameters)
- Transmission of signalling (FACCH)
- Transmission on a C0 carrier (dummy bursts)
- Transmission on a transmitter configured for filling (dummy bursts)

© Ericsson Radio Systems AB
— All Rights Reserved —

DTX handling non-transparent data

To detect idle data transmission in the downlink direction, the E1-bits of a complete RLP frame received from the RTC, are analysed / GSM:08.20:4.2/. This frame is not transmitted on the air interface.

When idle data transmission is detected, an L2 (Layer 2 protocol) fill frame /GSM:04.06:5.4.2.3/ is transmitted (on FACCH) in the SID positions of the TDMA frame according to /GSM:05:08:8:3/.

The output power is turned off during periods of idle data transmission, as described in the section DTX handling speech above.

11.2.2 DTX Uplink

The uplink DTX function is supported for Channel Modes:

- TCH speech, full rate
- TCH speech, half rate.

The RBS is always prepared to handle uplink DTX. Channel combinations supported are the same as for DTX downlink, see section DTX Downlink above.

The uplink DTX function for speech is initiated when a frame containing comfort noise parameters, is received from the MS.

To detect if a speech frame (received from MS) contains speech or comfort noise parameters, the RBS analyses the SID code word / GSM:06.12:2.2/ or /GSM:06.22:2.2/. An indication of comfort noise parameters, is sent in the speech frames to the RTC.

During periods of silence in speech (no frames received from MS), idle speech frames with a silence indication are transmitted to the RTC.

If half rate is used, speech frames with a bad frame indication are transmitted to the RTC.

Data frames (transparent and non-transparent) are passed transparently from the MS to the RTC without consideration of DTX.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

12 Encryption

"Encryption" is used for ciphering and deciphering of information to and from an MS over a dedicated resource. The RBS supports two encryption modes, either using no encryption or using a GSM encryption algorithm. The BSC controls which encryption mode is used.

There are two product variants with different encryption algorithms implemented:

- No encryption — GSM encryption algorithm version 1 (A5/1)
- No encryption — GSM encryption algorithm version 2 (A5/2)

12.1 References

/GSM:04.08/	GSM 04.08 (phase 2)
/GSM:08.58/	GSM 08.58 (phase 2)

12.2 Functions

12.2.1 Start Encryption at Channel Activation

By means of the CHANNEL ACTIVATION procedure /GSM:08.58:4.1/, the BSC controls initiation of encryption mode.

Fundamentals regarding channel activation are described in chapter Call Control.

Supported channel numbers:

- Bm + ACCH
- SDCCH/8 + ACCH
- SDCCH/4 + ACCH (and TN = 0)

The function is initiated when a CHANNEL_ACTIVATION message /GSM:08.58:8.4.1/ indicating start of encryption, is received from the BSC.

Access bursts, which are received from the MS at handover access, are not deciphered.

12.2.2 Encryption Mode Change

By means of the START OF ENCRYPTION procedure /GSM:08.58:-4.4/, the BSC controls initiation and change of encryption mode.

Channel numbers supported are described in the section above.

The function is initiated when an ENCRYPTION_COMMAND message /GSM: 08.58:8.4.6/ is received from the BSC for an active dedicated channel.

Encryption mode change is carried out according to /GSM:04.08:3.4.7/.

When encryption is active and a new ciphering key is to be loaded, there is a period of time where the old key is used for ciphering and the new key is used for deciphering simultaneously. Consequently, the RBS supports independent key update for ciphering and deciphering.

© Ericsson Radio Systems AB
— All Rights Reserved —

If encryption mode is set to "no encryption", the RBS updates the key setting by clearing the stored ciphering key.

When changing encryption mode, downlink ciphering is turned on when a correct layer 2 frame (deciphered with the new encryption mode) has been received from the MS.

When the encryption mode is changed, the MS sends a transparent CIPHER_MODE_COMPLETE message /GSM:04.08:-9.1.10/ to the BSC.

12.2.3 Encryption Mode Change at Mode Modify

By means of the Mode Modify procedure /GSM:08.58:4.2/, the BSC orders change of channel mode or encryption mode of an active dedicated channel group.

Channel numbers supported are described in the section “Start Encryption at Channel Activation” above.

The function is initiated when an MODE_MODIFY message /GSM:08.58:8.4.9/ is received from the BSC.

Encryption mode change is carried out according to /GSM:04.08:3.4.7/.

If encryption mode is set to “no encryption” the RBS updates the key setting by clearing the stored ciphering key.

The function is terminated when downlink ciphering is changed.

© Ericsson Radio Systems AB
— All Rights Reserved —

13 Frequency Hopping

"Frequency hopping" means that the radio frequency channel of a BPC may change on a per TDMA frame basis. Frequency hopping improves the quality of the transmission on the air interface.

The Frequency hopping function is used to increase the efficiency of the channel coding and interleaving in the following situations:

- Multipath (or Rayleigh) fading
  - Is often frequency-dependent. In case of a dip, changing of frequencies reduces this problem.
- Interference problems
  - Without frequency hopping, a connection may experience high interference for a long time. With frequency hopping this time is shortened. However, frequency hopping does not reduce the overall system interference level, but averages it.

There are two types of frequency hopping available:

- Baseband hopping
- Synthesiser hopping

13.1 References

/GSM 08.58/	GSM 08.58 (phase 2) version: 4.2.0
/GSM 05.02/	GSM 05.02 (phase 2) version: 4.3.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

13.2 Concepts

Baseband Hopping	Each transmitter will always transmit on the same frequency. The physical channel data will be sent from different transmitters with every burst.
Synthesiser Hopping	The physical channel data will be sent from the same transmitter all the time. But the transmitter will use a new frequency with every burst.

13.3 Function

Frequency hopping is provided on a slot-by-slot basis according to / GSM:05.02.6.2/.

Supported channel combinations /GSM:05.02:6.4/:

- (i) TCH/F+FACCH/F+SACCH/TF
- (ii) TCH/H(0,1) + FACCH/H(0,1) + SACCH/TH(0,1)
- (vii) SDCCH/8 [0..7]+SACCH/C8 [0..7]

© Ericsson Radio Systems AB
— All Rights Reserved —

Supported channel numbers are:

- Bm + ACCH
- Lm + ACCH
- SDCCH/8 + ACCH

This function is initiated when a CHANNEL_ACTIVATION message / GSM:08.58:8.4.1/ is received from the BSC.

The information element Channel Identification as defined in / GSM:08.58:9.3.5/ is ignored.

The BPC must have already been configured for frequency hopping by the BSC (OML link). All frequency hopping parameters are defined for each BPC at configuration, and cannot be changed at channel activation.

Frequency hopping is performed according to /GSM: 05.02:6.2.3/. Frequency hopping is not supported for the BPC carrying BCCH.

Other BPCs on the BCCH frequency can be frequency hopping when baseband hopping is used. The following configuration parameters are used for administration of frequency hopping, the parameters are used in the frequency hopping algorithms as described in /GSM: 05.02:6.2.3/.

Table 14 Configuration parameters

Parameter	**Supported values**	**Description**
HSN	/GSM: 05.02 6.2.2/	Hopping Sequence Number 0 = cyclic hopping 1-63 = random hopping
MAIO	/GSM: 05.02:6.2.2/	Mobile Allocation Index Offset
Frequency list	1-64 fields	Information element to provide a list of the ARFCNs used in a frequency hopping sequence

13.4 Operational Conditions

Both baseband and synthesiser frequency hopping are supported. A maximum of 64 frequencies can be used in the hopping sequence.

© Ericsson Radio Systems AB
— All Rights Reserved —

14 Mode Modify

The "Mode Modify" procedure is used by BSC to request a change of the channel mode (speech-to-data, data-to-speech, etc.) of an active channel.

14.1 References

/GSM 05.02/	GSM 05.02 (phase2) version 4.3.0
/GSM 08.58/	GSM 08.58 (phase2) version 4.2.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

14.2 Function

By means of the MODE MODIFY procedure /GSM: 08.58:4.2./ BSC orders RBS to change channel mode of an active dedicated channel group.

Supported channel combinations /GSM:05.02:6.4/:

- (i) TCH/F + FACCH/F + SACCH/TF
- (ii) TCH/H(0,1) + FACCH/H(0,1) + SACCH/TH(0,1).

RBS actions:

- Interpretation of MODE_MODIFY message from BSC
- Channel Mode Modification

The function is initiated when a MODE_MODIFY message / GSM:08.58:8.4.9/, is received from BSC. Any transition between the following full rate channel modes /GSM:08.58:9.3.6/ is supported:

TCH/F	Signalling
TCH/FS	Full rate speech
TCH/F9.6 NT	Full rate data 9.6kbit/s non-transparent
TCH/F9.6	Full rate data 9.6kbit/s transparent
TCH/F4.8	Full rate data 4.8kbit/s transparent
TCH/F2.4	Full rate data 2.4kbit/s transparent
TCH/F2.4	Full rate data 1.2kbit/s transparent
TCH/F2.4	Full rate data 1200/75 bit/s transparent
TCH/F2.4	Full rate data 600bit/s transparent

Any transition between the following half rate Channel Modes /IWD TRAFFIC/ are supported:

TCH/H	Signalling
TCH/HS	Half rate speech
TCH/H4.8 NT	Half rate data 4.8kbit/s non-transparent

© Ericsson Radio Systems AB
— All Rights Reserved —

TCH/H4.8	Half rate data 4.8kbit/s transparent
TCH/H2.4	Half rate data 2.4kbit/s transparent
TCH/H2.4	Half rate data 1.2kbit/s transparent
TCH/H2.4	Half rate data 1200/75bit/s transparent
TCH/H2.4	Half rate data 600bit/s transparent

Mode change between full rate channels and half rate channels is not accepted.

RBS checks the availability of the requested resources and acknowledges the MODE_MODIFY message by sending a MODE_MODIFY_ACKNOWLEDGE message /GSM:08.58:8.4.10./ or a MODE_MODIFY_NEGATIVE_ACKNOWLEDGE message / GSM:08.58:8.4.11./ to the BSC.

The MODE_MODIFY_ACKNOWLEDGE message to BSC is not related to the Air Interface. That is, the acknowledgement will be sent before the actual transmission is started.

If the Mode Modify procedure fails after the MODE_MODIFY_ACKNOWLEDGE message has been sent, a CONNECTION_FAILURE_INDICATION /GSM:08.58:8.4.4/ message is sent to BSC and the channel mode is changed to the mode requested in the MODE_MODIFY message.

If the MODE_MODIFY_NEGATIVE_ACKNOWLEDGE message is sent to the BSC, the channel mode is left unchanged (same as before the MODE_MODIFY message was received).

After the positive acknowledgement of the MODE_MODIFY message, the active service is deactivated and the requested service is activated.

14.3 Operational Conditions

The maximum delay from reception of a MODE_MODIFY command until the command is acknowledged (MODE_MODIFY_ACKNOWLEDGEMENT or MODE_MODIFY_NEGATIVE_ACKNOWLEDGEMENT) is 25 ms.

© Ericsson Radio Systems AB
— All Rights Reserved —

15 Mobile Station Power Control

By means of the "MS Power Control" procedure /GSM:08.58:- 4.8/, BSC gives RBS the power level to be used by MS, on a dedicated resource.

MS power control is employed to minimise the transmit power required by the MS while maintaining the quality of the radio links. By minimising the transmit power levels, interference to co-channel users is reduced.

Functionality supported:

- MS power control, at channel activation
- MS power control, for an active channel

Channel Activation function is not described here.

15.1 References

/GSM 04.04/	GSM 04.04 (phase2) version 4.0.0
/GSM 05.02/	GSM 05.02 (phase2) version 4.3.0
/GSM 08.58/	GSM 08.58 (phase2) version 4.2.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

15.2 Functions

15.2.1 MS Power Control at Channel Activation

Supported channel numbers:

- Bm + ACCH
- Lm + ACCH
- SDCCH/8 + ACCH
- SDCCH/4 + ACCH and TN = 0

Supported channel combinations /GSM:05.02:6.4/:

- (i) TCH/F + FACCH/F + SACCH/TF
- (ii) TCH/H(0,1) + FACCH/H(0,1) + SACCH/TH(0,1)
- (v) FCCH+SCH+BCCH+CCCH+SDCCH/4(0..3)+SACCH/C4(0..3)
- (vii) SDCCH/8(0..7) + SACCH/C8(0..7)

RBS actions:

- Storage of MS power level
- Order MS to set the commanded power level

© Ericsson Radio Systems AB
— All Rights Reserved —

Description

The function is initiated when a CHANNEL_ACTIVATION message /GSM:08.58:8.4.1/ containing MS Power is received from the BSC.

The value of the ordered MS power /GSM:08.58:9.3.13/ is passed transparently to the MS.

RBS stores the MS power level received from BSC and includes it in the L1 header of all downlink SACCH blocks /GSM:04.04:7.1/.

15.2.2 MS Power Control for an Active Channel

Supported channel numbers and Supported channel combinations /GSM:05.02:6.4/, see the section above.

RBS actions:

- Interpretation of the MS_POWER_CONTROL message
- Storage of MS power level
- Order MS to set the commanded power level

Description

The function is initiated when an MS_POWER_CONTROL message /GSM:08.58:8.4.15/ containing MS Power is received from the BSC for an active dedicated channel.

The value of the ordered MS Power /GSM:08.58:9.3.13/ is passed transparently to the MS.

The MS Power parameters /GSM:08.58:9.3.31/ is not supported by the RBS.

RBS stores the MS power level received from BSC and includes it in the L1 header of all downlink SACCH blocks /GSM:04.04:7.1/. It overwrites the MS power value set by any previous "Channel Activation" or "MS Power Control" functions.

© Ericsson Radio Systems AB
— All Rights Reserved —

16 Short Message Service

SMS P-P (Short Message Service Point-to-Point) provides a means of sending messages of limited size to and from a mobile.

SMSCB (Short Message Service Cell Broadcast) is a service in which short messages may be broadcast to all mobiles in a cell.

RBS Functionality supported:

- SMS Point-to-point, Mobile Terminated
- SMS Point-to-point, Mobile Originated
- SMS Cell Broadcast

The SMS P-P function is based on the following functions, not described in this specification:

- Link Establishment
- Link Release
- Transparent Message Transfer

16.1 References

/GSM 04.12/	GSM 04.12 (phase2) version 3.2.1
/GSM 05.02/	GSM 05.02 (phase2) version 4.3.0
/GSM 08.58/	GSM 08.58 (phase2) version 4.2.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

16.2 Functions

16.2.1 SMS Point-to-Point, Mobile Terminated

RBS supports:

- Establishment of a SAPI-3 (Service Access Point Identifier 3) link
- Transparent transmission of SMS messages
- Release of a SAPI-3 link

Supported logical channels /GSM:05.02:3.3.4/:

SDCCH/4	Stand-Alone Dedicated Control Channel/4
SDCCH/8	Stand-Alone Dedicated Control Channel/8
SACCH/TF	Slow Associated Control Channel, full rate traffic
SACCH/TH	Slow Associated Control Channel, half rate traffic.

Supported channel combinations /GSM:05.02:6.4/:

- (i) TCH/F + FACCH/F + SACCH/TF

© Ericsson Radio Systems AB
— All Rights Reserved —

- (ii) TCH/H(0,1) + FACCH/H(0,1) + SACCH/TH(0,1)
- (v) FCCH+SCH+BCCH+CCCH+SDCCH/4(0..3)+SACCH/C4(0..3)
- (vii) SDCCH/8(0..7) + SACCH/C8(0..7)

The SMS P-P MT function is initiated when an ESTABLISH REQUEST message for a SAPI-3 link is received from the BSC.

SMS P-P MT messages are transmitted as transparent L3 (Layer 3) messages (in acknowledged mode), on a SAPI-3 link between the network and the MSs.

SAPI-3 link establishment and release is made on request from BSC. The function is terminated when a RELEASE_CONFIRM message is sent to the BSC, as a result of a SAPI-3 link release.

16.2.2 SMS Point-to-Point, Mobile Originated RBS

RBS supports:

- Establishment of a SAPI-3 link
- Transparent transmission of SMS messages
- Release of a SAPI-3 link

See chapter above for:

- Supported logical channels
- Supported channel combinations

The SMS P-P MO function is initiated when a SABM frame (link layer connection) is received from a MS. SMS P-P MO messages are transmitted as transparent L3-messages (in acknowledged mode), on a SAPI-3 link between the network and the MSs.

SAPI-3 link establishment and release is made on request from MS. The function is terminated when a RELEASE_INDICATION message is sent to the BSC, as a result of a SAPI-3 link release.

16.2.3 SMS Cell Broadcast

This procedure is used by the BSC to request the RBS for transmission of SMS cell broadcast messages on the logical channel CBCH/GSM:08.58:5.6/.

The BSC handles the queuing and repetition of the SMSCB messages, taking the capacity of CBCH into account.

Supported Logical Channels /GSM:05.02:3.3.5/:

CBCH	Cell Broadcast Channel, allocated on SDCCH sub-channel 2

Supported Channel Combinations /GSM:05.02:6.4/:

- (v) FCCH + SCH + BCCH + CCCH + SDCCH/4[0,1,3] + SACCH/C4[0,1,3] + CBCH
- (vii) SDCCH/8[0,1,3..7] + SACCH/C8[0,1,3..7] + CBCH

RBS Actions:

© Ericsson Radio Systems AB
— All Rights Reserved —

- Interpretation of SMS_BROADCAST_REQUEST messages
- Transmission of SMSCB messages
- Transmission of CBCH Fill-frame

Description

Configuration parameter CBCH Ind must be set to 1, to indicate the usage of SDCCH sub-channel 2, for SMSCB messages.

Transmission of SMSCB messages on channel combination (vii) requires that configuration parameter BS_AG_BLKS_RES is set to a value greater than zero, /GSM:05.02:6.5.4/ /GSM:05.02:3.3.2.3/. The function is initiated when the first (out of four) SMS_BROADCAST_REQUEST message is received from the BSC.

Four SMS_BROADCAST_REQUEST messages together make a complete SMSCB message. All four blocks must be available before any transmission on the CBCH channel can take place.

Each SMS_BROADCAST_REQUEST message contains a complete frame (including a Message type field = Layer 2 header) /GSM:04.12:3/ , to be transmitted on the CBCH channel.

The Message Type field contains a sequence number, used to check the order of arrival. The correct order of arrival is defined as: 0,1,2,3.

The SMSCB messages are transmitted in four consecutive multiframes / GSM:05.02:6.5.4/ during periods when TB = 0, 1, 2 and 3.

CBCH Fill-frames are transmitted on the CBCH channel when TB=0, 1, 2 and 3, and no SMSCB message is available for transmission. Nothing is transmitted for TB = 4, 5, 6 and 7. TB = (FN DIV 51) MOD 8 (where FN = Frame Number).

A CBCH fill-frame consists of:

- 1 octet, Message Type /GSM:04.12:3.3.1/ with Sequence Number = F (hex)
- 22 octets=2B (hex)

16.3 Operational Conditions

16.3.1 SMS MT/MO P-P

The maximum length of a message can be 140 octets or 160 SMS characters.

16.3.2 SMS Cell Broadcast

The transmission time over the air interface for one SMSCB message (4 blocks, 23 octets each) is:

- 4 * 51 * 120/26 milliseconds = 0.941 seconds.

The maximum sending intensity is one message per 1.88 seconds (4 blocks of data and 4 empty frames).

RBS provides storage capacity for two complete SMSCB messages.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

17 Diversity Supervision

The "Diversity Supervision" function supervises the signal strength imbalance between the two diversity channels in an RBS with receiver diversity.

The function is capable of detecting major faults in the radio receiver paths or the receiver antenna system.

17.1 References

/GSM:05.08/	GSM Requirements 05.08 Phase 2 version 4.6.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

17.2 Concepts

Measurement Period	The Measurement Period corresponds to the "reporting period" of the radio link measurements as specified in /GSM 05.08/ . The Measurement Period is defined only for dedicated channels. Basic channel measurements on dedicated channels, as the signal strength measurements, are made for each Measurement Period
Observation Period	The Observation Period defines a time window during which the signal strength relationship between the two diversity channels is observed before any decision regarding a possible disturbance is taken.
Channel Utilisation Threshold	The Channel Utilisation Threshold (CUT) is the criterion for an active dedicated channel to be regarded as utilised. It is that the receiver signal strength is above a certain level on at least one of the diversity channels. The Channel Utilisation Threshold is characterised by the required signal strength.
Channel Utilisation Ratio	The Channel Utilisation Ratio (CUR) is defined here as the relative rate of utilisation of a dedicated channel or a set of dedicated channels during a certain period of time. The CUR is calculated per observation period. (It is the same for both of the receiver's diversity channels.)
Minimum CUR	The Minimum Channel Utilisation Ratio is the lowest CUR at which the receiver diversity is supervised. The minimum CUR is applied to the entire transceiver

© Ericsson Radio Systems AB
— All Rights Reserved —

Signal Strength Imbalance	The SSI (Signal Strength Imbalance) is defined here as the mean difference (in decibels) between the receiver's two diversity channels. The SSI is calculated per observation period
Disturbance Threshold	The Disturbance Threshold defines the limit for the signal strength imbalance, at which it is classified as abnormal and is regarded as a disturbance

17.3 Function

The signal strengths of the two diversity channels are measured and compared after the signals have passed through radio receiver equipment. The diversity supervision is applied to dedicated channels only.

The following actions are carried out separately for each TS:

- The signal strengths are measured separately for the two diversity channels during all measurement periods for all dedicated channel connections which qualify for the channel utilisation threshold criterion

In order to avoid degradation from possible DTX (Discontinuous Transmission) employed by MS, the signal strength measurements on TCH are restricted to the subset of 4 SACCH frames and 8 SID (Silence Descriptor) TDMA frames as defined in /GSM 05.08/.

- The CUR_i is calculated for the TS during each observation period
- The SSI_i value is calculated for the TS during each observation period

The CURi and the SSI_i values from all TSs are then evaluated together. The corresponding transceiver gross measures are calculated for each observation period:

SSI = iΣ (SSIi * CURi) / iΣ CURi ; i = 0..7

CUR = iΣ CURi / iΣ 1 ; i = 0..7

A disturbance is assumed to exist when both of the following criteria are fulfilled:

- The gross CUR exceeds the minimum channel utilisation ratio
- The value of the gross SSI exceeds the disturbance threshold

A fault is reported after filtering of the detected disturbances. The fault condition ceases only after a leaky bucket filter is emptied by a number of valid observation periods without disturbances.

Only those observation periods where the gross CUR exceeds the minimum channel utilisation ratio are taken into account in the filtering process. This means that a fault condition is only raised or ceased during valid observation periods.

© Ericsson Radio Systems AB
— All Rights Reserved —

17.4 Operational Conditions

The diversity supervision is characterised by a number of parameters which are implemented as software constants. The parameter values are selected so that the risk of false disturbances during normal operation is negligible:

Table 15 Preliminary diversity supervision parameters

Observation period	5 minutes
Channel utilisation threshold	-96 dBm
Minimum channel utilisation ratio	5 %
Disturbance threshold	12 dB

The disturbance filter characteristics will give the time to alarm. If 100% of the observation periods causes a disturbance, the time to alarm will be 50 minutes. If the disturbance ratio is less than 50% no alarm will be raised.

If 100% of the observation periods indicates no disturbance, the alarm will be terminated after 100 minutes. If the disturbance ratio is more than 15%, the alarm will not be terminated.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

18 Synchronization

The purpose of the "Synchronization" function is to synchronize an RBS internally. The function is needed to achieve air timeslot synchronization, according to /GSM:05.10/ and /JTC PCS:7/.

The transition between different states and functions can be seen in the figure below.

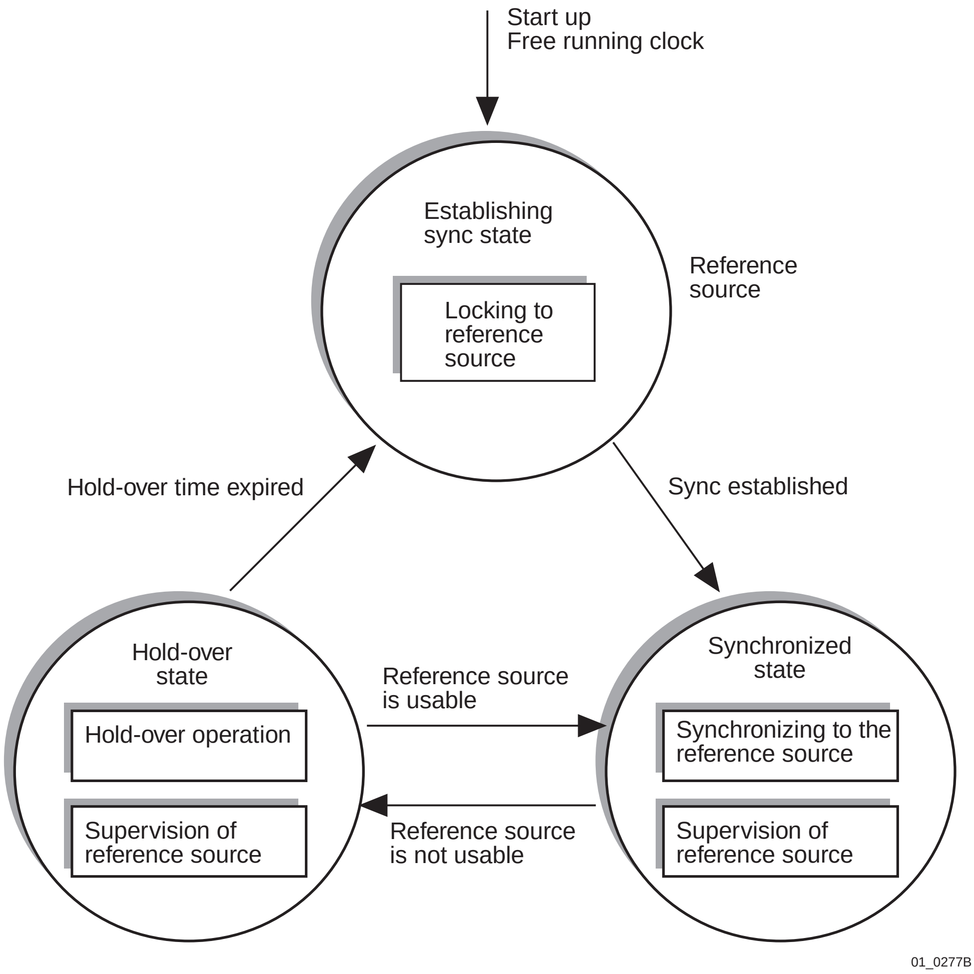

Figure 32 Synchronization function states

Short-term stability of the timing is achieved by the RBS itself. The long-term stability of the RBS will rely on an external or an optional synchronization reference.

The external synchronization reference is taken from the transport network interface. The optional synchronization reference is taken from an optional synchronization function in the RBS.

The two possible sources for synchronization are handled in the same way by the synchronization function.

The choice of reference source depends on the type of equipment installed. Units equipped with an optional reference source will always use this option.

© Ericsson Radio Systems AB
— All Rights Reserved —

18.1 References

/GSM 05.10/	GSM TS 05.10 revision 4.3.0
/JTC PCS/	JTC(AIR) 940904-231R4 Technical Specification of PCS 1900 by the PCS 1900 Joint Technical Committee
/G.823/	CCITT G.823, White Book

18.2 Concepts

Locking	The process of acquiring a phase lock to the references
Synchronizing	The process of maintaining a phase lock to the reference
Internal Source	An internal short-term stable oscillator
Optional Reference	An optional frequency reference source built into the RBS
PCM reference	A frequency reference extracted from the PCM-network
Hold-over Entered Time	The time before reporting a hold-over mode, i.e. a fault is sent to the BSC
Hold-over Expired Time	The maximum time in hold-over mode. After this time, the synchronization quality will not be guaranteed and the BSC should disable the RBS so that radio transmission ceases

18.3 Functions

18.3.1 Synchronizing to the Reference Source

The RBS has its own short-term stable oscillator; this internal source is locked to the reference source.

The generated frequency is used for both RF frequency and for clocking of the timebase counters, see /GSM:05.10:3/ and /JTC PCS:7.1/. The same source is used for all carriers.

18.3.2 Selection of Reference Source

In an RBS using the optional synchronization reference as reference source, there are no reselection possibilities.

In an RBS where the executive reference is taken from the PCM interface, PCM-A has to be usable as reference at startup.

If PCM-A is not usable as reference, a reselection of PCM-A as the executive reference is performed when it becomes usable as reference again.

© Ericsson Radio Systems AB
— All Rights Reserved —

18.3.3 Hold-over Operation

This function will be initiated when the reference source is considered not usable. See next section.

The function freezes the control values of the internal oscillator at their present values. This means that the frequency in the RBS is held constant except for ageing and the temperature drift of the oscillator.

Supervision of the reference will continue. The RBS will still be considered as synchronized. The function is terminated when the reference source is considered as usable or after "Hold-over expired time".

Faults are sent to the BSC after "Hold-over expired time" and "Hold-over entered time".

18.3.4 Supervision of Reference Source

The function is initiated when synchronization to the reference source is established.

The reference is supervised relative to the own short-term frequency source by monitoring the phase deviations between the two sources. The following criteria are used when evaluating deviations:

PCM interface as reference:

- LOS (Loss Of Signal), LOF (Loss Of Frame alignment) or AIS (Alarm Indication Signal) detected by the physical interface
- Illegal high wander. The limit is specified in /G.823/
- Illegal high relative frequency deviation. The limit is 0.1 ppm (parts per million)

Optional reference source:

- Failure of the optional reference source
- Illegal high wander. The limit is specified in /G.823/
- Illegal high relative frequency deviation. The limit is 0.1 ppm

The result of this continuous supervision of the reference can be:

- Usable as reference
- Not usable as reference

This result is used as a basis for entering hold-over mode.

The function terminates when "Hold-over expired time" ends in hold-over mode.

18.3.5 Locking to the Reference Source

This function limits the time for locking to the reference. The control values for the internal source must have stabilised to within a range not including the highest and lowest values, with a margin.

The following criteria are used when evaluating the locking process:

Locking to the PCM interface:

- PCM sync presence (detected by physical interface)

© Ericsson Radio Systems AB
— All Rights Reserved —

- Time. A timeout set at initiation
- The value of the oscillator control signal

Locking to the optional reference:

- Non-failure status of the optional sync function
- Time. A timeout set at initiation
- The value of the oscillator control signal

The timeout is in both cases used to disqualify a locking attempt that takes too long. A fault is sent to the BSC at timeout, but the internal source will still try to lock to an available reference.

The function is terminated when synchronization is established.

18.3.6 FN offset

The FN (Frame Number) offset function makes it possible for a TRU at a site to use a defined offset from the TDMA number distributed from the central timing of the RBS. The offset value is added to the distributed TDMA frame number.

The offset is configurable from the BSC per timeslot, provided that all timeslots are disabled. Configuration of one timeslot will reconfigure all the others. The configuration is carried out by the Functionality Administration function.

18.4 Operational Conditions

18.4.1 Synchronizing to the Reference Source

Full synchronism is reached as noted below from function initiation.

Table 16 Synchronizing time

Cold start	Transmission network as source	5 minutes
	Optional frequency source	10 minutes
Warm start	For both network and optional	90 s when there are no jitters in the synch. source

18.4.2 Selection of Reference Source

The function handles one optional reference source or one PCM reference source. The PCM reference must be marked available in order to be considered for selection. The function handles that one or both PCM interfaces are left unconnected.

There is no momentary change in phase or frequency of the RBS caused by reselection of synchronization source.

18.4.3 Hold-over Operation

The "Hold-over entered time" is 5 minutes.

The "Hold-over expired time" is 60 minutes.

© Ericsson Radio Systems AB
— All Rights Reserved —

18.4.4 Locking to the Reference Source

Limited synchronism is reached within 4 minutes from function initiation. Calls can be established but performance criteria are not fulfilled, i.e. the risk of dropped calls is higher.

The frequency error is less than 0.5 ppm after 4 minutes.

The timeout for locking is 6 minutes.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

19 Radio Reception

Radio reception denotes the function to "Receive a Radio Frequency (RF) signal".

19.1 References

For GSM 900 and GSM 1800:

/GSM:03.03/	GSM Requirements 03.03 Phase 2
/GSM:05.02/	GSM Requirements 05.02 Phase 2
/GSM:05.04/	GSM Requirements 05.04 Phase 2
/GSM:05.05/	GSM Requirements 05.05 Phase 2
/GSM:05.08/	GSM Requirements 05.08 Phase 2
/GSM:05.10/	GSM Requirements 05.10 Phase 2

For GSM 1900:

The references PCS:1-8 are chapters in the document: Volume 1, PCS 1900 Physical Layer 1 Specification marked: JTC(AIR)94.08.01-231R3

/PCS:1/	Physical Layer Overview
/PCS:2/	Multiplexing and Multiple Access on the Radio Path
/PCS:3/	Forward Error Protection Coding and Interleaving
/PCS:4/	Modulation
/PCS:5/	Radio Transmission and Reception
/PCS:6/	Radio Subsystem Link Control
/PCS:7/	Synchronization
/PCS:8/	Change History

When a reference is given in the text, it may have a section number added. As example /PCS:5.3.5/ points at chapter 5, section 3.5.

19.2 Concepts

Base Transceiver Station (BTS), unit operating on a set of radio frequencies in one cell.

Radio Base Station (RBS), all equipment forming an Ericsson base station; may comprise several BTSs.

The RX reference point X is defined as the point where the RX antenna signal crosses the RBS border, i.e. the connector for the antenna feeder.

© Ericsson Radio Systems AB
— All Rights Reserved —

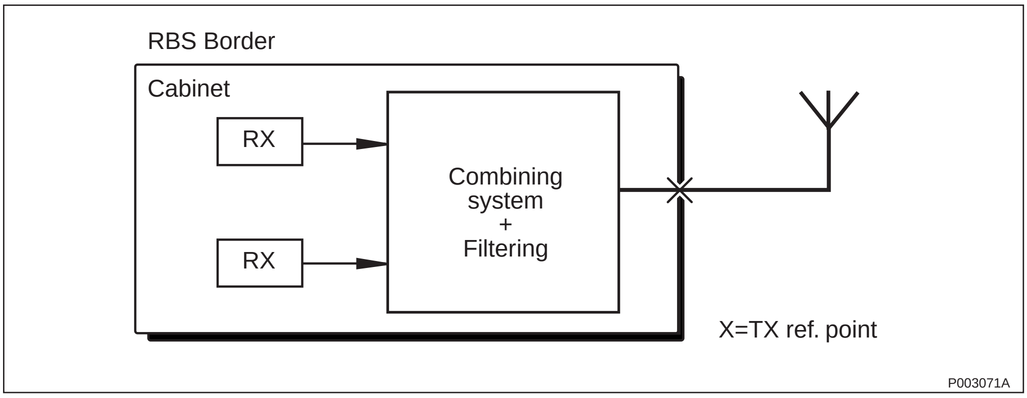

Figure 33 RX reference point x

When the RBS is configured with integral antenna the RX reference point is the cabinet input RF connector.

The antenna gain is defined as the total received gain, including the radome attenuation between the air interface and the RX reference point.

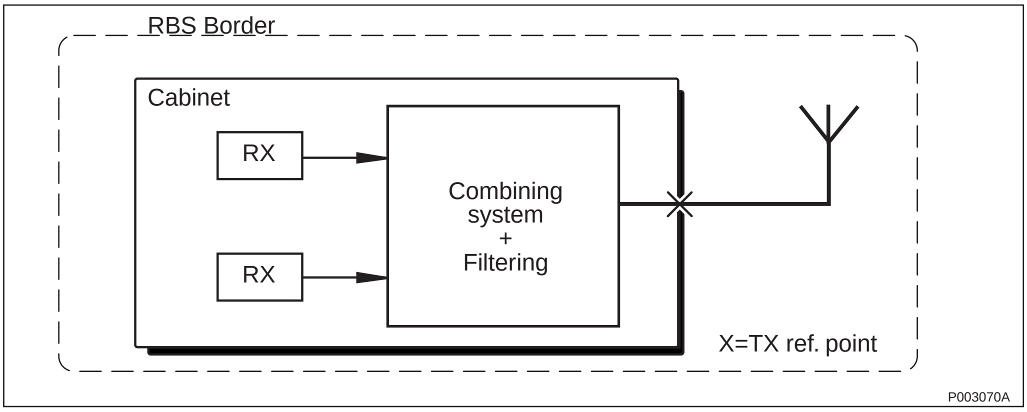

Figure 34 RX reference point with integral antenna

19.3 Functions

19.3.1 Radio Reception

Radio reception denotes the function to "Receive an RF signal" and restore the bit stream that constitutes a burst.

The GSM specification of Receiver characteristics is found in /GSM:05.04/ and /GSM:05.05/.

The PCS specification of Receiver characteristics is found in /PCS:4/, /PCS:5/ and /PCS:6/.

19.4 Operational Conditions

19.4.1 Frequency Band

The receiver can operate in the extended GSM 900 frequency band, 880 - 915 MHz. The Combining system supports the primary GSM band, 890 - 915 MHz, see /GSM:05.05:2/.

© Ericsson Radio Systems AB
— All Rights Reserved —

Receivers for the GSM 1800 band operates in the 1800 frequency band, 1710 - 1785 MHz, see /GSM:05.05:2/.

Receivers for the GSM 1900 band operates in the 1900 frequency band, 1850 - 1910 MHz, see /PCS:5.1/.

19.4.2 Frequency Hopping

The receiver is capable of frequency hopping as defined by the Frequency Hopping function.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

20 Radio Transmission

Radio transmission denotes the function to "Generate a Radio Frequency (RF) signal".

20.1 References

Whenever a reference is made to a function described in another document, please refer to the relevant Function Specification List to find the appropriate document.

20.1.1 For GSM 900 and GSM 1800:

/GSM:05.02/	GSM Requirements 05.02 Phase
/GSM:05.04/	GSM Requirements 05.04 Phase
/GSM:05.05/	GSM Requirements 05.05 Phase
/GSM:05.08/	GSM Requirements 05.08 Phase 2
/GSM:05.10/	GSM Requirements 05.10 Phase 2

20.1.2 For GSM 1900:

/GSM:05.02/	GSM Requirements 05.02 Phase 2

The references /PCS:1/-/PCS:8/ are chapters in the document: Volume 1, PCS 1900 Physical Layer 1 Specification;

The specification is labelled: JTC(AIR)94.08.01-231R3

/PCS:1/	Physical Layer Overview
/PCS:2/	Multiplexing and Multiple Access on the Radio Path
/PCS:3/	Forward Error Protection Coding and Interleaving
/PCS:4/	Modulation
/PCS:5/	Radio Transmission and Reception
/PCS:6/	Radio Subsystem Link Control
/PCS:7/	Synchronization
/PCS:8/	Change History

References in the text may have a section number added. For example /ref:5.3.5/ refers to chapter 5, section 3.5.

20.2 Concepts

Base Transceiver Station (BTS), unit operating on a set of radio frequencies in one cell.

Radio Base Station (RBS), all equipment forming an Ericsson base station, may comprise several BTSs.

© Ericsson Radio Systems AB
— All Rights Reserved —

Combining System and Filtering, is the interface between transmitters and the antenna system. The functionality is:

- Antenna system supervision support
- RF filtering
- Duplex filtering

The TX reference point is defined as the point where the TX antenna signal crosses the RBS border, i.e. the connector for the antenna feeder.

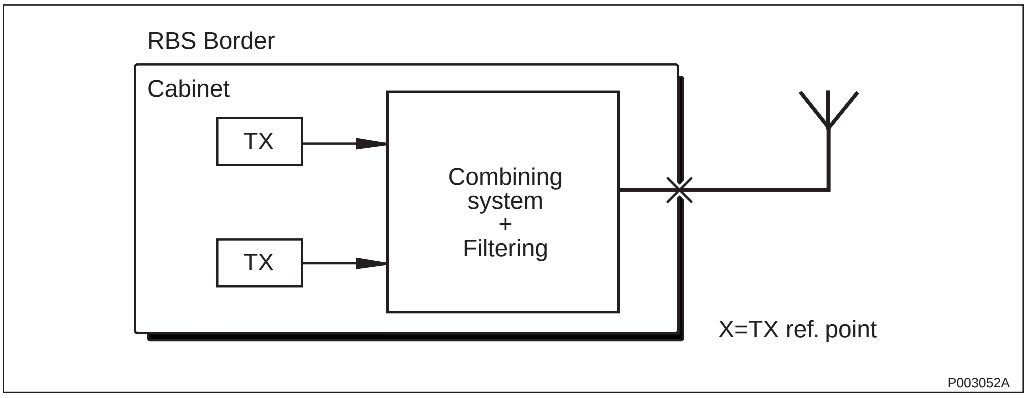

Figure 35 TX reference point

When the RBS is configured with integral antenna the TX reference point is the cabinet output RF connector.

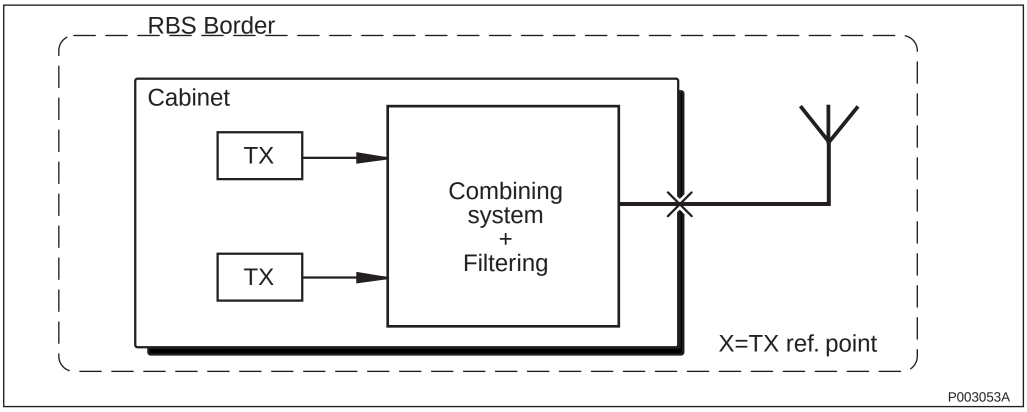

Figure 36 TX reference point with integral antenna

20.3 Functions

20.3.1 Radio Transmission

Radio transmission denotes the function to "Generate an RF signal" from the bit stream that constitutes a burst.

The transmitter uses the modulation format specified in /GSM:05.04/ for GSM 900 and GSM 1800, and /PCS:4/ for GSM 1900.

The RF transmission characteristics are in compliance with requirements in /GSM:05.05/ for GSM 900 and GSM 1800, and /PCS:5/ for GSM 1900.

© Ericsson Radio Systems AB
— All Rights Reserved —

The synchronization of the RF transmission is in compliance with requirements in /GSM:05.10/ for GSM 900 and GSM 1800, and /PCS:7/ for GSM 1900.

20.3.2 BCCH Carrier Filling

The output power for a transmitter sending the BCCH frequency is constant and equal to the nominal output power, except for the power ramping between bursts, see /GSM 05.08:7.1/ for GSM 900 and GSM 1800 and /PCS:6.5.1/ for GSM 1900.

During idle timeslots dummy bursts are transmitted, the dummy burst is defined in /GSM:05.02:5.2.6/.

20.3.3 Transmitter Filling

The RBS can be configured for transmitter filling. All transmitters serving a cell are then configured with a filling level which transmits dummy bursts in the idle timeslots.

Transmitter filling is not configurable for synthesized frequency hopping transmitters.

Transmitter filling is not configurable for transmitters configured for DTX.

Transmitters configured for BCCH carrier are not affected by the filling level.

20.3.4 TX–Diversity

In order to improve the downlink performance, the BTS can be configured for transmitter diversity. Two transmitters connected to different antennas are then transmitting with maximum power on the same frequency. One of the transmitters has its bursts forwarded in time two bits compared to the other. The MS receiver signal processing will then contribute to a downlink performance gain of 3–5 dB.

Transmitter diversity is initiated when the first transmitter is configured on A-bis to a nominal power value 2 dB higher than the maximum nominal power defined for the RBS, and no Operation & Maintenance Link is established to the second transceiver.

If any transmitter goes down, then the other transmitter will also be taken out of operation.

20.4 Operational Conditions

20.4.1 Capabilities

The transmitter can control the output power as defined by the Base Station Power Control function.

The transmitter is capable of frequency hopping as defined by the Frequency Hopping function.

© Ericsson Radio Systems AB
— All Rights Reserved —

20.4.2 Frequency Bands

Transmitters for the GSM band are capable to operate in the extended GSM frequency band, 925 - 960 MHz. The combining system supports the primary GSM 900 band, 935 - 960 MHz, see /GSM:05.05:2/.

Transmitters for the GSM 1800 band operates in the 1800 frequency band, 1805-1880 MHz, see /GSM:05.05:2/.

Transmitters for the GSM 1900 band operates in the 1900 frequency band, 1930-1990 MHz, see /PCS:5.1/.

20.4.3 Nominal Power

The nominal power is the maximum output power the transmitter is allowed to use. Nominal power is defined as the power level at the output of the transmitter which in the Micro Building System corresponds to the Tx ref point. The nominal power is set at configuration. It is possible to set 7 values in 2 dB steps with accuracy according to /GSM:05.05:4.1.2/ for GSM 900 and GSM 1800 and /PCS:3.3.3.1/ for GSM 1900.

20.4.4 Output Power

The output power is measured at the TX reference point, see Section 20.2 Concepts on page 135.

The output power is configuration dependent and is described in chapter Radio Configurations, RBS 2000 Micro.

© Ericsson Radio Systems AB
— All Rights Reserved —

21 Restart and Recovery

The "Restart and Recovery" function allows either a specific RU or the entire RBS to be started and restarted in a controlled way.

Restart and/or Recovery may occur for a number of different reasons, including, but not restricted to:

- Power on
- BSC-ordered reset
- Internal fault

The overall objective of Restart and Recovery is to determine that a restarting unit is capable of being put into operation and, if appropriate, to prepare the unit for being put into operation.

If a restarting unit cannot be taken into operation, the Restart and Recovery function identifies the reason using the visual indicators.

21.1 Concepts

Micro building system	Products where all vital units are enclosed in a sealed cabinet. The units are normally not replaceable in the field, but the cabinet will be replaced as a whole.
CMRU	Central Main RU. Subclass of Main RU. An RBS has only one CMRU.
DMRU	Distributed Main RU. Subclass of Main RU. A DMRU is subordinate to the CMRU.
Main RU	A Main RU: - contains one or more processors to which software can be downloaded from the BSC. - is either central or distributed, see above. - may, or may not, have a direct signalling link to the BSC.
Sub-RU	A sub-replaceable unit is always connected to a superior Main RU. This connection is used for retrieval of equipment information. A Sub-RU normally does not have a processor.
Passive RU	An RU with a very low level of intelligence. It is independent of the processor system and has no connection for O&M communication.
RU	The smallest unit that can be handled on site or in a repair center. Information about the RU can be retrieved via OMT or BSC.

© Ericsson Radio Systems AB
— All Rights Reserved —

21.2 Functions

21.2.1 Restart Origin

A restart can occur in any Main RU or in the entire RBS for any of the following reasons:

- Power on
- Reset button
- Software fault
- Memory fault
- BSC ordered reset

21.2.2 Central Main RU Restart and Recovery

The sequence of actions initiated in a CMRU at restart and recovery is summarised below:

- Select Application Software
  - The application software is available even after power on reset
  - Further information is found within the context of Function Change
- Conditional RBS Database Load
  - A valid RBS database must be present for restart and recovery to be completed

The RBS database is checked to ensure:

- The database exists
- The structure is correct
  - If either of these criteria is not fulfilled the restart is suspended pending the loading of a valid database via the OMT
  - A visual indicator, 'Fault Indicator', located on the backplane flashes to indicate when the RBS is waiting for the RBS database to be loaded
- Internal Link Establishment
  - The CMRU starts a continuous process which supervises the internal link establishment and loss, between itself and its Sub-RUs and the DMRUs.
  - On link establishment, with a DMRU, the CMRU compares the revision of DMRU application software in the DMRU with its own copy of the DMRU software. If the application software differs, the CMRU updates the DMRU application software with its own copy.

© Ericsson Radio Systems AB
— All Rights Reserved —

- At link establishment the CMRU updates the RBS database to reflect the contents of the RU database.

- Internal Configuration
  - Internal configuration parameters are fetched from the data base and used in the system
- Check RBS Operational Ability
  - The CMRU evaluates the fault status of the RBS. If no faults that affect the functionality have been detected, the RBS is put into operation.
  - The first time (after manufacture) that a CMRU is started, it will remain in local mode until switched to remote mode via the button, thereafter the CMRU will be taken into remote mode
  - Further information is found within the context of Operation and Maintenance Support

21.2.3 Distributed Main RU Restart and Recovery

The sequence of actions initiated in a DMRU at restart and recovery is summarised below:

- Select Application Software
  - The application software is available even after power on reset
  - Further information is found within the context of Function Change
- Internal Link Establishment
  - The DMRU starts a continuous process which supervises the internal link establishment and loss, between itself and its Sub-RUs
- Wait for CMRU Link Establish

Subsequent actions in a DMRU are controlled by the superior CMRU. These subsequent actions include:

- DMRU Software Check
  - The application software within the DMRU is checked by the CMRU against the revision of DMRU application software stored by the CMRU
  - If the two versions of application software differ, the DMRU will download the application software from the CMRU
  - Further information is found within the context of Function Change
- RBS Database Update

© Ericsson Radio Systems AB
— All Rights Reserved —

  - The RBS database will be updated to reflect the contents of the RU database and the RU databases of any Sub-RUs associated with this DMRU

- Internal Configuration

  - Internal configuration parameters are fetched from the data base and used in the system

21.2.4 Sub-RU Restart and Recovery

The sequence of actions initiated in a Sub-RU with processor at restart and recovery are summarised below:

- Software Start
- Wait Link Establish from Main RU

Subsequent actions in a Sub-RU are controlled by the superior Main RU. These subsequent actions include:

- RBS Database Update

  - The RBS database will be updated to reflect the contents of the RU database
  - Further information is found within the context of Installation database handling

21.3 Operational Conditions

21.3.1 Operation and Maintenance

Maintenance functions related to Restart and Recovery are described in chapter Operation and Maintenance Terminal.

The visual indicators relevant to Restart and Recovery are described in chapter Operation and Maintenance Support.

All of the visual indicators associated with an RU are temporarily turned on for a minimum of 2 seconds during the initial restart of that RU. This allows visual identification of any faulty indicators.

21.3.2 Capabilities

The start time is defined as the time elapsed from when the power is turned on (after having been off), or from the reception of reset (reset button pushed or BSC reset order received) to when the RBS is ready to enter remote mode.

Depending on the reason for restart, certain actions must be taken during start-up, which causes variation in start-up time.

A special case of restart is when the BSC orders a reset. Then the total start-up time for the RBS or CMRU is maximum 8 seconds.

© Ericsson Radio Systems AB
— All Rights Reserved —

22 Function Change

The purpose of "Function Change" is to facilitate the reload, change or upgrade of the RBS software and the subsequent activation of that software. The software is downloaded from the BSC to the RBS via the A-bis interface.

Function change incorporates the following features:

- Rapid initial start
  - Software preloaded in the non-volatile memory of the RBS during manufacture; permits rapid initial start.
- Rapid restart
  - At restart of an RBS following a power failure, the software does not have to be downloaded via the A-bis interface to the RBS. This is because of the non-volatile memory of the RBS.
- Minimised software download time
  - Software is distributed internally within the RBS. Only one copy of the software is downloaded to each RBS, minimising the time required for software download.
- Software download while in traffic
  - The RBS can perform download of software without affecting normal operation. Traffic is affected only when switching over to the downloaded software.

22.1 Concepts

CMRU	Central Main RU. Subclass of Main RU. An RBS has only one CMRU.
DMRU	Distributed Main RU. Subclass of Main RU. A DMRU is subordinate to the CMRU.
File Package	A set of individual software files which together constitute a revision of the software required by an entire RBS or by parts of the RBS.
File Revision	The file revision identifies a specific software file. This includes the type of Main RU the software is intended for execution on as well as the software revision.
Main RU	Contains one or more processors to which software can be downloaded from the BSC. A Main RU is either central or distributed, see above. A Main RU may,

© Ericsson Radio Systems AB
— All Rights Reserved —

	or may not, have a direct signalling link to the BSC.
RU	The smallest unit that can be handled on site or in a repair center. Information about the RU can be retrieved via OMT or BSC.
Software file	The software necessary for a class of Main RU. A software file contains application software.

22.2 Functions

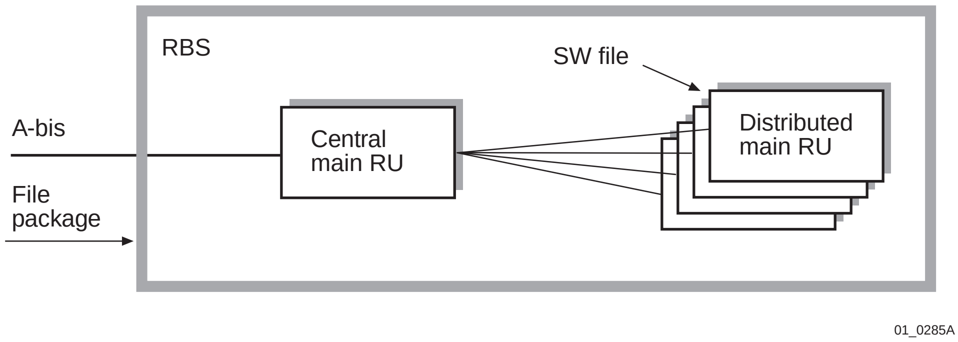

Figure 37 Overview of function change

22.2.1 Software Storage

Every Main RU is equipped with both volatile and non-volatile memory.

Application software, either downloaded via the A-bis interface, transferred internally, or installed during manufacture, is stored semi-permanently in the non-volatile memory.

Before execution, the software is copied from the non-volatile memory into the volatile memory, where it is executed. This arrangement permits the RBS to operate normally, i.e. executing one version of software while loading a new version of software as a background activity.

One area of the non-volatile memory contains the base application software. The base application software can only be updated by function change if the normal application software is valid, thus there is always one application software available. If the normal application is corrupt (or unavailable), the base application software is automatically selected instead.

22.2.2 Software File Relation

Each Main RU visible via the A-bis interface is offered every software file within the appropriate file package. The file revision of the offered software file is compared with that of the software files already held in non-volatile memory in order to determine whether download is necessary or not. Download is carried out only when the file offered has a different revision than the one held in RBS memory.

© Ericsson Radio Systems AB
— All Rights Reserved —

As an alternative to the above, unconditional download is also supported. In this case, there are no conditions on File Revision etc. for the download.

22.2.3 Software File Download

The CMRU accepts the download of software files intended for all Main RUs in the RBS.

A DMRU never accepts direct download of software files via A-bis, since this must be done via the CMRU.

This arrangement means that only the files actually needed by each Main RU are downloaded. Each individual file is downloaded only once, thus minimising the software download time required. Note that this is an improvement compared to the general A-bis concept; downloading a software file several times, once for each Main RU needing it.

Loading software to a Main RU is allowed in any state, even while operational.

The transfer of a software file is initiated and performed via the A-bis interface. The CMRU stores the transferred software file in non-volatile memory.

22.2.4 Start Required

On completion of the internal distribution of software files, the RBS informs the BSC that the new software can be activated.

22.2.5 Software Start

The activation of new software is ordered via the A-bis interface. When the order is received, the software is copied from non-volatile memory into volatile memory, where it is executed.

At switch-over to the new software, traffic is affected. This implies a restart as in the section *Restart and Recovery* followed by configuration and enabling as specified in the section *Functionality Administration*.

22.3 Operational Conditions

22.3.1 Operation and Maintenance

The visual indicators relevant to Function Change are described in the section *Operation and Maintenance Terminal*.

22.3.2 Capabilities

The download of software via the A-bis to the RBS and internal transfer of software files does not affect the normal operation of the RBS.

Switch-over, i.e. software start of an RBS, takes less than 60 seconds.

The switch-over time is defined as the time elapsed from the reception of a start command via A-bis to when the Main RU is ready for re-establishment of the link to the BSC.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

23 Functionality Administration

"Functionality Administration" provides the functionality necessary to allow the BSC to configure, enable and disable AOs within the RBS. This function also includes general layer 3 A-bis OML support for other functions within the RBS.

23.1 Concepts

Application Object	An abstract subclass of MO, which provides part of the functionality of a BTS
Elementary Procedure	The protocol over the A-bis OML at layer 3 consists of EPs (Elementary Procedures). An EP is a unit of interaction between the BSC and one of the MOs. An EP consists of an initiating message and a response. For example, an EP may consist of the BSC sending an initiating message CONFIGURE REQUEST and the MO in the RBS responding with a message CONFIGURE REQUEST ACK.
Managed Object	The BSC manages the O&M of the RBS via the A-bis O&M Interface. The RBS equipment is seen as MOs by the BSC. This is a means of describing the RBS in a function-oriented way, and a logical model of the RBS in terms of MOs is built in the BSC. All O&M actions are based on this logical model structure created in the BSC. An MO does not necessarily have a one-to-one relation with a physical unit in the RBS, and the MO comprises both hardware and software.

© Ericsson Radio Systems AB
— All Rights Reserved —

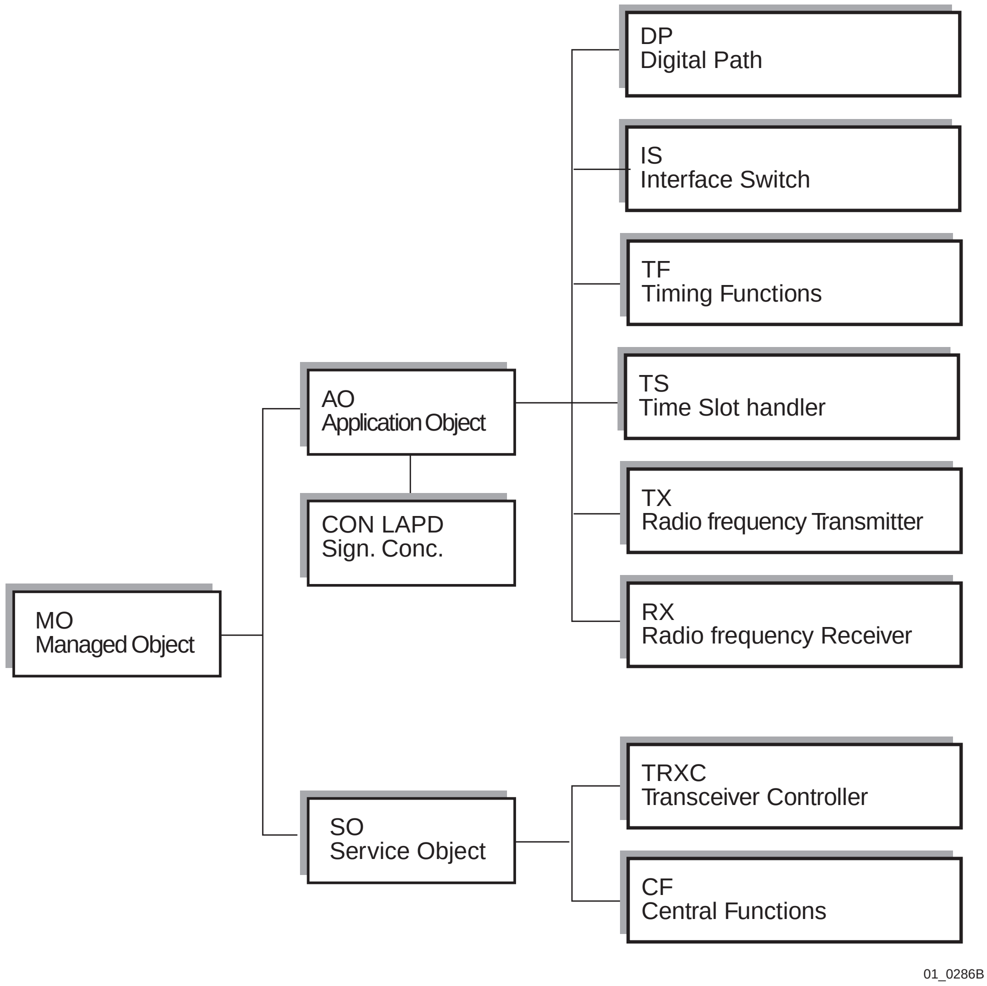

Figure 38 Managed Object classification

RU	The smallest unit that can be handled on site or in a repair center. Information about the RU can be retrieved via OMT or BSC.
SO	An abstract subclass of MO, which provides service functions for a set of MO instances including itself.

23.2 Functions

23.2.1 Application Object Connection

Before the BSC can communicate with an AO instance, that instance must be connected to its associated SO instance. This is performed by a command over the A-bis OML and includes both of the following:

- Connect an AO to an SO
- Disconnect an AO from an SO

© Ericsson Radio Systems AB
— All Rights Reserved —

23.2.2 Application Object Configuration

Each AO has a number of associated configuration parameters which control the way in which it functions.

An AO has two states relevant to configuration:

- Enabled
- Disabled

The configuration of an AO by the BSC involves three distinct operations performed over the A-bis OML:

- Configuration
- Enable
- Disable

Configuration

The process of setting the desired configuration parameters for an AO.

For most AOs and most configuration parameters this process must be performed while the AO is disabled. However there are a number of exceptions, certain parameters on certain AOs may be configured by the BSC while the AO is enabled.

When a configuration request is received over the A-bis, this function checks that all preconditions for a change in configuration are satisfied:

- All parameters are within the permitted range or have permitted values
- If the AO is enabled, parameters that cannot be changed in enabled state must not be changed
- For certain classes of AO, the configuration parameters must be consistent with each other

The BSC is informed of the successful configuration of the AO or, if unsuccessful, an indication of why the configuration failed is returned.

Enable

Enable attempts to activate an AO with the current configuration parameters.

When an enable request is received via A-bis, this function checks that all preconditions for a change to enabled state are satisfied:

- All required configuration parameters must be previously set by one or more configuration procedures
- Configuration parameters must be consistent with each other

If all checks are successful, the function of the appropriate AO is enabled.

The BSC is informed of the successful enable of the AO or, if unsuccessful, an indication of why the enable was unsuccessful is returned.

© Ericsson Radio Systems AB
— All Rights Reserved —

Disable

Disable deactivates an AO.

When a disable request is received over the A-bis, this function only needs to check that all preconditions for a change to disabled state are satisfied.

If the check is successful, the function of the appropriate AO is disabled. The AO IS and AO CON are exceptions to this, they retain their normal functions even when disabled.

The BSC is informed of the successful disable of the AO or, if unsuccessful, an indication of why the disable was unsuccessful is returned.

23.2.3 A-bis OML Support

Layer 3 downlink Elementary Procedures

Downlink EPs are those EPs initiated by the BSC. The initiating message is checked for the following criteria:

- Valid header and message code
- Correct length
- All mandatory parameters are present
- Only mandatory or optional parameters are present
- Parameter values are in range

An initial message that fails to meet any of these criteria is rejected. If the message is so badly corrupted that it is not recognisable, the message is simply ignored.

A message which meets all of these criteria is forwarded to the appropriate handling function. The handling function is then responsible for responding to the initial message.

Layer 3 uplink Elementary Procedures

Uplink EPs are those EPs initiated by the RBS. All functions within the RBS which initiate uplink EPs use this function to provide supervision as defined below.

An initiated EP is time-supervised. The initial message of an EP is repeated if time-out occurs before a response is received. The initial message is sent once, and then repeated a maximum of two times.

The response from the BSC is checked for the following criteria:

- Valid header and message code
- Correct length
- All mandatory parameters are present
- Only mandatory or optional parameters are present
- Parameter values are in range

© Ericsson Radio Systems AB
— All Rights Reserved —

A response message that fails to meet any of these criteria is simply ignored.

A response message that meets all of these criteria is forwarded to the function that initiated the EP.

23.3 Operational Conditions

23.3.1 Operation and Maintenance

The visual indicators relevant to Functionality Administration are described in chapter Operation and Maintenance Support.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

24 Operation and Maintenance Support

The "Operation and Maintenance Support" functions are as follows:

- Local/Remote Mode
  - This function allows an RU to be switched between local and remote mode.
- Remote Operational Indication
  - Provides an indication on site that the BSC has put an RU into operation.
- Loop Control
  - Provides support for the BSC to perform a loop test of the connection between the BSC and the RBS.
- Calendar Time
  - Maintains a regularly updated general-purpose time-of-day clock within the RBS.
- RSSI (Received Signal Strength Indicator) temperature compensation
  - Provides the possibility to compensate for temperature dependencies in the receiver path.

24.1 Concepts

CMRU
: Central Main RU. Subclass of Main RU. An RBS has only one CMRU.

DMRU
: Distributed Main RU. Subclass of Main RU. A DMRU is subordinate to the CMRU.

TDMRU
: Transceiver DMRU.

Main RU
: A Main RU:
  - contains one or more processors to which software can be downloaded from the BSC.
  - is either central or distributed, see above.
  - may, or may not, have a direct signalling link to the BSC.

Micro building system
: Products where all vital units are enclosed in a sealed cabinet. The units are normally not replaceable in the field, but the cabinet will be replaced as a whole.

MO
: The BSC manages the O&M of the RBS via the A-bis O&M Interface. The RBS equipment is seen as MOs by the BSC.

© Ericsson Radio Systems AB
— All Rights Reserved —

	This is a means of describing the RBS in a function-oriented way, and a logical model of the RBS in terms of MOs is built in the BSC. All O&M actions are based on this logical model structure created in the BSC. An MO does not necessarily have a one-to-one relationship with a physical unit in the RBS, and the MO comprises both hardware and software
Passive RU	An RU with a very low level of intelligence. It is independent of the processor system and has no connection for O&M communication.
Replaceable unit (RU)	The smallest unit that can be handled on site or in a repair center. Information about the RU can be retrieved via OMT or BSC.
Sub-RU	A sub—replaceable unit is always connected to a superior Main RU. This connection is used for retrieval of equipment information. A Sub-RU normally does not have a processor.

24.2 Functions

24.2.1 Local/Remote Mode

Each Main RU and associated Sub-RUs can be put or removed from operation locally on site via the local/remote mode function. An RU in local mode does not have communication with the BSC over the A-bis interface and is therefore not in operation.

On the cabinet there is a visual indication of current local/remote mode status for CMRU. There is also a button to toggle between the two modes.

When a Main RU, which has a direct signalling link to the BSC, is put into operation for the first time (after manufacture), this must be done manually using the local/remote button.

When an RU switches from remote mode to local mode, the BSC is informed by raising a class 1 external condition. Communication with the BSC is then terminated by disconnecting the A-bis OML and RSL on layer 2.

When an RU switches from local to remote mode, the RU accepts the A-bis OML and RSL re-establishment on layer 2. The external condition originally reported to the BSC is ceased internally, but not reported to the BSC.

24.2.2 Remote Operational Indication

The operational indicator associated with the micro RBS RU is under BSC control when the RU is in remote mode.

© Ericsson Radio Systems AB
— All Rights Reserved —

The BSC reports the operational status of each MO via the A-bis interface. The RBS uses this information to determine when a specific RU should be considered operational.

24.2.3 Loop Control

The loop control function allows the BSC to request the RBS to loop the speech data link associated with a TS back to the BSC. This allows the BSC to test the speech data link associated with each TS.

24.2.4 Calendar Time

Each RU maintains a general-purpose time-of-day clock for use by other functions, e.g. time-stamping entries in a log. The clock is initially set and periodically updated by the CMRU requesting the current time from the BSC.

The calendar time is requested from the BSC after each layer 2 link is established. This request is subsequently repeated every 24 hours while the layer 2 link remains established. The calendar time is then distributed internally to the RUs within the RBS.

24.2.5 RSSI Temperature Compensation

The loss in the receiver path varies with temperature. To obtain a more accurate estimate of the loss, the temperature of the receiver is measured continuously and a temperature-dependent part is used to update the RSSI compensation value.

24.2.6 Visual Indications

Products belonging to a Micro building system are equipped with a panel of visual indicators common for the whole cabinet.

Fault (red)

Off	No fault(s) is detected.
On	One or more fault(s) are detected in the RBS. *At restart*: Explicit test of indicators

There is one Fault indicator per cabinet.

Operational (green)

Off	The RU is not operational or change of RU mode is in progress
On	*When in local mode*: There is no fault that affects (or may affect) the function of the RU *When in remote mode*: Connected to BSC and considered operational by the BSC *At restart*: Explicit test of indicators
Flashing	Either:

© Ericsson Radio Systems AB
— All Rights Reserved —

	– Receiving application software
	– Activation of application software pending
	– Configuration activity, which may take more than 10 s to complete, in progress
Priority	"Flashing" has highest priority followed by "On". "Off" has lowest priority

There is one Operational indicator per cabinet.

Local mode (yellow)

On	The RU is in local mode
	At restart: Explicit test of indicators
Flashing	Change of mode is in progress
Off	The RU is in remote mode

There is one Local Mode indicator per cabinet.

External Alarms (yellow)

Off	No external alarms are active
On	One or more supervised external alarms are active
	At restart: Explicit test of indicators

There is one External Alarms indicator per RBS.

Reduced Capacity (yellow)

Off	All TDMRUs are operational
On	At least one TDMRU is not operational
	At restart: Explicit test of indicators

There is one Reduced Capacity indicator per cabinet.

AC Power On (yellow)

Off	No AC power supply
On	AC power supply
	At restart: Explicit test of indicators

There is one AC Power On indicator per cabinet.

Battery Fault (yellow)

Off	Battery connected
On	Battery disconnected or faulty

© Ericsson Radio Systems AB
— All Rights Reserved —

At restart: Explicit test of indicators

There is one Battery fault indicator per cabinet.

Test Result TDMRU1 (yellow)

(Test Operation is only HW supported, the indicator is not used.)

Test Result TDMRU2 (yellow)

(Test Operation is only HW supported, the indicator is not used.)

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

25 Installation Data Handling

The RBS contains a database which stores information relating to the RBS as a whole, and to each RU within the RBS.

The most important purpose of the database is to provide effective aid for:

- General operation and maintenance
- Fault diagnosis
- Fault localisation
- Traceability

The information stored in the database falls into one of two categories: configuration information or history information.

The database is at least partly accessible to each of the following:

- Other functions within the RBS
- The operator via the OMT
- The BSC via the A-bis interface

25.1 Concepts

CMRU	Central Main RU. Subclass of Main RU. An RBS has only one CMRU.
RU	The smallest unit that can be handled on site or in a repair center. Information about the RU can be retrieved via OMT or BSC.

© Ericsson Radio Systems AB
— All Rights Reserved —

25.2 Functions

25.2.1 General

The RBS database is stored in the CMRU within the RBS. Certain parts of the contents of the RBS database, relevant to specific RUs (RU databases) are stored in the Distributed Main RUs or Sub RUs as well.

The Installation Data Handling function provides basic access to the contents of the RBS database for other functions, the BSC via the A-bis interface, and the operator via the OMT.

25.2.2 Database Information Elements

Resident within RBS database

- RBS External Alarm:
  - Specifies the Alarm identity, Alarm data, Alarm severity and the Alarm criterion of each external alarm. Access: BSC and OMT.
- RBS Transmission Interface Configuration:
  - Stores configuration information for the transmission interface and TEI for the CMRU. Access: OMT.
- RBS Configuration Identifier:
  - Identifies the overall RBS configuration. Access: OMT.

Resident within RBS and RU databases

- RU Type:
  - Details the RU type, RU instance. Access: OMT.
- RU Identity:
  - Includes product number, revision and serial number of the RU. Access: BSC and OMT.
- RU Physical Position:
  - Identifies the location of the RU at a site, includes cabinet, rack, shelf and slot. Access: BSC (in fault reports and hardware information) and OMT.

Resident within RU database

- RU Specific:
  - Includes parameters specific to an RU which are dependent on the hardware design.

© Ericsson Radio Systems AB
— All Rights Reserved —

25.2.3 Functions Involving RBS Database

The RBS database provides a number of functions to access the database, as follows:

- Read/Install RBS Database:
  - The entire RBS database can be read or written. This function is used to transfer the RBS database between the OMT and the RBS.
- Read Hardware Information:
  - This function allows the BSC to read details of the hardware installed in the RBS, specifically:
    - Product number
    - Revision
    - Serial number
    - Placement information
- Read one Information Element:
  - This function allows the BTS to read different information elements in the RBS and RU databases.
- Update one Information Element:
  - This function allows the BTS to write information elements in the RBS and RU databases.

25.3 Operational Conditions

25.3.1 Operation and Maintenance

Maintenance functions related to Installation Data Handling are described in chapter Operation and Maintenance Terminal.

25.3.2 Capabilities

- Read of the entire RBS database (from the RBS to the OMT) takes less than 4 minutes.
- Installation of the entire RBS database (copy from the OMT to the RBS) takes less than 4 minutes.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

26 Self Test and Supervision

Self Test comprises an initial boot test performed during the start-up of an RU in order to test the functionality of the hardware required for execution of the application software.

Supervision is a subsequent activity which continuously monitors the correct function of all supervised entities within the RBS.

Faults detected by the supervision function are passed to the "Diagnostic and Fault Handling" function for further processing.

26.1 Concepts

RU	The smallest unit that can be handled on site or in a repair center. Information about the RU can be retrieved via OMT or BSC.

26.2 Self Test

26.2.1 Boot Test

The Boot test is performed on each processor before any normal application processes have started.

The Boot test is restricted to the hardware related to the processor performing the test.

The following entities are tested during Boot test:

- Processors
- Read/write memory
- Read only memory
- Hardware functions

26.3 Supervision

26.3.1 Memory

If the contents of the memory are incorrect, this is detected. Read only memory and non-volatile memory (FLASH, EEPROM) are supervised using checksums. Read/write memory is supervised by non-destructive test of all possible information states. Memory is supervised as a background activity.

26.3.2 Buses

If the data fed to the bus drive function or the data received is incorrect, this is detected. All buses between RUs or major function blocks are covered.

26.3.3 Cables

If a cable is removed, this is detected.

© Ericsson Radio Systems AB
— All Rights Reserved —

26.3.4 Software Execution

If a malfunction of the executing software occurs, this is detected.

26.3.5 Radio Transmission and Reception

If an error occurs in the signal strength or in the bit error rate in the transmitter or in the receiver of the transceiver, this is detected. All transceivers are covered.

26.3.6 Layer 2 Data Link Transmission

If a malfunction occurs in the layer 2 data link transmission, this is detected. The supervision covers external links and internal links, that is, the signalling multiplexing between the CMRU and the end-points of the DMRUs.

26.3.7 LAPD Concentration

If the transmit queue in the LAPD concentrator becomes full, this is detected.

26.3.8 Environmental Conditions

If the temperature rises above a level where destruction may occur, this is detected. Local actions are further described in chapter Diagnostics and Fault Handling.

If the temperature within the RBS is outside the normal conditions range or outside the safe function range, this is detected.

26.3.9 Power Conditions

If there is a fault in any of the units used for energy control, this is detected.

Incorrect power levels for AC power or DC power are detected. AC mains failure is detected.

26.3.10 Synchronization Sources

If the frequency generators of the transmitter or receiver are not locked to the reference frequency, this is detected.

If the quality of the reference source is too low, this is detected.

© Ericsson Radio Systems AB
— All Rights Reserved —

27 Diagnostics and Fault Handling

"Diagnostics and Fault Handling" supervises the handling of faults and disturbances detected by the "Self Test and Supervision" function.

Fault handling performs the following:

- Filters spurious disturbances. (Disturbances are events which may indicate a fault only under certain circumstances)
- Evaluates the underlying fault cause
- Determines the impact of a fault
- Localises faults to an offending RU
- Attempts to minimise the effect of a fault
- Reports any change in fault status of an MO to the BSC
- Maintains logs of faults

27.1 Concepts

Disturbance	An event which may indicate a fault only under certain circumstances
Managed Object	The BSC manages the O&M of the RBS via the A-bis O&M Interface. The RBS equipment is seen as MOs by the BSC. This is a means of describing the RBS in a functional-oriented way, and a logical model of the RBS in terms of MOs is built in the BSC. All O&M actions are based on this logical model structure created in the BSC. An MO does not necessarily have a one-to-one relation with a physical unit in the RBS, and the MO comprises either both hardware and software or software only.
RU	The smallest unit that can be handled on site or in a repair center. Information about the RU can be retrieved via OMT or BSC.

27.2 Functions

27.2.1 Fault Detection

Detected disturbances are processed by filtering, evaluation and classification.

The types of faults that are detected are specified in chapter Self Test and Supervision.

© Ericsson Radio Systems AB
— All Rights Reserved —

27.2.2 Fault Filtering

Disturbances are detected by the supervision function. All disturbances are filtered before a fault is considered to be present or absent. The filtering function is adapted to each fault situation for optimum performance. For example, the following parameters (or combinations of) may be used for the filter function:

- The reception frequency of disturbances
  - A frequency which is too high is considered to be a fault
- The measurement value of a parameter
  - A parameter exceeding a threshold is considered to be a fault
- Time
  - A condition which is valid for too long is considered to be a fault

27.2.3 Fault Evaluation

Detected faults are evaluated to determine the underlying fault. This is done by analysing faults reported on a low level (specific hardware units) and mapping them to a high level (RUs and MOs and the entire RBS), thus taking the complete fault situation into account.

27.2.4 Fault Classification

Faults detected by an MO are classified according to:

- Severity
  - Either affects (may affect) functionality of the MO or does not affect functionality of the MO
- Fault origin
  - Either internal or external to the MO
  - Either internal or external to the RBS

27.2.5 Fault Localisation

When detecting a fault, the RBS automatically evaluates the fault situation and indicates the suspected faulty RU. The fault status of the RBS is updated with this information.

When a fault is pin-pointed to a specific RU, or to the entire RBS, this is visually indicated as specified in chapter Operational and Maintenance Terminal.

27.2.6 Local Action

The impact of certain faults can sometimes be minimised by performing some suitable local action autonomously within the RBS. Permitted actions are:

© Ericsson Radio Systems AB
— All Rights Reserved —

- Re-initiation
  - Certain faults can sometimes be cleared by re-initiating the offending hardware. For example, if a communication circuit behaves unexpectedly, it is re-initiated. Note that re-initiation of an entire RU or a processor is not allowed as a local action.
- Fault isolation
  - If a detected fault could cause equipment damage, the equipment is isolated. For example, if a transmitter is too warm, it is switched off.
- Fault compensation
  - Certain faults can sometimes be compensated for elsewhere in the RBS. For example, if a fan is faulty, the speed of the other fans is increased.
  - Supervision continues after performing a local action. If the fault ceases, the local action is stopped.

A local action never prevents the BSC from controlling the RBS.

27.2.7 Fault Reporting

On the RBS's initiative, the BSC is informed of each change in the fault status of the RBS. Faults are reported on an MO basis. A certain fault can be detected and reported by several MOs.

The BSC may request the current fault status for a specified MO at any point in time.

27.2.8 Fault Logging

All changes in the fault status of the RBS are logged in a software log. The software log is distributed on the RUs. A log entry is stored in the RU where the fault is detected. The software log is stored in volatile memory.

27.3 Operational Conditions

27.3.1 Operation and Maintenance

Maintenance functions related to Diagnostics and Fault Handling are described in chapter Operational and Maintenance Terminal.

The visual indicators relevant to Diagnostics and Fault Handling are described in chapter Operational and Maintenance Terminal.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

28 Operation and Maintenance Terminal

The OMT is a tool that provides efficient aid for installation, site acceptance, diagnostics and maintenance of RBSs within the RBS 2000 series.

28.1 References

/G.703/	CCITT Recommendation G.703, White Book
/G.704/	CCITT Recommendation G.704, White Book
/GSM:11.20/	GSM 11.20 (phase 1)
/GSM:05.05/	GSM 05.05 (phase 2)

28.2 Concepts

CMRU
: Central Main RU. Subclass of Main RU. An RBS has only one CMRU.

DMRU
: Distributed Main RU. Subclass of Main RU. A DMRU is subordinate to the CMRU.

Installation Database
: Each RBS has a built-in database where information about installed hardware is stored. The information reflects the configuration as well as the history of the hardware. Within the RBS, each RU carries a database. The installation database is used by the operator (via the OMT), by RBS internal functions and partly by the BSC (via A-bis).

Main RU
: A Main RU:

- contains one or more processors to which software can be downloaded from the BSC.
- is either central or distributed, see above.
- may, or may not, have a direct signalling link to the BSC.

Managed Object
: The BSC manages the O&M of the RBS via the A-bis O&M Interface. The RBS equipment is seen as MOs by the BSC. This is a means of describing the RBS in a function-oriented way, and a logical model of the RBS, in terms of MOs, is built in the BSC. All O&M actions are based on this logical model structure created in the BSC.

© Ericsson Radio Systems AB
— All Rights Reserved —

	An MO does not necessarily have a one-to-one relation with a physical unit in the RBS, and the MO comprises either both hardware and software or software only.
Passive RU	An RU with a very low level of intelligence. It is independent of the processor system and has no connection for O & M communication.
RU	The smallest unit that can be handled on site or in a repair center. Information about the RU can be retrieved via OMT or BSC.
Spare Bits	A number of additional bits for spare use in a timeslot 0 multiframe structure. This is defined in /G. 704/. The use of these bits is defined by the customer.
Sub-RU	A sub-replaceable unit is always connected to a superior Main RU. This connection is used for retrieval of equipment information. A Sub-RU normally does not have a processor.
Timeslot 0	The timeslot 0 multiframe structure is defined in /G. 704/.

28.3 Functions

28.3.1 User Interface

The OMT provides an easy-to-use graphical user interface. Well-known hardware units and functions, for example a transmitter, appear as graphical objects. There are a number of operations attached to each graphical object, for example for retrieving information about it.

The user interface is based on a number of views. Each view contains a set of objects, chosen so that the natural work flow of the user is supported.

For user convenience there is an on-line help facility in the OMT.

28.3.2 Radio Base Station

The following user functions, related to the RBS as a whole, are available in the OMT:

- Display RBS configuration, see chapter Installation Data Handling.
- Display RBS software revisions, display RU software revisions for all Main RUs, see Section 28.3.11 Replaceable Unit on page 174.
- Display TEI/RU list, display list of TEI and RU Instances for the CMRU and for the DMRUs with a direct signalling link to the BSC in the cabinet (see also Section 28.3.11 Replaceable Unit on page 174).

© Ericsson Radio Systems AB
— All Rights Reserved —

The functions above are normally used for:

- General purposes (display RBS configuration)
- Maintenance (display RBS software revisions)
- Installation (display TEI/RU list)

28.3.3 OMT Connection

The following user functions, related to the OMT, are available in the OMT:

- Connect, establish a connection between the OMT and the RBS. A functionality and compatibility check is performed on RBS and OMT software versions. In case of different versions the OMT operator is informed about this fact and that all functionality is not supported.
- Disconnect, release the connection between the OMT and the RBS.

The functions above are used for general purposes.

28.3.4 Installation Database

The following user functions, related to the IDB, are available in the OMT:

- Read, copy the IDB from the RBS to the OMT.
- Install, copy the IDB from the OMT to the RBS.
- Save, copy the IDB from the OMT to any file media for example a floppy disk or a hard disk.
- Open, copy the IDB from any file media to the OMT.
- Print, print the IDB in formatted ASCII.
- Configure, generate a new configuration.
- Reconfigure, copy data from the old IDB to the new IDB.
- Modify, increase or decrease the number of activated RUs in the IDB.

The functions above are used for general purposes.

28.3.5 External Alarms

The following user functions, related to the external alarms, are available in the OMT:

- Display external alarm setup, display the external alarm setup parameters (see chapter External Alarms) associated with each of the external alarm inputs.
- Define external alarm setup.
- Monitor external alarms status, the status (on/off) of the external alarms is continuously monitored and displayed.

The functions above are normally used in connection with:

© Ericsson Radio Systems AB
— All Rights Reserved —

- Installation (display/define external alarm setup).
- Site acceptance (monitor external alarms status).

28.3.6 Cable Loss

The following user function, related to Cable loss, is available in the OMT:

- Define cable loss, defines cable and feeder loss values.

28.3.7 PCM Network

The following user functions, related to the PCM network, are available in the OMT:

- Set transmission interface type sets transmission interface type in the database to G.703 2048 kbit/s or DS1 1544 kbit/s
- Modify available synchronization source sets whether PCM link A and B, or anyone of them is to be available as synchronization source. Possible settings are: Activated or Not activated
- Display available synchronization source displays whether PCM link A and B, or anyone of them is available as synchronization source. Possible settings are: Activated or Not activated.

The following user functions, related to the /G. 703/ 2048 kbit/s PCM network, are available in the OMT:

- Display spare bits, display spare bits in timeslot 0 on G.703, values (0 or 1) for bits Sa4-Sa8.
- Define spare bits (bits can be defined independently of each other).
- Display CRC-4 (Cyclic Redundancy Check /G.704/), display whether handling of CRC-4 in timeslot 0 on G.703 is on or off.
- Switch on CRC-4.
- Switch off CRC-4.
- Monitor maintenance data, display PCM reference data and update changes continuously.
- Set Network_topology value.

  Set Network_topology value for stand alone or cascade connection of RBSs.
- Display Network_topology value.

  Display whether the network topology of the RBSs is stand alone or cascade connection.
- Set LBO values, set line build out values for a T1 transmission interface individually for PCM links A and B.
- Display LBO values.
- Set FDL use, sets facility data link use values for a T1 transmission interface.

© Ericsson Radio Systems AB
— All Rights Reserved —

- Display FDL use.

The functions above are normally used at:

- Installation (set transmission interface type, set/display available synchronization source, display/define spare bits, display/switch on/switch off CRC-4).
- Maintenance (monitor maintenance data).

28.3.8 Antenna System

The following user functions, related to the antenna system, are available in the OMT:

- Monitor maintenance data, display any of the following data and update changes continuously:
  - Diversity

The functions above are normally used for maintenance.

28.3.9 Transceiver

The following user functions, related to the transceivers, are available in the OMT:

- Switch on QIU, switch on subjective speech quality improvements uplink for one or more traffic channels within one transceiver[1)].
- Switch off QIU[1)].

  [1)]Facilitates BER measurements according to /GSM:11.20/ and /GSM:05.05/.

- Monitor maintenance data, display any of the following data and update changes continuously:
  - Transmission and reception
  - Timing advance
- Switch on Measurement Reports, switch on Measurement Reports for one or several timeslots.
- Switch off Measurement Reports, switch off Measurement Reports for one or several timeslots.

The functions above are normally used at:

- Maintenance (switch on/off QIU, Monitor maintenance data)
- Installation (switch on/off Measurement Reports)

28.3.10 Managed Object

The following user functions, related to the MOs, are available in the OMT:

- Display state, display the current state of the selected MO.
- Display relation, display which Main RU the selected MO is executing on.

© Ericsson Radio Systems AB
— All Rights Reserved —

- Display channel combination, display the channel combination of MO Timeslot.

The functions above are normally used for maintenance.

28.3.11 Replaceable Unit

The following user functions, related to the RUs in general, are available in the OMT:

- Display RU info, display any of the following parameters associated with a specific RU:
  - RU instance
  - TEI
  - Product number
  - Hardware revision
  - Serial number
  - Position (cabinet, rack, shelf, slot)
  - Logical RU identifier
  - Free text comment
- Define RU HW info, define any of the following parameters associated with a passive RU:
  - Product number
  - Hardware revision
  - Serial number
  - Free text comment
- Display RU software revision, for a specific Main RU, display the revision for the following software:
  - Currently executing software.
  - Base application software stored in non-volatile memory.
  - Normal application software in non-volatile memory.
- Define RU, define the following parameter associated with the CMRU:
  - TEI

The functions above are normally used for:

- Maintenance (display RU software revision, display RU HW info).
- Installation (define RU).

© Ericsson Radio Systems AB
— All Rights Reserved —

28.3.12 Faults

The following user functions, related to fault information, are available in the OMT:

- Monitor current fault status, read the fault status from the RBS and display changes continuously.
- Display fault info, display the current fault information for a specific object such as an RU or a PCM line.

The functions above are normally used in connection with:

- Site acceptance (monitor current fault status).
- Maintenance (display fault info).

28.3.13 Work Session

The concept of Work Sessions is essential to provide easy use of the OMT. By executing a work session, the user is guided through the views and provided with helping instructions. A typical work session includes all the guidance necessary for the user to complete a normal execution of an O & M process.

There are a number of predefined work sessions included in the OMT intended for the major O & M processes: installation test and maintenance. Further, the customer may define his own set of work sessions, giving maximum support to his own O & M organisation.

The following user function, related to work sessions, is available in the OMT:

- Execute, execute a work session.

The function above is normally used for general purposes.

28.3.14 Remote OMT

A connection between the RBS and a remotely connected OMT can be established. The remote OMT is placed at a BSC site.

The Remote OMT and the locally connected OMT are not interchangeable with each other. They are two separate products performing the same functions.

All functions available in a locally connected OMT are also available in a remotely connected OMT.

The following user functions, related to the Remote OMT, are available:

- Switch CMRU to local mode, the CMRU is switched into local operation.
- Switch CMRU to remote mode, the CMRU is switched into remote operation.
- Reset CMRU, the CMRU is reset.
- Display CMRU operational state, the CMRU operational state is displayed.

The functions above are used for general purposes.

© Ericsson Radio Systems AB
— All Rights Reserved —

The function can fail due to software incompatibility, if no RBS confirms the connection attempt or if an OMT already is connected (locally or remotely). In these cases the operator is informed about the failure. No further action is taken due to the failed connection.

The connection between the RBS and a remotely connected OMT is established on one PCM timeslot and the maximum transmission rate is 64 kbit/s.

28.4 Operational Conditions

The transmission rate between the OMT and the RBS is 19200 bit/s. The IDB transfer time (between the OMT and the RBS) is specified in chapter Installation Data Handling.

© Ericsson Radio Systems AB
— All Rights Reserved —

29 External Alarms

A number of customer-defined external alarm sources can be supervised by the RBS. The raising or termination of a supervised external alarm is reported to the BSC, for subsequent presentation to the operator.

29.1 Concepts

External Alarm	An alarm that originates from a source defined by the customer
Basic Character set	A subset of the CCITT International Alphabet No 5, International Reference Version viz:

Table 17 Basic Character set

Character	Code
Space	20_{hex}
0 1 2 3 4 5 6 7 8 9	30_{hex} - 39_{hex}
: ; < = > ? @	$3A_{hex}$ - 40_{hex}
A B C D E F G H I J K L M N O	41_{hex} - $4F_{hex}$
P Q R S T U V W X Y Z	50_{hex} - $5A_{hex}$
_	$5F_{hex}$

29.2 Function

Associated with each supervised external alarm are the following parameters:

Alarm identity	The numeric identity of a specific external alarm within the RBS.
Alarm severity	There are two possible severity classifications. The classification of a specific external alarm is fixed when defining the external alarm. How to handle a severity level is customer-defined.
Alarm data	An alphanumeric string which is presented to the operator when the external alarm is raised. A basic character set is allowed, see Section 29.1 Concepts on page 177.
Alarm criterion	The way in which the external alarm functions, either opening or closing the circuit on the external alarm input.

Each of these parameters is initially defined manually on RBS installation, using an OMT. Subsequently any of these parameters may be modified using an OMT.

The RBS supervises each configured external alarm. An external alarm is filtered, that is, must remain in a state for a fixed period of time (approximately 3 seconds) before the BSC is notified of the external alarm raising or termination.

© Ericsson Radio Systems AB
— All Rights Reserved —

The raising or termination of each external alarm is reported to the BSC with the associated Alarm identity, Alarm severity and Alarm data.

To determine which external alarms are raised, the BSC is permitted to request this information from the RBS via A-bis.

29.3 Operational Conditions

29.3.1 Operation and Maintenance

Maintenance functions related to external alarms are described in chapter Operation and Maintenance Support.

The visual indicators relevant to external alarms are described in chapter Operation and Maintenance Support.

29.3.2 Capabilities

Table 18 Number of external alarms defined by the customer

Radio Base Station	RBS 2301	RBS 2302
External alarms, maximum	4	8

The micro RBS 2301 supports up to 4 external alarms defined by the customer.

The micro RBS 2302 supports up to 8 external alarms defined by the customer.

The alphanumeric string associated with each external alarm may contain a maximum of 62 characters.

© Ericsson Radio Systems AB
— All Rights Reserved —

30 Power Supply

The Power System rectifies the incoming power supply to DC voltage for the users in the RBS. The internal DC power is converted centrally with several internal DC voltage levels.

Distribution of system voltage is possible if the DC/DC conversion is distributed.

Since the RBS is designed to apply to different national power systems, there will be a number of connection possibilities to achieve suitable mains power for the RBS.

Battery backup is internal.

30.1 References

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

30.2 Concepts

IT power system	A power distribution system having no direct connection to earth. The exposed conductive parts of the electrical installation are earthed.
TN power system	A power distribution system having one point directly earthed. The exposed conductive parts of the installation are connected to that point by protective earth conductors.
TT power system	A power distribution system having one point directly earthed. The exposed conductive parts of the installation are connected to earth electrodes electrically independent of the earth electrodes of the power system.
Hold-up	The ability to hold the DC output voltage within the allowed range on AC mains interruption, without batteries
RBS power system	The function within the RBS that provides the users with power. This comprises the following equipment: rectifiers, batteries, battery fuses, power distribution (cables etc.) and the power control logic.
User	In this document, any unit that needs power from the RBS power system in order to function.

© Ericsson Radio Systems AB
— All Rights Reserved —

30.3 Functions

30.3.1 Central AC-DC Conversion

The incoming AC mains is converted by the Cabinet power system to several DC voltages adapted to the users need.

To get the required AC power for the Cabinet, the Cabinet power system can be connected to the following alternative AC mains:

- Single-phase (2-wire; earthed end of phase), TN and TT power systems
- Single-phase (3-wire; earthed mid point), TN and TT power systems
- Single-phase (2-wire; impedance grounded (earthed) neutral, IT power system

TN, TT and IT power systems according to IEC 950.

30.3.2 DC Power Distribution

The users are disconnected from the DC power in cases of low system voltage. The users are reconnected to the DC power when the system voltage is restored.

The units for control and supervision of the Cabinet power system are powered independently of user disconnection.

The DC power is produced and distributed in different modes:

- Produced from incoming power and distributed
- Produced from backup batteries and distributed
- No distribution

30.4 Operational Conditions

30.4.1 Operation and Maintenance

Maintenance functions related to Power Supply are described in chapter Operation and Maintenance Terminal.

© Ericsson Radio Systems AB
— All Rights Reserved —

30.4.2 Capabilities

Central AC-DC Conversion

Table 19 Electrical data at 50 Hz

AC input single-phase voltage: (2-wire; earthed end of phase) (2-wire; impedance grounded (earthed) neutral)	Nominal	200 V- 250 V
	Tolerance	±10%
	Non-destruction range: (phase voltage)	
	Permanent	0 V- 280 V
	Overvoltage < 10 ms	280 V- 300 V
AC input frequency	Nominal	50 Hz
	Tolerance	±10%
AC input current	Inrush current (total, all phases)	Cabinet dependent
	Short circuit current	Cabinet dependent

© Ericsson Radio Systems AB
— All Rights Reserved —

Table 20 Electrical data at 60 Hz

AC input single-phase voltage: (2-wire; earthed end of phase)	Nominal	100 V - 127 V
	Tolerance	±10%
	Non-destruction range: (phase voltage)	
	Permanent	0 V - 140 V
	Overvoltage < 10 ms	140 V - 150 V
AC input single-phase voltage: (3-wire; earthed mid-point)	Nominal (line voltage/phase voltage)	200/100 V- 240/120 V
	Tolerance	±10%
	Non-destruction range: (line voltage)	
	Permanent	0 V - 270 V
	Overvoltage < 10 ms	270 V - 300 V
AC input frequency	Nominal	60 Hz
	Tolerance	±8%
AC input current	Inrush current (total, all phases)	Cabinet dependent
	Short circuit current	Cabinet dependent

Battery backup

Table 21 Battery backup data

Number of battery units	1
Minimum backup time with internal batteries (with fully charged batteries and +25 °C)	3 min

© Ericsson Radio Systems AB
— All Rights Reserved —

31 Climate Protection

The "Climate Protection" function:

- Supervises and maintains the internal temperature within allowed ranges for the units in the RBS
- Controls the connection and disconnection of power, at start (or restart) of the RBS and at extreme internal temperature.

The external temperature range for each RBS type is product-specific. To get a complete picture of the climate protection system's capacity, this document should be read in conjunction with the relevant product specification.

The Climate Protection of an RBS can be maintained with one or a combination of the functions described in this chapter.

31.1 Concepts

External
: Outside the RBS cabinet.

Internal
: Inside the RBS cabinet.

Normal range
: Is internal temperature within +5°C to +70°C.

Safe range
: Is internal temperature range which guarantees full function of the most temperature sensitive internal equipment.

Normal operation
: Is internal temperature range which is 5°C to 10°C within safe range in both high and low limits.

Specified external Normal Condition range
: Are stated in relevant product chapter.

Normal Condition, safe function and non-destruction
: Are defined within the context of Environmental Capability.

User
: In this chapter, any unit that needs power from the RBS power system in order to function.

© Ericsson Radio Systems AB
— All Rights Reserved —

31.2 Functions

31.2.1 Cooling by Convection

Operational Conditions

This function is available when the external temperature is below safe function high level and above 0°C.

Description

This function will maintain the internal temperature by convection between the cabinet surface and the external environment.

31.2.2 Climate Supervision

The internal temperature in the RBS is measured by sensors.

The following parameters are measured:

- The internal temperature outside the normal operation.
- The internal temperature outside the safe range.

31.2.3 Heating by Heat Conduction and Radiation

Operational Conditions

This function is available down to an external temperature corresponding to the normal condition low limit.

Description

This heating function works with a heating element placed inside the RBS. The heating function controls the internal temperature to above the normal operation low limit.

31.2.4 Reliability

The cooling Climate Protection is available when the temperature is within the specified external normal condition range. Alarm reporting is available within the safe range.

The Heating function is available when the temperature is above the specified external normal condition low limit and up to normal operation low limit. Alarm reporting is available within the safe range.

© Ericsson Radio Systems AB
— All Rights Reserved —

31.2.5 Power Connection

At start and restart of the RBS, the connection of the RBS power system to the incoming AC mains and the connection of the users to the DC power in the RBS depends on the current internal temperature.

There are a number of start-up scenarios, based on the internal temperature at the moment of startup:

- The internal temperature is within the safe range.
  - The RBS power system and the user are connected.
- The internal temperature is below the lower limit for safe function.
  - The internal temperature is increased by heating to above the lower limit for safe. Then the power system and the users are connected.
- The internal temperature is above the upper limit for safe function.
  - The RBS power system is connected but the users are not. However, as soon as the internal temperature falls below the upper limit for safe function, the users are connected.

31.2.6 Power Disconnection and Reconnection

The users are disconnected from the DC power when the internal temperature is outside the safe range.

When the internal temperature has returned back within the safe range, the users are reconnected to the DC power.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

32 Transmission Interface Handling G.703 2048 kbit/s

This function specification covers RBS functions for layer 1 communications on A-bis.

The function Layer 1 Termination terminates a 2048 kbit/s G.703 PCM line.

The function Supervision of Transmission faults detects faults in the transmission interface.

The function Supervision of Transmission Quality monitors the quality of the transmission.

32.1 References

/GSM 08.54/	GSM Technical Specification 08.54

All ITU-T references refer to the White Book (ITU=International Telecommunications Union).

32.2 Concepts

Timeslot 0 (TS0)	The content and structure of timeslot 0 is described in the table below. This figure is included to ease the understanding of the functions Layer 1 Termination and Supervision of Transmission Faults.

© Ericsson Radio Systems AB
— All Rights Reserved —

Table 22 Timeslot 0 and CRC-4 multiframe structure

Sub multi frame	***Frame number***	***Bit 1 to 8 of timeslot 0***							
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**
1	0	c1	0	0	1	1	0	1	1
	1	0	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	2	c2	0	0	1	1	0	1	1
	3	0	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	4	c3	0	0	1	1	0	1	1
	5	1	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	6	c4	0	0	1	1	0	1	1
	7	0	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
2	8	cl	0	0	1	1	0	1	1
	9	1	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	10	c2	0	0	1	1	0	1	1
	11	1	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	12	c3	0	0	1	1	0	1	1
	13	E	1	A	Sa4	Sa5	Sa6	Sa7	Sa8
	14	c4	0	0	1	1	0	1	1
	15	E	1	A	Sa4	Sa5	Sa6	Sa7	Sa8

CRC-4	Cyclic Redundancy Check (ITU-T G.704)
c1, c2, c3, c4	CRC-4 bits (see the section Layer 1 Termination 2048 kbit/s below)
A	Alarm bit (see the section Layer 1 Termination 2048 kbit/s below)
E	Error bit (see the section Layer 1 Termination 2048 kbit/s below)
Sa4, Sa5, Sa6, Sa7, Sa8	Spare bits (see the section Layer 1 Termination 2048 kbit/s below)
Downstream	The path for information from the BSC to the MS, see Figure 39 on page 189
Upstream	The path for information from the MS to the BSC, see Figure 39 on page 189
Linear Cascade Chain	A cascade of RBS:s according to Figure 39 on page 189

© Ericsson Radio Systems AB
— All Rights Reserved —

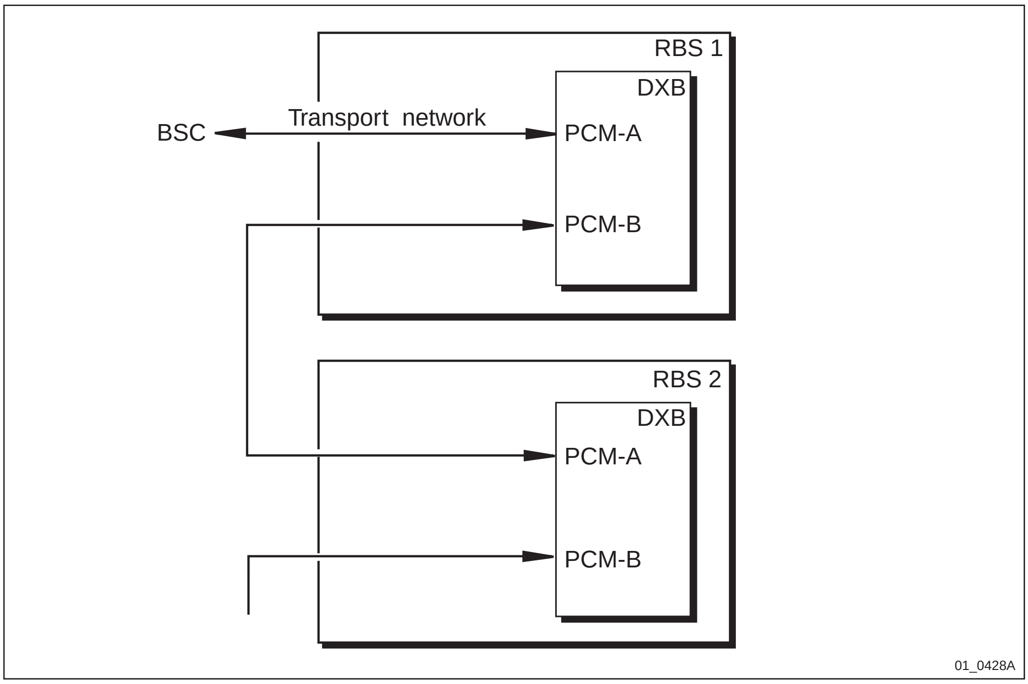

Figure 39 Upstream and Downstream

CMRU	Central Main Replaceable Unit. An RBS has exactly one CMRU. In the RBS 2000 hardware architecture the Distribution Switch is the CMRU.

For further information, see ITU-T G.704 White Book.

32.3 Functions

32.3.1 Layer 1 Termination 2048 kbit/s, 75 Ohm

The function is initiated during restart of CMRU.

Layer 1 termination of the transport network interface is handled according to /GSM:08.54:4.0.0/. This includes :

- Physical and electrical characteristics according to ITU-T rec. G.703 (interface at 2048 kbit/s, 75 ohm and over-voltage protection according to Annex B)
- Frame structure according to ITU-T rec. G.704 section 2.3 (includes handling of the E-bit in timeslot 0)
- Frame alignment and CRC-4 procedures according to ITU-T rec. G.706 section 4
- Synchronization of layer 1 handling is described in Section 32.3.3 on page 190.
- Detection of fault conditions, alarm states, and consequent actions. This includes detection of:
  - LOS (Loss Of Signal)
  - LOF (Loss Of Frame alignment)

© Ericsson Radio Systems AB
— All Rights Reserved —

- ERATE (Error RATE)
- AIS (Alarm Indication Signal)
- RAI (Remote Alarm Indication)

The consequent actions are transmission of:

- Alarm indication to the remote end (A-bit in time slot 0 equal to "1")
- CRC-4 error indicator (E-bit in time slot 0 equal to "0")

Both actions are according to ITU-T recommendations G.704 and G.732.

- Transmission of spare bits (Sa4-Sa8). The spare bits form a fixed bit pattern (see section Section 32.4.1 Operation and Maintenance on page 197)

Two PCM paths are supported: PCM-A and PCM-B. However, PCM-B can only be used when the function Multidrop (see chapter Channel Distribution Function) is activated.

32.3.2 Layer 1 Termination Long Haul 2048 kbit/s, 120 Ohm

The function is initiated during restart of CMRU.

The function is handled according to Section 32.3.1 on page 189 except for the receiver sensitivity and cable type.

The receiver dynamic range is 0 to -30 dB at 1024 kHz (0 dB = 6.0 Vp-p, 120 ohms twisted pair cables).

32.3.3 Layer 1 Synchronization

Synchronization of layer 1 is either derived from PCM A or taken from a free running oscillator. If PCM-A is in one of the alarm states

- LOF (Loss Of Frame), or
- LOS (Loss Of Signal)
- AIS (Alarm Indication Signal)

it cannot be used as reference source.

The synchronization of layer 1 is in one of two states:

1. PCM-A can be used as reference source

   PCM-A is selected as the reference source

   PCM-A incoming is used to synchronize PCM-A outgoing

   PCM-A incoming is used to synchronize PCM-B outgoing.

2. PCM-A cannot be used as reference source

   The free running oscillator is selected as reference source

   The free running oscillator is used to synchronize both PCM-A and B outgoing.

© Ericsson Radio Systems AB
— All Rights Reserved —

32.3.4 Supervision of Transmission Faults

The function is initiated during restart of DXU.

The configuration of fault supervision can only be performed when the AO DP (Digital Path) is in state "Disable". The reporting to the BSC is performed when the AO DP is in state "Enable". When the AO DP is enabled, all fault supervision states are set to zero.

Reports are sent to the BSC is sent to the BSC when the alarm status is changed or when the BSC requires it.

Fault supervision of the PCM line is performed according to /ITU-T rec. G.732 section 4/ and /GSM:08.54:4.0.0/.

This includes detection of the following fault conditions:

- LOF (Loss of Frame Alignment)
- CSES (Consecutive Severely Errored Seconds) or excessive bit ERATE (Error RATE)
- LOS (Loss Of incoming Signal)
- AIS (Alarm Indication Signal)
- RAI (Remote Alarm Indication)
- UAST (UnAvailable STate supervision)

Fault handling is according to Diagnostic and Fault Handling functionality.

LOF commences

CRC-4 is OFF: Three consecutive frame alignment signals in TS0 received with an error.

CRC-4 is ON: CRC multiframe alignment has not been achieved within a search time of 500 ms or three consecutive frame alignment signals in TS0 received with an error or CRC multiframe alignment is lost during monitoring for incorrect frame alignment (≥915 errored CRC blocks out of 1000).

LOF ceases

CRC-4 is OFF: Recovery of frame alignment signal.

CRC-4 is ON: Recovery of CRC multiframe alignment signal.

CSES commences

More than N SES (Severely Errored Seconds) detected consecutively. The criteria for SES are described in Section Severely Errored Seconds supervision on page 195.

This condition is set instead of ERATE when quality supervision including CRC-4 is used.

CSES ceases

More than N non-SES detected consecutively.

© Ericsson Radio Systems AB
— All Rights Reserved —

ERATE commences

Detection of bit error ratio equal to or more than 10^{-3}.

The frame alignment word in time slot 0 even frames is used to determine the error rate.

ERATE ceases

Detection of bit error ratio less than 10^{-3}.

LOS commences

Three or less 1's are received in a time interval of 250 μs.

LOS ceases

More than three 1's are received in a time interval of 250 μs.

AIS commences

A continuous stream of 1's during two frames. A limited number of 0's corresponding to BER = 10^{-3} is allowed.

AIS ceases

Frame alignment signal is detected or recognised.

RAI commences

The A-bit (in timeslot 0) = 1.

RAI ceases

The A-bit (in timeslot 0) = 0.

UAST commences

UAST commences when unavailable state is declared. Each direction (upstream and downstream) is supervised independently of the other.

An unavailable state for one direction is declared at the onset of P consecutive SES for the direction of interest. These P seconds are considered to be part of the unavailable time.

Together with the alarm status, time information for each direction of UAST is reported to the BSC. When UAST commences, zero is reported as time information. When UAST ceases, the time that the UAST alarm has been activated is reported.

When the BSC requests the alarm status, two scenarios are possible: UAST is activated and UAST is not activated. If it is activated, zero is reported as time information. Otherwise, the time that the UAST alarm was activated the latest time, is reported to the BSC.

UAST ceases

UAST ceases when available state is declared. Each direction (upstream and downstream) is supervised independently of the other.

© Ericsson Radio Systems AB
— All Rights Reserved —

A new period of available state begins at the onset of Q consecutive seconds with no SES detected. These Q seconds are considered to be part of the available time.

32.3.5 Supervision of Transmission Quality

The function is initiated when the AO DP is enabled from the BSC.

The configuration of quality supervision can only be performed when the AO DP is in state “Disable”. The reporting to the BSC is performed when the AO DP is in state “Enable”.

Quality supervision consists of six supervision functions:

- BFF (Bit Fault Frequency)
- DF (Disturbance Frequency)
- SF (Slip Frequency)
- ES (Errored Seconds)
- SES (Severely Errored Seconds)
- UAS (Unavailable Seconds)

Bit Fault Frequency supervision

The frame alignment word in time slot 0 in even frames is used to determine an error rate. The actual error rate is established by taking the number of faulty frame alignment words and dividing them by the total number of checked bits during the BI (Base Interval).

The bit fault frequency is supervised and reported as the mean bit error ratio in ppm (parts per million) during the BI.

Disturbance Frequency supervision

This supervision monitors the detected fault situations which are regarded as disturbances upon detection. Upon detection the following events are regarded as disturbances:

- LOF (Loss Of Frame) alignment
- LOS (Loss Of Signal)
- AIS (Alarm Indication Signal)
- RAI (Remote Alarm Indication) received from remote end

Two disturbance frequency counters exist. Both are derived from the downstream PCM port, but one is closely connected to downstream faults while the other one is related to upstream faults.

The DF downstream counter is incremented by 1 for each occurrence of

- LOF or
- LOS or
- AIS

The DF upstream counter is incremented by 1 for each occurrence of RAI.

© Ericsson Radio Systems AB
— All Rights Reserved —

Every detected fault situation is registered and regarded as a disturbance, even if it does not last long enough to be recognised as a fault.

The DF is supervised and reported as the number of disturbances during the BI. Both counters are handled separately.

Slip Frequency supervision

This supervision monitors the number of slips per time interval. A slip is defined as where one frame (256 bits) is either lost or duplicated.

The SF counter is incremented by one for each slip on the PCM port downstream.

The SF is supervised and reported as the number of slips during the BI.

Errored Seconds supervision

An ES is a second with at least one of the following events:

- CRC-4 is OFF: At least one frame bit error
- CRC-4 is ON: At least one CRC-4 error
- LOF alignment
- LOS
- Slip
- AIS
- A-bit equal to “1” from the remote end
- E-bit indication received from the remote end (only valid when CRC-4 is used)

Two counters for errored seconds exist. Both are derived from the downstream PCM port, but one is closely connected to downstream faults while the other one is related to upstream faults.

The downstream counter is incremented by 1 for each second with at least one of the events:

- CRC-4 error (only valid when CRC-4 is used) or
- Frame bit error (only valid when CRC-4 is not used) or
- LOF or
- LOS or
- AIS or
- Slip

The upstream counter is incremented by 1 for each second with at least one of the events:

- A-bit=”1” or
- E-bit=”0” (only valid when CRC-4 is used)

ES are not counted during unavailable state.

Both ES counters are reported after each BI.

© Ericsson Radio Systems AB
— All Rights Reserved —

Severely Errored Seconds supervision

An SES is a second with at least one of the events:

- CRC-4 is OFF: At least N4 frame bit errors
- CRC-4 is ON: At least N1 CRC-4 errors
- LOF alignment
- LOS
- AIS
- A-bit equal to “1” from the remote end
- N1 E-bit indication received from the remote end (only valid when CRC-4 is used)

Two counters for severely errored seconds exist. Both are derived from the downstream PCM port, but one is closely connected to downstream faults while the other one is related to upstream faults.

The downstream counter is incremented by 1 for each second with at least one of the following events:

- N1 CRC-4 errors (only valid when CRC-4 is used) or
- N4 frame bit errors (only valid when CRC-4 is not used) or
- 1 LOF or
- 1 LOS or
- 1 AIS

The upstream counter is incremented by 1 for each second with at least one of the following events:

- 1 A-bit=”1” or
- N1 E-bit=”0” (only valid when CRC-4 is used)

SES are not counted during unavailable state.

Both SES counters are reported after each BI.

UAS and Unavailable State supervision

UAS is a count of one-second intervals during which service is unavailable. This period of time is referred to as the unavailable state.

The two directions (upstream and downstream) are supervised separately. That is, one of the directions can be in the unavailable state but the other is in the available state.

The counting of ES and SES is stopped for both directions as soon as at least one of the directions is in the unavailable state.

An unavailable state for one direction is declared at the onset of P consecutive SES for the direction of interest. These P seconds are considered to be part of the unavailable time. A new period of available state begins at the onset of Q consecutive seconds with no SES detected. These Q seconds are considered to be part of the available time.

© Ericsson Radio Systems AB
— All Rights Reserved —

The number of unavailable seconds for each direction is reported after each BI.

32.3.6 Administration

Supervision of transmission faults and transmission quality can be performed in different ways. With the help of parameters, the supervision can be configured to meet a wide range of requirements. The configuration parameters can only be changed when the AO DP is in state “Disable”. The parameters of interest are given below:

- The configuration parameter N
  - Defines the threshold number (SES) for commence, and cease, of CSES
  - Value range is 5-60
  - Default value is 10
- The parameters P and Q
  - Used for defining unavailable state
  - Value range is 5-15 s
  - Default value is 10 s
- The parameters N1 and N4
  - Define the threshold numbers for ES and SES. Value range and default values are listed below:

Table 23 Parameters N1-N4

Parameter	**Value**	**Range**	**Description (number of...)**
N1	805	1-1000	CRC-4 errors for SES and E-bits equal to "0"
N2	-		Not used
N3	-		Not used
N4	28	1-100	Frame errors for SES

- The configuration parameter T
  - The parameter T defines the time interval for ERATE supervision
  - Value range is 1-5 s
  - Default value is 2 s
- The configuration parameter AFT
  - The configuration parameter AFT defines the Alarm Filtering Time for all the fault supervision functions
  - Value range is 50-5000 ms
  - Default value is 125 ms

© Ericsson Radio Systems AB
— All Rights Reserved —

- The resolution is 1 ms, but the accuracy is ±25 ms

- Base interval for ES, SES, UAS, BFF and SF
  - Valid values: 60 and 80 s
- Base interval for DF and SF
  - Value range: 1-24 h

32.3.7 Multidrop Layer 1

For an RBS configured for multidrop, the function is initiated during restart of CMRU.

For an RBS not configured for multidrop, the function is initiated when the parameter Network Topology is set by the OMT to indicate multidrop (cascade).

AIS Generation

- When entering one of the alarm states LOF, LOS or AIS at PCM-A input, AIS is transmitted on PCM-B output. AIS is transmitted until the alarm state is left
- When entering and leaving alarm states, the alarm filtering time is used (AFT).

32.4 Operational Conditions

32.4.1 Operation and Maintenance

Maintenance data such as CRC-4 status and the values of the spare bits in timeslot 0 can be set by the OMT. The OMT part is described in chapter Operation and Maintenance Terminal.

The values of the spare bits in timeslot 0 can also be set by the BSC. The BSC can set the data when the AO DP is in state "Disable". The new settings will take effect next time the AO DP is enabled. The IDB is not updated if a new setting is ordered from the BSC.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

33 Transmission Interface Handling DS1 1544 kbit/s

This function specification covers RBS functions for layer 1 communications on A-bis.

The function Layer 1 Termination terminates a 1544 kbit/s DS1 PCM line.

The function Supervision of Transmission faults detects faults in the transmission interface.

The function Supervision of Transmission Quality monitors the quality of the transmission.

33.1 References

Transmission references :

- ANSI T1.403-1989
- AT&T T1.5 Service (TR 62411) Dec. 1990
- Bellcore TR-NWT-000499 Apr. 1992

33.2 Concepts

ESF — Extended Superframe Format.

The content and structure of the F-bit is described in Table 24 on page 200. This table is included to ease the understanding of the functions: Layer 1 Termination, and Supervision of Transmission Faults.

© Ericsson Radio Systems AB
— All Rights Reserved —

Table 24 Extended Superframe Format (ESF)

Frame number	F bits				Bit use in each timeslot		Signalling bit use options			
	Bit number	**FPS**	**DL**	**CRC**	**Traffic[1)]**	**Sign.[1)]**	**T[1)]**	**2**	**4**	**16**
1	0	-	m	-	1 - 8	-	-	-	-	-
2	193	-	-	C1	1 - 8	-	-	-	-	-
3	386	-	m	-	1 - 8	-	-	-	-	-
4	579	0	-	-	1 - 8	-	-	-	-	-
5	772	-	m	-	1 - 8	-	-	-	-	-
6	965	-	-	C2	1 - 7	8	-	A	A	A
7	1158	-	m	-	1 - 8	-	-	-	-	-
8	1351	0	-	-	1 - 8	-	-	-	-	-
9	1544	-	m	-	1 - 8	-	-	-	-	-
10	1737	-	-	C3	1 - 8	-	-	-	-	-
11	1930	-	m	-	1 - 8	-		-	-	-
12	2123	1	-	-	1 - 7	8	-	A	B	B
13	2316	-	m	-	1 - 8	-	-	-	-	-
14	2509	-	-	C4	1 - 8	-	-	-	-	-
15	2702	-	m	-	1 - 8	-	-	-	-	-
16	2895	0	-	-	1 - 8	-	-	-	-	-
17	3088	-	m	-	1 - 8	-	-	-	-	-
18	3281	-	-	C5	1 - 7	8	-	A	A	C
19	3474	-	m	-	1 - 8	-	-	-	-	-
20	3667	1	-	-	1 - 8	-	-	-	-	-
21	3860	-	m	-	1 - 8	-	-	-	-	-
22	4053	-	-	C6	1 - 8	-	-	-	-	-
23	4246	-	m	-	1 - 8	-	-	-	-	-
24	4439	1	-	-	1 - 7	8	-	A	B	D

[1)]No channel associated signalling, only T-column applicable. 8 traffic bits in every frame.

Frame 1	Transmitted first
Frames 6, 12, 18 and 24	Denoted signalling frames
FPS	Framing Pattern Sequence (...001011...
DL	4 kbit/s Data Link (Message bits m)
CRC	CRC-6 Cyclic Redundancy Check (Bits C1-C6)
Option T	Traffic (Bit 8 not used for Robbed-bit signalling)
Option 2	2-State Signalling (Channel A)
Option 4	4-State Signalling (Channel A and B)
Option 16	16-State Signalling (Channel A, B, C and D)

© Ericsson Radio Systems AB
— All Rights Reserved —

Downstream	The path for information from the BSC to the MS.
Upstream	The path for information from the MS to the BSC.
Linear Cascade Chain	A cascade of RBS:s according to Figure 40 on page 201.

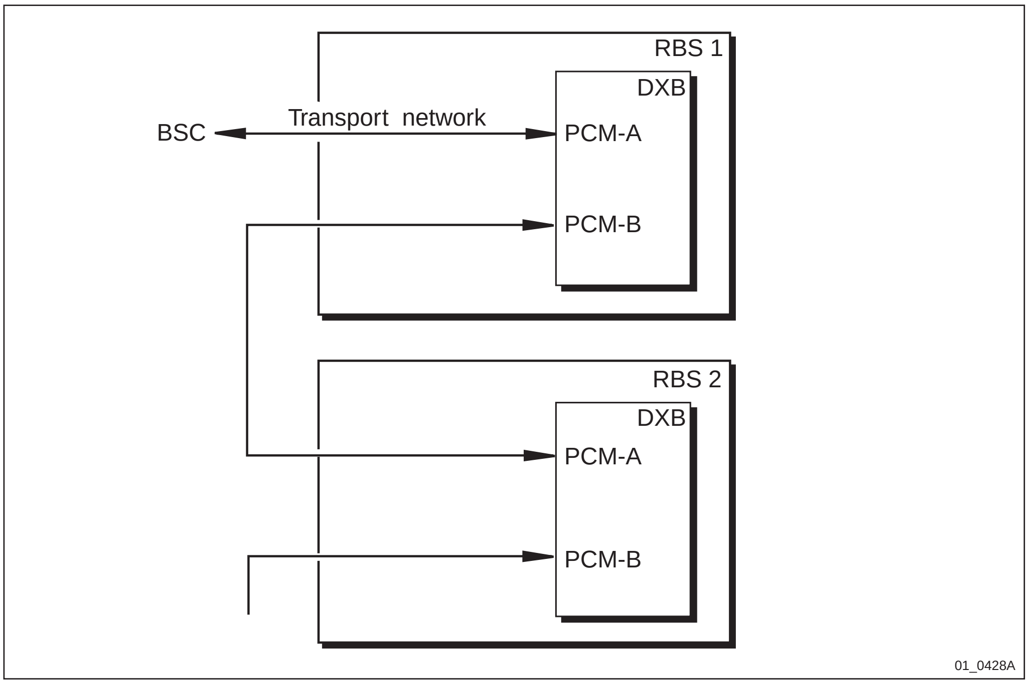

Figure 40 Two RBSs in a linear cascade chain

CMRU	Central Main Replaceable Unit. An RBS has exactly one CMRU. In the RBS 2000 hardware architecture the Distribution Switch is the CMRU.

33.3 Functions

33.3.1 DS1 Transmission

The function is initiated during restart of CMRU.

The function can be in one of the following two modes:

- Short haul
- Long haul

The functionality described under the heading Basic is common for both short and long haul.

Basic

- Physical and electrical characteristics according to ANSI T1.403 (interface at 1544 kbit/s, one pair for each direction of transmission, test load impedance 100 Ω, resistive).

© Ericsson Radio Systems AB
— All Rights Reserved —

- Frame structure according to ANSI T1.403, ESF. T option only, no bit robbing (i.e. 8 traffic bits in each time slot in all frames in the ESF).
- Line coding B8ZS according to ANSI T1.107. B8ZS is the only technology to provide 64 kbit/s Clear Channel Capability (64 CCC).
- When no message is sent on the Data Link (DL, message bit m) in the ESF, an idle pattern (01111110) (ref. ANSI T1.403, section 6.4 (1989)) is transmitted.
- Frame alignment and CRC-6 procedures according to ANSI T1.403, 24–frame ESF.
- Synchronization of layer 1 handling is described in section DS1 Synchronization.
- Synchronization of the outgoing signals (on the transport network interface) is according to AT&T Accunet T1.5 Service (TR 62411) Dec. 1990, chapter 6 “Synchronization and Timing” and derived from the corresponding incoming PCM paths.
- Fault supervision of each PCM path is performed according to:
  - ANSI T1.403, section 9 (1995)
  - AT&T Accunet T1.5, paragraph 7

  This includes detection of the fault conditions LOF, LOS, ERATE, AIS and RAI. It also includes a consequent action. The consequent action for the faults LOF, LOS, ERATE, AIS and UAST downlink is to send RAI patterns (...1111111100000000...) continuously on the 4 kbit/s link to the remote end. This is performed for at least one second.

Short Haul

The specific short haul functionality includes the possibility to amplify the output signal. This is used to adapt the line signal to optimize the line performance. The receiver dynamic range in short haul mode is +3 to – 6 dB at 772 kHz (0 dB = 6.0 V_{p-p}, 100 Ω twisted pair cables).

Long Haul

The specific long haul functionality provides higher sensitivity in the receiver compared with short haul. In addition the output signal can be attenuated with an LBO (Line Build Out). The LBO can be used in manual mode or automatic mode.

The LBO attenuates the signal from the transmitter. It does not produce simple (resistive) flat loss, but rather simulates cable loss so that the resulting signal can be handled properly by the receiver equalizer at the far end. The LBO also reduces near end cross talk.

The receiver dynamic range in long haul mode is 0 to – 30 dB at 772 kHz (0 dB = 6.0 V_{p-p}, 100 Ω twisted pair cables).

The default setting of LBO in RBS is:

© Ericsson Radio Systems AB
— All Rights Reserved —

DS1 longhaul, 0 dB output.

The parameters can be modified from OMT. The new setting is activated immediately. Thus, the updated parameters are used when the selection of LBO is performed.

Two PCM paths are supported: PCM-A and PCM-B.

33.3.2 Layer 1 Termination Long Haul 1544 kbit/s

The function is initiated during restart of CMRU.

Layer 1 termination on the transport network interface includes:

- Physical and electrical characteristics according to ANSI T1.403 (interface at 1544 kbit/s, one pair for each direction of transmission, test load impedance 100 Ω resistive), except the receiver dynamic, see below.
- Frame structure according to ANSI T1.403, ESF. T option only. See Table 24 on page 200

  8 traffic bits in all frames in the ESF.
- Line coding B8ZS according to AT&T T1.107. B8ZS is the only technology to provide 64 kb/s Clear Channel Capacity (64 CCC).
- When no message is sent on the Data Link (DL, message bit m) in the ESF, an idle pattern (01111110) (ref. ANSI 6.4(2)) is transmitted. The datalink is used for RAI information in both directions. See Table 24 on page 200
- Frame alignment and CRC–6 procedures according to ANSI TI.403, 24–frame ESF.
- Fault supervision of each PCM path is performed according to:
  - ANSI T1.403 section 9 (1995)
  - AT&T T1.5, paragraph 7

  This includes detection of the fault conditions LOF, LOS, ERATE, AIS and RAI. It also includes a consequent action. The consequent action for the faults LOF, LOS, ERATE, AIS and UAST downlink is to send RAI patterns (...1111111100000000...) continuously on the 4 kbit/s link to the remote end. This is performed for at least one second.

Two PCM paths are supported: PCM-A and PCM-B. However PCM-B can only be used when the function Multidrop (see chapter Channel Distribution Function) is activated.

The receiver dynamic range for layer 1 transmission long haul is 0 to -30 dB at 772 kHz (0 dB = 6.0 Vp-p, 100 Ω twisted pair cables).

33.3.3 DS1/Layer 1 Synchronization

Synchronization of layer 1 is derived either from one of the incoming PCM paths or taken from a free running oscillator.

The following cannot be used as a reference source:

© Ericsson Radio Systems AB
— All Rights Reserved —

- A PCM path with LOF, LOS or AIS.
- A PCM path that is "not available for synchronization" according to parameter in RBS DB.

The synchronization of layer 1 is in one of four states:

- Both PCM-A and PCM-B can be used as reference source.
  - PCM-A is selected as the reference source.
  - PCM-A incoming is used to synchronize PCM-A outgoing.
  - PCM-B incoming is used to synchronize PCM-B outgoing.
- PCM-A can be used as reference source, PCM-B cannot.
  - PCM-A is selected as the reference source.
  - PCM-A incoming is used to synchronize PCM-A outgoing.
  - PCM-A incoming is used to synchronize PCM-B outgoing.
- PCM-B can be used as reference source, PCM-A cannot.
  - PCM-B is selected as the reference source.
  - PCM-B incoming is used to synchronize PCM-A outgoing.
  - PCM-B incoming is used to synchronize PCM-B outgoing.
- Neither PCM-A nor PCM-B can be used as reference source.
  - The free running oscillator is selected as reference source.
  - The free running oscillator is used to synchronize both PCM-A and PCM-B outgoing.

The default setting for DS1 synchronization is:

- PCM-A: "Available for synchronization"
- PCM-B: "Not available for synchronization"

The default setting for Layer 1 synchronization is:

- PCM-A: "Available for synchronization"
- PCM-B: "Available for synchronization"

The parameters can be modified from OMT. The new setting is activated instantly. Thus the updated parameters are used when the synchronization source is selected.

33.3.4 Supervision of Transmission Faults

The supervision is initiated during restart of DXU.

© Ericsson Radio Systems AB
— All Rights Reserved —

Fault supervision of each PCM line is performed according to:

- ANSI T1.403, section 8
- AT&T T1.5 SERVICE, paragraph 7

The configuration of fault supervision can only be performed when the AO DP (Digital Path) is in state ”Disable”. The reporting to the BSC is performed when the AO DP is in state “Enable”. When the AO DP is enabled, all fault supervision states are set to zero.

Reports are sent to the BSC when the alarm status is changed or when required from the BSC.

The fault supervision includes detection and reporting of the following fault conditions:

- LOF (Loss of Frame Alignment)
- ERATE (Excessive Error RATE)
- LOS (Loss Of incoming Signal)
- AIS (Alarm Indication Signal),”Blue Alarm”
- RAI (Remote Alarm Indication), “Yellow Alarm”
- UAST (UnAvailable STate supervision). Consists of two directions; upstream and downstream.

Fault handling is according to Diagnostic and Fault Handling functionality.

LOS commences

At least 31 successive pulse positions with no pulses of either positive or negative polarity have occurred.

LOS ceases

Recovery of frame alignment signal.

LOF commences

A LOF condition is declared when any two of five consecutive received framing bits contain bit errors in the framing pattern or when LOS condition is declared.

LOF ceases

Recovery of frame alignment signal.

ERATE commences

An ERATE condition is declared when the bit error rate is equal to or greater than $1*10^{-3}$ during time T. The number of CRC-6 errors is used in this evaluation.

© Ericsson Radio Systems AB
— All Rights Reserved —

ERATE ceases

The ERATE condition ceases when the bit error rate is less than $1*10^{-3}$ during time T.

AIS commences

LOF and a continuous received stream of 1's during 24 frames (all-ones) is detected. The "all-ones" are detectable in the presence of a $1*10^{-3}$ BER (Bit Error Rate).

AIS ceases

When at least one of the conditions LOF and “all-ones” is cleared.

RAI commences

At least four consecutive 16-bit patterns consisting of eight 1's followed by eight 0's (i.e. 4 times 1111111100000000), is detected over the ESF data link. The signal is detected in less than one second and in the presence of a $1*10^{-3}$ BER.

RAI ceases

The RAI signal pattern does not occur in 8 to 13 contiguous 16-bit signal pattern intervals.

UAST commences

UAST commences when unavailable state is declared. Each direction (upstream and downstream) is supervised independently of the other.

Together with the alarm status, time information for each direction of UAST is reported to the BSC. When UAST commences, zero is reported as time information. When UAST ceases, the time that the UAST alarm has been activated is reported.

When the BSC requests the alarm status, two scenarios are possible: UAST is activated and UAST is not activated. If it is activated, zero is reported as time information. Otherwise, the time that the UAST alarm was activated the latest time, is reported to the BSC.

UAST ceases

UAST ceases when available state is declared. Each direction (upstream and downstream) is supervised independently of the other.

33.3.5 Supervision of Transmission Quality

The function is initiated when the AO DP is enabled from the BSC.

The configuration of quality supervision can only be performed when the AO DP is in state “Disable”. The reporting to the BSC is performed when the AO DP is in state “Enable”.

Quality supervision consists of six supervision functions:

- BFF (Bit Fault Frequency)

© Ericsson Radio Systems AB
— All Rights Reserved —

- DF (Disturbance Frequency)
- SF (Slip Frequency)
- ES (Errored Seconds)
- SES (Severely Errored Seconds)
- UAS (Unavailable Seconds)

Bit Fault Frequency supervision

The number of bit errors in the received 1544 kbit/s signal is used to establish an error rate. The CRC-6 sequence is used to obtain the number of bit errors. In this method, the distribution of errors in the time is considered. Bursts of faults decrease the number of CRC errors detected compared to what would have been detected with an equal distribution of faults in time.

The probability of bit faults appearing in bursts is greater than the probability of detecting single isolated bit faults. This probability increases with the real bit error rate, and with the length of the time period over which the real bit fault frequency is calculated.

In the used method, the number of CRC-6 errors is counted during the base interval. Then, a translation to bit fault frequency is performed.

The bit fault frequency is supervised and reported as the mean bit error ratio in ppm (parts per million) during the BI (Base Interval).

Disturbance Frequency supervision

This supervision monitors detected fault situations which are regarded as disturbances upon detection. Upon detection the following events are regarded as disturbances:

- LOF (Loss Of Frame) alignment
- LOS (Loss Of Signal)
- AIS (Alarm Indication Signal)
- RAI (Remote Alarm Indication) received from remote end

Two disturbance frequency counters exist. Both are derived from the downstream PCM port, but one is closely connected to downstream faults while the other one is related to upstream faults.

The DF downstream counter is increased by 1 for each occurrence of

- LOF or
- LOS or
- AIS

The DF upstream counter is increased by 1 for each occurrence of RAI.

Every detected fault situation is registered and regarded as a disturbance, even if it does not last long enough to be recognised as a fault.

The DF is supervised and reported as the number of disturbances during the BI. Both counters are handled separately.

© Ericsson Radio Systems AB
— All Rights Reserved —

Slip Frequency supervision

This supervision monitors the number of slips per time interval. A slip is defined as where one frame (193 bits) is either lost or duplicated.

The SF counter is increased by one for each slip on the PCM port upstream or on the PCM port downstream.

The SF is supervised and reported as the number of slips during the BI.

Errored Seconds supervision

An ES is a second with at least one of the following events:

- CRC-6 error
- LOF alignment
- LOS
- Slip
- AIS
- RAI

Two counters for errored seconds exist. Both are derived from the downstream PCM port, but one is closely connected to downstream faults while the other one is related to upstream faults.

The downstream counter is increased by 1 for each second with at least one of the events:

- CRC-6 error or
- LOF or
- LOS or
- AIS or
- Slip

The upstream counter is increased by 1 for each second with at least one

- RAI

ES are not counted during unavailable state.

Both ES counters are reported after each BI.

Severely Errored Seconds supervision

An SES is a is a second with at least one of the events:

- N1 CRC-6 errors
- LOF alignment
- LOS
- AIS
- RAI

© Ericsson Radio Systems AB
— All Rights Reserved —

Two counters for severely errored seconds exist. Both are derived from the downstream PCM port, but one is closely connected to downstream faults while the other one is related to upstream faults.

The downstream counter is increased by 1 for each second with at least one of the events:

- N1 CRC-6 errors or
- 1 LOF or
- 1 LOS or
- 1 AIS

The upstream counter is increased by 1 for each second with at least one

- RAI

SES are not counted during unavailable state.

Both SES contours are reported after each BI.

UAS and Unavailable State supervision

UAS is a count of one-second intervals during which service is unavailable. This period of time is referred to as the unavailable state.

The two directions (upstream and downstream) are supervised separately. That is, one of the directions can be in the unavailable state but the other is in the available state.

The counting of ES and SES is stopped for both directions as soon as at least one of the directions is in the unavailable state.

An unavailable state for one direction is declared at the onset of P consecutive SES for the direction of interest. These P seconds are considered to be part of the unavailable time. A new period of available state begins at the onset of Q consecutive seconds with no SES detected. These Q seconds are considered to be part of the available time.

The number of unavailable seconds for each direction is reported after each BI.

33.3.6 Administration

Supervision of transmission faults and transmission quality can be performed in different ways. With the help of parameters, the supervision can be configured to meet a wide range of requirements. The configuration parameters can only be changed when the AO DP is in state “Disable”. The parameters of interest are given below.

- The parameters P and Q
  - The parameters P and Q are used for defining unavailable state
  - Value range is 5-15 s
  - Default value is 10 s
- The parameter N1

© Ericsson Radio Systems AB
— All Rights Reserved —

- The parameter N1 defines the threshold numbers for SES. Value range is 1-1000
- Default value is 320

- The configuration parameter T
  - The parameter T defines the time interval for ERATE supervision
  - Value range is 1-5 s
  - Default value is 2 s
- The configuration parameter AFT
  - The configuration parameter AFT defines the Alarm Filtering Time for all the fault supervision functions except RAI supervision
  - Value range is 50-5000 ms
  - Default value is 125 ms
  - The resolution is 1 ms, but the accuracy is ±25 ms
- The configuration parameter AFT RAI
  - The configuration parameter AFT RAI defines the Alarm Filtering Time for the fault supervision function RAI supervision
  - Value range is 50-5000 ms
  - Default value is 125 ms
  - The resolution is 1 ms, but the accuracy is ±25 ms
- Base interval for ES, SES, UAS, BFF and SF
  - Valid values: 60 and 126 seconds. The value 126 seconds must be used when BFF supervision is activated in the BSC.
- Base interval for DF and SF
  - Value range: 1-24 h

33.3.7 Multidrop Layer 1

For an RBS configured for multidrop, the function is initiated during restart of CMRU.

For an RBS not configured for multidrop, the function is initiated when the parameter Network Topology is set by the OMT to indicate multidrop (cascade).

© Ericsson Radio Systems AB
— All Rights Reserved —

AIS Generation

- When entering one of the alarm states LOF, LOS or AIS at PCM-A input, AIS is transmitted on PCM-B output. AIS is transmitted until the alarm state is left
- When entering loop mode (Line loopback or Payload loopback) at PCM-A input, AIS is transmitted on PCM-B output, presuming that PCM-B is not in loop mode.

  AIS is transmitted until the loop mode on PCM-A is left.
- When entering and leaving alarm states, the alarm filtering time is used (AFT).
- When entering and leaving loop modes, AFT is not used.

33.3.8 CSU ANSI

For an RBS configured for CSU according to ANSI, the function is initiated during restart of the CMRU. The parameter FDL_use in RBS DB is used to control the configuration.

For an RBS not configured for CSU according to ANSI, the function is initiated when the parameter FDL_use in RBS DB is set to indicate CSU ANSI.

The function includes CSU Functionality by use of ANSI bit-patterned messages and loopback commands on the ESF Data Link (DL, message bit m). In this function, DL is referred to as Facility Data Link (FDL).

The commands for Payload Loop Back (PLB), Line Loop Back (LLB), and Universal command deactivate are supported. The commands are used to enable and disable loops within the T1 interface. A received AIS will also disable loops within the T1 interface.

General

- Detection of ANSI bit-patterned messages, received on the FDL, supporting line loopback, payload loopback, and universal loopback deactivate command is supported.

  The bit-patterned messages are two-byte words starting with one byte with all ones, followed by a unique byte (command) for each message type. The messages and loops are handled in accordance with ANSI T1.403 section 9.3 (1995).
- Information received on Facility Data Link (FDL) for PCM-A will make an action on PCM-A only. Information received on FDL for PCM-B will make an action on PCM-B only.
- The loop settings will be released at reset of the RBS.
- The code words for universal loopback deactivate, line loopback deactivate, and payload loopback deactivate will be sent on PCM-A and PCM-B after the function Multidrop Bypass has terminated. First 20 universal loopback deactivate code words are sent, then 20 LLB deactivate code words, and finally 20 PLB deactivate code words are sent.

© Ericsson Radio Systems AB
— All Rights Reserved —

Sending the loopback deactivation codes above minimizes the risk for faulty loops to be left in the network (in the RBS neighbour nodes) as result of loop activation codes sent when the Multidrop Bypass function is enabled.

- The LLB and PLB may co-exist in the RBS, but the LLB will be used. The PLB will be in use after release of the LLB. A PLB can be set as a “background” loop to an LLB. The universal loopback deactivate code releases both loops. A received AIS releases also both loops.

Line Loop Back (LLB)

The Line Loop Back is a loopback in which the signal returned towards the source of the loopback command consists of the full 1.544 Mbit/s signal. The loop includes no jitter attenuation. The bit sequence integrity will be maintained for the signal and no change in the framing, and no removal of bipolar violations.

The LLB is supported by two specific commands:

1. The command “Line Loopback Activate” sets the line loop.

   The code word “00001110 11111111” received five times in a sequence will make an action to connect a line loopback. The rightmost bit is received first.

2. The command “Line Loopback Deactivate” releases the line loop.

   The code word “00111000 11111111” received four times in a sequence will make an action to disconnect a line loopback.

Payload Loop Back (PLB)

The Payload Loop Back is a loopback in which the signal returned towards the source of the loopback command consists of the payload of the received signal. The signal has the bit sequence integrity retained and newly generated ESF framing, but not necessarily maintaining the integrity of the channel time-slots of the received signal.

The PLB is supported by two specific commands:

1. The command “Payload Loopback Activate” sets the payload loop.

   The code word “00010100 11111111” received five times in a sequence will make an action to connect a payload loopback.

2. The command “Payload Loopback Deactivate” releases the payload loop.

   The code word “00110010 11111111” received four times in a sequence will make an action to disconnect a payload loopback.

Universal Loopback Deactivation Signals

1. The command “Universal Loopback Deactivate” releases all loops whether they are of type LLB or PLB (or both).

© Ericsson Radio Systems AB
— All Rights Reserved —

The code word “00100100 11111111” received four times in a sequence will make an action to disconnect a loop of type LLB or PLB, or both loops.

2. A received AIS makes the same action as the universal loopback deactivate command, releasing both payload and line loopbacks. The loop release is made after the Alarm Filtering Time (AFT) has expired. The AFT is described in section Supervision of Transmission Faults under paragraph Description, and in section Administration.

The default setting of FDL_use is:

Used only for RAI

The parameters can be modified from OMT. The new setting is activated immidiately. Thus, the updated parameters are used when the selection of FDL use is performed.

Two PCM paths are supported: PCM-A and PCM-B.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

34 Terrestrial Link Handling

This chapter covers RBS functions for layer 2 communication on A-bis.

The function Layer 2 Link Handling is used for layer 2 signalling to/from RBS.

34.1 References

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

34.2 Concepts

Operation and Maintenance Link	Layer 2 communication link for operation and maintenance services on A-bis.
Radio Signalling Link	Layer 2 communication link for traffic services on A-bis.

34.3 Function

34.3.1 Layer 2 Link Handling of OML and RSL

The link layer used for signalling on the A-bis interface between BSC and BTS is established and maintained according to Technical Specification /GSM 08.56/.

LAPD (Link Access Protocol on the D-channel) is used for layer 2 signalling. Signalling conforms to /GSM 08.56/ with the exception that the TEI management procedures are not needed.

34.4 Operational Conditions

34.4.1 Operation and Maintenance

Maintenance functions related to definition of layer 2 address (TEI) are described in chapter Operation and Maintenance Terminal.

34.4.2 Capabilities

Not applicable.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

35 Channel Distribution Function

This chapter covers RBS functions for Layer 2 communication on A-bis.

The function Channel Distribution switches channels in the transport network interface to different RBS entities.

The function Scanning of Terrestrial Channels makes it possible to communicate with RBS on a non-predefined terrestrial channel.

The function Sharing Terrestrial Channel makes it possible to communicate with both CMRU and a TRX on a common terrestrial signalling channel.

The function Concentration of LAPD Signals makes it possible to reduce the number of required physical links between the BSC and the BTS.

The functions Multidrop and Multidrop Bypass makes it possible for several RBSs to share one PCM line.

35.1 References

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

35.2 Concepts

Channel	A channel is a 16, 32 or 64 kbit/s connection between two entities connected to the switch (see Figure 41 on page 218). A 64 kbit/s connection between a timeslot in the transport network interface and a signalling port in a TRX is an example of a channel.
CF	Central Functions. Functional entity for handling of RBS common functions.
CMRU	Central Main Replaceable Unit. An RBS has exactly one Central Main RU. In the RBS 2000 hardware architecture, the Distribution Switch is the Central Main RU.
Local Mode	A unit in Local mode has no communication with the BSC over the A-bis interface and is therefore not in operation.
OML	Operation and Maintenance Link. Layer 2 communication link for operation and maintenance services on A-bis.
Remote Mode	A unit enters Remote mode when accepting a layer 2 link establishment on A-bis. It remains in Remote mode until it is manually switched to Local mode.

© Ericsson Radio Systems AB
— All Rights Reserved —

RSL — Radio Signalling Link. Layer 2 communication link for traffic services on A-bis.

Terrestrial Channel — Terrestrial channels are physical channels for communication with, for example, the BSC over the Transport Network. There are different types of terrestrial channels, dependent on their use:

– Terrestrial Signalling channels

– Terrestrial Traffic channels

Terrestrial signalling channels are used for LAPD signalling only.

Unoccupied Terrestrial Channel

An unoccupied terrestrial channel is a physical channel which can be used as, but is currently not used as, a terrestrial signalling channel or as a terrestrial traffic channel.

35.3 Functions

The CDF (Channel Distribution Function) switches channels between the entities connected to the switch. See figure below:

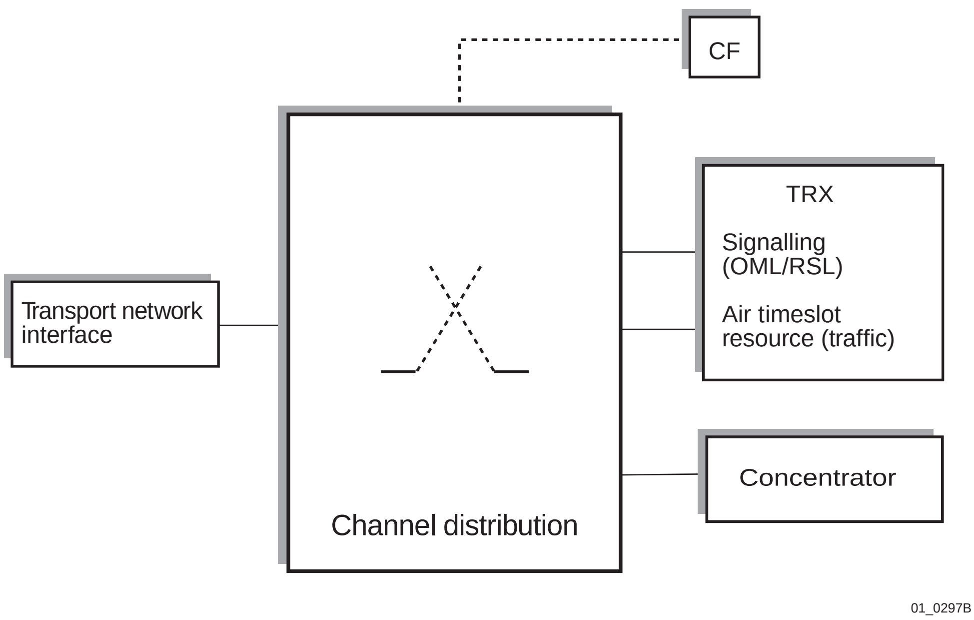

Figure 41 Channel distribution function (CDF)

- All connections through the switch are configured by A-bis commands as described within the context of Functionality Administration. The configuration commands consist of a number of connections between timeslots in the Transport network, the Concentrator and the TRXs.

© Ericsson Radio Systems AB
— All Rights Reserved —

- Configuration includes setup of new connections and release of connections no longer required. Connections which are the same in the old and the new configuration are left undisturbed.
- Idle pattern is transmitted on unoccupied timeslots in the transport network interface. An unoccupied timeslot is a timeslot which has no channel assigned to it. The idle pattern is 01010100 for a 2 Mbit/s system and 01111111 for a 1.5 Mbit/s system.
- If the timeslot is partly used, an idle pattern will be used for all unoccupied 16 kbit/s sub-timeslots within that timeslot. The subslot idle pattern is 01 for 2 Mbit/s systems and 11 for 1.5 Mbit/s systems.
- If the timeslot is partly used, an idle pattern will be used for all unoccupied 16 kbit/s sub-timeslots within that timeslot. The subslot idle pattern is 01 for 2 Mbit/s systems and 11 for 1.5 Mbit/s systems.
- Maximum capacity (Transport Network Interface) is 31 timeslots between the BSC and BTS for a 2 Mbit/s system and 24 timeslots for a 1.5 Mbit/s system. This corresponds to one PCM line towards the BSC.
- One signalling channel can be switched to each TRX, the capacity of this channel is 16, 32 or 64 kbit/s.
- Eight 16 kbit/s traffic channels can be switched to each TRX, that is, one for each available ATSR.
- 24 signalling channels can be switched to the concentrator, the capacity of each channel is 64 kbit/s.
- The physical mapping, which is needed to configure the switch, is based on ICPs. Each ICP represent a 16 kbit/s subrate connection point.
- The ICPs in the range 4 – 255 defines the incoming PCM timeslots according to Table 25 on page 219. The ICPs for timeslots 25 – 31 are only valid for 2 Mbit/s systems.

  The range 256 – 351 defines the concentrator.

  The ranges 512 – 575 and 640 – 711 define the TRXs, see Table 26 on page 220.

Table 25 ICPs range 4 – 255

ICP	**Usage**	
4-7	PCM-A	TS1
8-11	PCM-A	TS2
...	...	....
122-127	PCM-A	TS 31
132-135	PCM-B	TS 1
136-139	PCM-B	TS 2
...	...	...
250-255	PCM-B	TS 31

© Ericsson Radio Systems AB
— All Rights Reserved —

Table 26 ICPs ranges 512 – 575 and 640 – 711

TRX	Signalling	Traffic
0	512-515	516-523
1	524-527	528-535
2	536-539	540-547
3	548-551	552-559
4	560-563	564-571
5	572-575	576-583
6	640-643	644-651
7	652-655	656-663
8	664-667	668-675
9	676-679	680-687
10	688-691	692-699
11	700-703	704-711

35.3.1 Concentration of LAPD signals

The purpose of LAPD concentration is to reduce the number of required physical links between the BSC and the BTS. This is done by allowing a number of TRXs to use the same physical transmission link for LAPD signalling between the BSC and the BTS.

The function concentrates LAPD messages from a number of TRXs onto one physical link to the BSC (uplink). It also deconcentrates LAPD messages received on one physical link from the BSC (downlink), sending them forward to their destinations.

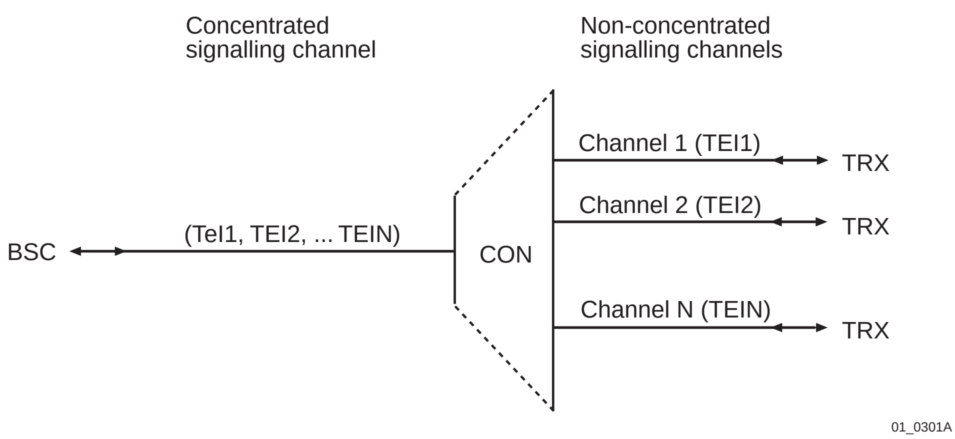

Figure 42 One N:1 concentrator Connection Group (CG)

Messages are sent forward to their destinations without adding, deleting or changing information.

The concentrator is configured by A-bis commands as described in chapter "Functionality Administration".

For each concentrated signalling channel there is a transmit queue for uplink messages to the BSC. The queue length is supervised as described in "Self Test and Supervision". If a new message is received

© Ericsson Radio Systems AB
— All Rights Reserved —

when the queue is full, all unnumbered information (UI) frames are discarded from the queue. If the queue still is full, the new message is discarded.

The bit rate for the concentrated channels is limited to 64 kbit/s, that is, LAPD concentration and LAPD multiplexing can not be combined.

© Ericsson Radio Systems AB
— All Rights Reserved —

35.3.2 Scanning of Terrestrial Channels

The function is initiated:

- When the CMRU is in Local mode and the Remote button is pressed
- When the CMRU is in Remote mode and (re-)started
- When CF has lost its layer 2 connection to BSC
- When the CF link is disconnected (reception of DISC command frame)

RBS searches all terrestrial signalling channels, plus a number of unoccupied terrestrial channels, for data link establishment attempts directed towards CF.

Searching for the establishment attempt is performed by the CF in intervals of one second. The searching can be performed in two ways.

Initially, when no valid CDF configuration exists, one set of unoccupied terrestrial channels is searched in each interval. If no establishment attempt is found during an interval, the search is continued on the next set of unoccupied terrestrial channels. The search is repeated until an establishment attempt is found.

If the scanning function is initiated when a valid CDF configuration exists, the search in each interval is performed on all the configured terrestrial signalling channels plus one set of unoccupied terrestrial channels. Thus all unoccupied terrestrial channels are searched in a cyclic way and all configured terrestrial signalling channels are searched continuously.

After a search-time of 5 minutes, the entire configuration of the channel distribution function is erased (all set up connections are lost and have to be reconfigured). The search continues but now all terrestrial channels are defined as unoccupied.

The function is terminated when the layer 2 link to CF is established or when CMRU enters Local mode.

35.3.3 Sharing Terrestrial Signalling Channel

The function is initiated when the channel distribution function becomes configured in such a way that the same terrestrial signalling channel is used for signalling to both MO CF and to one or more TRXs. This is the normal condition that occurs at configuration of the first TRX.

It is also initiated when RBS has, during scanning of terrestrial channels, found a link establishment to CF on a terrestrial signalling channel already used for signalling to one or more TRXs.

The function shares signalling to/from MO CF and signalling to/from one or more TRXs on a shared terrestrial signalling channel.

© Ericsson Radio Systems AB
— All Rights Reserved —

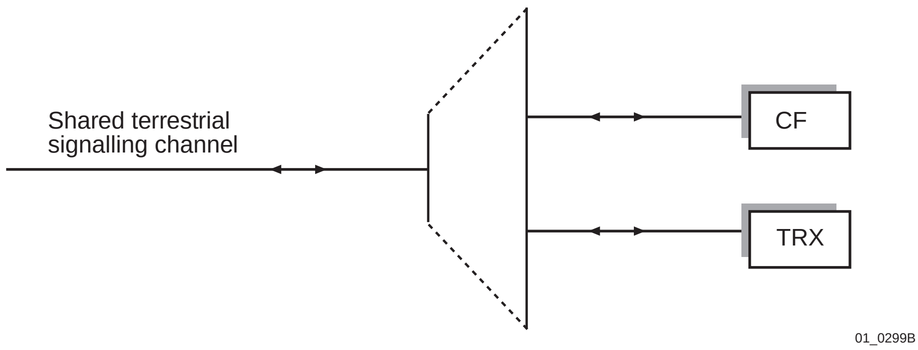

Figure 43 Sharing terrestrial signalling channel

Messages are sent forward to their destinations without adding, deleting or changing information.

Messages addressed to MO CF are sent to MO CF. All other messages are sent to the TRXs.

The function terminates when MO CF has lost its data link connection. At termination, MO CF is disconnected from the shared terrestrial signalling channel. The signalling link to/from the TRXs is undisturbed at the disconnection.

It also terminates when the channel distribution function becomes re-configured in such a way that signalling to any TRX is no longer performed on a shared terrestrial signalling channel. This is the normal way to terminate this function.

35.3.4 Multidrop

For an RBS configured for multidrop, the function is initiated during restart of the CMRU.

For an RBS not configured for multidrop, the function is initiated when the parameter Network Topology is set by the OMT to indicate multidrop (cascade).

The multidrop connected RBSs are connected so that each RBS uses its port A towards the BSC and port B towards the next RBS. The latter RBS is connected in the same way with port A towards the previous RBS (and indirectly the BSC), port B towards the next RBS, and so on.

Only RBSs supporting multidrop can be included in the multidrop connection chain. Figure 44 on page 224 illustrates the case with three RBSs.

© Ericsson Radio Systems AB
— All Rights Reserved —

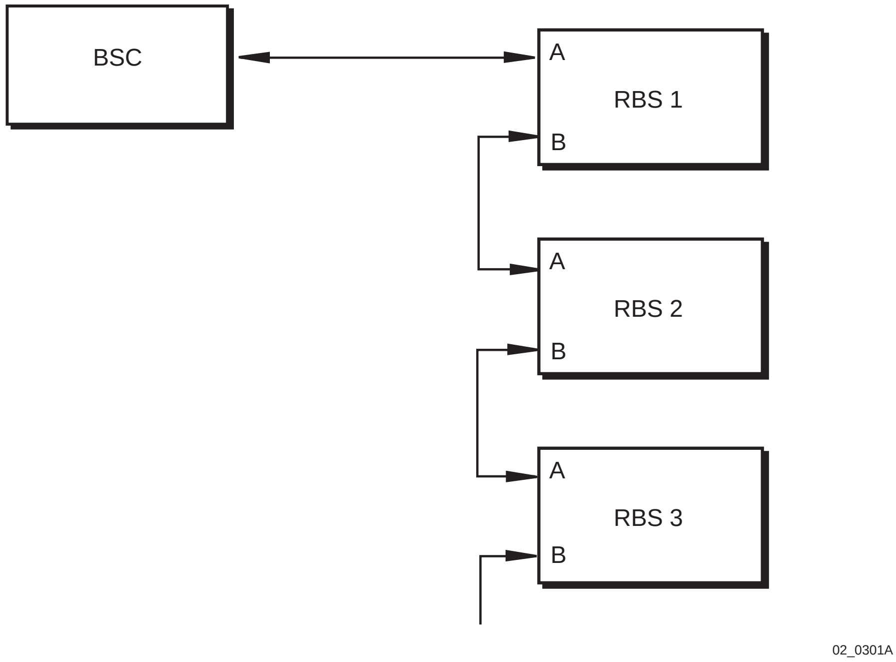

Figure 44 Linear Cascade Connection

The multidrop function only handles 64 kbit/s timeslots.

A 64 kbit/s timeslot is considered to be used by the RBS if any of its sub-timeslots are configured in the IS or used for the CF link.

If, for example, ICP 7 is used in the IS configuration, the whole timeslot 2 is considered to be used by the current RBS.

Figure 45 on page 225 shows a schematic example with two RBSs and seven timeslots. The first RBS uses timeslots 2, 5 and 6 and the second uses 1, 3 and 4.

© Ericsson Radio Systems AB
— All Rights Reserved —

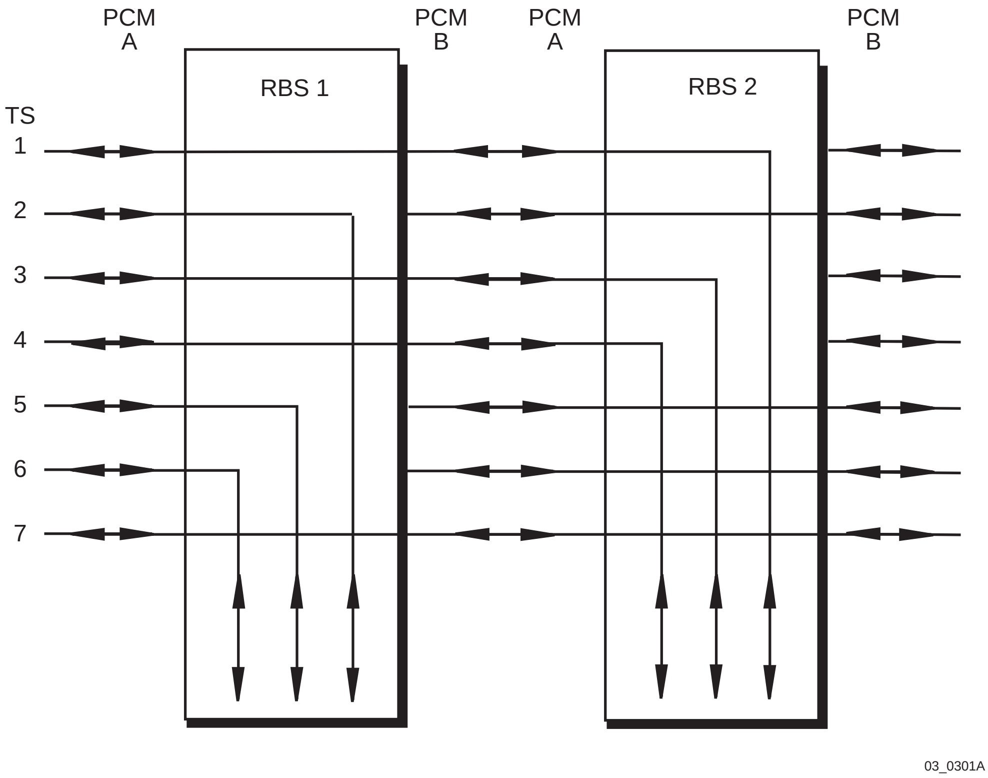

Figure 45 Multidrop example

All timeslots, not used by the own RBS, are transparently connected between PCM-A and PCM-B.

The timeslots used by the RBS will be connected from PCM A to the respective destination in the RBS. These timeslots will have valid idle pattern transmitted on PCM B and incoming data on PCM-B is ignored.

The RBS located at the end of the linear cascade chain transmits idle pattern on all time slots not dedicated for the RBS itself on PCM-A output.

- When entering at least one of the alarm states LOF, LOS or AIS at PCM-B input, the RBS is considered to be the RBS located at the end of the linear cascade chain, presuming that PCM-A is not in loop mode. It is considered to be so until the alarm state is left.
- When entering loop mode (Line loop back or Payload loop back) at PCM-B, the RBS is considered to be the RBS located at the end of the linear cascade chain, presuming that PCM-A is not in loop mode. It is considered to be so until the loop mode on PCM-B is left.
- When entering and leaving alarm states, the Alarm Filtering Time (AFT) is used.
- When entering and leaving loop modes AFT is not used.

The multidrop function is terminated when the parameter Network Topology is set not to indicate multidrop.

© Ericsson Radio Systems AB
— All Rights Reserved —

35.3.5 Multidrop bypass

This function is only valid if it is supported by the hardware.

The function handles transparent connection from PCM-A to PCM-B during such times that normal multidrop function is unavailable. This can be due to:

- Power off
- Fatal software fault
- Fatal hardware fault
- Reset button on CMRU is pushed
- BSC ordered reset
- Replacement of RBS

The multidrop connected RBSs are connected so that each RBS uses its port A towards the BSC and port B towards the next RBS. The latter RBS is connected in the same way with port A towards the previous RBS, port B towards the next RBS, and so on. Figure 46 on page 226 illustrates the case with two RBSs and with the first RBS in bypass mode.

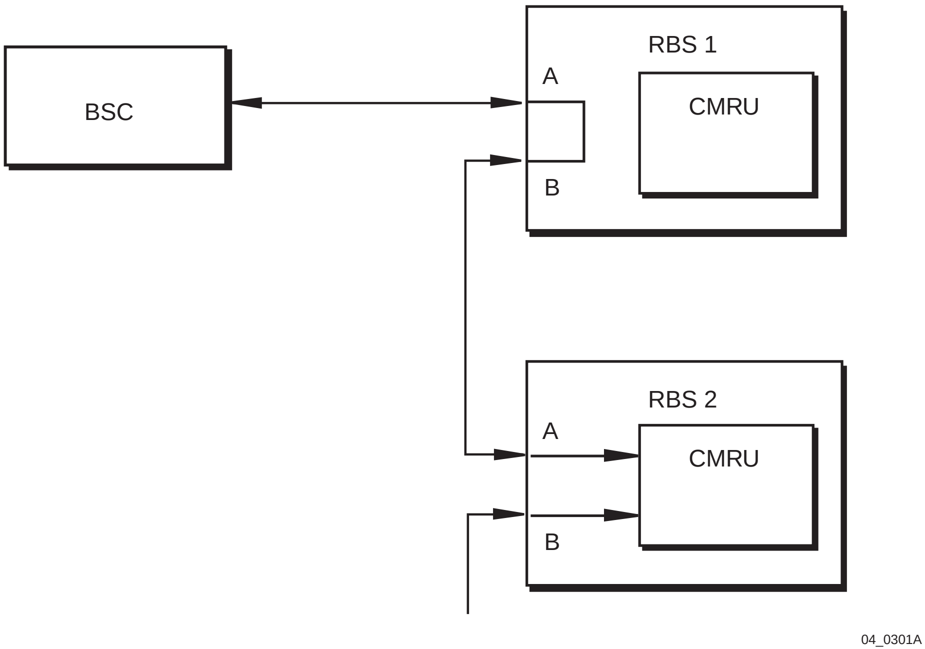

Figure 46 Linear Cascade connection with bypass

When switching to and from bypass mode, a disturbance will occur on the PCM line.

© Ericsson Radio Systems AB
— All Rights Reserved —

35.3.6 Remote OMT Link

The function is initiated during restart of CMRU.

The RBS searches for Remote OMT link establishment on PCM A timeslot 23 whenever this timeslot is not used for either:

- traffic functions
- subchannels with bitrate other than 64 kbit/s

When the remote OMT Link is established it uses a protocol based on LAPD. SAPI values in the range 20–30 is used. If the RBS is configured for multidrop it uses the CF TEI for the remote OMT link. Otherwise the TEI value 0 is used.

The remote OMT link will be disconnected if a new IS configuration configures PCM A timeslot 23 for either:

- traffic functions
- subchannels with bitrate other than 64 kbit/s

35.4 Operational conditions

35.4.1 Operation and maintenance

Not applicable.

35.4.2 Capabilities

The maximum number of concentration groups is 12 and the concentration ratios 1:1 to 12:1 are supported.

The maximum scanning capacity is 24 channels per 1–second interval.

Each TRX handles two links, one OML- and one RSL-link on a common terrestrial signalling channel.

The CMRU handles one OML link, normally on a signalling channel shared with a TRX.

When multidrop is used only one PCM path can be used for communication towards the BSC.

A maximum of five RBSs can be connected in a linear cascade chain.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

36 Common Control Channel Handling

"Common Control Channel Handling" denotes the RBS resources utilised for traffic on the Common Control channel.

36.1 References

/GSM:04.08/	GSM 04.08 (phase2) version 4.5.0
/GSM:08.58/	GSM 08.58 (phase2) version 4.6.1
/GSM:05.02/	GSM 05.02 (phase2) version 4.3.0
/GSM:05.03/	GSM 05.03 (phase2) version 4.1.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

36.2 Function

36.2.1 Paging

By means of the PAGING procedure /GSM:08.58:5.2/, the RBS pages mobiles on command from the BSC. The RBS supports:

- Reception, interpretation and check of PAGING_COMMANDs from BSC
- Queuing of IMSI and TMSI
- Scheduled transmission of PAGING_REQUEST messages on PCH
- Retransmission of PAGING_REQUEST messages on PCH

Channel combinations /GSM:05.02:6.4/ supported:

- (iv) FCCH+SCH+BCCH+CCCH
- (v) FCCH+SCH+BCCH+CCCH+SDCCH/4(0..3)+SACCH/C4(0..3)

PAGING_COMMAND messages from BSC with the following MS IDENTITY (Id-type) are supported:

IMSI	International Mobile Subscriber Identity
TMSI	Temporary Mobile Subscriber Identity

IMSIs and TMSIs are queued for scheduled transmission on PCH. One paging queue is supported for each paging group.

Scheduled transmission of IMSI and TMSI is made with the following messages:

- PAGING_REQUEST_TYPE_1 /GSM:04.08:9.1.22/
- PAGING_REQUEST_TYPE_2 /GSM:04.08:9.1.23/
- PAGING_REQUEST_TYPE_3 /GSM:04.08:9.1.24/

For dequeuing, priority handling, selection of Page mode, transmission and retransmission, see Section 36.2.3 on page 230.

© Ericsson Radio Systems AB
— All Rights Reserved —

36.2.2 Immediate Assign

By means of the IMMEDIATE ASSIGNMENT procedure /GSM:08.58:5.7./, the network signals acceptance or rejection of a CHANNEL_REQUEST message from MS.

The RBS supports:

- Reception, interpretation and check of IMMEDIATE_ASSIGN_COMMAND messages from BSC
- Queuing of IA (Immediate Assign) and IAR (Immediate Assign Reject)
- Scheduled transmission of IMMEDIATE_ASSIGNMENT messages on AGCH (Access Grant CHannel)
- Retransmission of IMMEDIATE_ASSIGNMENT messages on AGCH

IAs and IARs are queued for scheduled transmission on the AGCH. The RBS supports one queue for IA messages and one for IAR messages. Scheduled transmission of IA and IAR is made with the following messages:

- IMMEDIATE_ASSIGNMENT /GSM:04.08:9.1.18/
- IMMEDIATE_ASSIGNMENT_EXTENDED /GSM:04.08:9.1.19/
- IMMEDIATE_ASSIGNMENT_REJECT /GSM:04.08:9.1.20/

For dequeuing, priority handling, selection of Page Mode, transmission and retransmission, see Section 36.2.3 on page 230.

36.2.3 CCCH Dequeuing and Transmission

Downlink CCCH capacity is used for PAGING as well as for access grant (IMMEDIATE ASSIGN).

The RBS supports:

- Dequeuing and scheduling
- Packing of messages
- Selection of Page Mode
- Retransmission of messages
- Dummy paging

Handling of Paging is covered in section Paging above. Handling of Immediate Assign is covered in section Immediate Assign above.

Supported Logical Channels /GSM:05.02:3.3.3/:

AGCH	Access Grant Channel
PCH	Paging Channel

Dequeuing and Scheduling

The RBS dequeues and transmits messages from the CCCH queue system in the following order of priority, where a) has the highest priority:

© Ericsson Radio Systems AB
— All Rights Reserved —

a) IMMEDIATE_ASSIGNMENT

- /GSM:04.08:9.1.18/
- /GSM:04.08:9.1.19/

b) IMMEDIATE_ASSIGNMENT_REJECT

- /GSM:04.08:9.1.20/

c) PAGING_REQUEST (Normal Paging)

- /GSM:04.08:9.1.22/
- /GSM:04.08:9.1.23/
- /GSM:04.08:9.1.24/

d) PAGING_REQUEST (Extended Paging)

If no messages are queued for transmission:

- IMSIs, TMSIs and IAs stored for retransmission (see the section Retransmission of messages below) are sent at the same priority level as described above
- If no messages are stored for retransmission, "Dummy Paging" is used (see Dummy Paging on page 232)

IMMEDIATE_ASSIGNMENT messages:

The queues are handled in a FIFO (First-In-First-Out) manner when the following messages are composed:

- IMMEDIATE_ASSIGNMENT
- IMMEDIATE_ASSIGNMENT_EXTENDED (first IA)
- IMMEDIATE_ASSIGNMENT_REJECT (first IAR)

PAGING_REQUEST messages:

The queues are handled in a FIFO manner when the first IMSI or TMSI intended for a PAGING REQUEST message is dequeued.

Packing of Messages

IMMEDIATE_ASSIGNMENT messages:

If possible, two IAs (queued or stored for retransmission) will be packed into one IMMEDIATE_ASSIGNMENT_EXTENDED message.

A maximum of four unique IARs can be packed into one IMMEDIATE_ASSIGNMENT_REJECT message.

PAGING_REQUEST messages:

As many IMSIs and TMSIs as possible (for a certain paging group) will be packed into one PAGING_REQUEST message (type 1, 2 or 3). If Extended paging is used (see section Selection of Page Mode below), IMSIs and TMSIs originating from two different paging groups may be packed into the same PAGING_REQUEST message.

IMSIs and TMSIs stored for retransmission (in the corresponding paging stack) are included in the PAGING_REQUEST message if not enough IMSIs or TMSIs are found in the actual paging queue.

© Ericsson Radio Systems AB
— All Rights Reserved —

Selection of Page Mode

The RBS selects the appropriate Page mode value /GSM:04.08:-10.5.2.26./ for each message. The following Page modes are used:

- Normal
- Extended

The allowed use of extended page mode is configured (as a percentage) on command from the BSC. This is done by means of configuration parameter DRX_DEV_MAX, see Administration on page 232.

Retransmission of Messages

Copies of IMSIs, TMSIs and IAs transmitted from their respective queues, are stored on a stack (one stack/ paging queue) for retransmission (IARs are not stored for retransmission).

An IMSI or TMSI stored for retransmission is discarded, depending on the setting of parameter BS_PA_MFRMS (see Administration on page 232) as specified below:

- BS_PA_MFRMS _ 3
  - The IMSI/TMSI is discarded if it has not been retransmitted within two schedulings of its paging group
- BS_PA_MFRMS > 3
  - The IMSI/TMSI is discarded if it has not been retransmitted within one scheduling of its paging group

No message is retransmitted more than once. An IA is discarded if it has not been retransmitted within 80 ms. The BSC may turn the retransmission function on and off by means of configuration parameter CCCH Repeat, see Administration on page 232.

Dummy Paging

Whenever no PAGING_REQUEST or IMMEDIATE_ASSIGNMENT message is scheduled for transmission in a CCCH block, a Dummy Paging message is used.

The message used for Dummy Paging is a PAGING_REQUEST type 1 /GSM:04.08:9.1.22./.

Administration

The following configuration parameters are used to control the transmission of PAGING_REQUEST messages and IMMEDIATE_ASSIGNMENT messages on downlink CCCH:

© Ericsson Radio Systems AB
— All Rights Reserved —

Table 27 Configuration parameters

Parameter	**Supported values**	**Description**
BS_AG_BLKS_RES	0-1	Number of blocks in each 51 TDMA frame multiframe reserved for AGCH / GSM:05.02:3.3.2.3/ /GSM:05.02:6.5.1/.
BS_PA_MFRMS	2-9	Number of 51 TDMA frame multiframes between transmissions of paging messages to mobiles of the same paging group /GSM:05.02:3.3.2.3/ / GSM:05.02:6.5.1/.
CCCH repeat	ON, OFF	Automatic retransmission of pagings and immediate assigns in use (ON), or not in use (OFF).
DRX_DEV_MAX	0-100	0-100% allowed use of extended page mode per paging group (for example 50%, means that Page mode Extended is used every other time it is possible to use it).

36.2.4 Channel Request by MS

By means of the CHANNEL REQUEST BY MS procedure / GSM:08.58:5.1./, the RBS detects channel requests (random accesses) from MSs, and reports these as CHANNEL_REQUIRED messages to BSC.

The RBS supports:

- Detection of CHANNEL_REQUESTS on RACH
- Transmission of CHANNEL_REQUIRED messages to BSC

The channel request is coded as AB (access bursts) /GSM:05.02:5.2.7./ and /GSM:05.03:4.6./.

The RBS observes the TDMA frame number and measures the access delay of the AB arrival.

If the rate of CHANNEL_REQUESTs is higher than specified in the section Operational Conditions below, messages may be temporarily stored before transmission to the BSC. Messages not transmitted within 50 ms are discarded. Stored messages are transferred in the same order as they arrive from MS.

Emergency calls have precedence over temporarily stored messages.

Each accepted CHANNEL_REQUEST is reported to BSC as a CHANNEL_REQUIRED message according to /GSM:08.58:8.5.3/.

36.3 Operational Conditions

36.3.1 Paging

The number of paging groups supported by the RBS is dependent on the channel combination:

- (iv) The use of 16-81 paging groups is supported

© Ericsson Radio Systems AB
— All Rights Reserved —

- (v) The use of 4-27 paging groups is supported

The paging queue length varies between 6–14 depending on the number of paging queues in use. The length is calculated as:

Length = 14 - (PQMax/10) ; where PQMax = the highest paging group/ queue in use.

36.3.2 Immediate Assign

Max. number of elements in the IA queue = 10 and in the IAR queue = 10.

36.3.3 CCCH Dequeuing and Transmission

A number of stacks are used for message retransmission:

- One IA stack, number of elements = 4
- Paging stacks (one stack/paging queue), number of elements/stack = 4

36.3.4 Channel Request by MS

The RBS is able to receive and perform acceptance checks, corresponding to full RACH capacity. The RBS is able to report accepted channel requests, as CHANNEL_REQUIRED messages, corresponding to 37% of the requests on full RACH load.

© Ericsson Radio Systems AB
— All Rights Reserved —

37 Speech and Data Services

This chapter covers speech and data services, as well as the handling of the link between the RBS and the RTC (Remote TransCoder) when neither speech nor data is present.

37.1 References

/GSM:03.05/	GSM 03.05 Phase 2 Ver 4.0.0
/GSM:08.20/	GSM 08.20 Phase 2 Ver 4.1.0
/GSM:08.54/	GSM 08.54 Phase 2 Ver 4.0.0
/GSM:08.58/	GSM 08.58 Phase 2 Ver 4.2.0
/GSM:08.60/	GSM 08.60 Phase 2 Ver 4.1.0
/GSM:08.61/	GSM 08.61 Phase 2 Ver 4.1.0
/GSM:11.20/	GSM 11.20 Phase 1 Ver 3.11.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

37.2 Concepts

Air Timeslot Resource	The functional entity responsible for all Air interface functions for one Air timeslot. The Air timeslot resource can be seen as 1/8 of a TRX.
Terrestrial Traffic Channel	Physical channel used for communication with remote transcoder/rate adapter.
RTC	When the transcoders/rate adapters are positioned remote from the RBS, they are called RTCs. In this document, the RTC is a part of BSC but is controlled by the RBS.
TRAU Frame	To control the RTC from the RBS, control information is added to the coded speech information (or data information). This results in a data block called a TRAU (Transcoder Rate Adapter Unit) frame which is transferred between the RBS and RTC as described in /GSM:08.60/. The size of the TRAU frame for full rate speech/data/idle speech is 320 bits.

© Ericsson Radio Systems AB
— All Rights Reserved —

37.3 Functions

37.3.1 Idle Transmission over A-bis

Idle transmission over A-bis is initiated:

- When the Managed Object (MO) corresponding to an air timeslot resource receives a start order via A-bis Operation and Maintenance Link (OML)
- When a TCH ceases to exist because of a disable order to the MO corresponding to an air timeslot resource, via A-bis OML

Idle transmission over A-bis is active for the following channels and conditions:

- Common Resource channels, idle transmission always active
- SDCCH channels, idle transmission always active
- TCH channels, idle transmission active when there is no channel.

A 16 kbit/s idle pattern, as specified in /GSM:08.54/, is continuously sent to the RTC on the terrestrial traffic channel allocated to the air timeslot resource.

Idle transmission over A-bis is terminated when a traffic channel is enabled on the air timeslot resource.

37.3.2 Terrestrial Link Supervision

The function Terrestrial Link Supervision (TLS) supervises a terrestrial link (16 kbps) for a traffic channel and decides when a connection is considered lost.

The TLS function is set to On or Off for an idle or active subchannel.

TLS on idle subchannel is set On:

- 16 kbps resource in IDLE state:

  Idle speech is transmitted

  Terrestrial link supervision is active.

- 8 kbps resource in IDLE state (this case only exists when the other 8 kbps resource is in ACTIVE state):

  Idle pattern is transmitted

  Terrestrial link supervision is*not* active.

TLS on idle subchannel is set Off:

For all these cases terrestrial link supervision is not active.

- 16 kbps resource in IDLE state:

  Idle pattern is transmitted.

- 8 kbps resource in IDLE state (this case only exists when the other 8 kbps resource is in ACTIVE state)

© Ericsson Radio Systems AB
— All Rights Reserved —

Idle pattern is transmitted

When both 8 kbps subchannels of a common TS resource go into idle state they are transformed into one 16 kbps idle resource.

Idle pattern is generated as specified in /GSM:08.54/.

TLS on active subchannel is set On:

- TCH in ACTIVE state including all sub-states and the channel mode is *not* “signalling”.

  Terrestrial link used for traffic.

  Terrestrial link supervision is active.

- TCH in ACTIVE state including all sub-states and the channel mode is “signalling”.

  Idle pattern is transmitted.

  Terrestrial link supervision is *not* active.

TLS on active subchannel is set Off:

For all these cases terrestrial link supervision is not active.

- TCH in ACTIVE state including all sub-states and the channel mode is *not* “signalling”.

  Terrestrial link used for traffic.

- TCH in ACTIVE state including all sub-states and the channel mode is “signalling”.

  Idle pattern is transmitted.

Idle pattern is generated as specified in /GSM:08.54/.

This function supervises the downlink TRAU frames. The synchronization bits have to be correct and the received frame type must be expected.

The synchronization pattern for an idle subchannel is generated either in the TRA or the BTS (loop). The BTS accepts either one of the synchronization patterns.

If disturbances on the link result in a long duration of synchronization and/or frame type errors which exceeds the TLS Filtering Time (a configured value) then an error condition is considered present.

When an error condition is present and supervision is On this is reported to BSC via a FAULT_REPORT message.

If the channel is in ACTIVE state and TLS on active subchannel is On then a CONNECTION_FAILURE_INDICATION message is sent to the BSC.

37.3.3 Full Rate Speech

Full Rate Speech is either initiated by the Channel Activation function or the Mode Modify function.

© Ericsson Radio Systems AB
— All Rights Reserved —

In order to activate coding/decoding of speech in the RTC, the RBS issues TRAU frames of type Speech/Enhanced speech.

In order to deactivate speech coding/decoding in the RTC, the RBS issues TRAU frames of type Idle Speech.

During the exchange of TRAU frames between RBS and RTC carrying Full Rate Speech (or Full Rate Idle Speech), the RBS regularly calculates an appropriate time alignment value for controlling the downlink frame timing. This value is included in the transmitted TRAU frames.

The TRAU frames exchanged between BTS and RTC during an active call are of three types:

- Speech
- Enhanced Speech
- Idle Speech (used by DTX function GSM speech algorithm version 1 only)
- Speech containing coded silence information

TRAU frame type Speech uses GSM speech algorithm version 1 and frame type Enhanced Speech uses GSM speech algorithm version 2 as coding/decoding of full rate speech.

For TRAU frames of type Speech, improvements of the subjective speech quality is described under: Subjective Speech Quality Improvements.

Full rate speech is either terminated by the RF Channel Release function, or the Mode Modify function when Data or Signalling services are requested.

Subjective Speech Quality Improvements

The RBS supports subjective speech quality improvements that go beyond what is required in the GSM recommendations. The objective is to avoid unpleasant noise effects that would result from e.g. normal decoding of lost speech frames.

To improve the subjective speech quality uplink in cases of bad frames reception, the RBS takes local measures such as "substitution" and "muting" of frames and computes an improved BFI (Bad Frame Indicator). This calculation takes advantage of quality information from the channel decoder.

To improve speech quality downlink, filtering of TRAU frames is done after detection of disturbances in the frame quality. The filtering is removed when the disturbances have disappeared.

37.3.4 Half Rate Speech

Half Rate Speech is either initiated by the Channel Activation function or the Mode Modify function.

In order to activate coding/decoding of speech in the RTC, the RBS issues TRAU frames of type Speech.

© Ericsson Radio Systems AB
— All Rights Reserved —

In order to deactivate speech coding/decoding in the RTC, the RBS issues TRAU frames of type Idle Pattern according to /GSM:08.61/.

During the exchange of TRAU frames between RBS and RTC carrying half rate speech, the RBS regularly calculates an appropriate time alignment value for controlling the downlink frame timing. This value is included in the transmitted TRAU frames.

The TRAU frames exchanged between RBS and RTC during an active call are of the following types:

- Speech
- Speech containing coded silence information (used by function DTX).

Half Rate Speech is either terminated by the RF Channel Release function, or the Mode Modify function when Data or Signalling services are requested.

37.3.5 Full Rate Data

Full rate data is either initiated by the Channel Activation function or the Mode Modify function.

In order to activate and control rate adaptation of data in the RTC, the RBS issues TRAU frames of type Data and channel type Full Rate.

In order to deactivate rate adaptation of data in the RTC, the RBS issues TRAU frames of type Idle Speech and channel type Full Rate, according to /GSM:08.60/.

The rate adaptation is split up between RTC and RBS and is performed as described in /GSM:08.20/ and /GSM:08.60/.

The TRAU frames exchanged between RBS and RTC during an active call can be of the following types:

- Data
- Data, containing Idle Data

The arrival of data blocks from the air interface is supervised by the RBS.

If no data block is received, it is replaced by an idle data block.

Full Rate Data is either terminated by the RF Channel Release function, or the Mode Modify function when Speech or Signalling services are requested.

37.3.6 Half Rate Data

Full Rate Data is either initiated by the Channel Activation function or the Mode Modify function.

In order to activate and control rate adaptation of data in the RTC, the RBS issues TRAU frames opf type Data.

In order to deactivate rate adaptation of data in the RTC, the RBS issues TRAU frames of type Idle Speech according to /GSM:08.61/.

The rate adaptation is split up between RTC and RBS and is performed as described in /GSM:08.20/ and /GSM:08.61/.

© Ericsson Radio Systems AB
— All Rights Reserved —

The TRAU frames exchanged between RBS and RTC during an active call can be of the following types:

- Data
- Data, containing Idle Data

The arrival of data blocks from the air interface is supervised by the RBS.

If no data block is received, it is replaced by an idle data block.

Half Rate Data is either terminated by the RF Channel Release function, or the Mode Modify function when Speech or Signalling services are requested.

37.4 Operational Conditions

37.4.1 Full Rate Speech

The round-trip delay for a full rate speech channel, introduced by the BTS, is less than 68 ms.

The values are including additional delay due to the measuring method as described in /GSM 11.20:7.2.6, table 7–2b/.

37.4.2 Full Rate Data

Transparent data services supported:

- 9.6 kbits/s
- 4.8 kbits/s
- 2.4 kbits/s
- 1.2 kbits/s
- 1200/75 bits/s
- 600 bits/s

Non-transparent data services supported:

- 9.6 kbits/s

The round-trip delay for a full rate data channel, introduced by the RBS is:

- Less than 89 ms for TCH/F2.4 (this includes TCH/F1.2, TCH/F1.2/75 and TCH/F0.6 as well)
- Less than 160 ms for TCH/F4.8, TCH/F9.6
- Less than 175 ms for TCH/F9.6NT

The values are including additional delay due to the measuring method as described in /GSM 11.20:7.2.6, table 7–2b/.

37.4.3 Half Rate Speech

The round-trip delay for a half rate speech channel, introduced by the BTS, is less than 63 ms.

© Ericsson Radio Systems AB
— All Rights Reserved —

The values are including additional delay due to the measuring method as described in /GSM 11.20:7.2.6, table 7–2b/.

37.4.4 Half Rate Data

Transparent data services supported:

- 4.8 kbits/s
- 2.4 kbits/s
- 1.2 kbits/s
- 1200/75 bits/s
- 600 bits/s

Non-transparent data services supported:

- 4.8 kbits/s

The round-trip delay for a half rate data channel, introduced by the BTS is:

- Less than 284 ms for TCH/H4.8 and TCH/H2.4(this includes TCH/H1.2, TCH/H1.2/75 and TCH/H0.6 as well)
- Less than 315 ms for TCH/H4.8NT.

The values are including additional delay due to the measuring method as described in /GSM 11.20:7.2.6, table 7–2b/.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

38 Call Control

The "Call Control" function defines the RBS functions related to call establishment and call control on the air interface.

38.1 References

/GSM:04.04/	GSM 04.04 (phase 2) version: 4.0.4
/GSM:04.06/	GSM 04.06 (phase 2) version: 4.4.0
/GSM:04.08/	GSM 04.08 (phase 2) version: 4.10.1
/GSM:05.02/	GSM 05.02 (phase 2) version: 4.4.2
/GSM:05.05/	GSM 05.05 (phase 2) version: 4.10.0
/GSM:05.10/	GSM 05.10 (phase 2) version: 4.5.0
/GSM:08.58/	GSM 08.58 (phase 2) version: 4.7.0

Whenever a reference is made to a function described in another chapter, please refer to the table of contents to find the appropriate chapter.

38.2 Concepts

Access delay	The actual delay as measured by the RBS of the received signal from an MS, relative to the expected signal from a reference MS. The reference MS is assumed to be: positioned at zero distance from the RBS, operating under static channel conditions and having zero timing advance.
Ignored	Optional element in /GSM:08.58/. The element is ignored if received by the RBS.
Main DCCH	Main signalling channel (SDCCH or FACCH).

The following special terms, regarding A-bis information elements stated as optional by /GSM:08.58/, are used in this document:

Optional	Optional element in /GSM:08.58/. The RBS supports optional use of the element. If the element is present, it is used. However, the element is not required, i.e. if the element is not present the RBS takes no further action.
Rejected	Optional element in /GSM:08.58/. The message containing this element is rejected by the RBS. The sender of the message is notified using an appropriate error handling procedure.

© Ericsson Radio Systems AB
— All Rights Reserved —

Required	Optional element in /GSM:08.58/. The element is required by the RBS to carry out the function.
Timing Advance	A signal sent by the RBS to the MS which the MS uses to advance its timings of transmissions to the RBS to compensate for propagation delay.

38.3 Functions

38.3.1 Channel Activation

By means of the CHANNEL ACTIVATION procedure /GSM:08.58:4.1/, the BSC orders the RBS to prepare a dedicated channel resource for use, and to start reception and transmission on its associated logical channels.

Supported channel combinations /GSM:05.02:6.4/:

- (i) TCH/F + FACCH/F + SACCH/TF
- (ii) TCH/H(0,1) + FACCH/H(0,1) + SACCH/TH(0,1)
- (v) FCCH + SCH + BCCH + CCCH+ SDCCH/4[0..3] + SACCH/C4[0..3]
- (vii) SDCCH/8[0..7] + SACCH/C8[0..7]

Supported channel numbers /GSM:08.58:9.3.1/:

- Bm + ACCHs (Associated Control Channels)
- Lm + ACCHs
- SDCCH/8 + ACCH
- SDCCH/4 + ACCH

Supported activation types /GSM:08.58:9.3.3/:

- Immediate Assign
- Normal Assign
- Asynchronous Handover

Supported channel modes /GSM:08.58:9.3.6/:

TCH/F	Signalling
TCH/FS	Full rate speech
TCH/F9.6 NT	Full rate data 9.6 kbit/s non-transparent
TCH/F9.6	Full rate data 9.6 kbit/s transparent
TCH/F4.8	Full rate data 4.8 kbit/s transparent
TCH/F2.4	Full rate data 2.4 kbit/s transparent
TCH/F2.4	Full rate data 1.2 kbit/s transparent

© Ericsson Radio Systems AB
— All Rights Reserved —

TCH/F2.4	Full rate data 1200/75 bit/s transparent
TCH/F2.4	Full rate data 600 bit/s transparent
TCH/H	Signalling
TCH/HS	Half rate speech
TCH/H4.8 NT	Half rate data 4.8 kbit/s non-transparent
TCH/H4.8	Half rate data 4.8 kbit/s transparent
TCH/H2.4	Half rate data 2.4 kbit/s transparent
TCH/H2.4	Half rate data 1.2 kbit/s transparent
TCH/H2.4	Half rate data 1200/75 bit/s transparent
TCH/H2.4	Half rate data 600 bit/s transparent
SDCCH	Signalling

Classification (see section Concepts) of optional elements, common for all activation types:

Channel Identification	Ignored
BS Power	Optional
MS Power	Required
BS Power Parameters	Rejected
MS Power Parameters	Rejected

Immediate Assignment

The Activation for Immediate Assign procedure is in accordance with /GSM:08.58:4.1/.

Classification (see section Concepts) of optional elements:

Encryption Information	Rejected
Handover Reference	Rejected
Timing Advance	Required

Normal Assignment

The Activation for Normal Assign procedure is in accordance with /GSM:08.58:4.1/.

Classification (see section Concepts) of optional elements:

Encryption Information	Optional
Handover Reference	Rejected
Timing Advance	Required

© Ericsson Radio Systems AB
— All Rights Reserved —

SACCH Information	Optional

If the parameter SACCH Information is present, the contents will be used for this channel group instead of the information received in the SACCH FILLING INFORMATION MODIFY procedure described in the function Broadcast.

Asynchronous Handover

The Activation for Asynchronous Handover procedure is in accordance with /GSM:08.58:4.1/.

Classification (see section Concepts) of optional elements:

Encryption Information	Optional
Handover Reference	Required
Timing Advance	Rejected
SACCH Information	Optional

If the parameter SACCH Information is present, the contents will be used for this channel group instead of the information received in the SACCH FILLING INFORMATION MODIFY procedure described in the function Broadcast.

Channel Activation response

If the CHANNEL_ACTIVATION message is correct and the resources required are available, the RBS sends a CHANNEL_ACTIVATION_ACKNOWLEDGE message to the BSC / GSM:08.58:8.4.2/.Otherwise, a CHANNEL_ACTIVATION_NEGATIVE_ACKNOWLEDGE / GSM:08.58:8.4.3/ is sent to the BSC.

If the Channel Activation procedure fails after the acknowledgement has been sent to the BSC, a CONNECTION_FAILURE_INDICATION message /GSM:08.58:8.4.4/ is sent to the BSC.

38.3.2 Adaptive Frame Alignment

The Adaptive Frame Alignment procedure is used for ensuring that the bursts received in the RBS from active MSs at different distances from the RBS, are in time alignment. To ensure this, the RBS must inform the MS at which instant the MS shall start sending its bursts / GSM:05.10:5/.

Channel combinations supported are defined in section Channel Activation above.

Access Delay Measurement

From the start of normal burst reception on a dedicated channel, the RBS measures the Access Delay on all received bursts.

© Ericsson Radio Systems AB
— All Rights Reserved —

Initial Time Alignment

At start of the downlink SACCH transmission, an initial ordered TA value (received at channel activation) is used in the L1 header of the SACCH block.

Dynamic Time Alignment

Three inputs are used to calculate the new/next TA order value included in the L1 header of the downlink SACCH block /GSM:04.04:7.1/:

- The Access Delay measurements on all NBs (normal bursts), which are received since the last calculation (one SACCH reporting period)
- The actual used (by MS) TA value which is received in the L1 header /GSM:04.04:7.2/ of the uplink SACCH block
- The previous/init ordered TA value to MS

The ordered TA value must not be changed more than 1 step from the TA/GSM:05.10:5/ previously ordered.

38.3.3 Asynchronous Handover Detection

By means of the HANDOVER DETECTION procedure /GSM:-08.58:4.3/, the RBS detects and reports when the MS, at asynchronous handover, is connecting to a "target" dedicated resource.

Channel combinations supported are defined in section Channel Activation above.

The RBS measures the access delay of handover accesses received. This information is included in the PHYSICAL_INFORMATION message to MS and the HANDOVER_DETECTION message to BSC.

Acceptance of a HANDOVER_ACCESS message is based on:

- Handover Reference (received in HANDOVER message), which shall match the value received in the related CHANNEL_ACTIVATION from BSC
- Measured Access Delay, which must not exceed 63 (≥64 not accepted)

To accept the MS handover access, RBS shall receive:

- Two out of three acceptable HANDOVER_ACCESS messages (ABs) for channel combination (i)
- Two out of four acceptable HANDOVER_ACCESS messages (ABs) for channel combination (v) and (vii)

The TA difference between acceptable Access Bursts must be less than or equal to 4 bit periods.

On acceptance of the MS handover access, the RBS takes the following actions:

- Opens all logical channels for transceiving on the air (start Normal Burst reception) and starts active channel measurements on the dedicated resource

© Ericsson Radio Systems AB
— All Rights Reserved —

- Sends HANDOVER_DETECTION to BSC /GSM:08.58:8.4.7/ including the measured access delay value
- Sends a PHYSICAL_INFORMATION message to the MS / GSM:04.08:3.4.4.2.2/. The PHYSICAL_INFORMATION is sent in unacknowledged mode to the MS.

  If no correct frame is received from the MS, transmission of PHYSICAL_INFORMATION shall be repeated.

38.3.4 RF Channel Release

By means of the RF CHANNEL_RELEASE procedure / GSM:08.58:4.7/, the BSC commands the RBS to stop all traffic and signalling on a group of dedicated logical channels, and to release all associated resources.

Channel combinations and numbers supported are defined in section Channel Activation above.

After having released the channel, or if the channel is already released, the RBS sends an RF_CHANNEL_RELEASE_ACKNOWLEDGE message /GSM:08.58:8.4.19./ to BSC.

38.3.5 Deactivate SACCH

By means of the DEACTIVATE_SACCH procedure /GSM:08.58:4.6/, the BSC commands the RBS to immediately stop transmission on SACCH of the addressed channel group.

Channel combinations and numbers supported are defined in section Channel Activation above.

38.3.6 Link Establish Indication

By means of the LINK ESTABLISHMENT INDICATION procedure / GSM:08.58:3.1/, an indication is sent to the BSC that a layer 2 link on the radio path has been established in multiframe mode.

Channel combinations supported are defined in section Channel Activation above.

The link establishment procedure is in accordance with /GSM:08.58:3.1/ and /GSM:04.06:5.4.1/.

This function is applicable for:

- SAPI-0 (Service Access Point Identifier) on SDCCH and FACCH
- SAPI-3 on SDCCH and SACCH/T

There are two cases of establishment as described in /GSM:04.06:5.4.1/:

- Normal establishment
- Contention resolution establishment

The Normal Establishment is utilised for SAPI-0 links (in conjunction with a normal assign or handover) as well as for SAPI-3 links (at SMS point-to-point).

The Contention Resolution Establishment is utilised for SAPI-0 links only (in conjunction with an immediate assign).

© Ericsson Radio Systems AB
— All Rights Reserved —

An attempt to establish a SAPI-3 link is rejected (DM response to MS) if the SAPI-0 link is not established.

Messages queued for transmission are lost if the link is re-established.

When the link is established, an ESTABLISH_INDICATION message /GSM:08.58:8.3.6/ is sent to the BSC.

38.3.7 Link Release Indication

By means of the LINK RELEASE INDICATION procedure /GSM:08.58:3.3/, the RBS informs the BSC that the link layer connection in multiframe mode, on the air interface, is released by an initiative from the MS.

Channel combinations supported are defined in section Channel Activation above.

The link release procedure is in accordance with /GSM:08.58:3.3/ and /GSM:04.06:5.4.4/.

This function is applicable for:

- SAPI-0 on SDCCH and FACCH
- SAPI-3 on SDCCH and SACCH/T

When the link is released, a RELEASE_INDICATION message /GSM:08.58:8.3.9/ is sent to the BSC.

38.3.8 Link Establish Request

By means of the LINK ESTABLISHMENT REQUEST procedure /GSM:08.58:3.2/, the BSC requests the RBS to establish a link layer connection, on the air interface, in multiframe mode.

Channel combinations supported are defined in section Channel Activation above.

The Link Establishment procedure is in accordance with /GSM:08.58:3.2/ and /GSM:04.06:5.4.1/. This function is only applicable for SAPI-3 links on SDCCH and SACCH/T.

Messages queued for transmission are lost if the link is re-established. When the link is established, an ESTABLISH_CONFIRM message /GSM:08.58.8.3.5/ is sent to the BSC.

38.3.9 Link Release Request

By means of the LINK RELEASE REQUEST procedure /GSM:08.58:3.4/, the BSC requests the RBS to release a link layer connection, on the air interface, which has been established in multiframe mode.

Channel combinations supported are defined in section Channel Activation above.

The Link Release procedure is in accordance with /GSM:08.58:3.4/ and /GSM:04.06:5.4.4/. This function is only applicable for SAPI-3 links on SDCCH and SACCH/T.

The RBS supports Normal Release /GSM:04.06:5.4.4.2/ as well as Local End Release /GSM:04.06:5.4.4.4/.

© Ericsson Radio Systems AB
— All Rights Reserved —

Messages queued for transmission are lost when the link is released. When the link is released, a RELEASE_CONFIRM message /GSM: 08.58:8.3.8/ is sent to the BSC.

38.3.10 Transparent Message Transmission

By means of the TRANSPARENT MESSAGE TRANSFER procedure / GSM:08.58:3.5/, transparent messages are transmitted from the network to MSs.

Transparent transmission in acknowledged mode, requires that multiframe mode /GSM:08.58:3.1,3.2/ has been established.

Channel combinations supported are defined in section Channel Activation above.

Transmission of SAPI-0 messages have higher priority than SAPI-3 messages. A separate queue for SAPI-3 messages (Short Message Service) exists.

The RBS sends the L3-message (L3=Communication abstraction Layer 3) in accordance with /GSM:08.58:3.5/. Supported channels:

- SDCCH and FACCH on SAPI-0
- SDCCH and SACCH/T on SAPI-3

38.3.11 Transparent Message Reception

By means of the TRANSPARENT MESSAGE RECEPTION procedure /GSM:08.58:3.6/, transparent messages are received from MS and transmitted to the BSC.

Transparent transmission in acknowledged mode, requires that multiframe mode /GSM:08.58:3.1,3.2/ has been established.

Channel combinations supported are defined in section Channel Activation above.

The RBS receives the L3-messages in accordance with /GSM:08.58:3.6/ . Supported channels:

- SDCCH and FACCH on SAPI-0
- SDCCH and SACCH/T on SAPI-3

When the complete L3 message has been received, the RBS sends a DATA_INDICATION message /GSM:08.58:8.3.2/ to the BSC containing the received L3 message.

38.3.12 SACCH Info Modify

By means of the SACCH INFO MODIFY procedure /GSM:08.58:4.12/, the BSC can change the SACCH filling information of the addressed channel group.

Channel combinations supported are defined in section Channel Activation above.

Each System Information type for the channel group which is changed by the SACCH_INFO_MODIFY message will override the corresponding System Information type stored for the TRX.

© Ericsson Radio Systems AB
— All Rights Reserved —

38.3.13 LAPDm

The LAPDm (Link Access Procedure on the Dm-channel) function denotes the overall functionality included in the LAPDm protocol and the radio link layer management procedures.

The function is active and available for all traffic functions using the radio link layer. LAPDm conforms to /GSM:04.06/.

LAPDm supports two modes of operation:

- Unacknowledged
- Acknowledged

Both SAPI-0 and SAPI-3 are supported, establishment of SAPI-3 requires that SAPI-0 is established.

SAPI-0

SAPI-0 is used for Call control, Mobility management and Radio resource management signalling.

The following channels are supported:

BCCH + CCCH	Downlink. Unacknowledged mode is supported
SDCCH	Acknowledged and unacknowledged modes are supported
FACCH	Acknowledged and unacknowledged modes are supported
SACCH/C	Unacknowledged mode is supported
SACCH/T	Unacknowledged mode is supported

SAPI-3

SAPI-3 is used for Short message service point-to-point. The following channels are supported:

SDCCH	Acknowledged mode is supported
SACCH/T	Acknowledged mode is supported

38.4 Operational Conditions

38.4.1 Channel Activation

The maximum delay from reception of a CHANNEL_ACTIVATION command, until the CHANNEL_ACTIVATION_ACKNOWLEDGEMENT or CHANNEL_ACTIVATION_NEGATIVE_ACKNOWLEDGEMENT is sent, is 25 ms.

© Ericsson Radio Systems AB
— All Rights Reserved —

38.4.2 Adaptive Frame Alignment

The RBS calculates TA when uplink DTX is used. The conditions under which the accuracy of access delay assessments are met, are those specified in /GSM:05.10:5/.

In order to meet the accuracy of adaptive frame alignment, ideal MS response according to /GSM:05.10:6/ is required.

38.4.3 Asynchronous Handover Detection

On a TCH (under TU50 propagation conditions at the reference sensitivity and interference levels /GSM:05.05:6/), the overall reception performance is such, that the probability of a correct handover detection within 60 ms after reception of the initial handover access sent from MS /GSM:04.08:3.4.4/ is better than 99.99%. This assumes that the initial MS access occurs within 1.0 second after the channel is activated for asynchronous handover and that a random RF input is received during the delay.

On an SDCCH, under the same general conditions as for TCH, the probability of a correct handover detection within 500 ms after reception of the initial handover access sent from MS is better than 99.99%.

With a random RF input, the probability of a false handover detection within 1.0 second after the channel is activated for asynchronous handover is less than 10^{-6}.

The HANDOVER DETECTION message is sent to BSC within 25 ms after the reception of the last handover access used in the handover detection.

The sending of PHYSICAL INFORMATION to MS begins less than 40 ms after a handover detection, counting from the last handover access used in the handover detection, to the first burst in the first PHYSICAL INFORMATION message.

38.4.4 Deactivate SACCH

Transmission on SACCH is stopped, within a multiframe period at the latest, after reception of the DEACTIVATE_SACCH message.

38.4.5 Transparent Message Transmission

RBS provides storage capacity for at least 500 octets per established SAPI link.

38.4.6 SACCH Info Modify

The new SACCH Information is stored for the addressed channel group at the latest within a multiframe period after reception of the SACCH_INFO_MODIFY message.

38.4.7 LAPDm

The RBS uses a repetition delay between 138.5 and 143.1 ms on FACCH/F (depending on the position in the multiframe).

© Ericsson Radio Systems AB
— All Rights Reserved —

The RBS will respond to a received message within 26.0 ms on FACCH/F (counting from the last burst in the received message, to the first burst in the response).

A mobile station is required to respond to a received message within 47.9 ms on FACCH/F (counting from the last burst in the received message, to the first burst in the response). On all other channels, the repetition delay specified in /GSM:04.06/ applies.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

39 EMC Capabilities for RBS 2301

This chapter covers the capabilities of the RBS 2000 in respect of EMC (ElectroMagnetic Compatibility). The capabilities include conducted and radiated emission as well as conducted and radiated immunity thresholds.

39.1 References

1. 89/336/EEC EMC directive

   Council directive of 3 May 1989 on approximation of laws of the Member States relating to electromagnetic compatibility.

2. ETS 300 342–2, Nov 1994

   EMC for European digital cellular telecommunication (GSM) mobile radio and ancillary equipment.

3. EN 55 022, April 1987

   Limits and methods of Measurement of Radio Interference Characteristics of Information Technology Equipment.

4. EN 50 081-1, January 1992

   Electromagnetic compatibility - Generic emission standard, Part 1: Residential, commercial and light industry.

5. EN 50 082-1, January 1992

   Electromagnetic compatibility - Generic immunity standard, Part 1: Residential, commercial and light industry.

6. IEC 801-3, 1984

   Radiated electromagnetic field requirement.

7. IEC 1000–3–2, EMC part 3, section 2

   limits for harmonic current emissions, 1995

8. IEC 1000–3–3, EMC part 3, section 2

   limitation of voltage fluctuations and flicker in low-voltage supply systems for equipment with rated current <16 A, 1994.

9. IEC 1000–4–2, 1995

   Electrostatic discharge requirements.

10. IEC 1000–4–4, 1995

    Electrical fast transient/burst requirement.

11. IEC 1000–4–5

    Surge Immunity Requirements.

12. IEC 1000–4–8, 1993

    Power frequency magnetic field immunity tests.

13. IEC 1000–4–11

© Ericsson Radio Systems AB
— All Rights Reserved —

Voltage Dips, short interruptions and voltage variations. Immunity tests.

14. VDE 0878, 1986

    Radio Interface Suppression of Telecommunication Systems and Apparatus.

15. ITU-T Recommendation K.20, 1984

    Resistibility of Telecommunication Switching Equipment to Overvoltages and Overcurrents.

The following standards are equal in all matters:

IEC 1000-3-2	=	EN 61000-3-2
IEC 1000-3-3	=	EN 61000-3-3
IEC 1000-4-2	=	EN 61000-4-2
IEC 1000-4-3	=	EN 61000-4-3
IEC 1000-4-4	=	EN 61000-4-4
IEC 1000-4-5	=	EN 61000-4-5
IEC 1000-4-8	=	EN 61000-4-8
IEC 1000-4-11	=	EN 61000-4-11

39.2 Concepts

External signal line - outdoor systems	Cable or lead longer than 1 meter intended for connection to units located outside the cabinet.
Telecommunication line	Cable intended for connection to a public network.
Enclosure Port	The physical boundary of the RBS through which electromagnetic fields may radiate or impinge.
Performance Criteria A	The system shall continue to operate as intended. During the test, no degradation of performance or loss of function is allowed below the specified test level.
Performance Criteria B	The system shall continue to operate as intended after the test. During the test, degradation of performance is however allowed below the specified test level. No change of actual operating state or stored data is allowed.

© Ericsson Radio Systems AB
— All Rights Reserved —

Performance Criteria C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.
Performance Criteria CT	Continuous phenomena applied to Transmitters. A communication link shall be established at the start of the test and maintained during the test. For the system the RXQUAL (as defined in GSM 05.08) of the downlink shall not exceed three, measured during each individual exposure in the test sequence.
Performance Criteria TT	Transient phenomena applied to Transmitters. A communication link shall be established at the start of the test and maintained during and after injection of the transients.
Performance Criteria CR	Continuous phenomena applied to Receivers. A communication link shall be established at the start of the test and maintained during the test. For the system the RXQUAL (as defined in GSM 05.08) of the uplink shall not exceed three, measured during each individual exposure in the test sequence.
Performance Criteria TR	Transient phenomena applied to Receivers. A communication link shall be established at the start of the test and maintained during and after injection of the transients.

Performance Criteria A(K.20):

The test object shall withstand the test without damage or other disturbances after the test.

Performance Criteria B(K.20):

A fire hazard should not arise in the test object. Any damage or permanent malfunction occurring should be confined to a small number of external line interface circuits.

© Ericsson Radio Systems AB
— All Rights Reserved —

39.3 Capabilities

39.3.1 RBS Description

Hardware

The capabilities are tested for an RBS equipped with a minimum representative configuration of units. This system is representative of installed systems in terms of function, which includes at least one of each function unit type, and electromagnetic radiation characteristics. The number and types of sub-units are given from results of investigations in accordance with ETS 300 342-2, Nov 1994.

Software

The capabilities are valid for a standard setup of system software with default parameters.

Performance

For the immunity capabilities the RBS is operating and will fulfil the performance criteria stated for each test.

For emission capabilities all equipment in the RBS was enabled during verification to create the worst emission case.

EMC directive

The EMC capabilities of the RBS fulfills the mandatory requirements specified in the EMC directive, 89/336/EEC, which gives compliance for trade in EU member countries.

Generic Standards

The following generic standards are fulfilled by the system:

EN 50 081–1, Jan 1992 Emission

EN 50 082–1, Jan 1992 Immunity

39.3.2 Conducted Emission

Table 28 Voltage fluctuation on AC power supply leads

Basic standard	IEC 1000-3-3
Limit	Set by Table II in IEC 1000-3-3

Table 29 Harmonics on AC power supply leads

Basic standard	IEC 1000-3-2
Limit	Set by Table 1 in IEC 1000-3-2

Table 30 Interference on AC power supply leads

Basic standard	EN 55 022
Limit	Class B

© Ericsson Radio Systems AB
— All Rights Reserved —

Limit standard	VDE 0878, Conducted emission, part 1
Limit	Class B

Table 31 Interference on DC power supply leads

Basic standard	EN 50 022 and proposed amendment to CISPR 22
Limit	Class B

Limit standard	ETS 300 342-2, Nov 1994
Limit	Class B

Table 32 Interference on signal and telecommunication lines

Basic standard	CISPR/G(sec) December 1993

39.3.3 Radiated Emission from Enclosure

Table 33 Electric field emission

Basic standard	EN 55 022
Limit	Class B

Table 34 Magnetic field emission

Limit standard	VDE 0878, Magnetic emission, part 1
Limit	Class B

39.3.4 Conducted Immunity on AC Input Power Ports

Table 35 Fast transient test

Basic standard	IEC 1000-4-4
Test level	6 kV common mode between all lines and cabinet ground reference
Performance	Criteria B

Limit standard	ETS 300 342-2
Test level	6 kV common mode between all lines and cabinet ground reference
Performance	Criteria A for a complete system Criteria TT for transmitter units Criteria TR for receiver units

© Ericsson Radio Systems AB
— All Rights Reserved —

Table 36 Surge test

Limit standard	ETS 300 342-2
Test level	6 kV common mode between all lines and cabinet ground reference [1)] 6 kV differential mode, between line and line
Performance	Criteria A for a complete system Criteria TT for transmitter units Criteria TR for receiver units

1) System primary protected

Table 37 RF common mode test

Limit standard	ETS 300 342-2
Test level	10 V(rms)
Performance	Criteria A for a complete system Criteria CT for transmitter units Criteria CR for receiver units

Table 38 Voltage dips and interruptions on AC ports

Basic standard	IEC 1000-4-11
Performance	Criteria A for a complete system

39.3.5 Immunity on Telecommunication and External Signal Lines

Table 39 Fast transient test

Basic standard	IEC 1000-4-4
Test level	2 kV common mode between line and cabinet ground reference
Performance	Criteria B

Limit standard	ETS 300 342-2
Test level	4 kV common mode between line and cabinet ground reference
Performance	Criteria A for a complete system Criteria TT for transmitter units Criteria TR for receiver units

Table 40 Surge test 1.2/50 pulses

Limit standard	IEC 1000-4-5
Test level	2 kV common mode between line and cabinet ground reference 1 kV differential mode between line and line
Performance	Criteria B for a complete system Criteria TT for transmitter units Criteria TR for receiver units

© Ericsson Radio Systems AB
— All Rights Reserved —

Table 41 Surge test 10/700 pulses

Limit standard	IEC 1000-4-5
Test level	1 kV common mode between line and cabinet ground reference 1 kV differential mode between line and line
Performance	Criteria B for a complete system Criteria TT for transmitter units Criteria TR for receiver units

Table 42 Power induction test

Basic standard	ITU-T K.20
Test level	600 V(rms) common mode
Performance	Criteria A(K.20)

Table 43 RF common mode test

Limit standard	ETS 300 342-2
Test level	10 V(rms)
Performance	Criteria A for a complete system Criteria CT for transmitter units Criteria CR for receiver units

39.3.6 Radiated Immunity of Enclosure Port

Table 44 Immunity of continuous electric fields

Basic standard	IEC 801-3
Test level	10 V/m
Performance	Criteria A

Limit standard	ETS 300 342-2
Test level	10 V/m, 80 MHz - 1 GHz
Frequency range	30 V/m, 1 GHz-20 GHz
Performance	Criteria A for a complete system Criteria CT for transmitter units Criteria CR for receiver units

Table 45 Immunity of 50/60 Hz magnetic fields

Basic standard	IEC 1000-4-8
Test level	10 A/m, 50/60 Hz
Performance	Criteria A

© Ericsson Radio Systems AB
— All Rights Reserved —

39.3.7 Electrostatic Discharges

Table 46 Immunity of enclosure port

Basic standard	IEC 1000-4-2
Test level	Air discharges: 15 kV Contact discharges: 8 kV
Performance	Criteria B

Limit standard	ETS 300 342-2
Test level	Air discharges: 8 kV Contact discharges: 4 kV.
Performance	Criteria A for a complete system Criteria TT for transmitter units Criteria TR for receiver units

© Ericsson Radio Systems AB
— All Rights Reserved —

40 EMC Capabilities for RBS 2302

This chapter covers the capabilities of the RBS 2302 in respect of EMC (ElectroMagnetic Compatibility). The capabilities include conducted and radiated emission as well as conducted and radiated immunity thresholds.

40.1 References

1. 89/336/EEC EMC directive

   Council directive of 3 May 1989 on approximation of laws of the Member States relating to electromagnetic compatibility.

2. I-ETS 300 609–1, 1997

   Digital cellular telecommunications system (Phase 2); Base Station System (BSS) equipment specification.

   Part 1: Radio Aspects (GSM11.21)

3. I-ETS 300 609–4, 1997

   Digital cellular telecommunications system (Phase 2); Base Station System (BSS) equipment specification.

   Part 4: Repeaters (GSM11.24)

4. prETS 300 342–3, October 1997

   Radio Equipment and System (RES); Electro-Magnetic Compatibility (EMC) for Digital cellular telecommunication system.

   Part 3: Base station radio and ancillary equipment and repeaters meeting Phase 2 GSM requirements.

5. EN 55 022, 1993 + AM1, 1995

   Limits and methods of measurement of radio disturbances characteristics of information technology equipment.

6. EN 50 081–1, 1992, Electromagnetic compatibility - Generic emission standard

   Part 1: Residential, commercial and light industry.

7. EN 50 082–1, 1992, Electromagnetic compatibility - Generic emission standard

   Part 1: Residential, commercial and light industry.

8. EN 61 000–3–2, 1995

   Electromagnetic compatibility (EMC)

   Part 3: Limits

   Section 2: Limits for harmonic current emissions (equipment input current < 16 A per phase)

9. EN 61 000–3–3, 1995

   Electromagnetic compatibility (EMC)

© Ericsson Radio Systems AB
— All Rights Reserved —

Part 3: Limits

Section 2: Limits for voltage fluctuations and flicker in low-voltage supply systems for equipment with current <16 A.

10. EN 61 000–4–2, 1995

    Electromagnetic compatibility (EMC)

    Part 4: Testing and measurement techniques

    Section 2: Electrostatic discharge immunity test

11. EN 61 000–4–3, 1995

    Electromagnetic compatibility (EMC)

    Part 4: Testing and measurement techniques

    Section 3: Radiated, radio-frequency, electromagnetic field immunity test

12. EN 61 000–4–4, 1995

    Electromagnetic compatibility (EMC)

    Part 4: Testing and measurement techniques

    Section 4: Electrical fast transient/burst immunity test

13. EN 61 000–4–5, 1995

    Electromagnetic compatibility (EMC)

    Part 4: Testing and measurement techniques

    Section 5: Surge immunity test

14. EN 61 000–4–6, 1995

    Electromagnetic compatibility (EMC)

    Part 4: Testing and measurement techniques

    Section 6: Immunity to conducted disturbances, induced by radio frequency fields

15. EN 61 000–4–8, 1994

    Electromagnetic compatibility (EMC)

    Part 4: Testing and measurement techniques

    Section 8: Power frequency magnetic field immunity test, Basic EMC Publication

16. EN 61 000–4–11, 1994

    Electromagnetic compatibility (EMC)

    Part 4: Testing and measurement techniques

    Section 11: Voltage dips, short interruptions and voltage variations immunity tests

17. IEC 801-2, 1984

© Ericsson Radio Systems AB
— All Rights Reserved —

Electromagnetic compatibility (EMC) for industrial-process measurement and control equipment

Part 2: Electrostatic discharge requirements

18. IEC 801-3, 1984

Electromagnetic compatibility (EMC) for industrial-process measurement and control equipment

Part 3: Radiated electromagnetic field requirement

19. IEC 801-4, 1988

Electromagnetic compatibility (EMC) for industrial-process measurement and control equipment

Part 4: Electrical fast transient/burst requirement

20. IEC 1312–3, 1994

Protection against Lightning Electromagnetic Impulse

Part 3: Requirements of surge protective devices

21. ITU-T Recommendation K.20, 1993

Resistibility of Telecommunication Switching Equipment to Overvoltages and Overcurrents.

22. CISPR 16–1, 1993

Specification for Interferences Measuring Apparatus and Measuring Methods

Part 1: Radio disturbance and immunity measuring apparatus

23. Code of Federal Regulations title 47

FCC part 24

Personal Communications Services

24. Code of Federal Regulations title 47

FCC part 2

Frequency allocations and radio treaty matters, General rules and regulations

25. Code of Federal Regulations title 47

FCC part 15

Radio Frequency devices

© Ericsson Radio Systems AB
— All Rights Reserved —

40.2 Concepts

External signal Port	Cable or lead intended for connection to units located outside the Radio Base System without connection to a public network.
Telecommunication Port	Cable or lead intended for connection to a public network.
Enclosure Port	The physical boundary of the test unit through which electromagnetic fields may radiate or impinge.
Performance Criteria A	The unit shall continue to operate as intended. During the test, no degradation of performance or loss of function is allowed below the specified test level.
Performance Criteria B	The system shall continue to operate as intended after the test. During the test, degradation of performance is however allowed below the specified test level. No change of actual operating state or stored data is allowed.
Performance Criteria C	Temporary loss of function is allowed, provided the function is self-recoverable or can be restored by the operation of the controls.
Performance Criteria CT	Continuous phenomena applied to Transmitters. A communication link is established at the start of the test and maintained during the test.
Performance Criteria TT	Transient phenomena applied to Transmitters. A communication link must be established at the start of the test and maintained during and after injection of the transients.
Performance Criteria CR	Continuous phenomena applied to Receivers. A communication link must be established at the start of the test and maintained during the test.
Performance Criteria TR	Transient phenomena applied to Receivers. A communication link must be established at the start of the test and maintained during and after injection of the transients.
Performance Criteria CRptr	Continuous phenomena applied to Ancillary RF amplifiers. The gain measured during the test must not change from the gain measured before the test by more than 1 dB. During the test no

© Ericsson Radio Systems AB
— All Rights Reserved —

degradation of performance or loss of function is allowed.

Performance Criteria TRptr	Transistent phenomena applied to Ancillary RF amplifiers. The gain measured after the test must not change from the gain measured before the test by more than 1 dB. During the test no degradation of performance or loss of function is allowed.
Performance Criteria A(K.21):	The test object must withstand the test without damage or other disturbances after the test.
Performance Criteria B(K.21):	A fire hazard should not arise in the test object. Any damage or permanent malfunction occurring should be confined to a small number of external line interface circuits.

© Ericsson Radio Systems AB
— All Rights Reserved —

40.3 Emission

40.3.1 Conducted Emission, Interference on AC power supply ports

RBS 2302

Table 47 Fulfills EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 55 022, 1994
Limit	Class B

Table 48 Fulfills FCC type approval verification requirements according to:

Digital device	Non TX mode
Limit	Class B

Specification references:

Code of Federal Regulations 47, FCC part 15 chapter 15.107

PBC

Table 49 Fulfills EEC self certification requirements according to:

Generic standard	EN 50 081-1, 1992
Basic standard	EN 55 022, 1994
Limit	Class B

40.3.2 Conducted Emission, Interference on DC power supply ports

RBS

Table 50 Fulfills EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 55 022, 1994
Limit	Class A

PBC

Table 51 Fulfills EEC self certification requirements according to:

Generic standard	EN 50 081-1, 1992
Basic standard	EN 55 022, 1994
Limit	Class A

© Ericsson Radio Systems AB
— All Rights Reserved —

40.3.3 Radiated Emission, Electric Field Emission

RBS

Table 52 Fulfills EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	I-ETS 300 609-1, 1997
Frequency range	30 MHz - 4 GHz
Operating mode	Transmitters with full output power

PBC

Table 53 Fulfills EEC self certification requirements according to:

Generic standard	EN 50 081-1, 1992
Basic standard	EN 55 022, 1994
Limit	Class B

40.3.4 Radiated Emission, TX Mode

RBS

The value of the spurious emission is at least 80 dB or 43 +10*log (mean output power in Watt), whichever the lesser, below the mean power of the unmodulated carrier.

The calculated radiated power limit for radiated emissions is -13 dBm.

Specification references:

Code of Federal Regulations 47, FCC part 2 chapter 2.993, 2.997 and FCC part 24 chapter 24.238

40.3.5 Radiated Emission, None TX Mode

RBS

The radiated emission limit is specified up to the frequency shown in the following table:

Table 54 Radiated emission limit

Highest frequency generated or used in the device or on which the device operates or tunes on (MHz), Emission (MHz)	**Upper frequency of measurement range (MHz)**
<1.0705	30
1.0705 - 108	1000
108 - 500	2000
500 -1000	3000
>1000	5th harmonic of the highest freq. or 40 GHz which ever is lower

© Ericsson Radio Systems AB
— All Rights Reserved —

The field strength of radiated emissions does not exceed the limits in the following table at 3 m distance:

Table 55 Field strength of radiated emissions limits

Frequency of emission (MHz)	**Field strength**	
	(uV/m)	(dBuV/m)
30 - 88	100	40
88 - 216	150	43.5
216 - 960	200	46
>960	500	54

Specification references:

Code of Federal Regulations 47, FCC part 15 chapter 15.33, 15.109

40.4 Immunity

Note: Increased test level, extended frequency range and more severe performance criteria are specified by Ericsson internal EMC document.

40.4.1 Conducted Immunity on AC power ports

Fast Transient Test: RBS

Table 56 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-4, 1995
Test level	2 kV common mode between all lines and cabinet ground reference.

Performance	Criteria TT Criteria TR

Note: see note 40.4

Fast Transient Test: PBC

Table 57 Fulfills the EEC self certification requirements according to:

Generic standard	EN 50 082-1, 1992
Basic standard	IEC 801-4, 1988
Mandatory test level	1 kV common mode between all lines and cabinet ground reference.

Performance	Criteria B

Note: see note 40.4

© Ericsson Radio Systems AB
— All Rights Reserved —

Surge Test: RBS

Table 58 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-5, 1995
Pulse shape	1, 2/50 (8/20) us
Test level	1 kV common mode between all lines and cabinet ground reference. 0.5 kV differential mode between line and line.

Performance	Criteria TT Criteria TR

Note: see note 40.4

Surge Test: PBC

Note: see note 40.4

RF Common Mode: RBS

Table 59 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-6, 1996
Frequency range	150 kHz - 80 MHz
Test level	3 V(rms)

Performance	Criteria CT Criteria CR

Note: see note 40.4

RF Common Mode: PBC

Note: see note 40.4

Voltage Dips and Interruptions on AC Power Ports, RBS/ PBC

Table 60 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-11, 1994
Test level 1	Voltage dip, 30% reduction of nominal voltage during 10 ms
Test level 2	Voltage dip, 60% reduction of nominal voltage during 100 ms
Test level 3	Voltage dip, >95% reduction of nominal voltage during 5000 ms

© Ericsson Radio Systems AB
— All Rights Reserved —

Performance	Criteria TT Criteria TR Level 1 without battery back-up Level 2 and 3 with battery back-up

40.4.2 Conducted Immunity on DC power ports

Fast Transient Test: RBS

Table 61 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-4, 1995
Test level	1 kV common mode between all lines and cabinet ground reference.

Performance	Criteria TT Criteria TR

Note: see note 40.4

Fast Transient Test: PBC

Table 62 Fulfills the EEC self certification requirements according to:

Generic standard	EN 50 082-1, 1992
Basic standard	IEC 801-4, 1988
Test level	0.5 kV common mode between all lines and cabinet ground reference.

Performance	Criteria B

Note: see note 40.4

Surge Test: RBS, PBC

Note: see note 40.4

RF Common Mode: RBS

Table 63 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-6, 1996
Frequency range	150 kHz - 80 MHz
Test level	3 V(rms)

Performance	Criteria CT Criteria CR

Note: see note 40.4

© Ericsson Radio Systems AB
— All Rights Reserved —

RF Common Mode: PBC

No requirements are applicable for the PBC.

40.4.3 Conducted Immunity on intra-connecting signal ports

Fast Transient Test: RBS

Table 64 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-4, 1995
Test level	0.5 kV common mode between all lines and cabinet ground reference.

Performance	Criteria TT Criteria TR

Note: see note 40.4

Fast Transient Test: PBC

Table 65 Fulfills the EEC self certification requirements according to:

Generic standard	EN 50 082-1, 1992
Basic standard	IEC 801-4, 1988
Test level	0.5 kV common mode between all lines and cabinet ground reference.

Performance	Criteria B

Note: see note 40.4

RF Common Mode: RBS

Table 66 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-6, 1996
Frequency range	150 kHz - 80 MHz
Test level	3 V(rms)

Performance	Criteria CT Criteria CR

Note: see note 40.4

RF Common Mode: PBC

Note: see note 40.4

© Ericsson Radio Systems AB
— All Rights Reserved —

40.4.4 Conducted Immunity on telecommunication and external signal ports

Fast Transient Test: RBS

Table 67 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-4, 1995
Test level	0.5 kV common mode between all lines and cabinet ground reference.

Performance	Criteria TT Criteria TR

Note: see note 40.4

Fast Transient Test: PBC

Table 68 Fulfills the EEC self certification requirements according to:

Generic standard	EN 50 082-1, 1992
Basic standard	IEC 801-4, 1988
Test level	0.5 kV common mode between all lines and cabinet ground reference.

Performance	Criteria B

Note: see note 40.4

RF Common Mode: RBS

Table 69 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-6, 1996
Frequency range	150 kHz - 80 MHz
Test level	3 V(rms)

Performance	Criteria CT Criteria CR

Note: see note 40.4

RF Common Mode: PBC

Note: see note 40.4

Power Induction Test: RBS, PBC

Note: see note 40.4

© Ericsson Radio Systems AB
— All Rights Reserved —

40.4.5 Conducted Immunity For Direct Lightning Strike

RBS, PBC:

Note: see note 40.4

40.4.6 Radiated Immunity of enclosure port, electric fields

RBS

Table 70 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-3, 1995
Test level	3 V/m
Frequency range	80 MHz - 1 GHz

Performance	Criteria CT Criteria CR

Note: see note 40.4

PBC

Table 71 Fulfills the EEC self certification requirements according to:

Basic standard	IEC 801-3, 1984
Test level	3 V/m unmodulated signal
Frequency range	27 MHz - 500 MHz

Performance	Criteria A

Note: see note 40.4

40.4.7 Radiated Immunity of enclosure port, magnetic fields 50/60 Hz

RBS, PBC:

Note: see note 40.4

40.4.8 Electro-static Discharges, Immunity of enclosure port

RBS

Table 72 Fulfills the EEC type approval certification requirements according to:

Product standard	prETS 300 342-3, October 1997
Basic standard	EN 61 000-4-2, 1995
Test level	Contact discharge 4 kV Air discharge 8 kV

© Ericsson Radio Systems AB
— All Rights Reserved —

Performance	Criteria TT Criteria TR

Note: see note 40.4

PBC

Table 73 Fulfills the EEC self certification requirements according to:

Product standard	EN 50 082-1, 1992
Basic standard	IEC 801-2, 1984
Test level	Air discharge 8 kV

Performance	Criteria B

Note: see note 40.4

© Ericsson Radio Systems AB
— All Rights Reserved —

41 Environmental Capabilities

The purpose of this chapter is to specify the environmental capabilities for RBS 2301 and RBS 2302.

41.1 Scope

This chapter describes the environmental capabilities for the indoor and outdoor temperature non-controlled operation conditions. Subjects included are: Climatic, Biological, and Chemically active substances; Mechanically active substances, and Mechanical conditions.

The capabilities cover the base station excluding installation and adjacent parts as antenna and earth connectors.

Note: The names of the various climate classes in the following chapter are for classification purpose only and is not intended to limit the use of the products.

41.2 Terminology

Definition of concepts:

Normal operation conditions

Environmental conditions where all units shall be able to function as specified.

Safe function

Environmental stress above the limits for normal operation where all units shall continue to function during the stress, but performance or capacity may be reduced.

Reduction of performance or capacity shall be documented as typical value.

When the environmental stress has dropped to normal operation conditions, function as specified shall automatically be achieved.

Safe function refers to an operation period of not more than 72 consecutive hours, and a total of not more than 15 days in one year.

Non-destruction

Environmental stress above the limits for safe function during which no function is guaranteed and performance may degrade in an unspecified manner.

When the environmental stress has dropped to normal operation conditions, no manual intervention (on site) is needed to restore full performance of the RBS.

Non-destruction refers to an operation period of not more than 96 consecutive hours, and a total of not more than 5.5 days in a 3 years period.

© Ericsson Radio Systems AB
— All Rights Reserved —

GSM concepts

The GSM concepts for Normal operation and Extreme operation conditions as defined in GSM 11.20-12.3.2 are both equal to the Normal condition as defined and used in this document. This means, all RF parameters are guaranteed within the Normal condition range as defined in this document.

41.3 References

IEC 721-3-..	Classification of groups of environmental parameters and their severities.
ETSI 300 019-1-..	Classification of environmental conditions.
ETSI 300 019-2-..	Environmental conditions and environmental tests for telecommunications equipment.

41.4 Transport -40°C - +70°C

41.4.1 General Conditions

The severity of the requirements is in conformity with: IEC 721-3-2 classes 2K4/2B2/2C2/2S2/2M2. and ETS 300 019-1-2 Class 2.3 "PUBLIC transportation".

These requirements are valid for equipped cabinets (excluding batteries). The values in these conditions are valid for a maximum transport time of 3 months. The time is measured from the packages are leaving the shipping store, and includes storing in connection with the transport.

Note: These requirements restrict flight transportation to aircraft with pressure cabins. As modern aircraft have pressure cabins, these limitations are expected to be only formal.

41.4.2 Climatic conditions

During transportation the equipment could be exposed to extremes in temperature and humidity. The equipment shall be in packaged condition.

Table 74

Environmental Parameters	**Unit**	**Value**
Temperature	°C	- 40- +70
Relative Humidity	%	5-100

41.4.3 Biological conditions.

The severity of these requirements is in conformity with:

- IEC 721-3-2 class 2B2.
- ETS 300 019-1-2 Class 2.3.

© Ericsson Radio Systems AB
— All Rights Reserved —

41.4.4 Chemically Active Substances.

The severity of these requirements is in conformity with:

- IEC 721-3-2 class 2C2.
- ETS 300 019-1-2 Class 2.3.

41.4.5 Mechanically active substances.

The severity of these requirements is in conformity with:

- IEC 721-3-2 class 2S2.
- ETS 300 019-1-2 Class 2.3.

41.4.6 Mechanical conditions

The packing and transport method is chosen in order not to expose the equipment to stress beyond these limits.

The severity of these requirements are in conformity with:

- IEC 721-3-2 class 2M2.
- ETS 300 019-1-2 Class 2.3.

Requirements

Table 75

Environmental Parameters	Unit	Value		
Vibration sinus:				
displacement	mm	3.5		
acceleration	m/s^2		10	15
frequency	Hz	2-9	9-200	200-500
Random ASD:	m^2/s^3		1.0	
acceleration	m/s^2		12.0	
frequency	Hz		2-200	
Shock:				
peak acceleration	m/s^2		100	
duration	ms		11	

41.5 Storage -25°C - +55°C

41.5.1 General Conditions

The severity of the requirements is in conformity with: IEC 721-3-1 classes 1K4/1Z2/1Z3/1Z5/1B2/1C2/1S3/1M2, and ETS 300 019-1-1 Class 1.2. "WEATHERPROTECTED, not temperature-controlled storage".

During storage the equipment shall be packaged. The values in these conditions are valid for a maximum storage time of 12 months. The time refers to equipment in its outer package and stored at the consignee in a conditioned store.

© Ericsson Radio Systems AB
— All Rights Reserved —

41.5.2 Climatic conditions

The equipment shall be shall be in packaged condition.

The severity of these requirements is in conformity with:

- IEC 721-3-1 classes 1K4/1Z2/1Z3/1Z5.
- ETS 300 019-1-1 Class 1.2.

Requirements

Table 76

Environmental Parameters	**Unit**	**Value**
Temperature	°C	- 25 - +55
Relative Humidity	%	10 -100

41.5.3 Biological conditions

The severity of these requirements is in conformity with:

- IEC 721-3-1 class 1B2.
- ETS 300 019-1-1 class 1.2

41.5.4 Chemically Active Substances

The chemically active substances are according to

- IEC 721-3-1 class 1C2
- ETS 300 019-1-1 class 1.2

Note: The values are average yearly levels of airborne contamination that can be accepted. It is assumed that one of the contaminations is dominant at each site, and that the other are present in insignificant amounts.

41.5.5 Mechanically Active Substances

The severity of these requirements is in conformity with:

- IEC 721-3-1 class 1S3.
- ETS 300 019-1-1 Class 1.2.

41.5.6 Mechanical Conditions

The packing and transport method shall be chosen in order not to expose the equipment to stress beyond these limits.

The severity of these requirements is in conformity with:

- IEC 721-3-1 class 1M2
- ETS 300 019-1-1 Class 1.2

In addition to this Ericsson demands more rigorous values than stated by IEC and ETSI above.

© Ericsson Radio Systems AB
— All Rights Reserved —

Requirements

Table 77

Environmental Parameters		Unit	Value	
Vibration sinus:				
	displacement	mm	3.5	
	acceleration	m/s²		10
	frequency	Hz	2-9	9 -200
Shock:				
	peak acceleration	m/s²	40	
	duration	ms	22	

41.6 Handling -40°C - +70°C

41.6.1 General Conditions

This section refers to shorter periods of transport and storage in unpacked conditions. Precautions to avoid condensation before subjecting the equipment to operational conditions are necessary.

41.6.2 Climatic conditions

During handling the equipment withstand the conditions stated in Section 41.4.2 on page 278 in this document.

41.6.3 Biological conditions.

During Handling the equipment withstand the conditions stated in Section 41.4.3 on page 278 in this document.

41.6.4 Chemically active substances

During Handling the equipment withstand the conditions stated in Section 41.4.4 on page 279 in this document.

41.6.5 Mechanically active substances

During Handling the equipment withstand the conditions stated in Section 41.4.5 on page 279 in this document.

41.6.6 Mechanical conditions

The equipment shall endure stresses normal for handling, during handling the equipment withstand the conditions stated in Section 41.4.6 on page 279 in this document.

41.7 Operation Mast Mounted Equipment -33°C - +45°C

General conditions

General conditions conform to

- IEC 721-3-4 classes 4K2/4Z5/4Z7/4B1/4C2(4C3)/4S2/4M5

© Ericsson Radio Systems AB
— All Rights Reserved —

- ETS 300 019-1-4 class 4.1 NON-WEATHER PROTECTED Location
- Additional requirements for mast mounted equipment are included.

Note: The temperature range is extended to +45°C.

This clause refers to the environment which an RBS for outdoor non-weather protected location shall endure. The equipment must in all situations fulfil legal requirements and not become hazardous to people.

The figures below refer to the environment that surrounds the cabinet and the temperature is the shaded ambient air temperature.

Climatic conditions

The climatic conditions conform to

- IEC 721-3-4 classes 4K2/4Z5/4Z7
- ETS 300 019-1-4 class 4.1

In addition to this, Ericsson demands more rigorous values than stated by IEC and ETSI above.

Table 78 Climatic conditions during outdoor operation

Environmental parameters	Value	
	Normal condition	**Non-destructive**
Temperature, °C	-33 - +45	-40 - +70
Relative humidity, %	15 - 100	15 - 100

Biological conditions

The biological conditions conform to

- IEC 721-3-4 class /4B1/
- ETS 300 019-1-4 class 4.1

Chemically active substances

The chemically active substances conform to

- IEC 721-3-4 classes /4C2(4C1)/
- ETS 300 019-1-4 class 4.1

Note: The values of these capabilities are average yearly levels of airborne contamination that can be accepted. It is assumed that one of the contaminations is dominant at each site, and that the others are present in insignificant amounts.

Mechanically active substances

The mechanically active substances conform to

- IEC 721-3-4 class /4S2/
- ETS 300 019-1-4 class 4.1

© Ericsson Radio Systems AB
— All Rights Reserved —

Mechanical conditions

The mechanical conditions conform to

- IEC 721-3-4 class /4M5/
- ETS 300 019-1-4 class 4.1

In addition to this, Ericsson demands more rigorous values than stated by IEC and ETSI above.

Table 79 Mechanical conditions during operation outdoor

Environmental parameter		***Value***	
Vibration sinusoidal	displacement, mm	3.0	
	acceleration, m/s^2		10
	frequency, Hz	2 - 9	9 - 200
Vibration random	ASD(1), m^2/s^3	0.5	
	frequency, Hz	2 - 200	
	Duration of exposure, min	30	
	no. of test directions	3	
Shock	peak acceleration, <100 kg m/s^2	250	
	peak acceleration, >100 kg m/s^2	100(2)	
	duration, ms	6	

(1) ASD = Acceleration Spectral Density
(2) The requirement belongs to safe function with the following exception: Performance of the RBS shall be verified as "no loss of calls".

Seismic exposure

Table 80 Safe function during seismic exposure

Testing severity	
Frequency range	1-15 Hz
Required Response Spectrum	RRS (Required Response Spectrum)
Shape of RRS	as IEC 68-2-57 fig. 3

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

42 Product Safety Requirements RBS 2000

This chapter specifies the product safety requirements for RBS 2000.

42.1 References

IEC 215	Safety requirements for radio transmitting equipment.
EN 60950	Safety of Information Technology Equipment. Including Electrical Business Equipment.
IEC 950	Safety of Information Technology Equipment. Including Electrical Business Equipment.
CAN/CSA-C22.2	No 1-M94
	Audio, Video and Similar Electronic Equipment.
CAN/CSA-C22.2	No 950-95
	Safety of Information Technology Equipment Including Electrical Business Equipment.
UL 1419	Standard for Professional Video and Audio Equipment.
73/23/EEC	Low Voltage Directive.
UL 1950 3rd edition	Safety of Information Technology Equipment Including Electrical Business Equipment.
IEC 529	Classification of degrees of protection provided by enclosures. (IP Code).

42.2 Product Safety

This section defines the Electrical, Mechanical, Heat and Fire Safety Requirements for the Radio Base Station. The RBS is designed to fulfil the following International Standards:

73/23/EEC Low Voltage Directive. (To achieve this, the RBS conforms to the standards below).

EN 60 950 "Safety of Information Technology Equipment Including Electrical Business Equipment".

This means that we comply with the general IEC 950 including national differences notified in EN 60 950.

IEC 215 Safety requirements for transmitting equipment.

The product shall be listed by National Recognized Testing Laboratory (NRTL).

For the US the following standards are applicable:

UL 1950 3rd edition “Safety of Information Technology Equipment Including Electrical Business Equipment”.

UL 1419 Standard for Professional Audio and Video Equipment.

© Ericsson Radio Systems AB
— All Rights Reserved —

For Canada the following standards are applicable:

CAN/CSA-C22.2 No 1-M94 Audio, Video and Similar Electronic Equipment.

CAN/CSA-C22.2 No 950-95 Safety of information technology including electrical business equipment.

General

The RBS fulfills encapsulation class IP 55. Additional to this the product fulfils the environmental requirements.

According to: IEC 529.

This document gives the requirement for the RBS to fulfill the general safety requirements as follows:

The RBS is so designed and constructed that, under all conditions of normal use and under a likely fault condition, it protects against personal injury from electrical shock and other hazards. The RBS is also protecting against serious fire originating in the equipment, mechanical hazards in the equipment, as well as mechanical hazards in the meaning of the applicable standard.

The RBS is connected directly to the Telecommunication network; hence the equipment must be provided with adequate protection, as specified in IEC 950 and UL 1950 3rd edition.

- Protection to ensure compliance with the requirements for TNV circuits, and protection against electric shock.
- Protection for the Service Personnel and other users of the Telecommunication Network from hazards in the equipment.
- Protection for the equipment users from voltages on the Telecommunication Network.
- Protection against overvoltage. (Only applicable for UL 1950 3rd edition.)

42.2.1 Declaration of Conformity

Tests and inspections are carried out according to ECMA requirements.

© Ericsson Radio Systems AB
— All Rights Reserved —

43 Building Practice Requirements RBS 2000

This chapter specifies the building practice requirements for RBS 2000.

43.1 Fire Resistance

The fire resistance of assemblies for Ericsson equipment are based on the properties of the materials, components and cables which are used for the construction of these assemblies. The properties concerning fire resistance are measured according to widely accepted national and international standards.

Fulfilled standards

For Europe the following standard is met:

EN 60 950 Safety of Information Technology (IEC 950).

For US the following standards is met:

UL 1950 third edition."Safety of Information Technology Equipment Including Electrical Business Equipment".

For Canada the following standard is met:

CAN/CSA-C22.2 No 950 Safety of information technology including electrical business Eq.

43.1.1 Criteria for fire resistance of wire and cables

For Europe the following standard are used:

IEC standard 332, Part 1.

IEC standard 332, Part 3 Category C.

For the US and Canada the following standards are used:

UL 1581, section 1160

UL 1685, Fire-propagation and Smoke-release

CAN/CSA-C22.2 No 03.

43.1.2 Criteria for fire resistance of components.

IEC Standard 695-2-2, Fire Hazard Testing, part 2 Test Methods - Needle Flame Test, with application times according to the table below:

Table 81 Fire resistance of components

Components volume (mm^3)	**Application time (s)**
<250	5
250 - 500	10
500 - 1750	20
> 1750	30

Required test result:

The afterburning time for a component may not exceed 15 s. No burning or glowing particles may fall from specimen.

© Ericsson Radio Systems AB
— All Rights Reserved —

43.1.3 Criteria for flame resistance of materials

ASTM Standard D 2863-77, Oxygen Index (OI)

Required Test result: OI >= 28

or

UL Standard 94 Vertical Burning Test for Classifying Materials.

Requirements according to specification in:

IEC 950, UL 1950, CSA C22.2 No. 950.

43.2 Poisonous Fumes

Apart from the inevitable carbon monoxide fumes and the possible HCl (Hydrochloric acid) fumes there will be no other noxious, corrosive or poisonous fumes in any harmful concentration during fire in Ericsson equipment.

43.3 Declaration of Materials

Materials which are under legal restrictions are declared according to relevant standards.

43.4 Silicone

The use of silicone products is restricted to the use of wiremesh silicone rubber gasket for encloses of Ericsson equipment cabinets. The wiremesh is applied as EMC protection.

43.5 Environmental Consideration during the Life-Cycle

According to "US Clean air act" Amendment Sect. 611. Label requirements for Ozone-depleting substances, all products that are manufactured using and containing the substance listed below shall be marked in accordance to previous mentioned law. Products with subunits manufactured using the substance below do not have to be marked on higher level than subunit level.

Substance which Clean Air Act is applicable for:

CFC-11, CFC-12, CFC-13, CFC-111, CFC-112, CFC-113,CFC-114, CFC-115, CFC-211,CFC-212, CFC-213, CFC-214, CFC-215, CFC-216, CFC-217,Halon-1211, Halon-1301, Halon-2402, Carbon tetrachloride (CT), Methyl- chloroform (1, 1, 1 - trichloroetane).

© Ericsson Radio Systems AB
— All Rights Reserved —

44 BTS Parameter Limitations

This chapter specifies configurable BTS parameters with limitations compared with the parameter ranges in the Abis O&M IWD. BTS parameters with no limitations compared to the Abis O&M IWD are not stated in this chapter.

44.1 Purpose and Readers

The purpose is to show BTS parameters with parameter range limitations compared to the Abis O&M IWD.

People involved in the preparation of data transcripts for the BSC are the target group of this specification.

44.2 Terminology

See 3/155 19–ANT 241 05 Uen, Abis O&M Interface, Part I, Model.

44.3 References

See 4/155 19–ANT 241 05 Uen, Abis O&M Interface, Part II, Procedures.

44.4 Parameters

The parameters listed are extracted from the Data Elements listed in the Abis O&M IWD document (see ref. 1). This chapter states the BTS parameters with parameter range limitations compared with the Abis O&M IWD.

For each parameter in the list, the range supported by the BTS and the Abis O&M IWD is stated.

All coding in the document is in hexadecimal (hex) representation if nothing else is stated.

44.4.1 Accordance Indication

BTS-supported value range:

AIP: 0 - 1

IWD-defined value range: 0 - 2

44.4.2 Alarm Status Type

BTS-supported value range:

Alarm status type: 1

IWD

IWD-defined value range: 0 - 1

© Ericsson Radio Systems AB
— All Rights Reserved —

44.4.3 BS_AG_BLKS_RES

BTS-supported value range:

BS_AG_BLKS_RES: 0 - 1

IWD-defined value range: 0 - 7

44.4.4 CON Connection List

BTS supported value range:

y		0 -12
mi		2 - 13
CCP		
	CCP number	256, 260, ... 348
	Reserved	0 - 255, 257 - 259, 261 - 263, ... 349 - 1023
Tag	CP gives deconcentrated inlet/outlet	0
	CP gives concentrated inlet/outlet and Tag=sequential number of CG within Input Concentration Map	1 - 12

IWD defined value range:

y		0 - 16
mi		2 - 17
CCP		
	CCP number	0, 4, ... 1020
	Reserved	1- 3, 5 - 7, ... 1021 - 1023
Tag	CP gives deconcentrated inlet/outlet	0
	CP gives concentrated inlet/outlet and Tag=sequential number of CG within Input Concentration Map	1 - 16

44.4.5 Extended Range Indicator

BTS-supported parameter range:

ERI: 0 (extended range off)

IWD-defined value range: 0 - 1

© Ericsson Radio Systems AB
— All Rights Reserved —

44.4.6 External Condition Map Class 1

BTS-supported value ranges:

LAPD Q CG:	0
L/R TI:	0 - 1
L/R SWI:	0 - 1
TRA:	0 - 1
PCM SYNC:	0 - 1
EXT SYNC:	0
IWD-defined value range:	0 - 1

44.4.7 External Condition Map Class 2

BTS-supported value ranges:

RBS DOOR:	0 - 1
LAPD Q CG:	0
EXT SYNC:	0
PCM SYNC:	0 - 1
IWD-defined value range:	0 - 1

44.4.8 File Relation Indication

BTS-supported value ranges:

Other state:	0, 3
IWD-defined value range:	0 - 3

Note: There are limitations for specific combinations of current state and other state.

44.4.9 FN Offset

FN (Frame Number) Offset must be equal for all TSs within a TRX. Configuration of FN Offset on one TS will also reconfigure all previously configured TSs on that TRX, provided that no TS within the TRX is enabled.

BTS-supported value range:

FN offset:	0 - 1023 $(03FF)_{hex}$
IWD-defined value range:	0 - 1325 $(052D)_{hex}$

© Ericsson Radio Systems AB
— All Rights Reserved —

44.4.10 Frequency List

BTS-supported value range:

ARFCN 900 MHz: $1 - 124_{(dec)}$

ARFCN 1800 MHz: $512 - 885_{(dec)}$

ARFCN 1900 MHz: $512 - 810_{(dec)}$

IWD-defined value range:

ARFCN 900 MHz: $1 - 124_{(dec)}$

ARFCN 1800/1900 MHz: $512 - 885_{(dec)}$

Note: Frequency channel number should be defined in steps of two to prevent interference between two nearby channels.

44.4.11 Frequency Specifier RX

BTS-supported value range:

ARFCN 900 MHz: $1 - 124_{(dec)}$

ARFCN 1800 MHz: $512 - 885_{(dec)}$

ARFCN 1900 MHz: $512 - 810_{(dec)}$

IWD-defined value range:

ARFCN 900 MHz: $1 - 124_{(dec)}$

ARFCN 1800/1900 MHz: $512 - 885_{(dec)}$

Note: Frequency channel number should be defined in steps of two to prevent interference between two nearby channels.

44.4.12 Frequency Specifier TX

BTS-supported value range:

ARFCN 900 MHz: $1 - 124_{(dec)}$

ARFCN 1800 MHz: $512 - 885_{(dec)}$

ARFCN 1900 MHz: $512 - 810_{(dec)}$

IWD-defined value range:

ARFCN 900 MHz: $1 - 124_{(dec)}$

ARFCN 1800/1900 MHz: $512 - 885_{(dec)}$

Note: Frequency channel number should be defined in steps of two to prevent interference between two nearby channels.

© Ericsson Radio Systems AB
— All Rights Reserved —

44.4.13 IS Connection List

BTS-supported value range:

ICP: $4 - 127_{(dec)}$
$256 - 351_{(dec)}$
$512 - 711_{(dec)}$

CI: $1 - 72_{(dec)}$

The IWD-defined value ranges:

ICP: $0 - 1023_{(dec)}$

CI: $1 - 255_{(dec)}$

Note: There are limitations for specific combinations. For more information see figure in appendix.

44.4.14 Local Access State

BTS-supported value range:

Local Access State parameter: 0

IWD-defined value range: 0 - 1

44.4.15 MO Identifier

Table 82 BTS-supported/IWD-defined value range

MO class	**BTS-supported value (hex)**		**IWD-defined value (hex)**	
		Instance number		**Instance number**
TRXC	01	00 - 0B	01	00 - 0F
TX	0B	00 - 0B	0B	00 - 0F
RX	0C	00 - 0B	0C	00 - 0F

44.4.16 MO State

Table 83 BTS-supported codes

Code	**MO State Parameter**	**Used by MO**
00	Reset	CF, IS, TRXC, RX, TF, TS, TX, DP
01	Started	CF, TRXC
02	Enabled	IS, RX, TF, TS, TX, DP
03	Disabled	IS, RX, TF, TS, TX, DP

IWD-defined value range: 00 - 03

© Ericsson Radio Systems AB
— All Rights Reserved —

44.4.17 Power

BTS-supported value range:

Nominal power parameters:

900 MHz: $21 – 33_{(dec)}$

1800 MHz: $21 – 33_{(dec)}$

1900 MHz: $21 - 33_{(dec)}$

IWD-defined value range: $0 - 63_{(dec)}$

Note: Only steps by 2 is configurable (from the highest value).

44.4.18 Result Code

BTS-supported codes:

Wrong state or out of sequence: 02

File error: 03

Fault unspecified: 04

Protocol error: 06

MO not connected: 07

IWD-defined value range: 01 - 0A

44.4.19 TCH Capabilities

BTS-supported value:

Cross Combination Indicator: 127

IWD-defined value range: 0, 127

44.4.20 TF Mode

BTS-supported code:

TF mode parameter: 1 (= stand-alone)

IWD-defined value range: 00 - 02, FF

© Ericsson Radio Systems AB
— All Rights Reserved —

44.5 Appendix

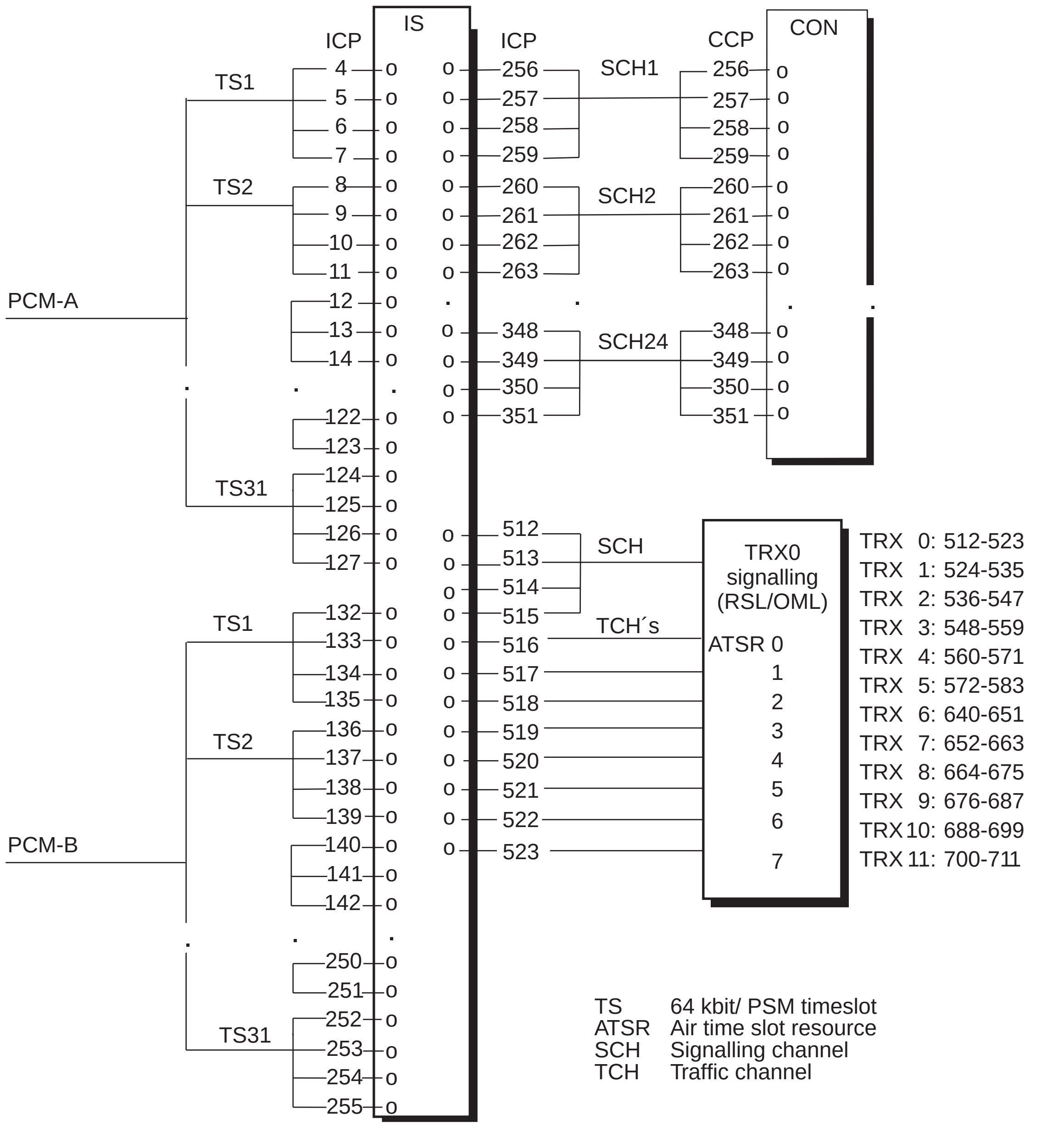

Figure 47 Physical mapping of entities and ICP/CCP

Note: TS25 - TS31 are only applicable for 2048 kbit/s systems

Each ICP (IS Connection Point) or CCP (CON Connection Point) represents a 16 kbit/s connection point. They are numbered from 4 to 711. A 16 kbit/s channel is established by connecting two ICPs to each other. A 32 or 64 kbit/s signalling channel is established by connecting two or four pairs of consecutive ICPs to each other. The consecutive ICPs must belong to the same TS or SCH.

© Ericsson Radio Systems AB
— All Rights Reserved —

This page is intentionally left blank

© Ericsson Radio Systems AB
— All Rights Reserved —

45 Glossary

This glossary lists abbreviations and acronyms used in texts dealing with RBS 2301. Some basic terms and acronyms needed for cross-references are included in the list.

In the RBS manuals, terminology defined by GSM is used together with terms related to Ericsson and the CME 20 and CMS 40 projects.

Terms and Abbreviations

An arrow -> is used to indicate a reference to another entry in this list.

AAU	Active Antenna Unit
Abis	GSM interface standard defining attributes of the communication between BSC and BTS.
AC	Alternating Current
A/D converter	Analog to Digital converter
AIS	Alarm Indication Signal
AO	Application Object
ARFCN	Absolute Radio Frequency Channel Number
ARP	Antenna Reference Point
ASIC	Application Specific Integrated Circuit
Astra	ASIC in the TRU
BCCH	Broadcast Control CHannel Downlink only broadcast channel for broadcast of general information at a base station, on a base station basis.
BER	Bit Error Rate
BSC	Base Station Controller GSM network node for control of one or more BTSs.
BSCSim	Base Station Controller Simulator
BSS	Base Station System GSM network logical unit comprising one BSC and one or more BTSs.
BTS	Base Transceiver Station GSM network unit operating on a set of radio frequency channels in one cell.

© Ericsson Radio Systems AB
— All Rights Reserved —

Burst	A portion of digital information, the physical content, that is transferred within the time interval of one time slot.
CAN	Canada
Cabinet	The physical housing of a base station.
Cascade connections	Connection of several cabinets by the PCM cable. Similar to serial connection. -> Cascading
Cascading	Connection of several cabinets by the PCM cable. Similar to serial connection. -> Cascade connections
CCCH	Common Control CHannel Channel combining the following common control channels: PCH Paging CHannel RACH Random Access CHannel AGCH Access Grant CHannel
CDU	Combining Distribution Unit
Cell	An area of radio coverage identified by the GSM network by means of the cell identity.
CF	Central Functions
Channel	The common term channel denotes the virtual connection, consisting of physical and logical channels between BSS and MS, during a call in progress. -> Logical Channel -> Physical Channel
Channel Combination	A physical channel on an air interface carries a defined set of logical channels.
Channel group	A channel group is a group of dedicated logical channels to a specific MS.
CM	Common Mode
CME 20	Cellular Mobile Europe —CME 20 Ericsson digital land mobile telecommunication system based on the GSM standards. —CME 201 Ericsson GSM system comprising Ericsson equipment only.

© Ericsson Radio Systems AB
— All Rights Reserved —

CMRU	Central Main Replaceable Unit. Main RU. The RBS is physically connected to the Base Station Controller (BSC) via the CMRU. There is only one CMRU in each RBS.
CMS 40	Cellular Mobile System Ericsson digital land mobile telecommunication system based on the Joint Technical Committee (JTC) specification for PCS 1900.
CPU	Central Processing Unit
CSA	Canadian Standards Association
CSES	Consecutive Severely Errored Second
CSU	Customer Service Unit
Dannie	ASIC in the TRU
DB	DataBase
DC	Direct Current
DCC	Digital Cross Connector
DCS	Digital Communication System International standard for 1800 MHz based on the GSM standard.
DIP	DIgital Path The name of the function used for supervision of the connected PCM lines.
Dixie	ASIC in the TRU
DM	Degraded Minute
DM	Differential Mode
DMRU	Distributed Main Replaceable Unit. If a Main RU is subordinated to the CMRU, it is said to be distributed.
Downlink	Signalling direction, from the system to the MS.
DP	Distribution Panel
DS1	Digital Signal Level 1 (1544 kbit/s)
DSP	Digital Signal Processor

© Ericsson Radio Systems AB
— All Rights Reserved —

DXB	Distribution Switch Board
DXX	Ericsson Cellular Transmission System including NMS
E1	Short for G.703 2048 kbit/s PCM link
EEPROM	Electrically Erasable Programmable Read-Only Memory
EIRP	Effective Isotropic Radiated Power
EMC	Electro Magnetic Compatibility
ES	Errored Second
ESD	ElectroStatic Discharge
ETS	European Telecommunication Standard
EXT	External
FCC	Federal Communications Commission
FDL	Facility Data Link
FS	Function Specification
FSC	Field Support Centre
FU	Filtering Unit
GS	General Specification
GSM	Global System for Mobile communications International standard for a TDMA digital mobile communication system. Originally, GSM was an abbreviation for Groupe Special Mobile, which is a European mobile telecommunication interest group, established in 1982.
GSM 1800	(GSM-based) Digital Communication System 1800 MHz (generic)
GSM 1900	(GSM-based) Digital Communication System 1900 MHz (generic)
HDLC	High level Data Link Control
HDSL	High bit rate Digital Subscriber Line
HLIN	High Level IN
HLOUT	High Level OUT
HW	Hardware

© Ericsson Radio Systems AB
— All Rights Reserved —

HWU	Hardware Unit An HWU consists of one or more SEs. An HWU is a functional unit within the RBS. The HWU is either active (equipped with a processor) or passive (without processor).
ID	Identification
IDB	Installation DataBase
IEC	International Electric Commission
INT	Internal
IS	Interface Switch
I1A	Internal Fault Map Class 1A
I1B	Internal Fault Map Class 1B
I2A	Internal Fault Map Class 2A
JTC	Joint Technical Committee
LAPD	Link Access Procedures on D-channel LAPD is the data link layer (layer 2) protocol used for communication between the BSC and the BTS on the Abis interface. Abis layer 2 is sometimes used synonymously with LAPD.
LBO	Line Build Out
LED	Light Emitting Diode
LLB	Line Loop Back
LNA	Low Noise Amplifier
Local bus	The local bus offers communication between a central main RU (DXU) and distributed main RUs (TRU and ECU).
Local mode	When the RU is in RU mode Local it is not prepared for BSC communication.
Local/Remote switch	Using the Local/Remote switch, an operator orders the RU to enter Local or Remote mode.
LOF	Loss Of Frame
Logical Channel	A logical channel represents a specified portion of the informationcarrying capacity of a physical channel.

© Ericsson Radio Systems AB
— All Rights Reserved —

	GSM defines two major categories of logical channels: TCHs Traffic CHannels, for speech or user data CCHs Control CHannels, for control signalling. -> Physical Channel -> Channel Combination
Logical RU	A unit which can be referred to, but is not a single physical unit. There are three different kinds of logical RUs: 1. Buses 2. Antennas 3. Environment
LOS	Loss Of Signal
LVF	Low Voltage Filter
MADT	Mean accumulated downtime
Main RU	A main replaceable unit is a replaceable unit that contains one or more processors, to which software can be downloaded from the BSC.
MHS	Modification Handling System Ericsson trouble report database
MMI	Man-Machine Interface
MO	Managed Object
MRT	Mean repair time
MS	Mobile Station
MTBF	Mean Time Between Failure
MTBCF	Mean Time Between Catastrophe Failure
NCS	National Colour System
NMS	Ericsson Network Management System in DXX
Nominal Power	The nominal power is the power level defined when configuring the transceiver.
O&M	Operation and Maintenance

© Ericsson Radio Systems AB
— All Rights Reserved —

	General term for activities such as configuration, utilization of channels (frequency bands), cell planning, system supervision, hardware and software maintenance, subscriber administration, etc.
OMC	Operation and Maintenance Centre
OMT	Operation and Maintenance Terminal The OMT is a terminal that supports functions for handling the RBS on site. The terminal can be a portable PC.
Operation	Operation is the normal, everyday running of the RBS with full functionality.
OPI	OPerational Instructions
PA	Power Amplifier
PAM	Power Amplifier Module
PBA	Printed Board Assembly
PBC	Power and Battery Cabinet
PC	Personal Computer
PCH	Paging CHannel Downlink only subchannel of CCCH for system paging of MSs. -> CCCH
PCM	Pulse Code Modulation
PCS	Personal Communication Services
PFWD	Power Forward
Physical Channel	An air interface physical channel carries one or more logical channels. A physical channel uses a combination of frequency and time division multiplexing and is defined as a sequence of radio frequency channels and time slots. -> TDMA frame -> Logical channel
PIN	Personal Identification Number
PLB	Payload Loop Back
PREFL	Power Reflected
PSU	Power Supply Unit

© Ericsson Radio Systems AB
— All Rights Reserved —

RACH	Random Access CHannel Uplink only subchannel of CCCH for MS request for allocation of a dedicated channel. -> CCCH
RAI	Remote Alarm Indication
RAM	Random Access Memory
RBS	Radio Base Station All equipment forming one or more Ericsson base stations. ->BTS
RBS 2000	New RBS generation
Remote mode	When the RU is in RU mode Remote, a link is established between the BCS and the central main RU.
RF	Radio Frequency
RLC	Repair Logistic Centre
R-state	Release state
RTN	Return
RU	Replaceable Unit An RU consists of one or more HWUs. An RU may be replaced by another RU of the same type. The RU is the smallest unit that can be handled on site.
RX	Receiver
RXA	Receiver antenna branch A
RXB	Receiver antenna branch B
RXDA	Receiver Divider Amplifier
RXQUAL	Measure of signal quality as defined in GSM 05.08:8.2.4
RXU	Reciver Unit
SES	Severely Errored Second
SO	Service Object
Sub RU	A sub-replaceable unit is always connected to a superior Main RU. This

© Ericsson Radio Systems AB
— All Rights Reserved —

	connection is used for example for retrieval of the RU identity. A sub-RU normally does not have a processor. Note that an RU with a processor that is not loadable is classified as a sub-RU.
SW	Software
SWR	Standing Wave Ratio
SYNC	Synchronous
T1	Transmission facility for DS1 (1544 kbit/s).
TCB	Tranceiver Control Board
TCH	Traffic CHannel The traffic channels carry either encoded speech or user data.
TDMA	Time Division Multiple Access Multiplexing of several channels in a common frequency band. Each channel is assigned a certain time division, a time slot.
TDMA frame	GSM air interface time frame comprising eight time slots.
TEI	Terminal Endpoint Identifier TEI is an identification code carried by a LAPD frame as a terminal connection endpoint within a Service Access Point (SAP).
TEMS	TEst Mobile Station
TF	Timing Function
TG	Transceiver Group
Timing bus	The timing bus carries air timing information from the timing unit in the DXU to the TRUs.
TM	Transport Module
TMA	Tower Mounted Amplifier
TN O&M	Transport Network Operation and Maintenance (in general).
Tora	ASIC in the TRU
TRA	Transcoder Rate Adapter

© Ericsson Radio Systems AB
— All Rights Reserved —

	The TRA Unit in BSC performs transcoding of speech information and rate adaption of data information.
Tracy	ASIC in the TRU
TRX	Transceiver
TS	Time Slot A 0.577 ms period (TDMA frame subunit) corresponding to 156.25 raw bits of information. The eight time slots of each TDMA frame are numbered 0...7. -> Burst
TT	Total Time
TX	Transmitter
TXU	Transmitter Unit
UAS	Unavailable Seconds
UL	Underwriters Laboratories Inc.
Uplink	Signalling direction, from the MS to the system.
UPS	Uninterrupted Power Supply
VCO	Voltage Controlled Oscillator
VSWR	Voltage Standing Wave Ratio RF signal measure. The quotient between transmitted and reflected power.
X bus	The X bus carries transmit air data frames between trancievers. This is used for baseband frequency hopping.

© Ericsson Radio Systems AB
— All Rights Reserved —