P007551A

Ericsson GSM System, BSS R8

RBS 2206

Reference Manual

ERICSSON

EN/LZT 720 0008 R1A

RBS 2206 Reference Manual

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

Contents

1 Preface

This Reference Manual is valid for the Ericsson GSM system BSS R8.

For the RBS 2000 library structure, *see Figure 1 on page 14*.

1.1 Objectives

This manual is a detailed overview of the Ericsson RBS 2000 Macro system based on 12–TRX cabinets for GSM 900, GSM 1800 and GSM 1900. The manual describes RBS 2206, and comprises the following:

- Preface (chapter 1)
- RBS 2000 General information (chapters 2 – 3):

  System Specifications and Requirements.
- RBS 2000 Hardware descriptions (chapters 4 – 5):

  System overviews and hardware configurations.
- Unit descriptions (chapters 6 – 14)
- Function Specifications (chapters 15 – 51):

  Provide detailed information about the RBS from a functional point of view. The Function Specifications are customer-adapted and give a deeper understanding of the behaviour of the RBS.
- BTS Parameter Limitations (chapter 52):

  State 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 chapter.
- Glossary (chapter 53)

1.2 Target Groups

Customers and Ericsson personnel involved in RBS activities.

1.3 RBS 2000 Library Overview

1.3.1 Outdoor RBS

The Customer Product Information (CPI) for dTRU based RBS 2000 Macro cabinets consists of the following manuals:

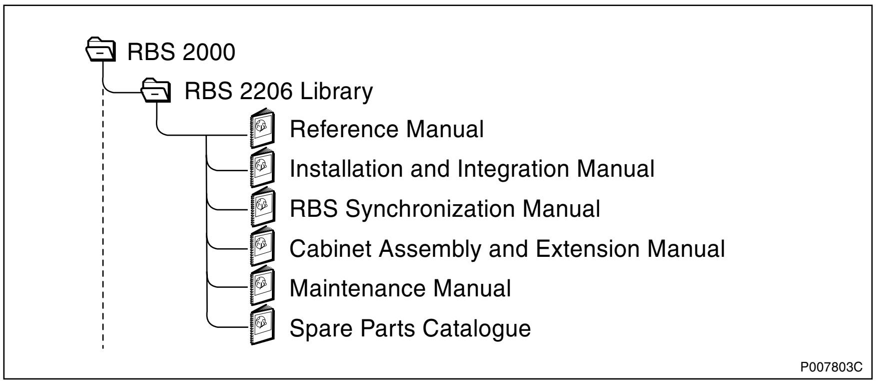

Figure 1 The CPI for the RBS 2206 Macro 12–TRX cabinet

1.4 How to Order CPI

CPI can be ordered in the same way as all other Ericsson products using the product number to identify each product. Orders can be placed through any local Ericsson company, or alternatively, on the Internet. How operators and customers and Ericsson companies order CPI is described in detail below.

1.4.1 Outside Ericsson

To place an order for CPI, contact any Ericsson company and follow the same procedure as with all other Ericsson products.

The most up-to-date CPI can be downloaded from the Extranet by customers and contractors that have obtained access by visiting Ericsson's Extranet e-business site. See access information below.

How to Obtain Access to the Extranet

Access is granted by the Key Account Manager (KAM) from your local Ericsson company. The Extranet address is:

https://ebusiness.ericsson.net

To be able to access the Extranet site you need to ensure that:

- your company allows access to secure sites (HTTPS) through its firewall.
- your PC has either Microsoft Internet Explorer 4.01 with SP2 or later, or Netscape navigator 4.61 or later.
- your browser has the plug-ins necessary to view or download PDF and Microsoft office files.

If you are unsure of any of these preconditions, please check with your local IS/IT Support or help desks within your company.

The Access Process

- To access the site you must have an individual user name and password. To request access, send an e-mail to the support centre **asq.ex@era.ericsson.se** stating your name, telephone number, e-mail address and with which customer or Ericsson company you work.

Once your access is setup, a reply with all the details you need will be sent to you.

Alternatively, you can download the Portal Order form from the Extranet.

- The first time you log in to the site, we recommend you to read the user instructions.

More information about Extranet can be found at the Extranet address below. For support on issues related to the Extranet,
Tel.: +46 8 585 33085.

1.4.2 Inside Ericsson

The Intranet is an internal Ericsson web that can only be accessed by Ericsson personnel.

All CPI products are available on the Intranet at CPI Store:

http://cpistore.ericsson.se

Ericsson personnel, who may require access to CPI while operating outside Ericsson's firewall, can get more information about Extranet access from the following address:

http://inside.ericsson.se/ebusiness/

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2 Product Safety Requirements RBS 2000

The purpose of this document is to specify the product safety requirements for RBS 2000.

2.1 References

73/23/EEC	Low Voltage Directive
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
EN 60950	Safety of Information Technology Equipment Including Electrical Business Equipment
IEC 215	Safety requirements for radio transmitting equipment
IEC 529	Classification of degrees of protection provided by enclosures (IP Code)
IEC 60950	Safety of Information Technology Equipment Including Electrical Business Equipment
UL 1419	Standard for Professional Video and Audio Equipment
UL 1950	Safety of Information Technology Equipment Including Electrical Business Equipment

2.2 Product Safety

This part of the document defines the Electrical, Mechanical, Heat and Fire Safety Requirements for the Radio Base Station.

General

The RBS is designed to comply with the following International Standards:

- 73/23/EEC Low Voltage Directive. (To achieve this, the RBS shall conform to the standards below.)
- EN 60950 "Safety of Information Technology Equipment Including Electrical Business Equipment".
- The RBS fulfils the requirements in the general IEC 60950 including national differences notified in EN 60950.
- IEC 215 Safety requirements for transmitting equipment.
- The RBS shall be listed by National Recongnized Testing Laboratory (NRTL).
- The RBS fullfills encapsulation class IP XX according to IEC 529.

In addition to this the product fulfills the environmental requirements.

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 protected against serious fire originating in the equipment as well as mechanical hazards in the equipment, as well as mechanical hazards in the meaning of the applicable standard.

For the US the following standards are applicable:

- UL 1950 "Safety of Information Technology Equipment Including Electrical Business Equipment".

For Canada the following standards are applicable:

- CAN/CSA-C22.2 No 1-M94 Audio, Video and Similar Electronic Equipment.

2.2.1 Declaration of Conformity

Tests and inspections shall be carried out according to ECMA requirements.

3 Environmental Capabilities

3.1 Scope

This chapter covers the environmental requirements for the indoor and outdoor temperature non-controlled operation conditions. Subjects covered are: Climatic, Biological, Chemically active substances, Mechanically active substances and Mechanical conditions.

3.2 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.

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.

3.3 References

IEC 721-3-..	Classification of groups of environmental parameters and their severities.
ETSI 300 019-1-..	Classification of environmental conditions.

3.4 Transport -40°C - +70°C

3.4.1 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 aircrafts with pressure cabins. As modern aircrafts have pressure cabins, these limitations are expected to be only formal.

Note: The severity levels are chosen with equipped cabinets in mind. Therefore transport of equipment outside the cabinets can result in extremes. These extremes shall be handled by its own packing.

3.4.2 Climatic conditions

During transportation the equipment could be exposed to extremes in temperature and humidity. The equipment shall be packaged. The equipment shall be operational after being subjected to the ambient temperature and humidity stated hereafter.

The severity of these requirements are in conformity with: IEC 721-3-2 class 2K4. and ETS 300 019-1-2 Class 2.3.

Requirements

Table 1

Environmental Parameters	Unit	Value
Temperature	°C	- 40- +70
Relative Humidity	%	5-100

3.4.3 Biological conditions.

The severity of these requirements is in conformity with: IEC 721-3-2 class 2B2. and ETS 300 019-1-2 Class 2.3.

3.4.4 Chemically Active Substances.

The severity of these requirements is in conformity with: IEC 721-3-2 class 2C2. and ETS 300 019-1-2 Class 2.3.

Note: The values are average yearly levels of airborne contaminants that can be accepted. It is assumed that one of the contaminants is dominant at each site, and that the other is present in insignificant amounts.

3.4.5 Mechanically active substances

The severity of these requirements is in conformity with: IEC 721-3-2 class 2S2. and ETS 300 019-1-2 Class 2.3.

3.4.6 Mechanical conditions

The packing and transport method shall be chosen in order not to expose the equipment to stress beyond these limits. The equipment shall function as specified when installed after test.

The severity of these requirements is in conformity with: IEC 721-3-2 class 2M2. and ETS 300 019-1-2 Class 2.3.

Requirements

Table 2

Environmental Parameters		Unit	Value		
Vibration sinus:					
	displacement	mm	3.5		
	acceleration	m/s²		10	15
	frequency	Hz	2-9	9-200	200-500
Random ASD:		m^2/s^3		1.0	
	acceleration	m/s²		12.0	
	frequency	Hz		2-200	
Shock:					
	peak acceleration	m/s²		100	
	duration	ms		11	

3.5 Storage -25°C - +55°C

3.5.1 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.

3.5.2 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. and ETS 300 019-1-1 class 1.2

Requirements

Table 3

Environmental Parameters	Unit	Value
Temperature	$^{\circ}$C	- 25 - +55
Relative Humidity	%	10 -100

3.5.3 Biological conditions

The severity of these requirements is in conformity with IEC 721-3-1 class 1B2. and ETS 300 019-1-1 class 1.2

3.5.4 Chemically Active Substances

The severity of these requirements is in conformity with: IEC 721-3-1 class IC2 and ETS 200 019-1-1 Class 1.2.

Note: The values are average yearly levels of airborne contaminants that can be accepted. It is assumed that one of the contaminants is dominant at each site, and that the other is present in insignificant amounts.

3.5.5 Mechanically Active Substances

The severity of these requirements is in conformity with: IEC 721-3-1 class 1S3. and ETS 300 019-1-1 Class 1.2.

3.5.6 Mechanical Conditions

The packing and transport method shall be chosen in order not to expose the equipment to stress beyond these limits. The equipment shall function as specified when installed after test.

The severity of these requirements is in conformity with: IEC 721-3-1 class 1M2. and ETS 300 019-1-1 Class 1.2.

Requirements

Table 4

Environmental Parameters		Unit	Value	
Vibration sinus:				
	displacement	mm	3.5	
	acceleration	m/s^2		10
	frequency	Hz	2-9	9 -200
Shock:				
	peak acceleration	m/s^2	40	
	duration	ms	22	

3.6 Handling -40°C - +70°C

3.6.1 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.

3.6.2 Climatic conditions

During handling the equipment withstands the conditions stated in Section 3.4.2 on page 20 in this document.

3.6.3 Biological conditions.

During Handling the equipment withstands the conditions stated in Section 3.4.3 on page 20 in this document.

3.6.4 Chemically active substances

During Handling the equipment withstands the conditions stated in Section 3.4.4 on page 20 in this document.

3.6.5 Mechanically active substances

During Handling the equipment withstands the conditions stated in Section 3.4.5 on page 21 in this document.

3.6.6 Mechanical conditions

The equipment shall endure stresses normal for handling, during handling the equipment withstand the conditions stated in Section 3.4.6 on page 21in this document.

3.7 Operation Indoor +5°C - +40°C

3.7.1 General Conditions

The severity of these requirements is in conformity with: IEC 721-3-3 classes 3K3/3Z2/3Z4/3B1/3C2(3C1)/3S2/3M1. and ETS 300 019-1-3 Class 3.1 "TEMPERATURE-controlled locations".

This clause refers to the environment which an RBS for indoor use shall endure.

Note: The different operating temperature levels according to Safe function and Non destruction, refer to situations where the RBS is supposed to have been operating in "normal condition" mode for a certain time. Then the surrounding temperature in the compartment increases (decreases) according to this figures. Accordingly, this means that the surrounding temperature is allowed to change within the limits while the RBS still operates and has its own loss of energy.

3.7.2 Climatic conditions.

The severity of these requirements are in conformity with: IEC 721-3-3 classes 3K3/3Z2/3Z4. and ETS 300 019-1-3 Class 3.1.

Table 5

Environmental Parameters	Unit	Value		
		Normal Condition	**Safe funct.**	**Non Destr.**
Temperature	°C	+5- +40	0 - +45	-10 - +55
Relative Humidity	%	5-85	5 - 90	5 - 90

3.7.3 Biological conditions

Requirements

There are no requirements for this condition.

3.7.4 Chemically active substances

The severity of these requirements is in conformity with: IEC 721-3-3 classes /3C2(3C1)/. and ETS 300 019-1-3 Class 3.1.

Note: The values are average yearly levels of airborne contaminants that can be accepted. It is assumed that one of the contaminants is dominant at each site, and that the other is present in insignificant amounts.

3.7.5 Mechanically active substances

The severity of these requirements is in conformity with: IEC 721-3-3 class /3S2/. and ETS 300 019-1-3 Class 3.1.

3.7.6 Mechanical conditions

The severity of these requirements is in conformity with: IEC 721-3-3 class/3MI/. and ETS 300 019-1-3 class 3.1.

Table 6

Environmental Parameters	**Unit**	**Value**	
Vibration sinus:			
displacement	mm	0.6	
acceleration	m/s²		2
frequency	Hz	2-9	9 -200
Vibration random:			
ASD	m^2/s^3	0.1	[1]
ASD	m^2/s^3	0.2	[2]
acceleration	m/s²	3.8	[1]
acceleration	m/s²	5.4	[2]
frequency	Hz	2-200	
Shock:			
peak acceleration	m/s²	40	[3]
duration	ms	11	

[1]Safe function

[2]Non destruction

[3]This requirement belongs to ’Safe function’ with the exemption: performance of the RBS shall be verified as ’no loss of calls

Seismic Exposure

The complete equipped RBS shall be tested for seismic exposure. Deviations shall be reported.

Safe function during seismic exposure. Deviations shall be reported.

Table 7

Test frequency range	1-15 Hz
Required Response Spectrum	RRS
Shape of RRS	as IEC fig 3
Number of time scale histories	1/ testing direction
Duration of time scale histories	35 s
Number of testing directions	3

If necessary there are possibilities to equip the RBS with an optional Seismic Exposure protection device.

3.8 Operation Outdoor -33°C - +40°C

This Environmental class corresponds in full to ’Operation Outdoor -33°C - +45°C’ with the exception of the upper temperature limit.

3.9 Operation Outdoor -33°C - +45°C

The severity of the requirements is in conformity with: IEC 721-3-4 classes 4K2/4Z5/4Z7/4B1/4C2(4C3)/4S2/4M5. and ETS 300 019-1-4 Class 4.1. "NON-WEATHERPROTECTED location", except for the temperature range which is extended to +45°C.

This clause refers to the environment which an RBS for outdoor non-weather protected location shall endure.

The figures below refers to the environment that is surrounding the cabinet and the temperature is the shaded air temperature.

3.9.1 Climatic Conditions

The severity of these requirements is in conformity with: IEC 721-3-4 classes 4K2/4Z5/4Z7. and ETS 300 019-1-4 Class 4.1. In addition to this Ericsson demands more rigorous values than stated by IEC and ETSI above.

The RBS shall be designed for a power loss of max. 48 hours. This applies both to installation and operation.

Table 8

Environmental	**Unit**	**Value**	
Parameters		**Normal Condition**	**Non Destr.**
Temperature	°C	-33 - +45	-40 - +70
Relative Humidity	%	15 - 100	15 - 100

3.9.2 Biological Conditions

The severity of these requirements is in conformity with: IEC 721-3-4 class /4B1/. and ETS 300 019-1-4 Class 4.1.

3.9.3 Chemically Active Substances

The severity of these requirements is in conformity with: IEC 721-3-4 classes /4C2(4C1)/. and ETS 300 019-1-4 Class 4.1.

Note: The values are average yearly levels of airborne contaminants that can be accepted. It is assumed that one of the contaminants is dominant at each site, and that the other is present in insignificant amounts.

3.9.4 Mechanically Active Substances

The severity of these requirements is in conformity with: IEC 721-3-4 class /4S2/. and ETS 300 019-1-4 Class 4.1.

3.9.5 Mechanical Conditions

The severity of these requirements are in conformity with: IEC 721-3-4 class /4M5/. and ETS 300 019-1-4 Class 4.1.

Table 9

Environmental Parameters	Unit	Value		
Vibration sinus:				
displacement	mm	0.6		
acceleration	m/s^2			2
frequency	Hz	2-9		9 -200
no. of sweep cycles			5	
no. of test directions			3	
testing method			IEC 68-2-6	
Vibration random:				
ASD	m^2/s^3		0.1	[1]
ASD	m^2/s^3		0.2	[2]
acceleration	m/s^2		3.8	[1]
acceleration	m/s^2		5.4	[2]
frequency	Hz		2-200	
testing method			IEC 68-2-64	
Shock:		<100 kg	>100 kg	
peak acceleration	m/s^2	250	100	[3]
duration	ms	6	6	
pulse shape			half sine	
no. of shock pulses			500 per direction	
no. of test directions			6	
testing method			IEC 68-2-27	

[1] Safe function

[2] Non destruction

[3] These requirements belong to ’Safe function’ with the exemption: performance of the RBS shall be verified as ’no loss of calls’

Seismic Exposure

The complete equipped RBS shall be tested for seismic exposure. Deviations shall be reported.

Safe function during seismic exposure. Deviations shall be reported.

Table 10

Test frequency range	1-15 Hz
Required Response Spectrum	RRS
Shape of RRS	as IEC fig 3
Number of time scale histories	1/ testing direction
Duration of time scale histories	35 s
Number of testing directions	3

There are possibilities to equip the RBS with an optional Seismic Exposure protection device.

3.10 Operation Outdoor -33°C - +55°C

This Environmental class corresponds in full to 'Operation Outdoor -33°C - +45°C' with the exception of the upper temperature limit.

3.11 Operation Mast Mounted Equipment -33°C - +45°C

This Environmental class corresponds to 'Operation Outdoor -33°C - +45°C' with the exceptions stated below.

Table 11

Environmental Parameters	**Unit**	**Value**	
		Normal Cond.	**Non destruct.**
Temperature	°C	-33 - +45	-40 - +70
Change of temperature	°C/min	6	6
Vibration sinus:			
displacement	mm	3.0	
acceleration	m/s^2		10
frequency	Hz	2 - 9	9 - 200
Vibration random:			
ASD	m^2/s^3	0.5	
frequency	Hz	2 - 200	
duration of exposure	min	30	
no. of test directions	Hz	3	
Fauna	none	Not Appl.	Not Appl.

3.12 Operation Mast Mounted Equipment -33°C - +55°C

This Environmental class corresponds to 'Operation Outdoor -33°C - +55°C' with the exceptions stated below.

Table 12

Environmental Parameters		Unit	Value	
			Normal Cond.	Non destruct.
Temperature		°C	-33 - +55	-40 - +70
Relative humidity		%	5 - 100	5 - 100
Absolute humidity		g/m^3	0.26 -40	0.26 - 40
Change of temperature		°C/min	6	6
Rain temperature		°C	5	5
Vibration sinus:				
	displacement	mm	3	
	acceleration	m/s^2		10
	frequency	Hz	2 - 9	9 - 200
Vibration random:				
	ASD	m^2/s^3	0.5	0.2
	frequency	Hz	2 - 200	200 - 500
Shock:				[1)]
	peak acc.	m/s^2	100	
	duration	ms	11	
Fauna		none	Not Appl.	Not Appl.

[1)] The requirements belong to ’Safe function’ with the exemption: performance of the RBS shall be verified as ’no loss of calls’

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4 Radio Configurations, RBS 2206

This chapter describes the RBS 2206 radio configurations and their performance.

All configurations, especially GSM 1900, are not described in this chapter.

4.1 Introduction

4.1.1 Mobile Telephone System

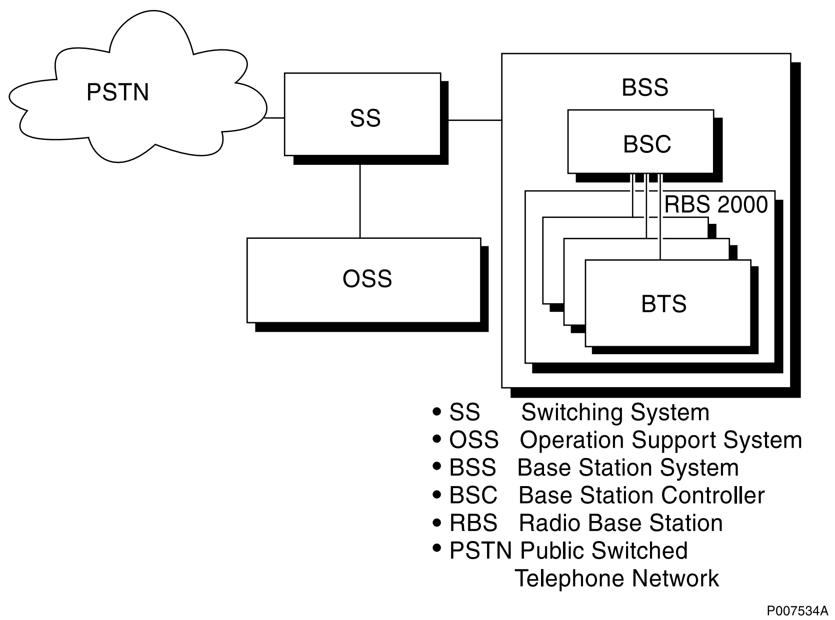

Figure 2 RBS 2000 in the Ericsson GSM system

The Base Station System (BSS) contains two functional entities: the Base Station Controller (BSC) and the Base Transceiver Station (BTS).

The BSC handles radio-related functions, such as handover, management of the radio network resources, and cell configuration data. It also controls radio frequency power levels in RBSs and MSs.

The BTS is a network component which serves one cell and is controlled by the BSC. The BTS contains a number of transceivers. It consists of the radio transceivers and all the digital signal processing equipment. RBS 2000 contains equipment for 1 - 3 BTSs.

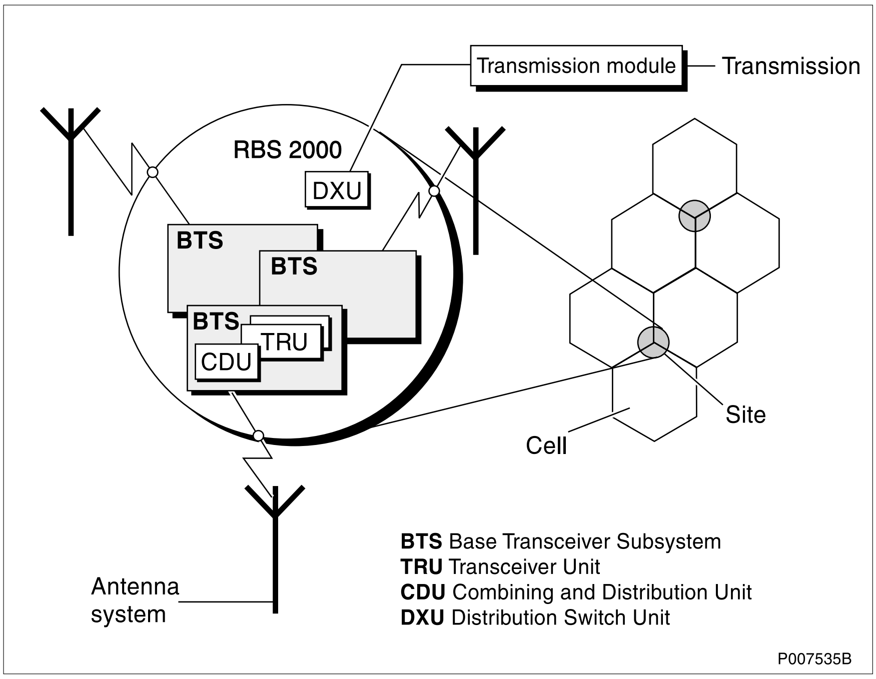

Figure 3 An example of an RBS 2000 servicing a three-cell site

4.1.2 Radio Base Station

The Radio Base Station 2000 (RBS 2000) is Ericsson’s second generation of RBSs developed to meet the GSM specifications for BTSs.

4.2 References

/GSM:05.05/	GSM Requirements 05.05 phase 2+ Radio Transmission and Reception.
/GSM:05.08/	GSM Requirements 05.08 phase 2+ Radio Subsystem Link Control.

4.3 Definitions

Tower Mounted Amplifier (TMA)

The TMA compensates for signal loss in the receiver antenna cables, reduces system noise and improves uplink sensitivity. The TMA can consist of a duplex filter. Duplex is the function that allows communication in two directions (sending and receiving) on one channel.

The TMA used for 12 TRX products is Dual Duplex TMA (ddTMA).

Antenna Reference Point

The antenna reference point is the point where the radio signal crosses the RBS border, that is, the connector for the antenna feeder. See the figure below.

Note: The TMA is inside the RBS border.

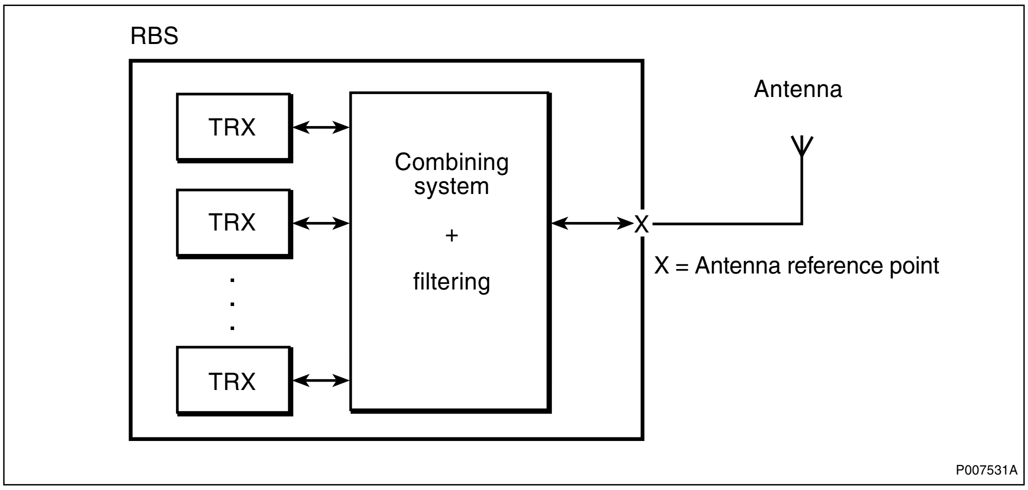

Figure 4 Antenna reference point

Antenna System

The antenna system is constituted by all RF transmission and reception antennas, directed to cover the same area or multi-casting configurations.

Base Transceiver Station (BTS)

A BTS is a unit operating on a set of frequencies in one cell.

Basic Configuration

A basic configuration is a specified set of transceivers, CDUs, and in some cases, TMAs, connected to one antenna system.

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

Variations of a basic configuration may exist, differing in cable lengths. This depends on factors such as implementation in different cabinets.

Radio Base Station (RBS)

An RBS is all equipment in an Ericsson base station, and may be comprised of several BTSs.

Each RBS has one DXU, controlling a maximum of 12 TRXs.

Site/Cell Configuration (SCC)

The SCC is a geographical concept describing how an area around one RBS site is divided into radio traffic areas. The following types of site are defined:

Omni-site	Radio coverage in one 360 degree sector, that is in one area, using one BTS.
2–sector site	Radio coverage in two sectors, that is two distinct areas, using two BTSs.
3–sector site	Radio coverage in three sectors, that is three distinct areas, using three BTSs.

4.3.1 Cabinet Types

RBS 2206	Indoor cabinet with a maximum of six dTRUs/12 TRXs per cabinet

4.3.2 Definition of Configurations

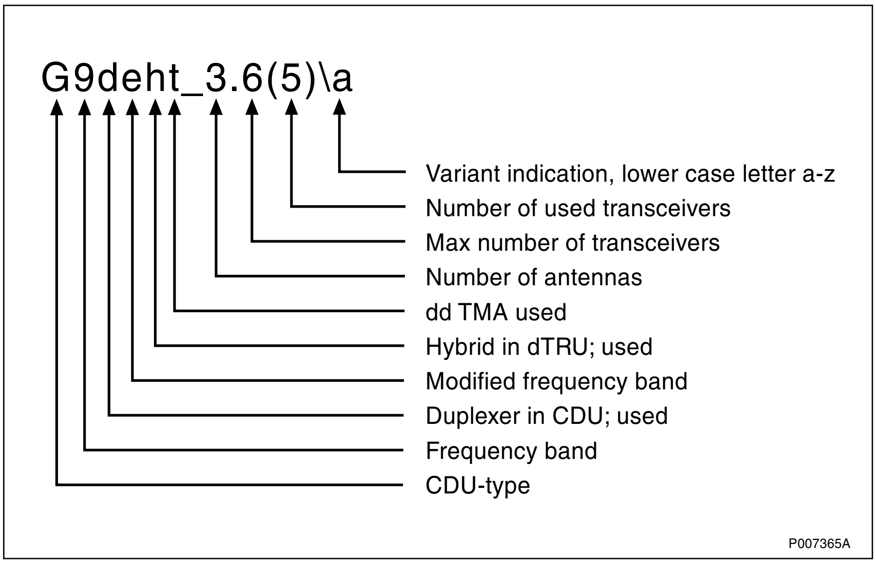

Figure 5 The definition of the basic configuration type refers to CDU type

4.4 Frequency Bands

P-GSM 900	Uplink:	890 – 915 MHz
	Downlink:	935 – 960 MHz
E-GSM 900	Uplink:	880 – 915 MHz
	Downlink:	925 – 960 MHz
GSM 1800	Uplink:	1710 – 1785 MHz
	Downlink:	1805 – 1880 MHz
GSM 1900	Uplink:	1850 – 1910 MHz
	Downlink:	1930 – 1990 MHz

4.5 RF Properties

This section defines the properties of the RF parts integrated in the BTS. The RF parts consist of transceivers and CDUs.

The CDU’s functions are:

- Filters and combines transmitted signals into the same transmit antenna system.

- Filters, amplifies and distributes received signals to receivers belonging to one BTS.

4.5.1 Isolation Values

The RF isolation between the antenna reference points within any configuration is required to be at least 30 dB. *See industry standard / GSM:05.05/.*

4.5.2 RX Description

The receiver system performance is configuration dependent.

Third-Order Intermodulation Products

Receiver sensitivity is reduced when a third-order intermodulation product, generated by the radio transmitters in the RBS, is received at the same ARFCN as the useful signal. This occurs when the distance in frequency between two simultaneous transmitters is chosen in such 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.

The receiver sensitivity reduction due to third-order intermodulation products can be avoided with frequency planning.

No frequency planning is needed for intermodulation products of higher than third-order.

4.6 Basic Configurations

The GSM 900 and GSM 1800 configurations meet the GSM requirements, except where otherwise stated.

The capacity of a configuration is defined at the TX and RX antenna reference points at the RBS border. There is an X close to every reference point in the figures. The RBS border is not included in the figures.

The equivalent output power with SW power boost (TX diversity) configured is the original output power specified for the basic configuration increased with typically 3 dB, if separate TX antennas are used. The configurations that support SW power boost are listed in *Section 4.7.3 SW Power Boost Configurations with CDU-G on page 73*.

Functional views of radio signal paths for various configurations are shown in *Figure 6 on page 36* upto and including *Figure 24 on page 64*. Only components necessary to illustrate the configuration are shown.

In some configurations, the radio signal paths can differ depending on where in the cabinet the basic configuration is used. The figures show fully-equipped cabinets with two or three BTSs, that is two or three basic configurations are shown in the same figure. These are different physical implementations of the same basic configuration, not different configurations. The second BTS is drawn with dotted lines to show how an SCC in a fully-equipped cabinet is connected.

4.6.1 dTRU Topology

Configuration of Hybrid Combiner

The dTRU can be configured with or without the hybrid combiner, using two external cables.

RX Signals Distributed from Two Ports

The RX signals can be distributed from the RX1 and RX2 ports to all four receivers when both transceivers are connected to the same antenna system.

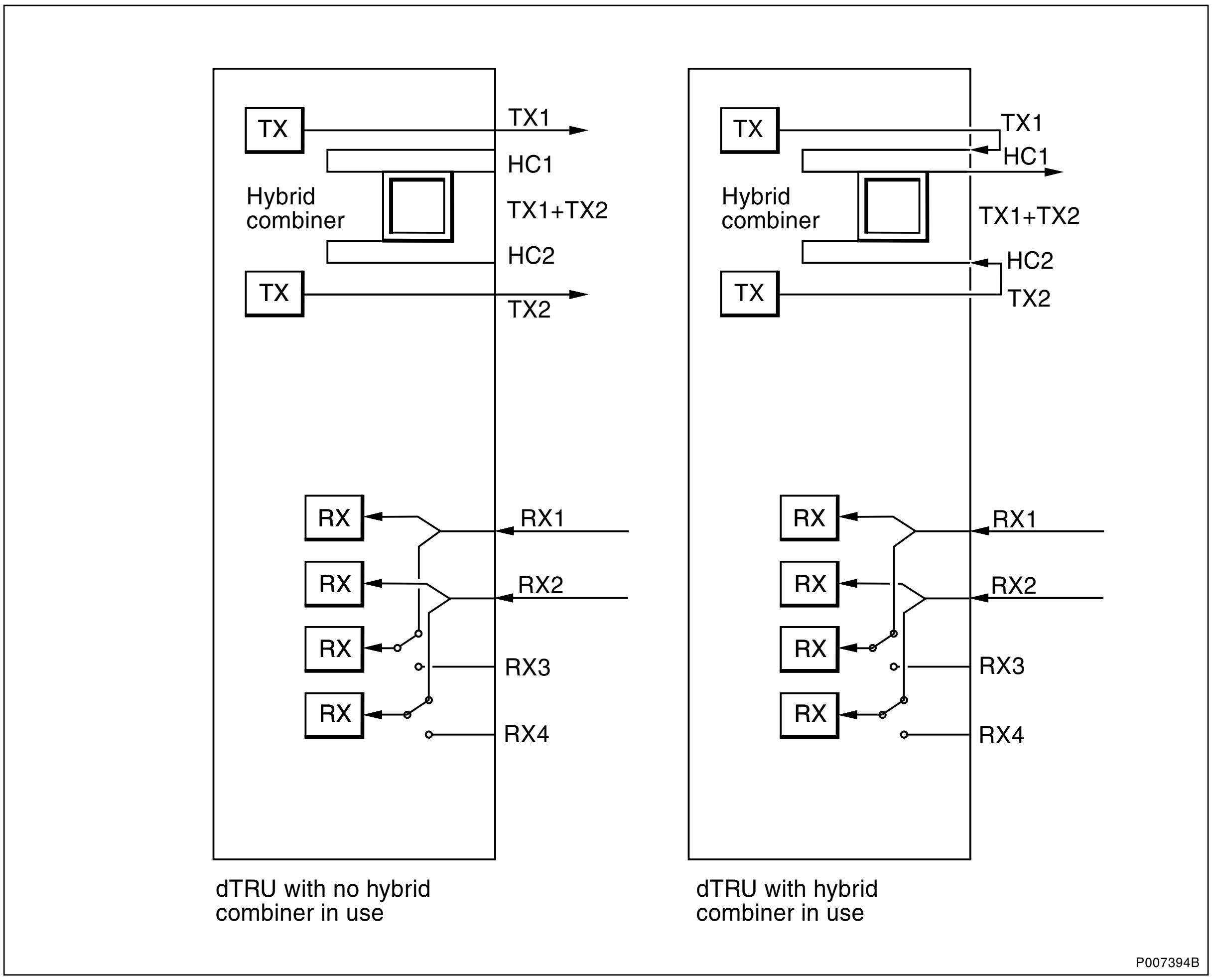

Figure 6 dTRU with and without hybrid combiner in use

4.6.2 CDU-F Configurations

Basic Configuration F9de_2.4 and F18d_2.4

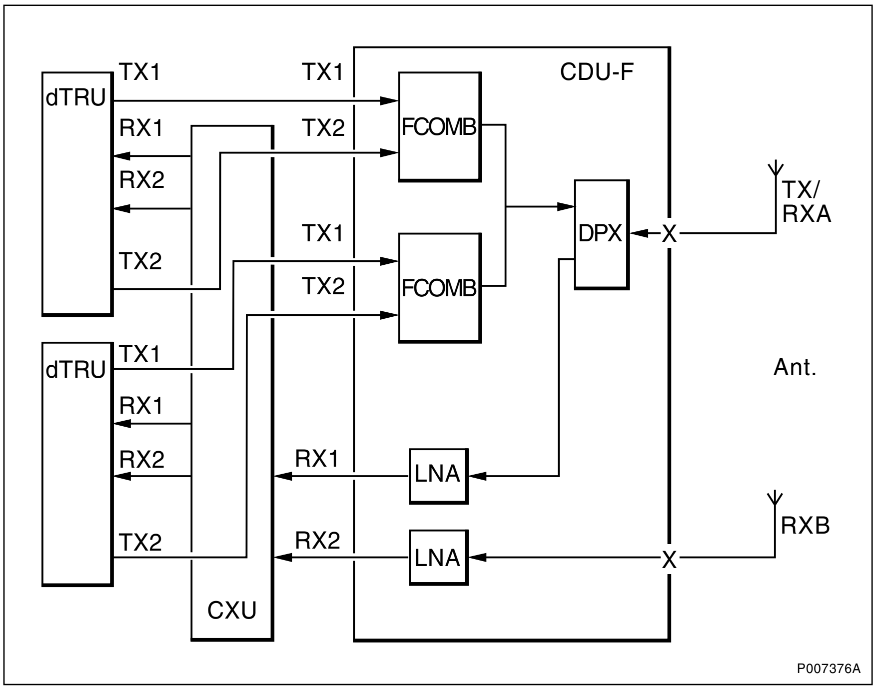

Figure 7 F9de_2.4 and F18d_2.4

Characteristics

Number of CDUs	1	
Frequency band	E-GSM	(F9de_2.4)
	GSM 1800	(F18d_2.4)
Max. number of TRXs	4	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + RX	

Basic Configuration F9det_2.4 and F18dt_2.4

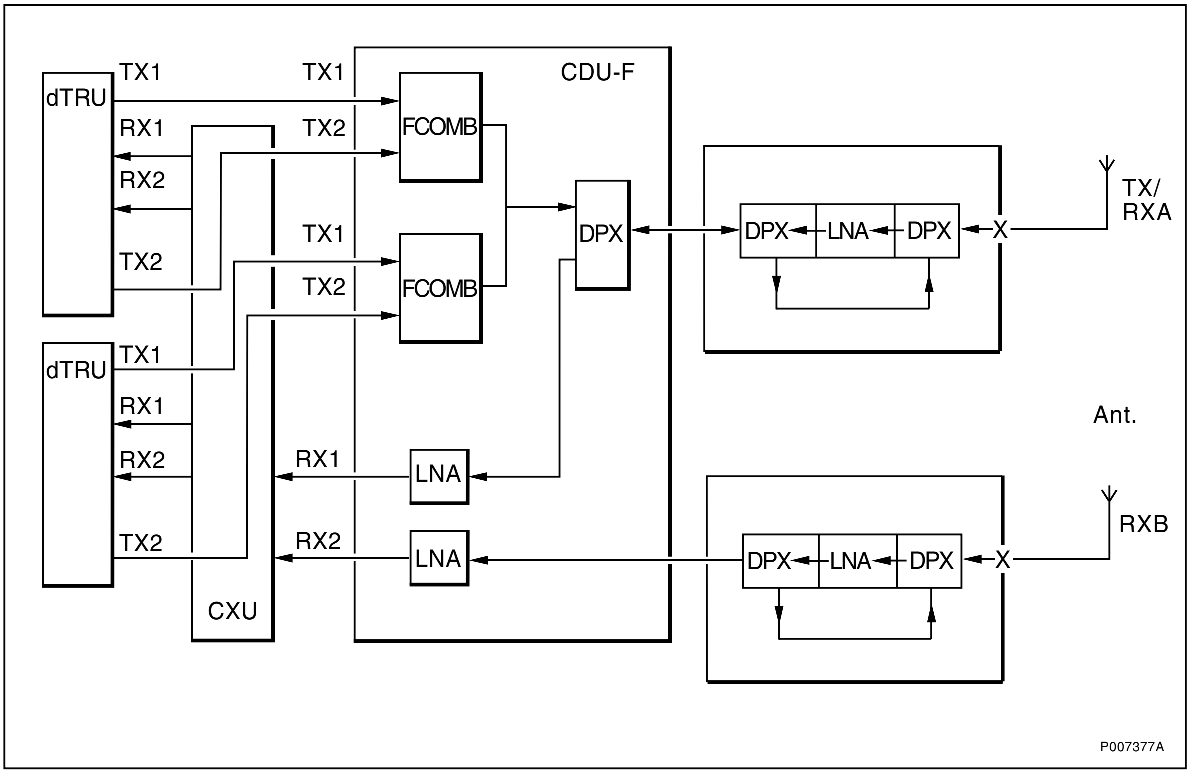

Figure 8 F9det_2.4 and F18dt_2.4

Characteristics

Number of CDUs	1	
Frequency band	E-GSM	(F9det_2.4)
	GSM 1800	(F18dt_2.4)
Max. number of TRXs	4	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + RX	
TMA configuration	ddTMA + ddTMA or ddTMA + rTMA	

Basic Configuration F9de_2.6 and F18d_2.6

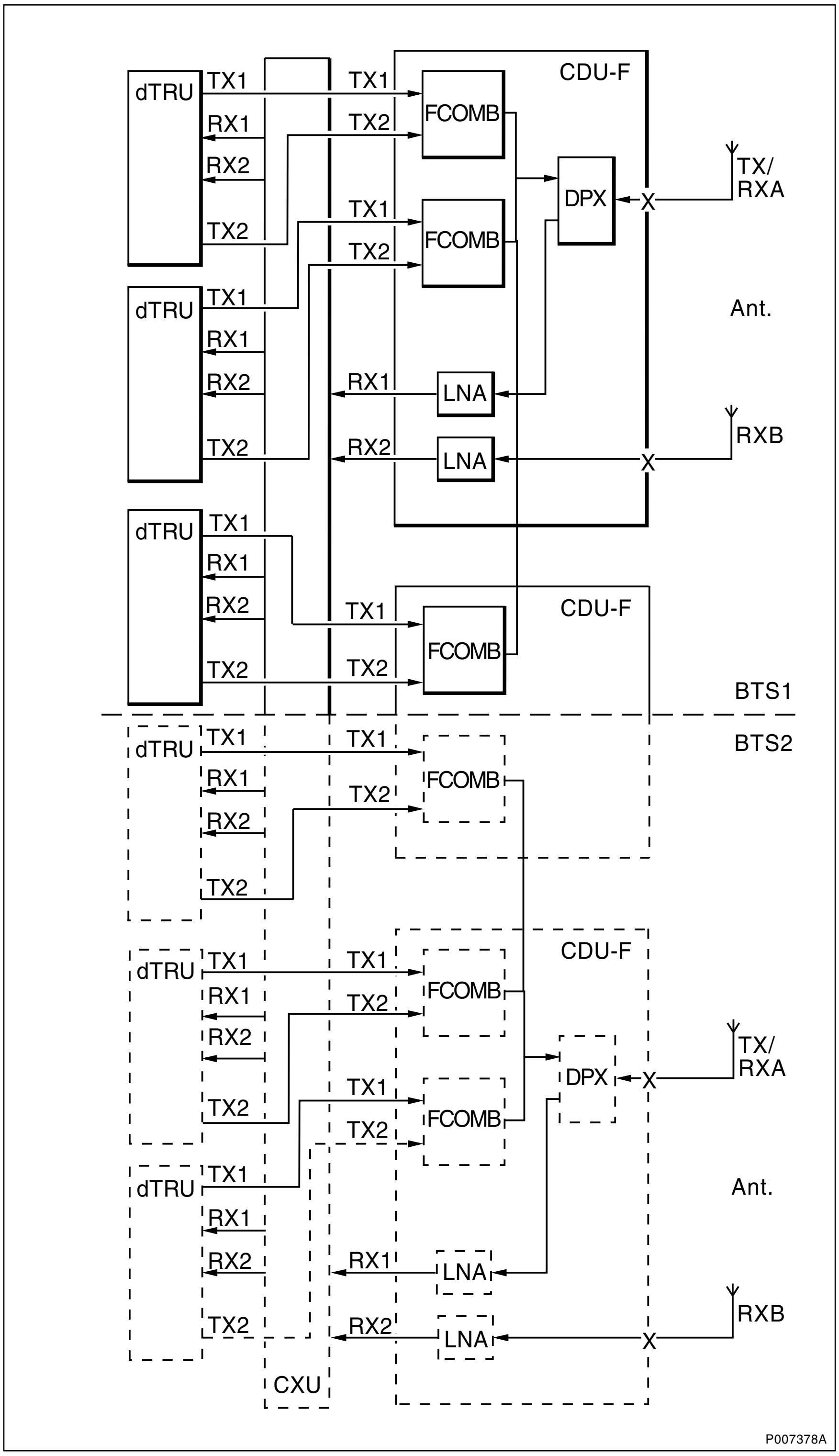

Figure 9 F9de_2.6 and F18d_2.6

Characteristics

Number of CDUs	2*	
Frequency band	E-GSM	(F9de_2.6)
	GSM 1800	(F18d_2.6)
Max. number of TRXs	6	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + RX	

* Three CDU-Fs support two sectors.

Note: The second BTS is only shown to illustrate a 2 x 6 configuration. BTS1 and BTS2 are two different physical implementations of the same basic configuration.

Basic Configuration F9det_2.6 and F18dt_2.6

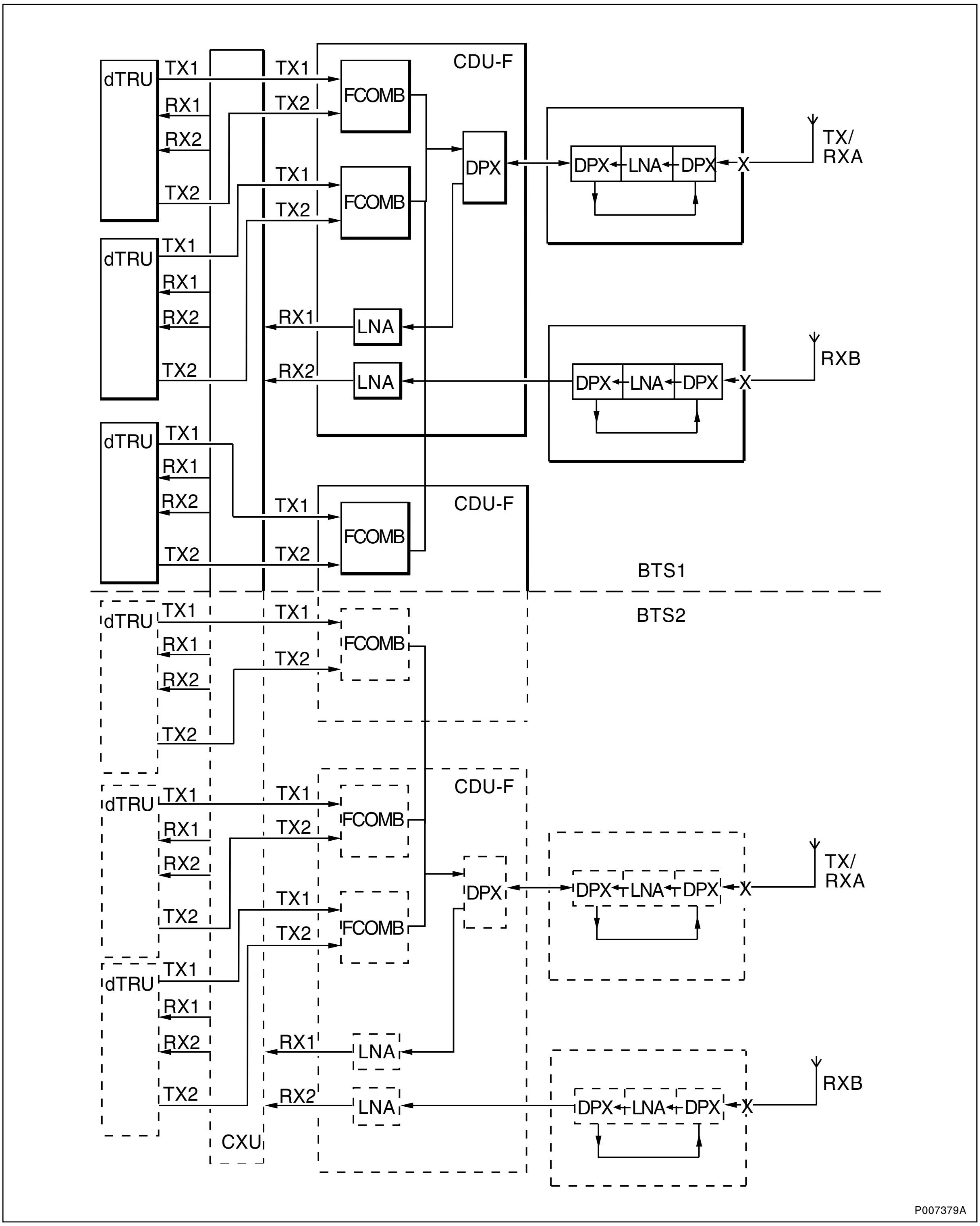

Figure 10 F9det_2.6 and F18dt_2.6

Characteristics

Number of CDUs	2*	
Frequency band	E-GSM	(F9det_2.6)
	GSM 1800	(F18dt_2.6)
Max. number of TRXs	6	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + RX	
TMA configuration	ddTMA + ddTMA or ddTMA + rTMA	

* Three CDU-Fs support two sectors.

Note: The second BTS is only shown to illustrate a 2 x 6 configuration. BTS1 and BTS2 are two different physical implementations of the same basic configuration.

Basic Configuration F9de_2.8 and F18d_2.8

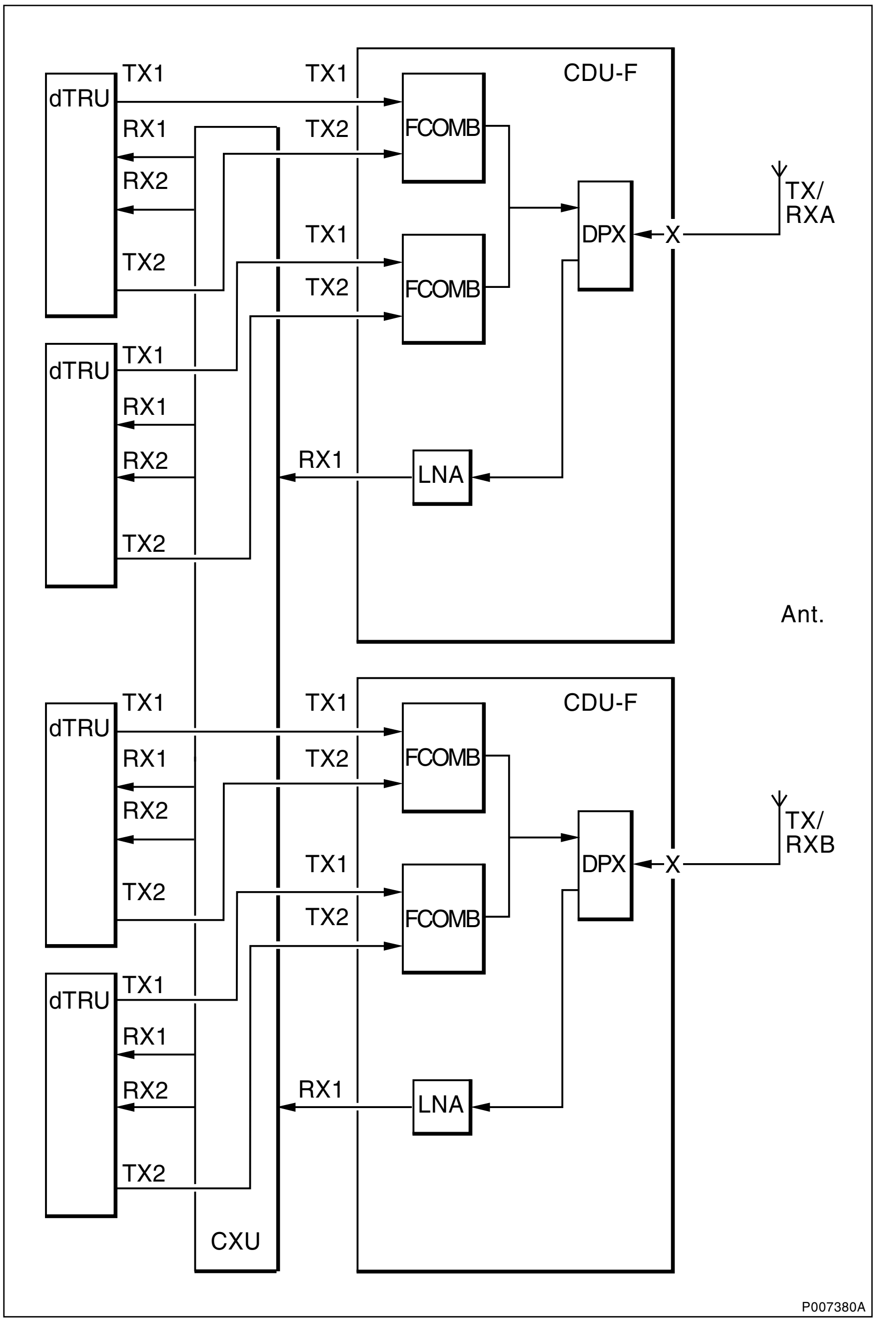

Figure 11 F9de_2.8 and F18d_2.8

Characteristics

Number of CDUs	2	
Frequency band	E-GSM	(F9de_2.8)
	GSM 1800	(F18d_2.8)
Max. number of TRXs	8	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + TX/RX	

Basic Configuration F9det_2.8 and F18dt_2.8

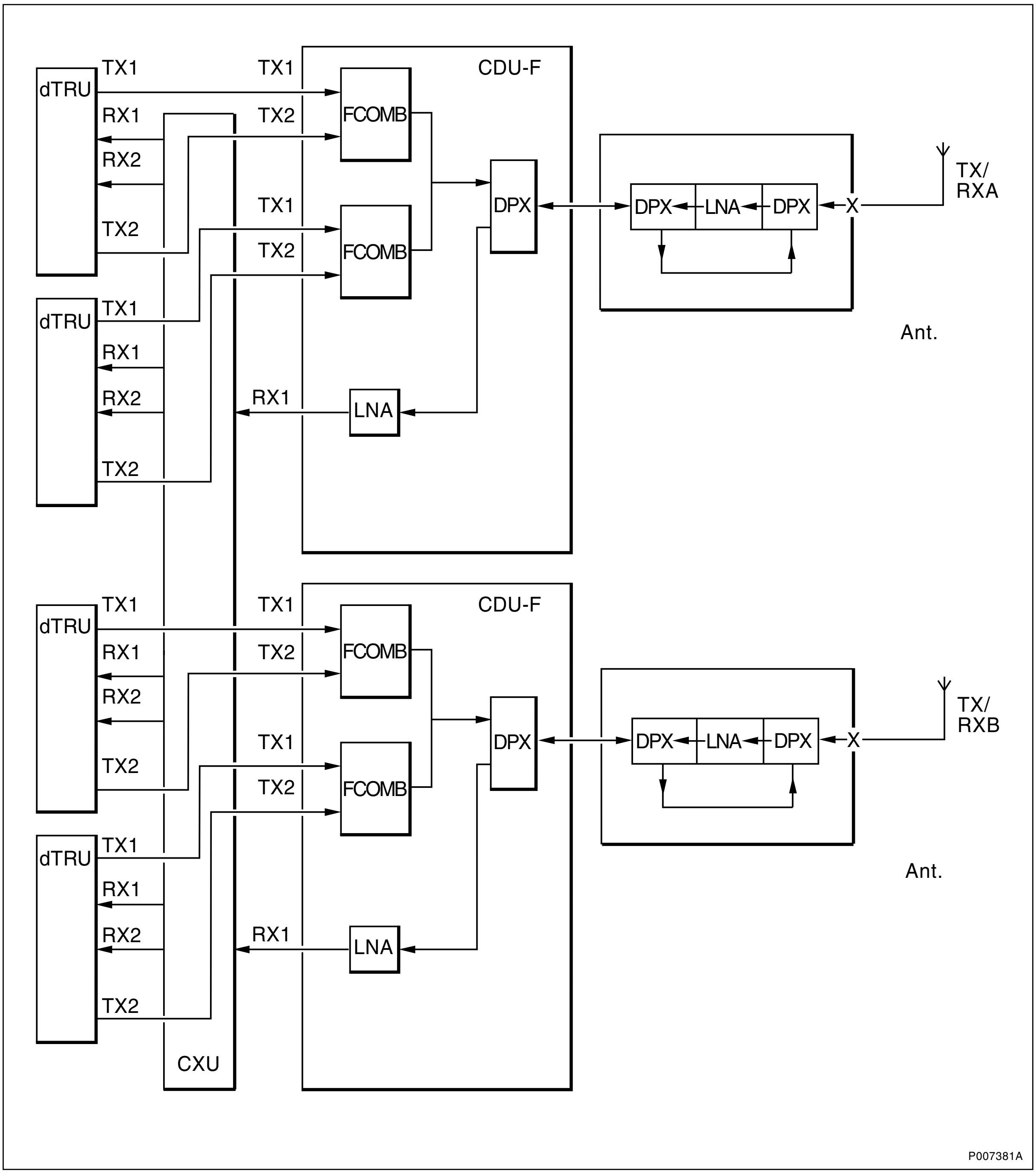

Figure 12 F9det_2.8 and F18dt_2.8

Characteristics

Number of CDUs	2	
Frequency band	E-GSM	(F9det_2.8)
	GSM 1800	(F18dt_2.8)
Max. number of TRXs	8	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + TX/RX	
TMA configuration	ddTMA + ddTMA	

Basic Configuration F9de_2.12 and F18d_2.12

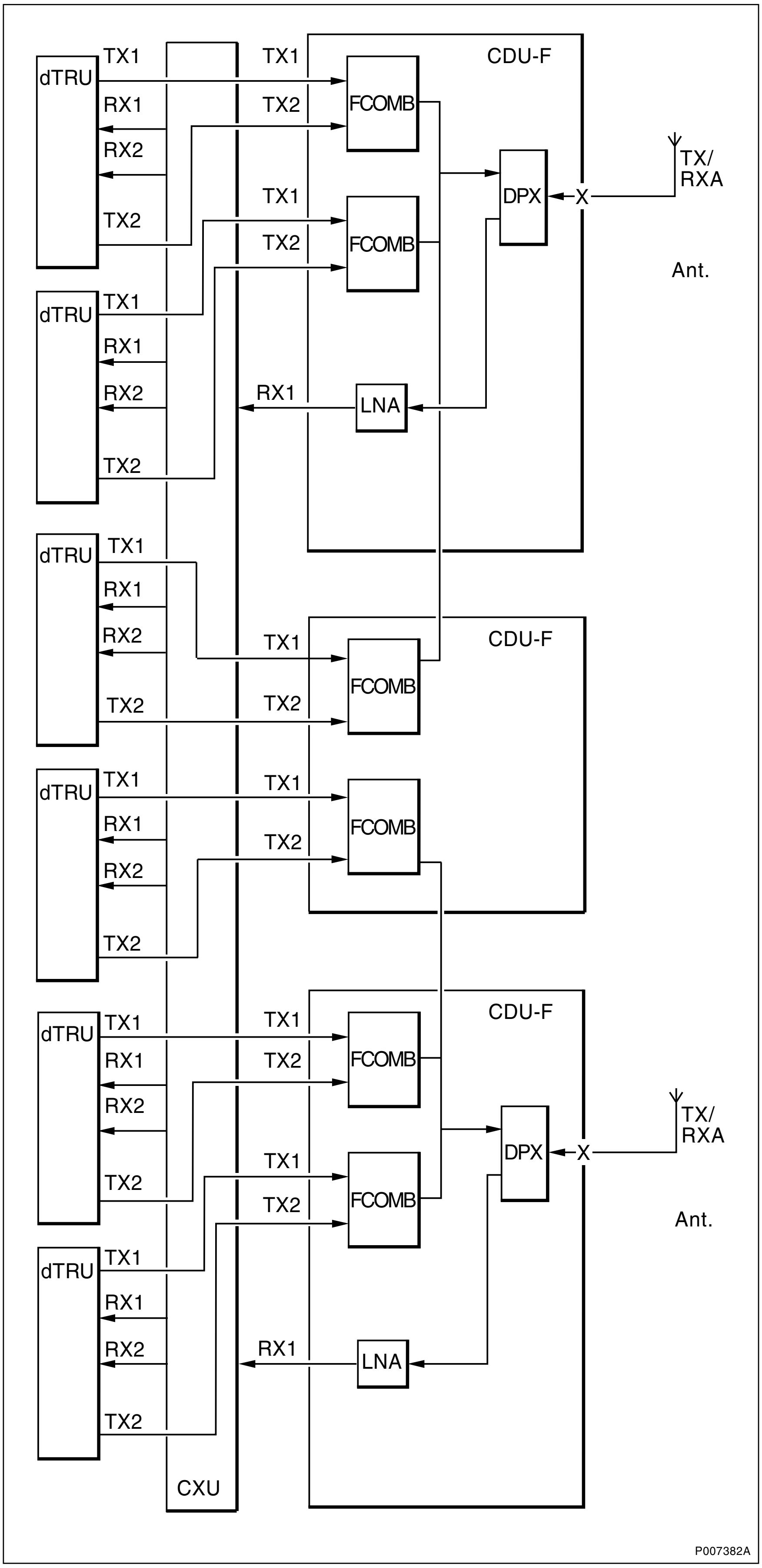

Figure 13 F9de_2.12 and F18d_2.12

Characteristics

Number of CDUs	3	
Frequency band	E-GSM	(F9de_2.12)
	GSM 1800	(F18d_2.12)
Max. number of TRXs	12	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + TX/RX	

Basic Configuration F9det_2.12 and F18dt_2.12

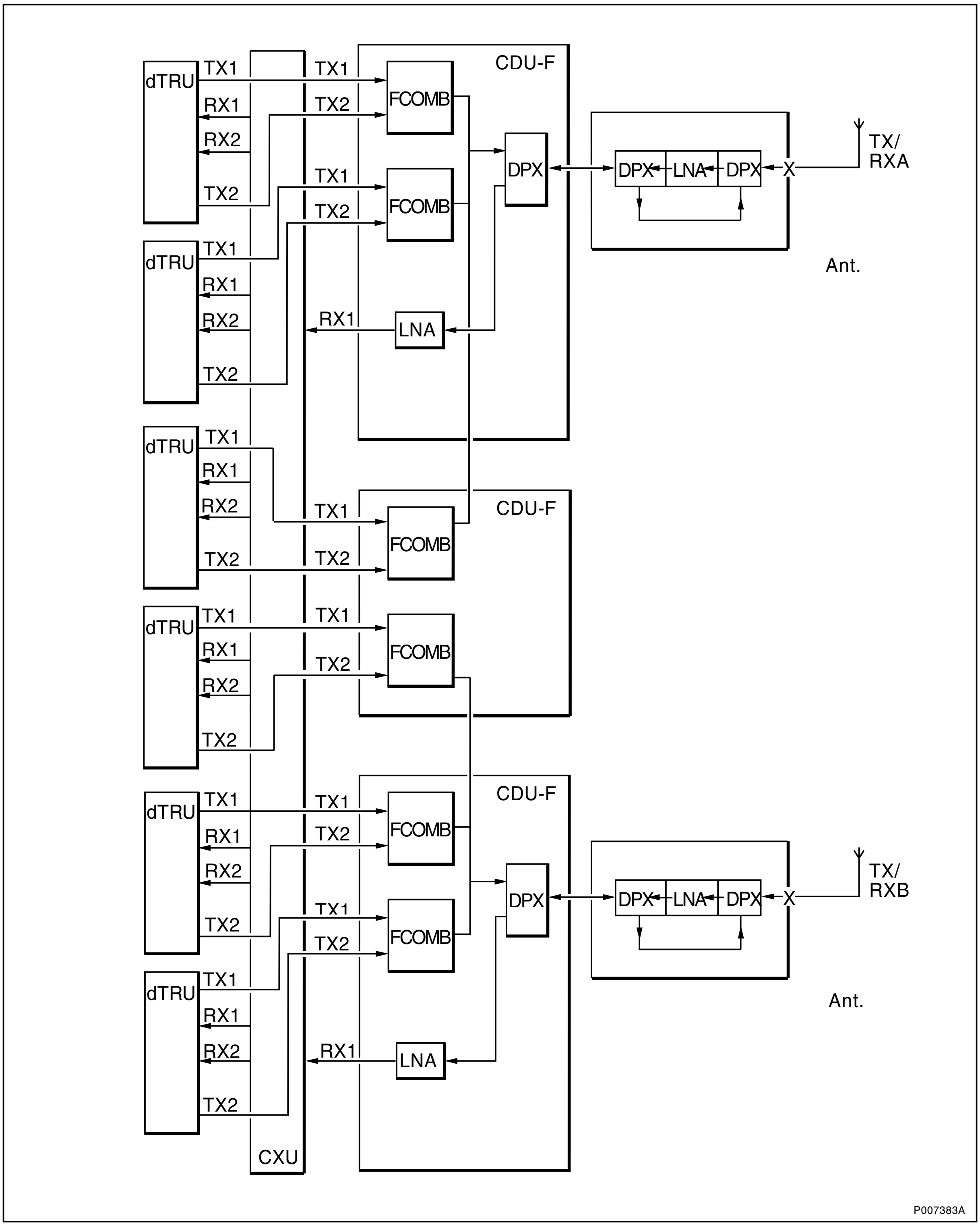

Figure 14 F9de_2.12 and F18dt_2.12

Characteristics

Number of CDUs	3	
Frequency band	E-GSM	(F9det_2.12)
	GSM 1800	(F18dt_2.12)
Max. number of TRXs	12	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + TX/RX	
TMA configuration	ddTMA + ddTMA	

4.6.3 CDU-G Configurations

Basic Configuration G9de_2.2, G18d_2.2 and G19d_2.2

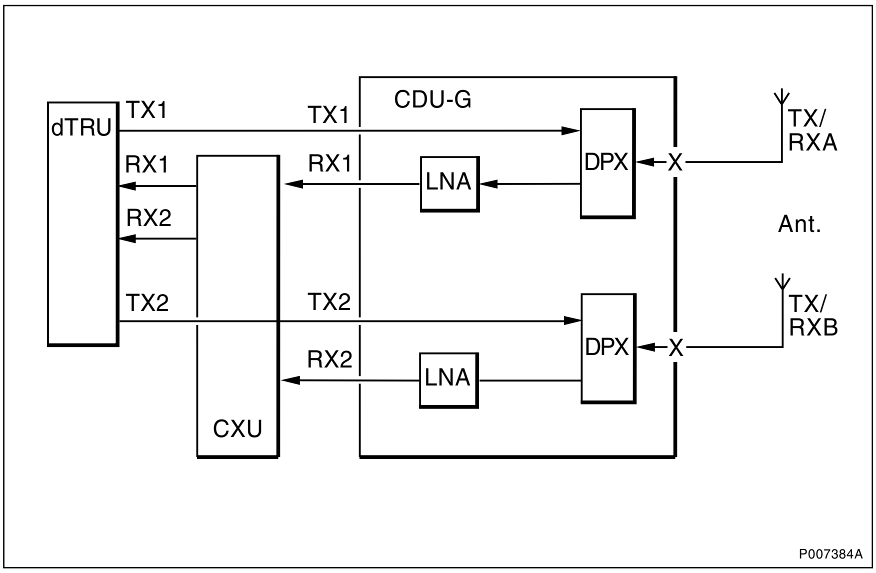

Figure 15 G9de_2.2, G18d_2.2 and G19d_2.2

Characteristics

Number of CDUs	1	
Frequency band	E-GSM	(G9de_2.2)
	GSM 1800	(G18d_2.2)
	GSM 1900	(G19d_2.2)
Max. number of TRXs	2	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + TX/RX	

Basic Configuration G9det_2.2, G18dt_2.2 and G19dt_2.2

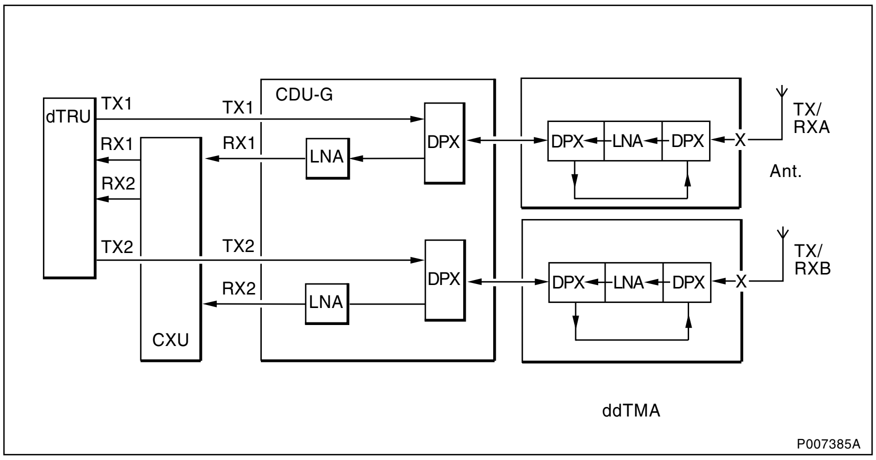

Figure 16   G9det_2.2, G18dt_2.2 and G19dt_2.2

Characteristics

Number of CDUs	1	
Frequency band	E-GSM	(G9det_2.2)
	GSM 1800	(G18dt_2.2)
	GSM 1900	(G19dt_2.2)
Max. number of TRXs	2	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + TX/RX	

Basic Configuration G9deh_2.4, G18dh_2.4 and G19dh_2.4

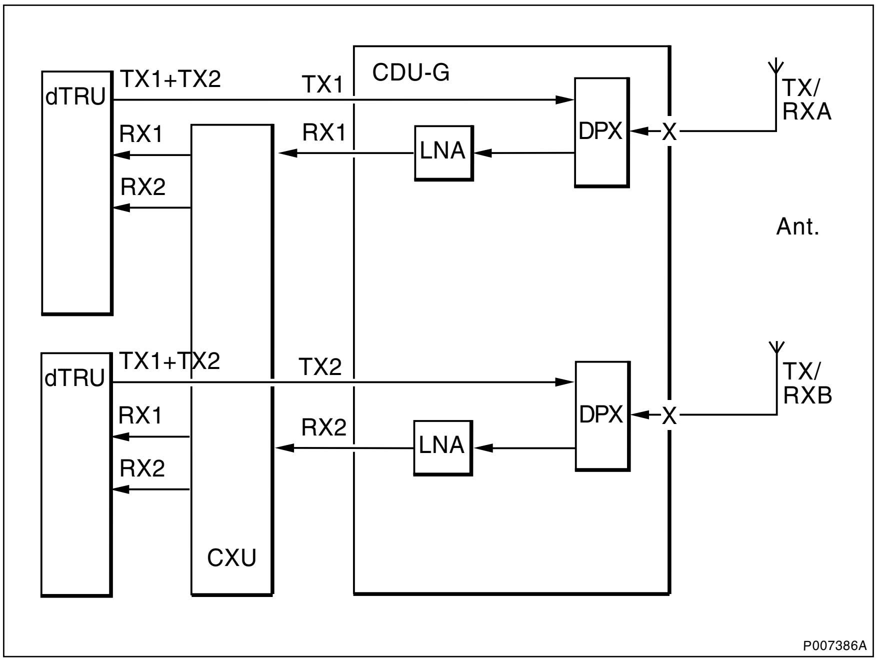

Figure 17 G9deh_2.4, G18dh_2.4 and G19dh_2.4

Characteristics

Number of CDUs	1	
Frequency band	E-GSM	(G9deh_2.4)
	GSM 1800	(G18dh_2.4)
	GSM 1900	(G19dh_2.4)
Max. number of TRXs	4	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + TX/RX	

Basic Configuration G9deht_2.4, G18dht_2.4 and G19dht_2.4

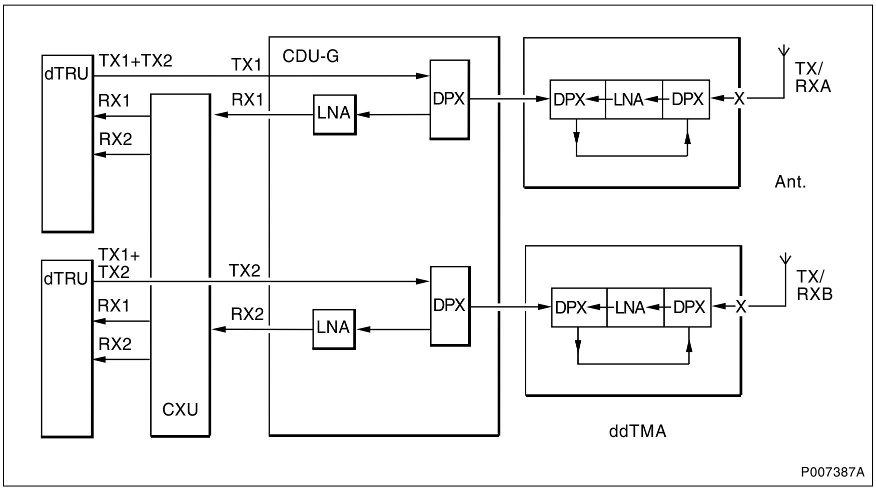

Figure 18 G9deht_2.4, G18dht_2.4 and G19dht_2.4

Characteristics

Number of CDUs	1	
Frequency band	E-GSM	(G9deht_2.4)
	GSM 1800	(G18dht_2.4)
	GSM 1900	(G19dht_2.4)
Max. number of TRXs	4	
Number of feeders	2	
Number of antennas	2	
Antenna configuration	TX/RX + TX/RX	

Basic Configuration G9deh_3.6, G18dh_3.6 and G19dh_3.6

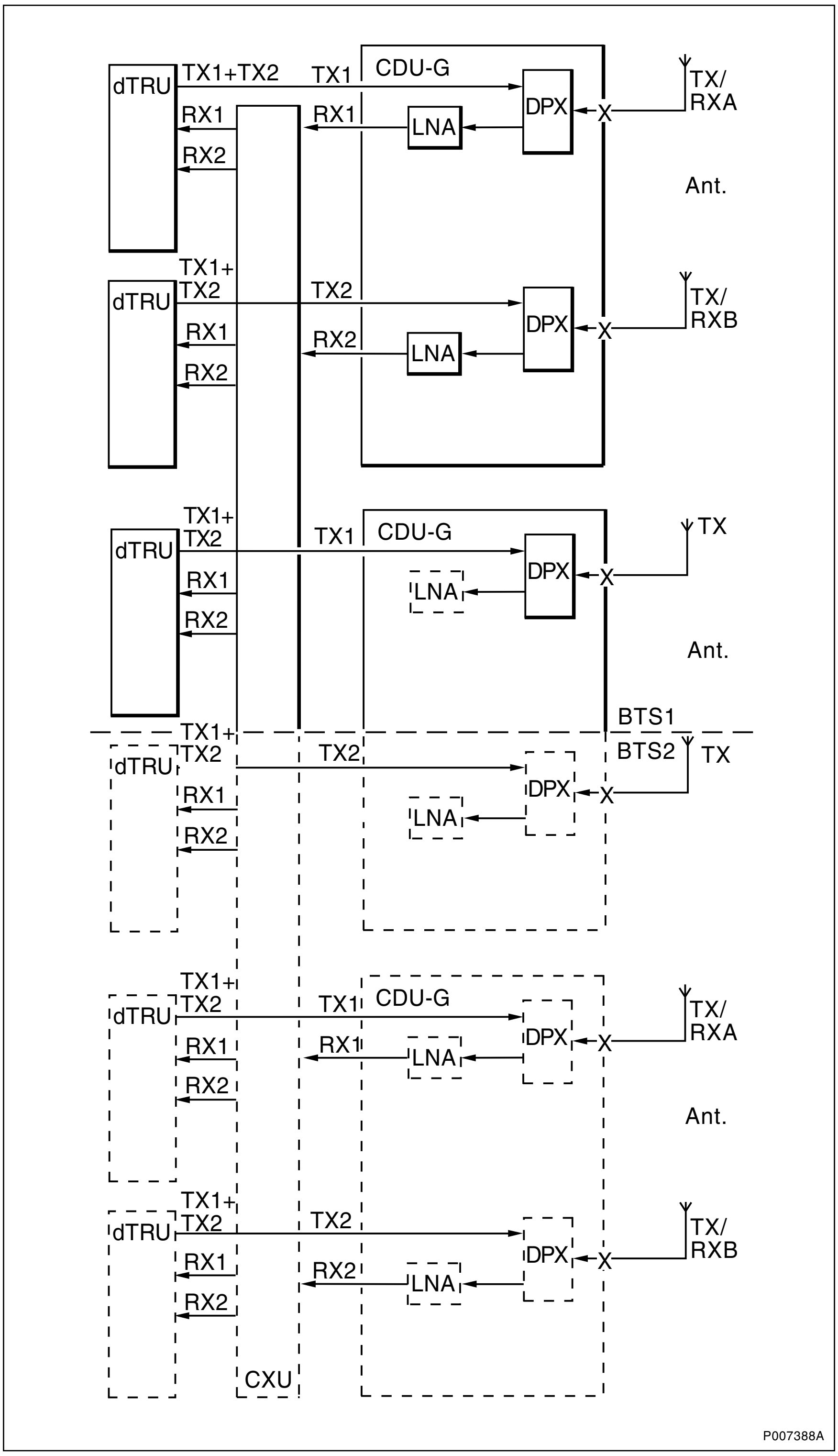

Figure 19 G9deh_3.6, G18dh_3.6 and G19dh_3.6

Characteristics

Number of CDUs	2*	
Frequency band	E-GSM	(G9deh_3.6)
	GSM 1800	(G18dh_3.6)
	GSM 1900	(G19dh_3.6)
Max. number of TRXs	6	
Number of feeders	3	
Number of antennas	3	
Antenna configuration	TX/RX + TX/RX + TX	

* Three CDU-Fs support two sectors.

Note: The second BTS is only shown to illustrate a 2 x 6 configuration. BTS1 and BTS2 are two different physical implementations of the same basic configuration.

Basic Configuration G9deht_3.6, G18dht_3.6 and G19dht_3.6

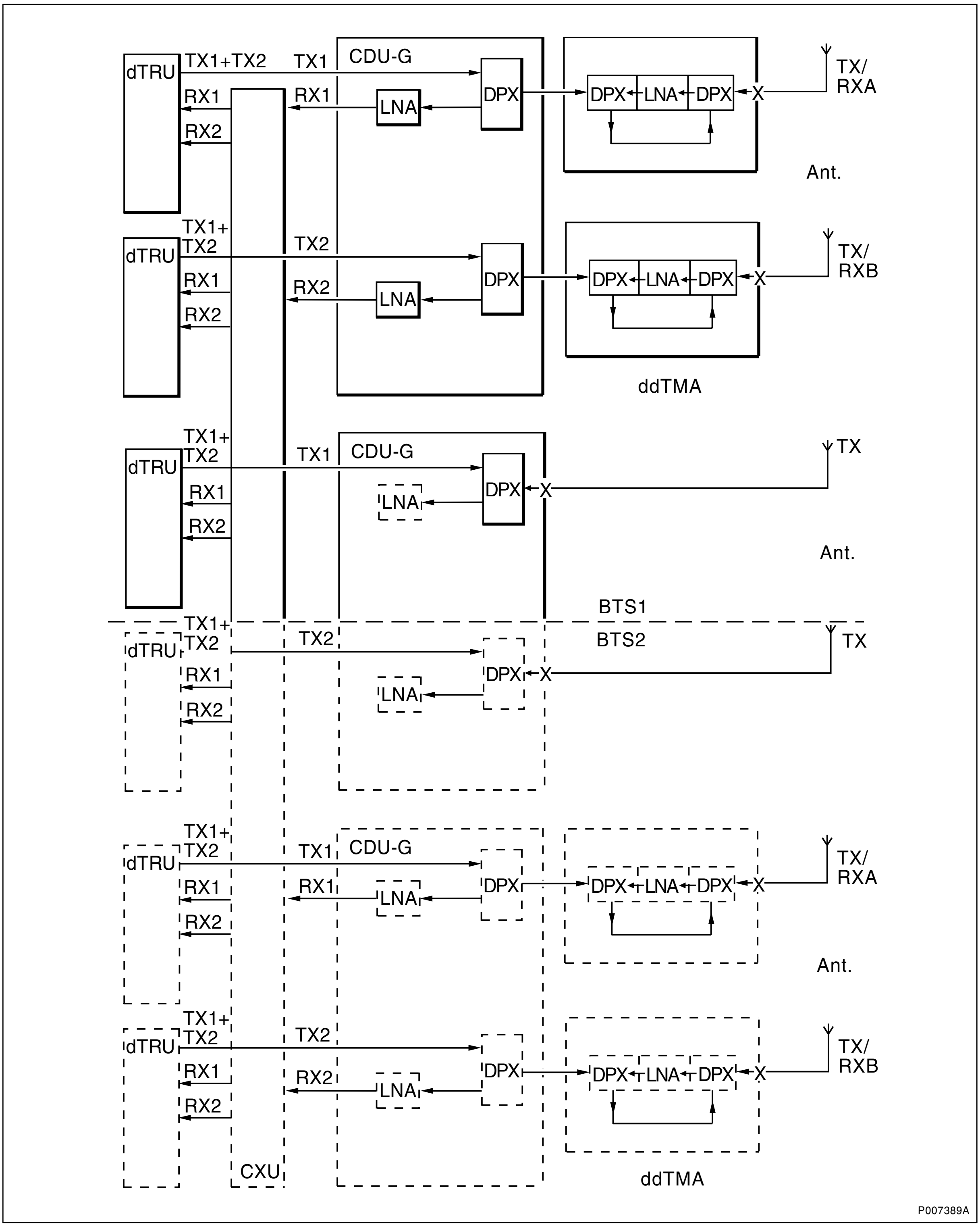

Figure 20 G9deht_3.6, G18dh_3.6 and G19dh_3.6

Characteristics

Number of CDUs	2*	
Frequency band	E-GSM	(G9deht_3.6)
	GSM 1800	(G18dht_3.6)
	GSM 1900	(G19dht_3.6)
Max. number of TRXs	6	
Number of feeders	3	
Number of antennas	3	
Antenna configuration	TX/RX + TX/RX + TX	
TMA configuration	ddTMA + ddTMA	

* Three CDU-Fs support two sectors.

Note: The second BTS is only shown to illustrate a 2 x 6 configuration. BTS1 and BTS2 are two different physical implementations of the same basic configuration.

Basic Configuration G9deh_4.8, G18dh_4.8 and G19dh_4.8

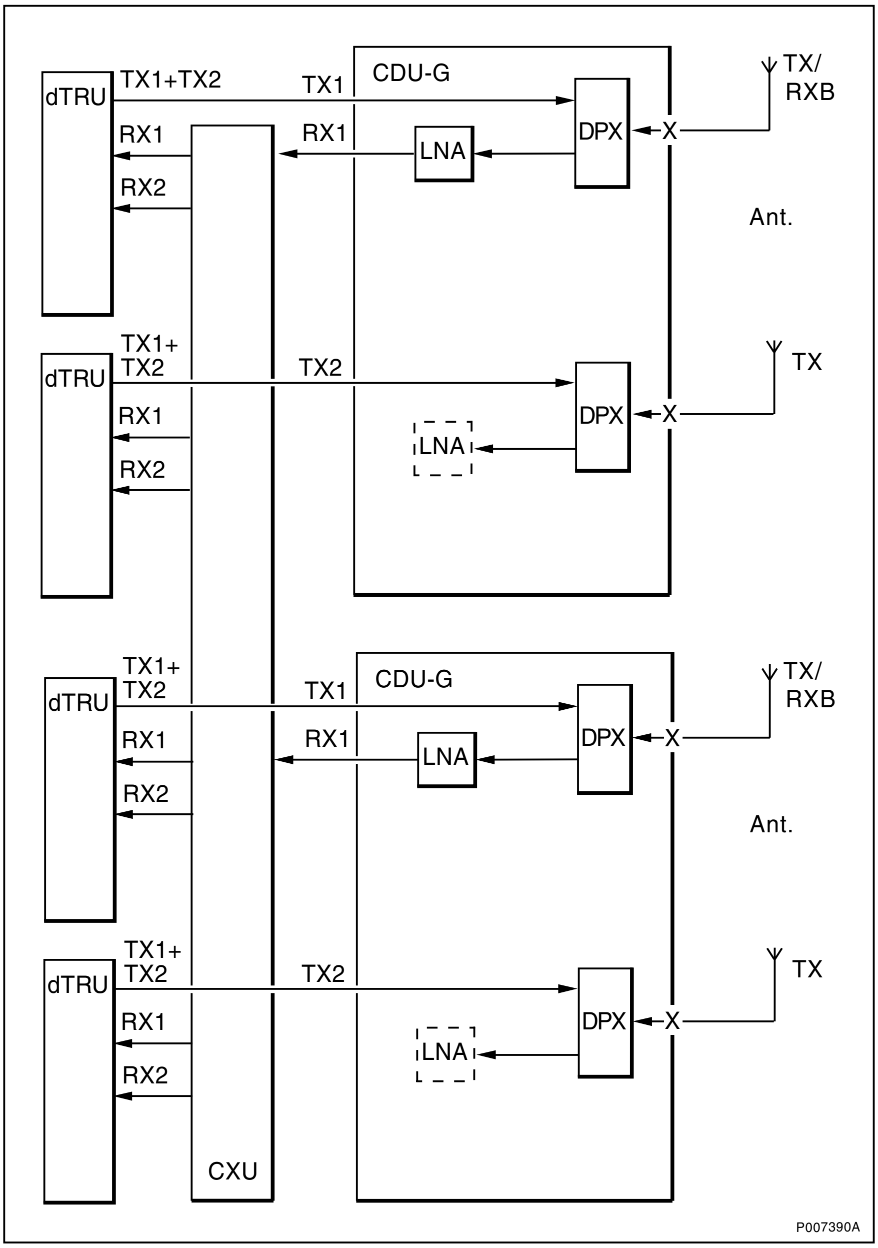

Figure 21 G9deh_4.8, G18dh_4.8 and G19dh_4.8

Characteristics

Number of CDUs	2	
Frequency band	E-GSM	(G9deh_4.8)
	GSM 1800	(G18dh_4.8)
	GSM 1900	(G19dh_4.8)
Max. number of TRXs	8	
Number of feeders	4	
Number of antennas	4	
Antenna configuration	TX/RX + TX + TX/ RX + TX	

Basic Configuration G9deht_4.8, G18dht_4.8 and G19dht_4.8

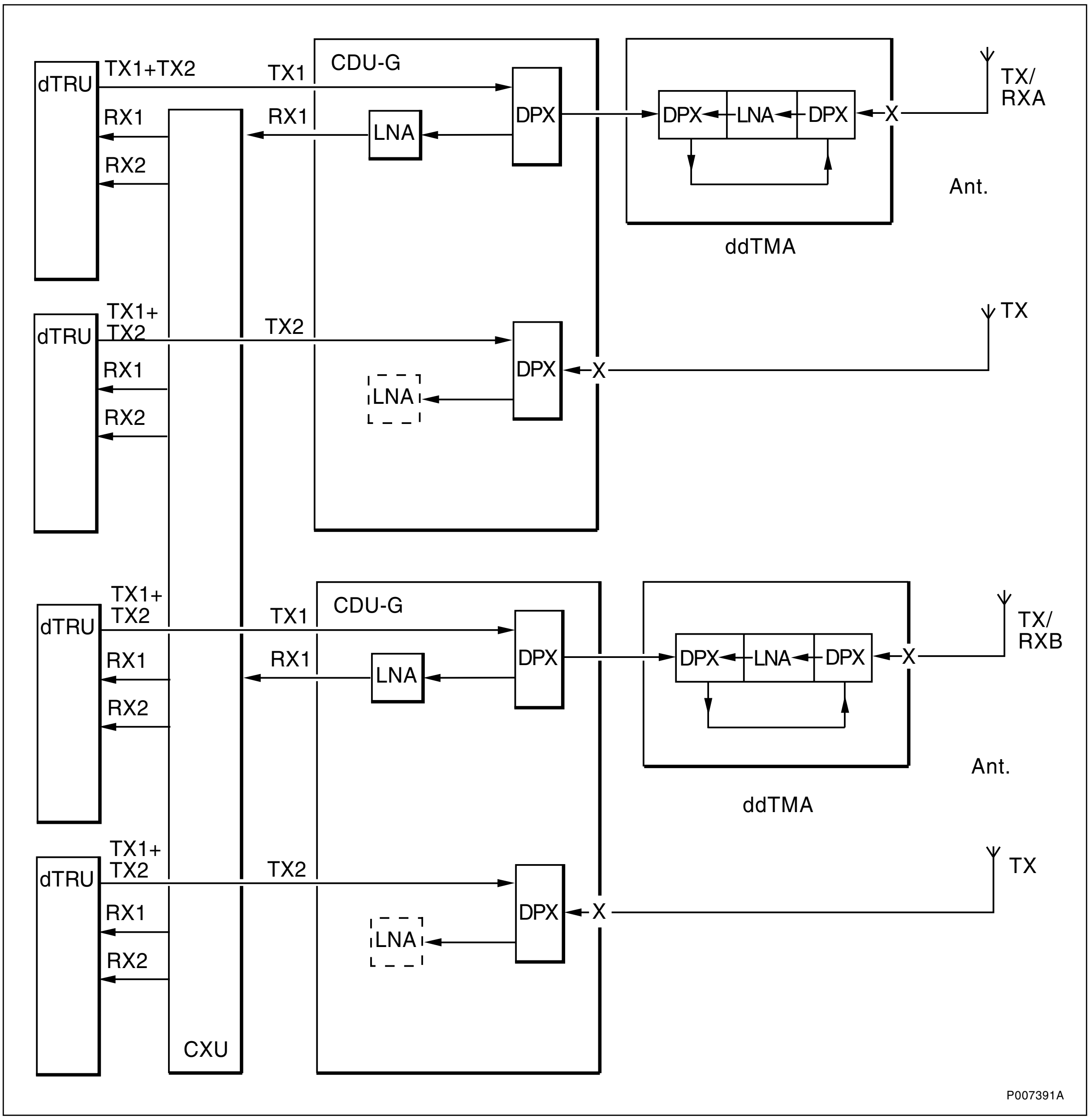

Figure 22 G9deht_4.8, G18dht_4.8 and G19dht_4.8

Characteristics

Number of CDUs	2	
Frequency band	E-GSM	(G9deht_4.8)
	GSM 1800	(G18dht_4.8)
	GSM 1900	(G19dht_4.8)
Max. number of TRXs	8	
Number of feeders	4	
Number of antennas	4	
Antenna configuration	TX/RX + TX + TX/ RX + TX	
TMA configuration	ddTMA + ddTMA	

Basic Configuration G9deh_6.12, G18dh_6.12 and G19dh_6.12

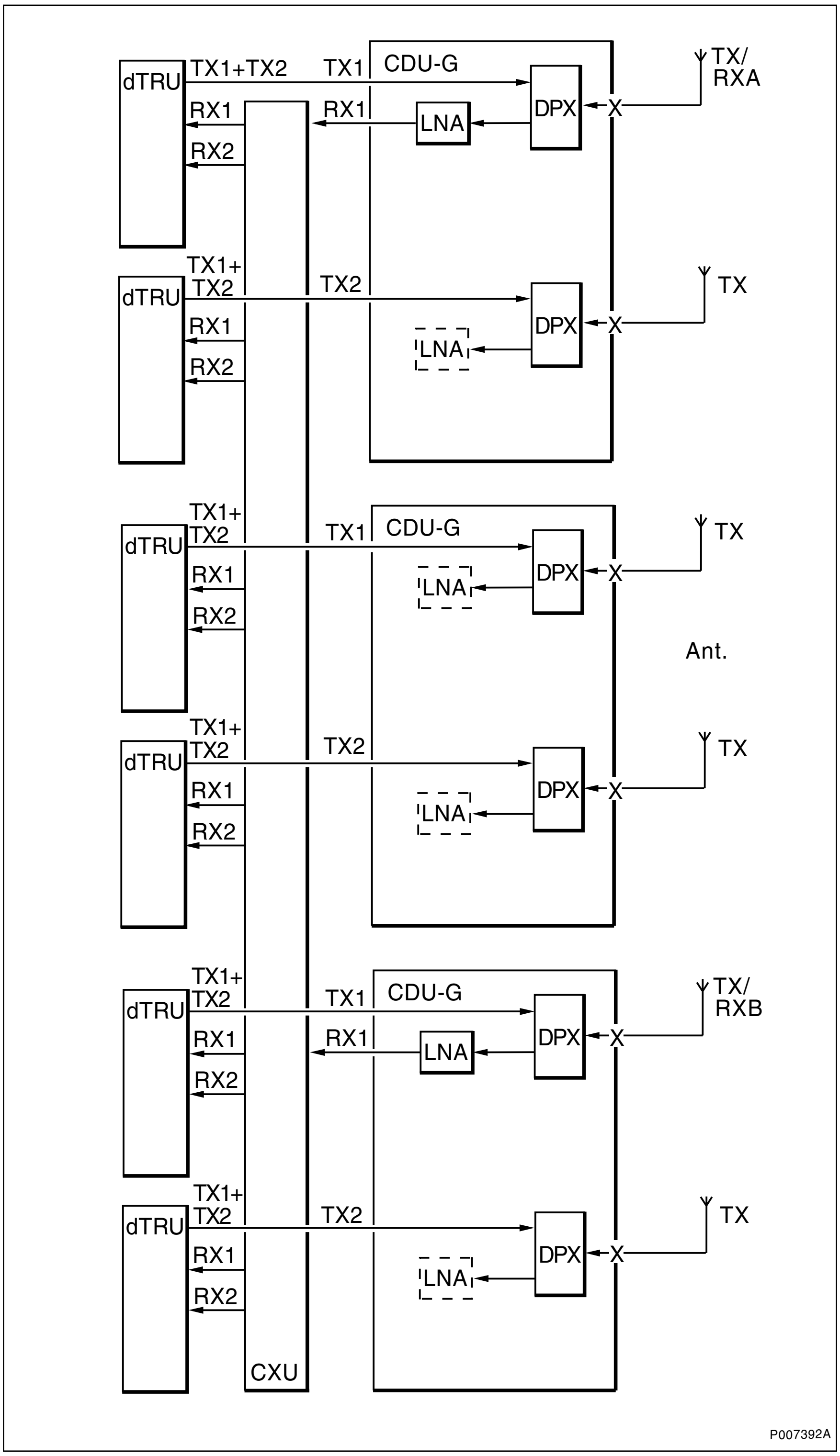

Figure 23 G9deh_6.12, G18dh_6.12 and G19dh_6.12

Characteristics

Number of CDUs	3	
Frequency band	E-GSM	(G9deh_6.12)
	GSM 1800	(G18dh_6.12)
	GSM 1900	(G19dh_6.12)
Max. number of TRXs	12	
Number of feeders	6	
Number of antennas	6	
Antenna configuration	2 x TX/RX + 4 x TX	

Basic Configuration G9deht_6.12, G18dht_6.12 and G19dht_6.12

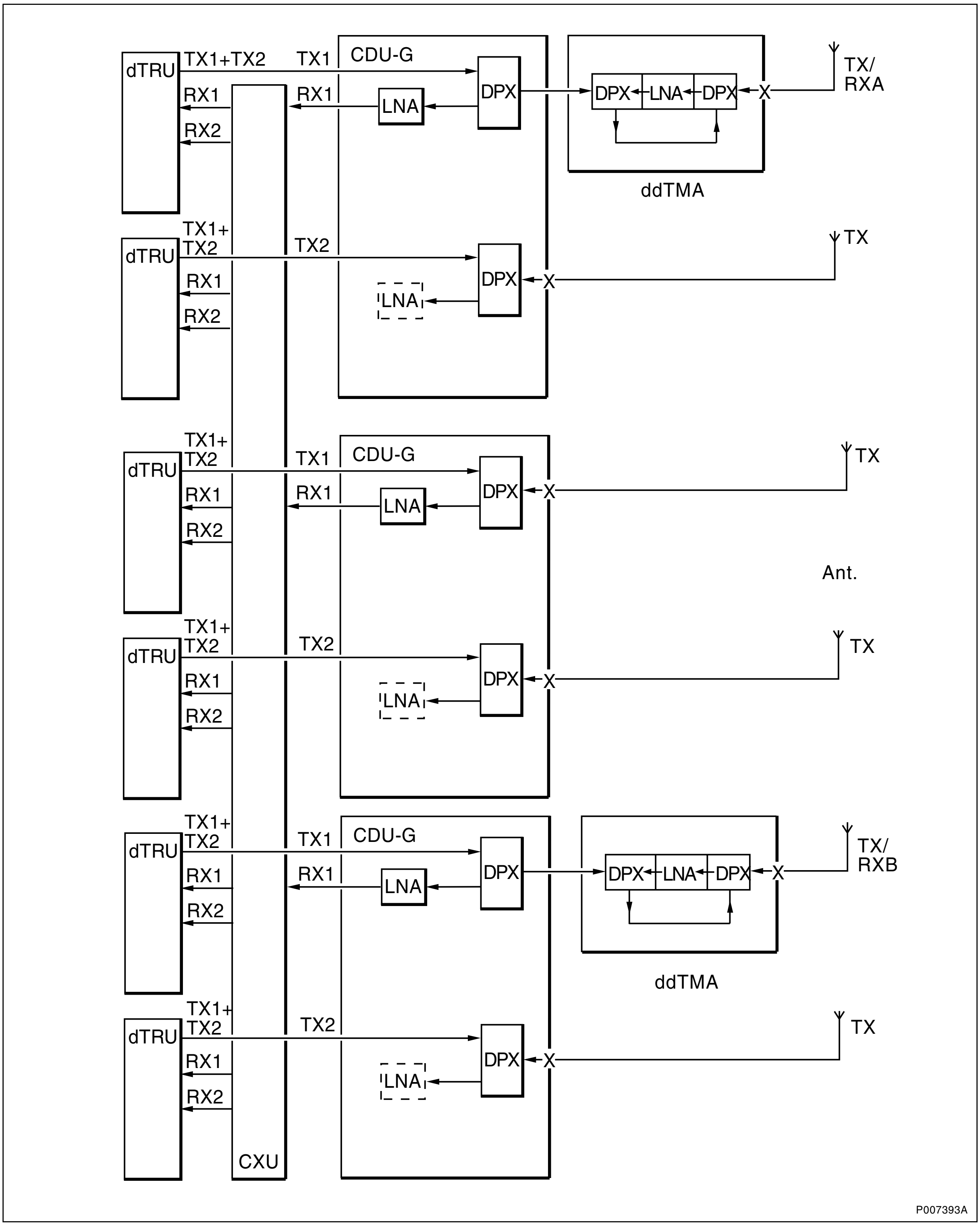

Figure 24 G9deht_6.12, G18dht_6.12 and G19dht_6.12

Characteristics

Number of CDUs	3	
Frequency band	E-GSM	(G9deht_6.12)
	GSM 1800	(G18dht_6.12)
	GSM 1900	(G19dht_612)
Max. number of TRXs	12	
Number of feeders	6	
Number of antennas	6	
Antenna configuration	2 x TX/RX + 4 x TX	
TMA configuration	ddTMA + ddTMA	

4.6.4 RX Connection from Antenna to dTRU

Connection in the RX path is performed using the CXU. It varies, depending on the basic configurations used and the position in the cabinet. To avoid having to change cables for different configurations, the connections are set up automatically by the software.

The TX antenna connections are independent of the CXU.

The tables below show how TMAs and their associated bias injectors are connected to configurations using TMAs.

Table 13 1 x 12 configurations with CDU-F

CDU No. / Connector	TMA No. (TMA config. only)	Antenna
1 / TX / RX	1	TX / RXA
3 / TX / RX	5	TX / RXB

Table 14 1 x 12 configurations with CDU-G

CDU No. / Connector	TMA No. (TMA config. only)	Antenna
1 / TX / RX1	1	TX / RXA
3 / TX / RX1	5	TX / RXB

Table 15 2 x 6 configurations with CDU-F

	CDU No. / Connector	TMA No. (TMA config. only)	Antenna
Cell 1	1 / TX / RX	1	TX / RXA
	1 / RX	2	RXB
Cell 2	3 / TX / RX	5	TX / RXA
	3 / RX	6	RXB

Table 16 2 x 6 configurations with CDU-G

	CDU **No. / Connector**	**TMA** **No. (TMA config. only)**	**Antenna**
Cell 1	1 / TX / RX1	1	TX / RXA
	1 / TX / RX2	2	TX / RXB
Cell 2	3 / TX / RX1	5	TX / RXA
	3 / TX / RX2	6	TX / RXB

Table 17 3 x 4 configurations with CDU-F

	CDU **No. / Connector**	**TMA** **No. (TMA config. only)**	**Antenna**
Cell 1	1 / TX / RX	1	TX / RXA
	1 / RX	2	RXB
Cell 2	2 / TX / RX	4	RXB
	2 / RX	3	TX / RXA
Cell 3	3 / TX / RX	6	RXB
	3 / RX	5	TX / RXA

Table 18 3 x 4 and 3 x 2 configurations with CDU-G

	CDU **No. / Connector**	**TMA** **No. (TMA config. only)**	**Antenna**
Cell 1	1 / TX / RX1	1	TX / RXA
	1 / TX / RX2	2	TX / RXB
Cell 2	2 / TX / RX1	4	TX / RXB
	2 / TX / RX2	3	TX / RXA
Cell 3	3 / TX / RX1	6	TX / RXB
	3 / TX / RX2	5	TX / RXA

Table 19 1 x 8 configurations with CDU-F

	CDU **No. / Connector**	**TMA** **No. (TMA config. only)**	**Antenna**
Cell 1	1 / TX / RX	1	TX / RXA
	1 / TX / RX	3	TX / RXB
Alt cell 1	3 / TX / RX	3	TX / RXA
	3 / TX / RX	5	TX / RXB

Table 20 1 x 8 configurations with CDU-G

	CDU **No. / Connector**	**TMA** **No. (TMA config. only)**	**Antenna**
Cell 1	1 / TX / RX1	1	TX / RXA
	1 / TX / RX1	3	TX / RXB
Alt. cell 1	3 / TX / RX1	3	TX / RXA
	3 / TX / RX1	5	TX / RXB

Note: It is only possible to have one 1 x 8 configuration in the cabinet. One 1 x 8 configuration can be combined with one 1 x 4 configuration.

4.7 Site Cell Configurations

The following section shows site cell configurations in one RBS. More RBSs can be combined to form larger configurations at a site. Possible expansions, where different RBSs are connected using TG-synchronization, are described in *Section 4.8 Co-Siting with RBS 200 or RBS 2000 Macro Cabinet on page 74.*

The following SCCs are supported by the RBS:

- specified basic radio configurations
- the RBS with any number of dTRUs within the specified range inserted in the specified position order.

4.7.1 RBS 2106 and RBS 2206 Configurations

CDU-F Single Band Configurations

Table 21 CDU-F configurations with a fully-equipped cabinet

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
1 x 12	F9de_2.12	No	(2)	(0..6)
	F9det_2.12	M	(2)	(0..6)
	F18d_2.12	No	(2)	(0..6)
	F18dt_2.12	M	(2)	(0..6)
2 x 6	2 x F9de_2.6	No	(2) (2)	(0..3) (0..3)
	2 x F9det_2.6	M	(2) (2)	(0..3) (0..3)
	2 x F18d_2.6	No	(2) (2)	(0..3) (0..3)
	2 x F18dt_2.6	M	(2) (2)	(0..3) (0..3)
3 x 4	3 x F9de_2.4	No	(2) (2) (2)	(0..2) (0..2) (0..2)
	3 x F9det_2.4	M	(2) (2) (2)	(0..2) (0..2) (0..2)
	3 x F18d_2.4	No	(2) (2) (2)	(0..2) (0..2) (0..2)
	3 x F18dt_2.4	M	(2) (2) (2)	(0..2) (0..2) (0..2)
1 x 8 + 1 x 4	F9de_2.8 + F9de_2.4	No	(2) (2)	(0..4) (0..2)
	F9det_2.8 + F9det_2.4	M	(2) (2)	(0..4) (0..2)
	F18d_2.8 + F18d_2.4	No	(2) (2)	(0..4) (0..2)
	F18dt_2.8 + F18dt_2.4	M	(2) (2)	(0..4) (0..2)
1 x 4 + 1 x 8	F9de_2.4 + F9de_2.8	No	(2) (2)	(0..2) (0..4)
	F9det_2.4 + F9det_2.8	M	(2) (2)	(0..2) (0..4)
	F18d_2.4 + F18d_2.8	No	(2) (2)	(0..2) (0..4)
	F18dt_2.4 + F18dt_2.8	M	(2) (2)	(0..2) (0..4)

M = Mandatory

SCC 1 x 2 and 2 x 2 can be achieved as a subset of SCC 3 x 4 or 2 x 6.

SCC 1 x 4 can be achieved as a subset of either SCC 3 x 4 or 2 x 6.

SCC 1 x 6 can be achieved as a subset of SCC 2 x 6 or 1 x 12.

SCC 2 x 4 can be achieved as a subset of SCC 3 x 4 or 2 x 6.

SCC 3 x 2 can be achieved as a subset of SCC 3 x 4.

SCC 1 x 2 and 1 x 4 require one CDU-F.

SCC 2 x 2 and 2 x 4 require two CDU-Fs.

SCC 1 x 6 as a subset of SCC 2 x 6 requires two CDU-F or one CDU-F and one CDU-Fx.

SCC 1 x 6 as a subset of SCC 1 x 12 requires two CDU-F or one CDU-F and one CDU-Fx.

SCC 3 x 2 requires three CDU-Fs.

Table 22 CDU-F configurations with a partly-equipped cabinet

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
1 x 4	F9de_2.4	No	(2) (0) (0)	(0..2) (0) (0)
	F9det_2.4	M	(2) (0) (0)	(0..2) (0) (0)
	F18d_2.4	No	(2) (0) (0)	(0..2) (0) (0)
	F18dt_2.4	M	(2) (0) (0)	(0..2) (0) (0)
2 x 4	2 x F9de_2.4	No	(2) (2) (0)	(0..2) (0..2) (0)
	2 x F9det_2.4	M	(2) (2) (0)	(0..2) (0..2) (0)
	2 x F18d_2.4	No	(2) (2) (0)	(0..2) (0..2) (0)
	2 x F18dt_2.4	M	(2) (2) (0)	(0..2) (0..2) (0)
1 x 8	F9de_2.8	No	(2) (0)	(0..4) (0)
	F9det_2.8	M	(2) (0)	(0..4) (0)
	F18d_2.8	No	(2) (0)	(0..4) (0)
	F18dt_2.8	M	(2) (0)	(0..4) (0)

M = Mandatory

CDU-G Single Band Configurations without Hybrid Combiner

Table 23 CDU-G configurations without hybrid combiner in a fully or partly-equipped cabinet

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
3 x 2	3 x G9de_2.2	No	(2) (2) (2)	(0..1) (0..1) (0..1)
	3 x G9det_2.2	M	(2) (2) (2)	(0..1) (0..1) (0..1)
	3 x G18d_2.2	No	(2) (2) (2)	(0..1) (0..1) (0..1)
	3 x G18dt_2.2	M	(2) (2) (2)	(0..1) (0..1) (0..1)
	3 x G19d_2.2	No	(2) (2) (2)	(0..1) (0..1) (0..1)
	3 x G19dt_2.2	M	(2) (2) (2)	(0..1) (0..1) (0..1)

M = Mandatory

Table 24 CDU-G configurations without hybrid combiner in a partly-equipped cabinet only

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
1 x 2	G9de_2.2	No	(2) (0) (0)	(0..1) (0) (0)
	G9det_2.2	M	(2) (0) (0)	(0..1) (0) (0)
	G18d_2.2	No	(2) (0) (0)	(0..1) (0) (0)
	G18dt_2.2	M	(2) (0) (0)	(0..1) (0) (0)
	G19d_2.2	No	(2) (0) (0)	(0..1) (0) (0)
	G19dt_2.2	M	(2) (0) (0)	(0..1) (0) (0)
2 x 2	2 x G9de_2.2	No	(2) (2) (0)	(0..1) (0..1) (0)
	2 x G9det_2.2	M	(2) (2) (0)	(0..1) (0..1) (0)
	2 x G18d_2.2	No	(2) (2) (0)	(0..1) (0..1) (0)
	2 x G18dt_2.2	M	(2) (2) (0)	(0..1) (0..1) (0)
	2 x G19d_2.2	No	(2) (2) (0)	(0..1) (0..1) (0)
	2 x G19dt_2.2	M	(2) (2) (0)	(0..1) (0..1) (0)

M = Mandatory

CDU-G Single Band Configuration with Hybrid Combiner

Table 25 CDU-G configurations with hybrid combiner in a fully- or partly-equipped cabinet

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
3 x 4	3 x G9deh_2.4	No	(2) (2) (2)	(0..2) (0..2) (0..2)
	3 x G9deht_2.4	M	(2) (2) (2)	(0..2) (0..2) (0..2)
	3 x G18dh_2.4	No	(2) (2) (2)	(0..2) (0..2) (0..2)
	3 x G18dht_2.4	M	(2) (2) (2)	(0..2) (0..2) (0..2)
	3 x G19dh_2.4	No	(2) (2) (2)	(0..2) (0..2) (0..2)
	3 x G19dht_2.4	M	(2) (2) (2)	(0..2) (0..2) (0..2)
2 x 6	2 x G9deh_3.6	No	(3) (3)	(0..3) (0..3)
	2 x G9deht_3.6	M	(3) (3)	(0..3) (0..3)
	2 x G18dh_3.6	No	(3) (3)	(0..3) (0..3)
	2 x G18dht_3.6	M	(3) (3)	(0..3) (0..3)
	2 x G19dh_3.6	No	(3) (3)	(0..3) (0..3)
	2 x G19dht_3.6	M	(3) (3)	(0..3) (0..3)
1 x 12	G9deh_6.12	No	(6)	(0..6)
	G9deht_6.12	M	(6)	(0..6)
	G18dh_6.12	No	(6)	(0..6)
	G18dht_6.12	M	(6)	(0..6)
	G19dh_6.12	No	(6)	(0..6)
	G19dht_6.12	M	(6)	(0..6)

M = Mandatory

SCC 1 x 2 and 2 x 2 can be achieved as a subset of SCC 3 x 4.

SCC 1 x 4 can be achieved as a subset of either SCC 3 x 4 or 2 x 6.

SCC 1 x 6 can be achieved as a subset of SCC 2 x 6.

SCC 2 x 4 can be achieved as a subset of SCC 3 x 4 or 2 x 6.

SCC 3 x 2 can be achieved with use of SCC 3 x 4.

SCC 1 x 2 and 1 x 4 require one CDU-G.

SCC 2 x 2 and 1 x 6 require two CDU-Gs.

SCC 3 x 2 requires three CDU-Gs.

Table 26 CDU-G configurations with hybrid combiner in a partly-equipped cabinet only

SCC	**Configuration**	**TMA**	**Number of Antennas**	**Allowed Number of dTRUs**
1 x 4	G9deh_2.4	No	(2) (0) (0)	(0..2) (0) (0)
	G9deht_2.4	M	(2) (0) (0)	(0..2) (0) (0)
	G18dh_2.4	No	(2) (0) (0)	(0..2) (0) (0)
	G18dht_2.4	M	(2) (0) (0)	(0..2) (0) (0)
	G19dh_2.4	No	(2) (0) (0)	(0..2) (0) (0)
	G19dht_2.4	M	(2) (0) (0)	(0..2) (0) (0)
2 x 4	2 x G9deh_2.4	No	(2) (2) (0)	(0..2) (0..2) (0)
	2 x G9deht_2.4	M	(2) (2) (0)	(0..2) (0..2) (0)
	2 x G18dh_2.4	No	(2) (2) (0)	(0..2) (0..2) (0)
	2 x G18dht_2.4	M	(2) (2) (0)	(0..2) (0..2) (0)
	2 x G19dh_2.4	No	(2) (2) (0)	(0..2) (0..2) (0)
	2 x G19dht_2.4	M	(2) (2) (0)	(0..2) (0..2) (0)
1 x 8	G9deh_4.8	No	(4) (0)	(0..4) (0)
	G9deht_4.8	M	(4) (0)	(0..4) (0)
	G18dh_4.8	No	(4) (0)	(0..4) (0)
	G18dht_4.8	M	(4) (0)	(0..4) (0)
	G19dh_4.8	No	(4) (0)	(0..4) (0)
	G19dht_4.8	M	(4) (0)	(0..4) (0)

M = Mandatory

4.7.2 GSM 900/GSM 1800 Dual Band Configurations

The notation for dual band configurations is done with the lower frequency (900 MHz) configuration to the left and the higher frequency (1800 MHz) configuration to the right, separated by the | symbol. This notation is valid regardless of the position in the cabinet.

CDU-F Configurations

Table 27 Dual band configurations with CDU-F in a fully- or partly-equipped cabinet

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
1 x 4 | 1 x 8	F9de_2.4 | F18d_2.8 F9det_2.4 | F18dt_2.8	No | No M | M	(2) | (2) (2) | (2)	(0..2) | (0..2) (0..2) | (0..4)
1 x 8 | 1 x 4	F9de_2.8 | F18d_2.4 F9det_2.8 | F18dt_2.4	No | No M | M	(2) | (2) (2) | (2)	(0..4) | (0..2) (0..4) | (0..2)

M = Mandatory

There are two options for placing the equipment in the cabinet:
GSM 900 on the left-hand side/GSM 1800 on the right-hand side, or the other way round.

Table 28 Dual band configurations with CDU-F in a partly-equipped cabinet only

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
1 x 4 | 1 x 4	F9de_2.4 | F18d_2.4 F9det_2.4 | F18dt_2.4	No | No M | M	(2) | (2) (2) | (2)	(0..2) (0) | (0..2) (0..2) (0) | (0..2)

M = Mandatory

There are two options for placing the equipment in the cabinet:
GSM 900 on the left-hand side/GSM 1800 on the right-hand side, or the other way round. In each case the middle positions are not used.

CDU-G Configurations

Table 29 Dual band configurations, CDU-G with hybrid in a fully- or partly-equipped cabinet

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
1 x 8 | 1 x 4	G9deh_4.8 | G18dh_2.4 G9deht_4.8 | G18dht_2.4	No | No M | M	(4) | (2) (4) | (2)	(0..4) | (0..2) (0..4) | (0..2)
1 x 4 | 1 x 8	G9deh_2.4 | G18dh_4.8 G9deht_2.4 | G18dht_4.8	No | No M | M	(2) | (4) (2) | (4)	(0..2) | (0..4) (0..2) | (0..4)

M = Mandatory

There are two options for placing the equipment in the cabinet:
GSM 900 on the left-hand side/GSM 1800 on the right-hand side, or the other way round.

Table 30 Dual band configurations, CDU-G with hybrid in a partly-equipped cabinet only

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
1 x 4 | 1 x 4	G9deh_2.4 | G18dh_2.4 G9deht_2.4 | G18dht_2.4	No | No M | M	(2) | (2) (2) | (2)	(0..2) (0) | (0..2) (0..2) (0) | (0..2)

M = Mandatory

There are two options for placing the equipment in the cabinet: GSM 900 on the left-hand side/GSM 1800 on the right-hand side, or the other way round. In each case the middle position is not used.

4.7.3 SW Power Boost Configurations with CDU-G

This section does not include any additional site cell configurations, it specifies which configurations support SW power boost.

A minimum of two TRXs is required in an antenna system to use SW power boost in the antenna system. Separate TX antennas are used for the two transmitters in a SW power boost configuration.

SPB with CDU-G Configurations without Hybrid Combiner

The following SCC supports SW power boost. The basic radio configurations specified are used.

Table 31 CDU-G configurations without hybrid combiner

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
3 x 2	3 x G9det_2.2	M	(2) (2) (2)	(0..1) (0..1) (0..1)
	3 x G18dt_2.2	M	(2) (2) (2)	(0..1) (0..1) (..1)
	3 x G19dt_2.2	M	(2) (2) (2)	(0..1) (0..1) (0..1)

M = Mandatory

SCC 1 x 2 and 2 x 2 can be achieved as a subset of SCC 3 x 2.

SCC 1 x 2 requires one CDU-G.

SCC 2 x 2 requires two CDU-Gs.

SPB with CDU-G Configurations with Hybrid Combiner

The following SCC supports SW power boost. The basic radio configurations specified are used. SW power boost can be used in cells that have two dTRUs installed.

Table 32 CDU-G configurations with hybrid combiner

SCC	Configuration	TMA	Number of Antennas	Allowed Number of dTRUs
3 x 4	3 x G9deht_2.4	M	(2) (2) (2)	(0..2) (0..2) (0..2)
	3 x G18dht_2.4	M	(2) (2) (2)	(0..2) (0..2) (0..2)
	3 x G19dht_2.4	M	(2) (2) (2)	(0..2) (0..2) (0..2)

M = Mandatory

Each sector is split into two cells:

- one underlaid cell consisting of the second TRX in the first dTRU and the first TRX in the second dTRU. SPB is used in this cell.
- one overlaid cell consisting of the two other TRXs. SPB is not used in this cell.

4.8 Co-Siting with RBS 200 or RBS 2000 Macro Cabinet

This section shows expansions where RBSs, forming an original SCC, are co-sited and use TG-synchronization to form one new resulting SCC. Antennas are not shared.

4.8.1 RBS 200 Expanded with 12–TRX Cabinet

Co-Siting with RBS 200 Using a Filter Combiner

Using TG-synchronization, it is possible to build one resulting SCC from the described SCC in the table below. The antenna systems are not shared between RBSs.

Table 33 Expansion using filter combiner

Result SCC	Original SCC	Cabinet	Combiner	Antennas	TMA	Original SCC	Basic Configuration	Antennas
1 x 16 *	1 x 4	RBS 200	FCOMB	(3)	No	1x12	F9de_2.12	(2)
		RBS 205	FCOMB	(3)	No		F18d_2.12	(2)
		RBS 205	FCOMB	(3)	M		F18dt_2.12	(2)
		RBS 205	FCOMB&DPX	(2)	No		F18d_2.12	(2)
		RBS 205	FCOMB	(2)	M		F18dt_2.12	(2)
1 x 20 **	1 x 8	RBS 200	FCOMB	(3)	No	1x12	F9de_2.12	(2)
		RBS 205	FCOMB	(3)	No		F18d_2.12	(2)
		RBS 205	FCOMB	(3)	M		F18dt_2.12	(2)
		RBS 205	FCOMB&DPX	(2)	No		F18d_2.12	(2)
		RBS 205	FCOMB	(2)	M		F18dt_2.12	(2)
3 x 8 ***	3 x 4	RBS 200	FCOMB	(3) (3) (3)	No	3x4	3 x F9de_2.4	(2) (2) (2)
	****	RBS 205	FCOMB	(3) (3) (3)	No		3 x F18d_2.4	(2) (2) (2)
		RBS 205	FCOMB	(3) (3) (3)	M		3 x F18dt_2.4	(2) (2) (2)
		RBS 205	FCOMB&DPX	(2) (2) (2)	No		3 x F18d_2.4	(2) (2) (2)
		RBS 205	FCOMB	(2) (2) (2)	M		3 x F18dt_2.4	(2) (2) (2)

M = Mandatory

* 1 x 6, 1 x 8, 1 x 10, 1 x 12 and 1 x 14 can be accomplished with a partly-equipped expansion configuration.

** 1 x 10, 1 x 12, 1 x 14, 1 x 16 and 1 x 18 can be accomplished with a partly-equipped expansion configuration.

*** 3 x 6 can be accomplished with a partly-equipped expansion configuration.

**** When using TG-synchronization, only one RBS 200/RBS 205 can act as master. Therefore the 3 x 4 configuration, which is three separate RBSs, must be rebuilt to one single RBS, that is, all three sectors of the RBS 200 must be connected to the same TMCB.

Co-Siting with RBS 200 Using Hybrid Combiner

Using TG-synchronization, it is possible to build one resulting SCC from the described SCC in the table below. The antenna systems are not shared between RBSs.

Table 34 Expansion using hybrid combiner

Result SCC	Original SCC	Cabinet	Combiner	Antennas	TMA	Original SCC	Basic Configuration	Antennas
3 x 8 *	3 x 4 **	RBS 200	HCOMB	(3) (3) (3)	No	3 x 4	3 x G9deh_2.4	(2) (2) (2)
		RBS 205	HCOMB	(3) (3) (3)	No		3 x G18dh_2.4	(2) (2) (2)
		RBS 205	HCOMB	(3) (3) (3)	M		3 x G18dht_2.4	(2) (2) (2)
		RBS 205	HCOMB&DPX	(2) (2) (2)	No		3 x G18dh_2.4	(2) (2) (2)
		RBS 205	HCOMB	(2) (2) (2)	M		3 x G18dht_2.4	(2) (2) (2)

M = Mandatory

* 3 x 6 can be accomplished with a partly-equipped expansion configuration. 1 x 8 can be accomplished with one RBS 200/RBS 205 and a partly-equipped expansion configuration.

** When using TG-synchronization, only one RBS 200/RBS 205 can act as master. Therefore the 3 x 4 configuration, which is three separate RBSs, must be rebuilt to one single RBS, that is, all three sectors of the RBS 200 must be connected to the same TMCB.

4.8.2 6–TRX RBS 2000 Macro Cabinets Expanded with 12–TRX Cabinet

Co-Siting with Single TRU-Based RBS 2000 Using Filter Combiner

Using TG-synchronization, it is possible to build one resulting SCC from the described SCC in the table below. The antenna systems are not shared between RBSs.

Table 35 Expansion using filter combiner

	RBS 1			RBS 2		
Result SCC	**Original SCC**	**Basic Configuration**	**Antennas**	**Original SCC**	**Basic Configuration**	**Antennas**
1 x 18 *	1 x 6	D9de_2.6	(2)	1 x 12	F9de_2.12	(2)
		D18d_2.6	(2)		F18d_2.12	(2)
		D18_2.6	(2)		F18dt_2.12	(2)
1 x 24 **	1 x 12	D9de_2.12	(2)	1 x 12	F9de_2.12	(2)
		D18d_2.12	(2)		F18d_2.12	(2)
		D18_2.12	(2)		F18dt_2.12	(2)

* 1 x 8, 1 x 10, 1 x 12, 1 x 14 and 1 x 16 can be accomplished with a partly-equipped RBS 2.

** 1 x 14, 1 x 16, 1 x 18, 1 x 20 and 1 x 22 can be accomplished with a partly-equipped RBS 2.

Co-Siting with Single TRU-Based RBS 2000 Using Hybrid Combiner

Using TG-synchronization, it is possible to build one resulting SCC from the described SCC in the table below. The antenna systems are not shared between RBSs.

Table 36 Expansion using hybrid combiner

	RBS 1			RBS 2		
Result SCC	**Original SCC**	**Basic Configuration**	**Antennas**	**Original SCC**	**Basic Configuration**	**Antennas**
3 x 8 *	3 x 4	3 x C + 9d_2.4	(2) (2) (2)	3 x 4	3 x G9deh_2.4	(2) (2) (2)
		D9de_2.12 3 x C + 9de_2.4	(2) (2) (2)		3 x G9deh_2.4	(2) (2) (2)
		3 x C + 18d_2.4	(2) (2) (2)		3 x G18dh_2.4	(2) (2) (2)
		3 x C + 18_2.4	(2) (2) (2)		3 x G18dht_2.4	(2) (2) (2)
		3 x C + 19d_2.4	(2) (2) (2)		3 x G19dh_2.4	(2) (2) (2)
		3 x C + 19_2.4	(2) (2) (2)		3 x G19dht_2.4	(2) (2) (2)

* 3 x 6 is accomplished with a partly-equipped RBS 2.

4.8.3 12–TRX RBS 2000 Macro Cabinet Expanded with 12–TRX Cabinet

Co-Siting with dTRU-Based RBS 2000 Macro Cabinet Using Filter Combiner

It is possible to build one resulting SCC from the described SCC in the table below, using TG-synchronization. The antenna systems are not shared between RBSs.

Table 37 Expansion using filter combiner

	RBS 1			RBS 2		
Result SCC	**Original SCC**	**Basic Configuration**	**Antennas**	**Original SCC**	**Basic Configuration**	**Antennas**
3 x 8 *	8 + 4	F9de_2.8 + F9de_2.4	(2) (2) (-)	4 + 8	F9de_2.4 + F9de_2.8	(-) (2) (2)
		F9det_2.4 + F9det_2.4	(2) (2) (-)		F9det_2.4 + F9det_2.8	(-) (2) (2)
		F18d_2.8 + F18d_2.4	(2) (2) (-)		F18d_2.4 + F18d_2.8	(-) (2) (2)
		F18dt_2.8 + F18dt_2.4	(2) (2) (-)		F18dt_2.4 + F18dt_2.8	(-) (2) (2)
1 x 24 **	1 x 12	F9de_2.12	(2)	1 x 12	F9de_2.12	(2)
		F9det_2.12	(2)		F9det_2.12	(2)
		F18d_2.12	(2)		F18d_2.12	(2)
		F18d_2.12	(2)		F18dt_2.12	(2)

* 3 x 6 can be accomplished with a partly-equipped RBS 1 and RBS 2, although it is more easily performed with 2 x 6 in RBS 1 and 1 x 8 with three dTRUs in RBS 2. TG-synchronization is not required.

** 1 x 14, 1 x 16, 1 x 18, 1 x 20 and 1 x 22 are accomplished with a partly-equipped RBS 2.

Co-Siting with dTRU-Based RBS 2000 Using Hybrid Combiner

Using TG-synchronization, it is possible to build one resulting SCC from the described SCC in the table below. The antenna systems are not shared between RBSs.

Table 38 Expansion using hybrid combiner

	RBS 1			RBS 2		
Result SCC	**Original SCC**	**Basic Configuration**	**Antennas**	**Original SCC**	**Basic Configuration**	**Antennas**
3 x 8 *	3 x 4	3 x G9deh_2.4	(2) (2) (2)	3 x 4	3 x G9deh_2.4	(2) (2) (2)
		3 x G9deht_2.4	(2) (2) (2)		3 x G9deht_2.4	(2) (2) (2)
		3 x G18dh_2.4	(2) (2) (2)		3 x G18dh_2.4	(2) (2) (2)
		3 x G18dht_2.4	(2) (2) (2)		3 x G18dht_2.4	(2) (2) (2)

* 3 x 6 is accomplished with a partly-equipped RBS 2.

Co-Siting with dTRU-Based RBS 2000 without Hybrid Combiner

Using TG-synchronization, it is possible to build one resulting SCC from the described SCC in the table below. The antenna systems are not shared between RBSs.

Table 39 Expansion using CDU-G without hybrid combiner

	RBS 1			RBS 2		
Result SCC	**Original SCC**	**Basic Configuration**	**Antennas**	**Original SCC**	**Basic Configuration**	**Antennas**
3 x 4	3 x 2	3 x G9de_2.2	(2) (2) (2)	3 x 2	3 x G9de_2.4	(2) (2) (2)
		3 x G9det_2.2	(2) (2) (2)		3 x G9det_2.4	(2) (2) (2)
		3 x G18d_2.2	(2) (2) (2)		3 x G18d_2.4	(2) (2) (2)
		3 x G18dt_2.2	(2) (2) (2)		3 x G18dt_2.4	(2) (2) (2)
		3 x G19dh_2.4	(2) (2) (2)		3 x G19dh_2.4	(2) (2) (2)
		3 x G19dht_2.4	(2) (2) (2)		3 x G19dht_2.4	(2) (2) (2)

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5 Product Data

5.1 Site Equipment Overview

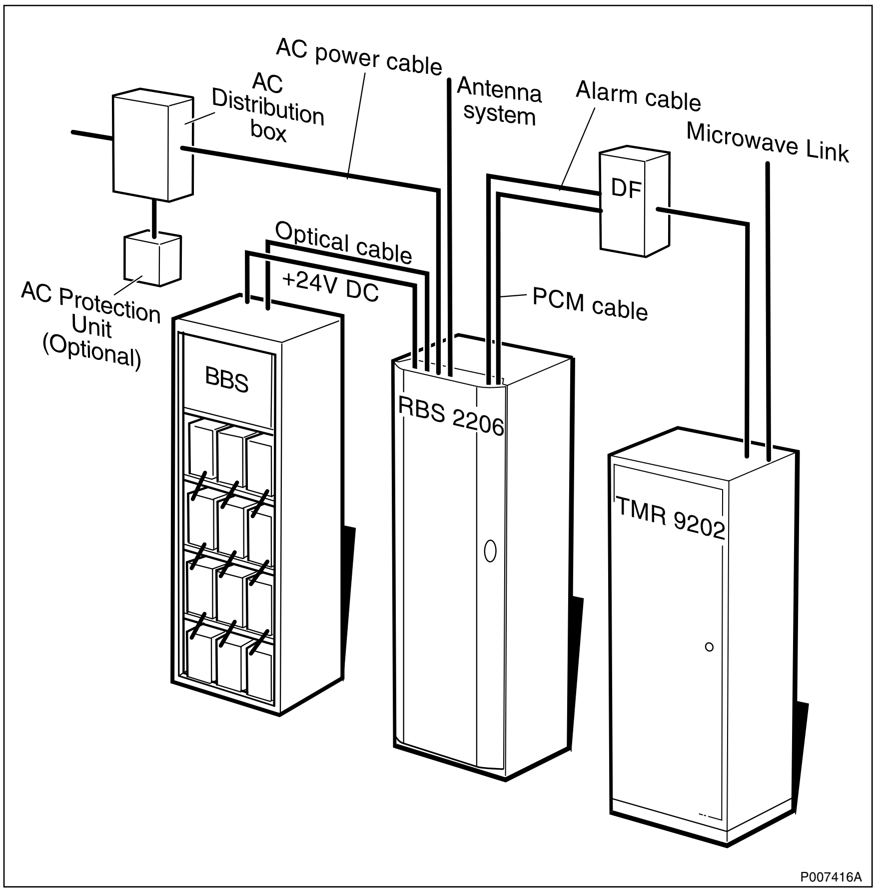

Figure 25 Site Equipment Overview

The following is a list of the most common equipment on a radio site, divided into function groups:

RBS 2206

Power:

BBS 2000

AC Distribution box

Power cables

Antenna System

Antennas

TMA

Feeder cables

Transmission

TMR 9202

DXX

Mini DXC

Mini Link

Installation Material

Earthing

DF

Cable ladder

5.2 Site Power Options

The RBS cabinet has three power source options:

- 120 - 250 V AC mains input power through screw-terminals. The power inputs feed four separate PSUs. A battery back-up +24 V DC may be connected simultaneously as an option. This is the same as the +24 V described below.
- +24 V DC. The radio cabinet can operate on +24 V DC from an external power source.
- -(48 - 60) V DC is connected in a similar manner as the AC. Observe that the +24 V DC battery back-up is not available in this power configuration.

5.3 Power Connections

DANGER

Improper electrical installation may cause fire or electrical shock. Approved circuit breakers for the AC mains and the cable's cross sectional areas must always be selected in accordance with local laws and regulations. Only a qualified and authorized electrician is permitted to install or modify the electrical installation.

The RBS 2206 can be delivered in two versions. The first version has power interface inlets for one AC mains supply voltage and one inlet for DC power: +24 V DC. The other version has power interface for -(48 - 60) V DC, *see table below.*

Table 40 The power supply voltage can be one of the following alternatives:

Nominal	Range	PSU
120 - 250 V AC, 50 - 60 Hz	90 - 275 V AC, 45 - 65 Hz	PSU-AC
+24 V DC	+20.5 - +29 V DC	PSU not needed
-(48 - 60) V DC	-(39 - 72) V DC	PSU-DC

5.3.1 AC Mains Power Connection

There are two ways to connect power to the base station. They are:

- Single phase line to neutral.
- Single phase line to line.

Single Phase Line to Neutral

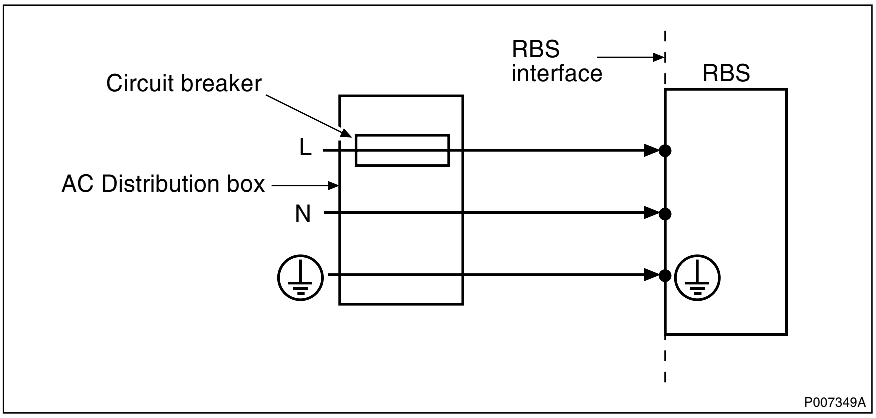

Figure 26 Power connection, L1-N (120 - 250 V AC)

One circuit breaker per PSU is required.

Single Phase Line to Line

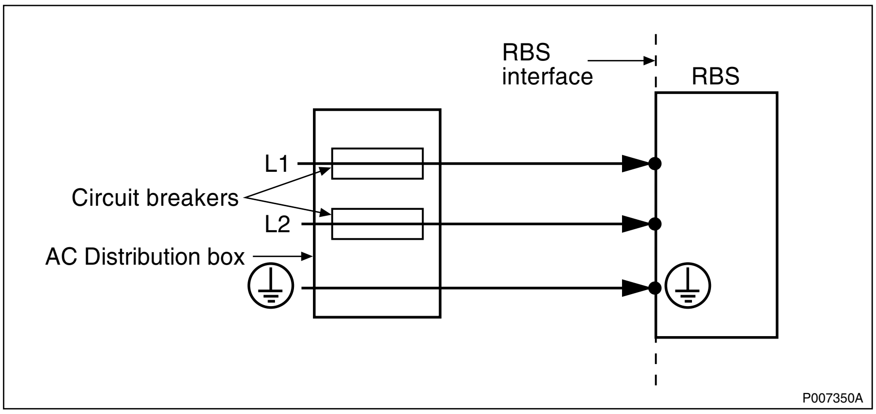

Figure 27 Power connection, L1-L2 (120 - 250 V AC)

Two circuit breakers per PSU are required.

AC Mains Power Requirements

AC mains power is connected to the ACCU in the cabinet using four AC cables. The cables must be protected by a circuit breaker according to the figures above.

If the existing power system does not meet the specified requirements, measurements must be taken to avoid damage to the RBS and to secure proper operation, for example by installing filters and stabilizers.

Table 41 AC mains power requirements

Voltage range for specified performance (phase voltage)	120 - 250 V AC
Voltage range	108[(1)]-275 V AC
Frequency	45 - 65 Hz
Inrush current, max.	30 A
Maximum AC power	1.4 kW x 4
Non-destructive range	0 – 300 V AC
Overvoltage <20 ms	300 V[(2)]

(1) 90 V AC with reduced output power.
(2) Install external filter and stabilizer if not met.

Mains Fuses

Table 42 Mains fuses recommendation

Voltage	Minimum for Safe Function	Maximum Allowed Fuse Rating
Nominal 120 - 250 V	10 A[(1)]/15 A	16 A

(1) For 200 - 250 V range only

Minimum for safe value means the smallest fuse that can be used with respect to power consumption and start up current.

Maximum allowed must not be exceeded due to the dimensions of the internal wiring and components.

AC Power Cables

There are four external power cables for the radio cabinet, one for each Power Supply Unit. They are connected to the ACCU main switch with screw terminals.

The conductor area can be 1.5 – 2.5 mm^2 and the cable diameter can be 8.5 – 12.5 mm.

5.3.2 +24 V DC Power Supply

DC Power Supply Requirements (+24 V)

Table 43 DC power supply requirements

Nominal	+24 V DC
Default	+27.2 V DC
Range	+20.5 – +29.0 V DC
Non-destructive range	+0 - +32.0 V DC
Inrush current	max. 500 A (0.1 - 10 ms)

Fuses

The +24 V DC cables must be protected with an approved circuit breaker/fuse.

Table 44 +24 V DC fuses recommendation

Minimum for Safe Function	Maximum Allowed Fuse Rating
175 A	200 A

+24 V DC Cables

The +24 V DC supply is connected to the DC filter by a pair of 95 - 150 mm^2 cables, one for + and one for -.

5.3.3 -(48 - 60) V DC Power Supply

DC Power Requirements -(48 - 60) V

Table 45 DC power requirements

Nominal	-48/-60 V DC
Range	-(40.0 - 72.0) V DC
Non-destructive range	+0 - (-80) V DC
Inrush current, typical	200 A (0.1 - 0.5 ms)

Fuses

Table 46 -(48 - 60) V fuses recommendation

Fuse Rating for -60 V DC	Fuse Rating for -48 V DC
32 A	40 A

-(48 - 60) V DC Cables

There are four power cables for the cabinet, one pair for each Power Supply Unit. They are connected to the DCCU main switch with screw terminals. The cables must be connected via an approved circuit breaker/fuse for each cable.

The conductor area can be 6 – 10 mm^{2}and cable diameter can be 4.5 – 7 mm.

5.4 RBS 2206 Cabinet Hardware Description

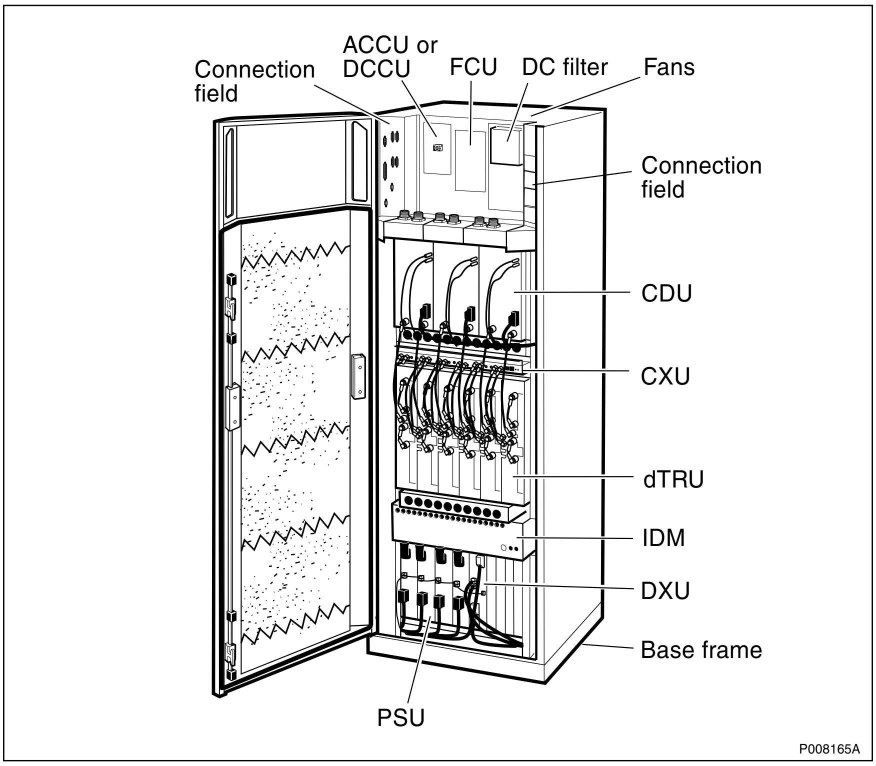

Figure 28

ACCU	*AC Connection Unit*
CDU	*Combining and Distribution Unit*
CXU	*Configuration Switch Unit*
DCCU	*DC Connection Unit*
dTRU	*Double Transceiver Unit*
DXU	*Distribution Switch Unit*
FCU	*Fan Control Unit*
IDM	*Internal Distribution Module*
PSU	*Power Supply Unit*
OXU	*Optional Expansion Unit*

RBS 2206 is a high-capacity indoor base station. It is used for indoor applications, with up to six double Transceiver Units (dTRU). The RBS 2206 is designed to be transported as a fully-assembled cabinet to the site.

All units in the cabinet are easily accessible from the front of the cabinet, which means that the cabinets can be mounted side by side with their backs against a wall.

5.4.1 RBS Cabinet Hardware

The RBS 2206 has a number of replaceable units. The functions of specific units of the RBS 2206 are described briefly here.

Distribution Switch Unit (DXU-21)

The DXU is the central control unit for the RBS. It supports the interface to the BSC, and it collects and transmits the alarms. The DXU controls the power and climate equipment for the RBS. It has a removable compact flashcard which makes it possible to replace a faulty DXU without the need for loading RBS software from the BSC.

The DXU is also provided with four connections for transmission lines. It can handle both 2 Mbit (E1) and 1.5 Mbit (T1) PCM links.

The DXU has hardware support for EDGE on 12 TRXs.

Double Transceiver Unit (dTRU)

RBS 2206 has capacity for a maximum of six dTRUs. The dTRU contains two TRXes for transmission and reception of two radio carriers.

It has a built-in combiner with the optional possibility of combining two TX signals into one TX output. It is also prepared for four-branch RX diversity for further improvements in sensitivity.

One version of the dTRU imports only GMSK and the other version supports both GMSK and EDGE.

Combining and Distribution Unit (CDU)

The CDU is the interface between the transceivers and the antenna system. All signals are filtered before transmission and after reception by means of bandpass filters. The CDU allows several dTRUs to share antennas. There are a maximum of three CDUs in one RBS 2206.

The task of the CDU is to combine transmitted signals from several transceivers, and to distribute received signal to several transceivers. The CDU is hardware-prepared to support EDGE.

Two different CDU types are used in RBS 2206 to support all the configurations.

CDU-F is a filter combiner intended for high capacity solutions. It can handle up to four transceivers on two antennas. One-, two- and three-sector configurations are possible in one cabinet with only two antennas per sector. A combination of three CDU-Fs can handle 12 transceivers on two antennas.

CDU-G can be configured either for high capacity or for high coverage. It is a combiner that can be used for synthesizer hopping.

To achieve capacity, CDU-G is used in a configuration where the hybrid combiner in the dTRU is used. Up to two dTRUs (four transceivers) can be connected to two antennas. One-, two- and three-sector configurations are supported.

To achieve maximum coverage, CDU-G is used in a configuration where the hybrid combiner within the dTRU is not used. Only one dTRU can be connected to each antenna. The number of dTRUs in an RBS 2206 cabinet is limited to three in this case.

Configuration Switch Unit (CXU)

The task of the CXU is to cross-connect the CDU and the dTRU in the receiver path. The CXU makes it possible to expand or reconfigure a cabinet without moving or replacing any RX cables.

The RX inputs/outputs on the dTRU and the CDU are placed in such positions that they minimize the amount of cable types for connecting the CXU with the dTRUs and the CDUs.

The CXU is configured by means of software.

Power Supply Unit (PSU)

The RBS 2206 contains up to four Power Supply Units (PSU). The PSUs are available in two versions, PSU AC for connection to AC mains, or PSU DC for connection to -48 or -60 V DC power supply. The PSU AC converts 120-250 V to regulated +24 V DC. The PSU DC converts -(48 - 60) V DC to regulated +24 V DC.

Cooling System

The cooling system uses forced air. The air inlet is the perforated door and the outlet is on the roof.

The cooling system consists of four fans and a Fan Control Unit (FCU) that controls the fan speed. The FCU is controlled by the DXU. When the cabinet is not fully equiped, RU dummies are needed to ensure that the cooling system works properly.

The fans are positioned between the CDU subrack and the roof, giving a common suction area. They draw the air through three separate channels around the RUs.

Internal Distribution Module (IDM)

The IDM is a panel for distributing the internal +24 V DC power to the various units. Each distribution circuit in the cabinet is connected to a circuit breaker in the IDM.

AC Connection Unit/DC Connection Unit (ACCU/DCCU)

The ACCU/DCCU handles distribution and connection/disconnection of the incoming power supply voltages to the PSUs. The connection/disconnections are performed by the main switch. The units also contain filter equipment.

DC Filter Unit

The DC filter unit is the interface for +24 V DC power supply or battery back-up.

Space for Optional Expansion (OXU)

There are four positions available for optional RUs in the DXU/PSU subrack, for example for TMA-CM and DXX. One 19-inch OXU-position is also available between the CXU and the dTRU subrack.

5.4.2 Measurements

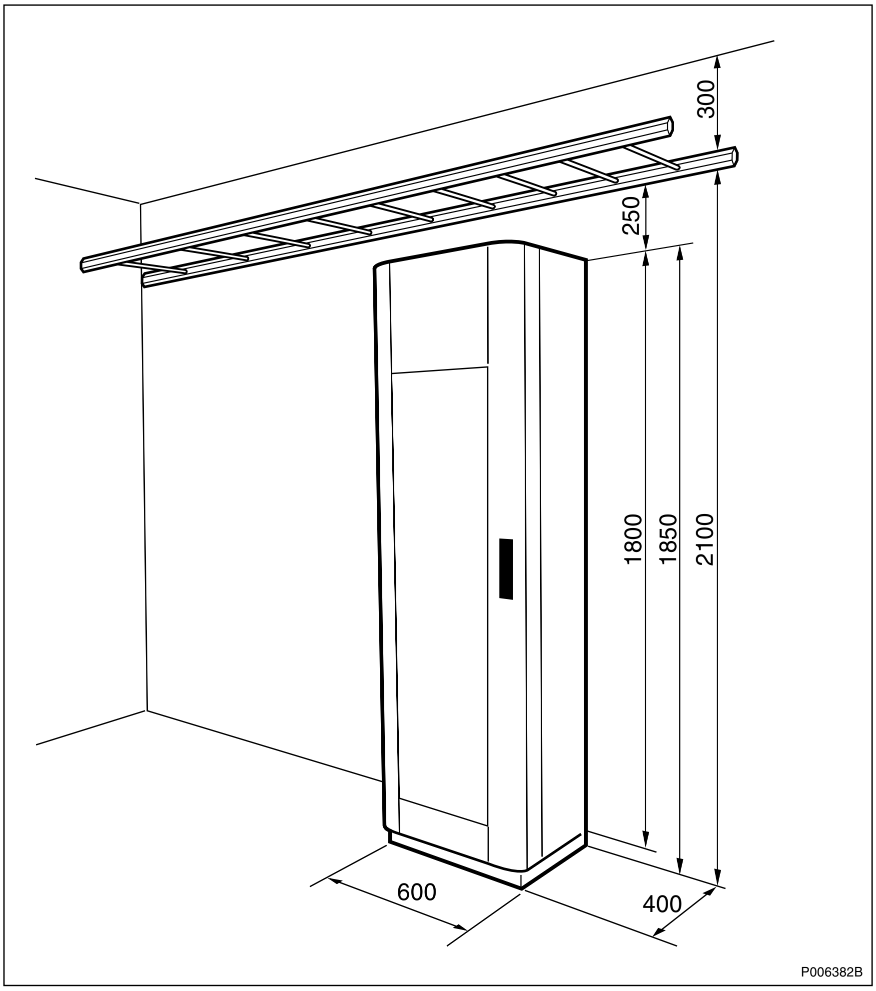

Figure 29 Radio cabinet measurements

Recommended distance between the cabinet and cable ladder is 250 mm. A shorter distance makes it difficult to exchange fans and may hinder the air flow.

The door projects 50 mm in front of the cabinet.

Site Equipment Room

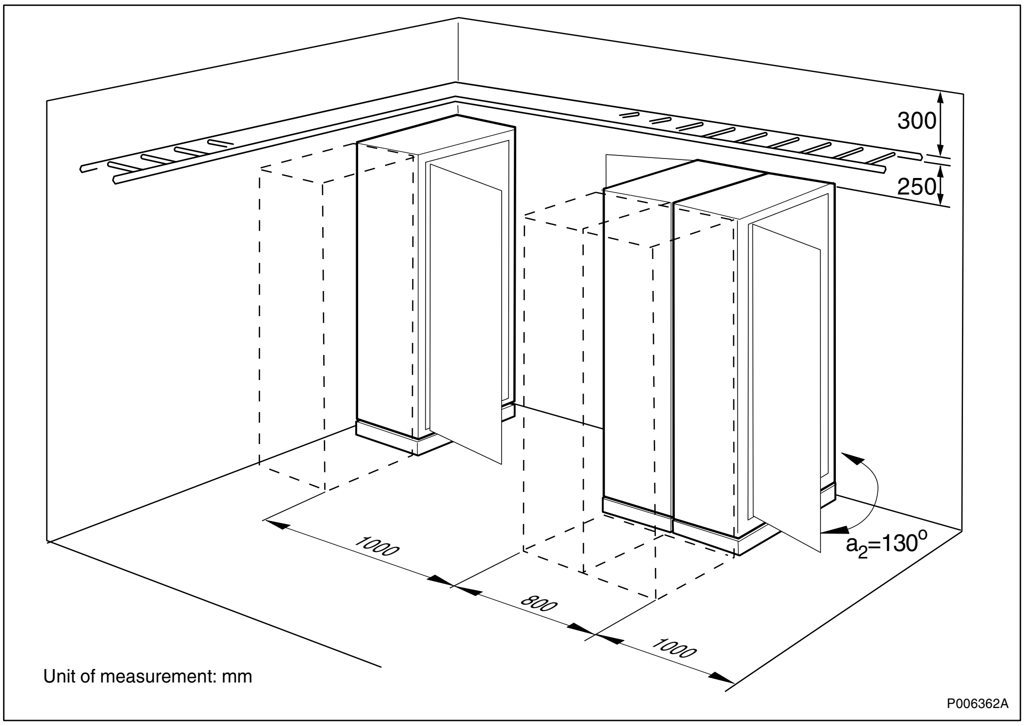

Figure 30 Floor layout and space requirements

The picture above shows floor layout and space requirements.

There must always be a space between the cabinet and the cable ladder for the flow of exhaust air, and to be able to replace fans.

If the RBS cabinet must meet earthquake requirements, the space between wall and cabinet must be at least 100 mm, and between cabinets at least 150 mm.

5.4.3 Weights

Table 47 Weight of cabinet

Unit	**Weight**
Fully equipped cabinet incl. base frame	230 kg
Base frame	12 kg

The weight of the heaviest replaceable unit is less than 15 kg (CDU-G).

5.4.4 Foot Print

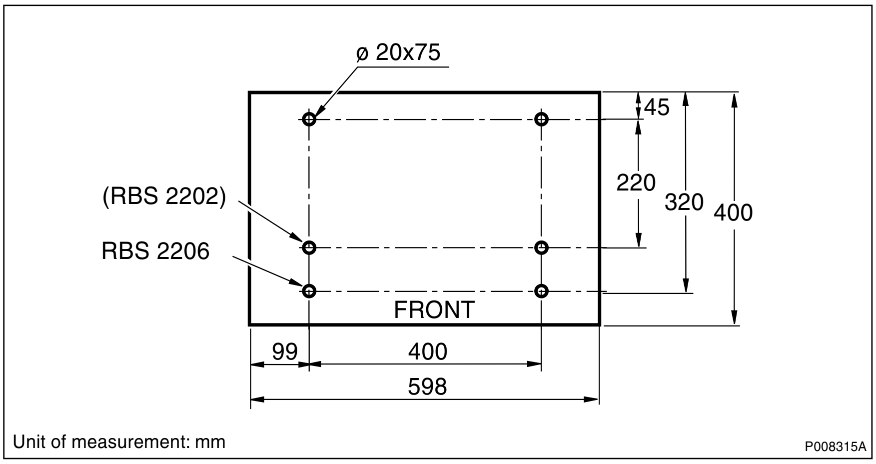

Figure 31 Drilling template for RBS 2206

The RBS 2206 has the same footprint as both cabinets in the RBS 200 system, and the RBS 2202 cabinet. The base frame is used as a template to mark new holes for the RBS 2206.

Replacements

The RBS 2206 cable interfaces are different from the RBS 200 and the RBS 2202. New power distribution circuit breakers and new matching power cables may have to be installed between the power distribution board and the cabinet, see *Section 5.3 Power Connections on page 80.*

Make sure the existing feeders and other cables reach the radio cabinet and that the battery back-up cables have the correct cross-sectional area.

5.4.5 Power Consumption

Table 48 Power consumption for RBS 2206

RBS (fully equipped)	Power Supply Voltage		
	120 - 250 V AC	+24 V DC	-48 V DC
Maximum power consumption	3.9 kW/ 5.8 kW(1)	3.2 kW	3.8 kW

(1) Power consumption during maximum battery charging.

The RBS 2206 has capacity to supply units with power up to 4.8 kW. The power consumption during operation depends upon configuration and traffic.

5.4.6 Heat Dissipation

All power consumed by the RBS can be considered as heat dissipation in the RBS room.

5.4.7 Climate Endurance

Table 49 Climatic endurance

Environmental Parameters	Units	Normal Conditions	Non–Destructive Conditions
Temperature	°C	+5 - +40	-10 - +55
Relative humidity	%	5 - 85	5 - 90

Normal conditions describe the environmental conditions where all units function as specified.

Non-destructive conditions describe environmental stress above the limits for normal conditions with no function guaranteed and unspecified degradation. When the environmental stress has dropped to normal conditions, restoring full RBS performance requires no manual intervention on site.

Non-destructive conditions refer to a period of maximum 96 consecutive hours, and a total of maximum 5.5 days in a three year period.

5.4.8 Acoustic Dispersion

In operation, the base station will not generate acoustic noise exeeding the following limits:

Sound power of 5.8 Bel (B) at environmental temperature below +30°C.

Sound power of 6.3 Bel (B) at maximum environmental temperature, above +30°C.

5.4.9 Vibrations

RBS 2206 is tested to withstand random vibrations of up to 0.2 m^2/s^2. It is also tested for single shocks up to 40 m/s^2.

RBS 2206 is tested for seismic exposure with a test frequency of 1 - 35 Hz. Maximum test level of the Required Response Spectrum (RRS) is 50 m/s^2 within 2 - 5 Hz. The shape of RRS is defined by ETSI standard.

5.4.10 External Alarms

The external alarm inputs in the RBS 2206 do not have overvoltage protection. It is compulsory to use the DF to protect the external alarm inputs.

The optional Distribution Frame (DF) provides connections for RBS 2206 external alarms. There are 16 external alarms available. The alarm device can set the alarm by either an open or closed circuit.

The alarm device connected to the screw terminals should be isolated relay contacts. A closed contact (logic zero) is required to be below 2 kΩ, and an open contact (logic one) above 100 kΩ. The current through a closed 0 Ω contact is 1.2 mA. The voltage between terminals with an open contact is 24 V DC.

The external alarms are defined at the installation. They are defined by using the Operation and Maintenance Terminal (OMT) or from the BSC.

For further information *see Section 5.5.1 Distribution Frame with Overvoltage Protection on page 93*.

5.4.11 RBS 2206 Connection Interface

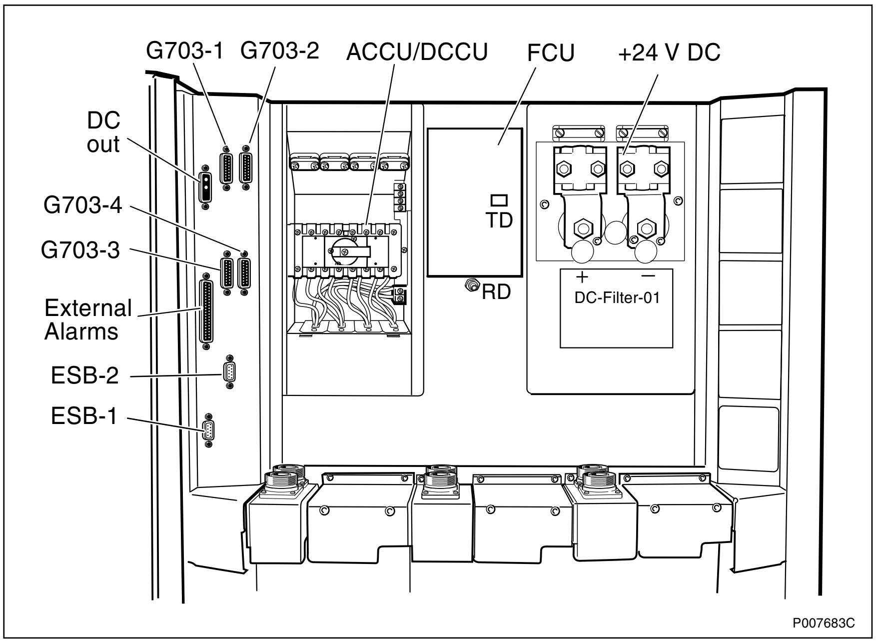

Figure 32 Connection field for external connectors

External cable connections are made in the top section of the cabinet, towards the front, inside the door.

Signal Cable Connections

Table 50 Signal Cable Connections

Connector	Description
G703-1	Transmission Link 1
G703-2	Transmission Link 2
G703-3	Transmission Link 3
G703-4	Transmission Link 4
DC out	+24 V DC to external equipment
External Alarms	External alarm inputs
ESB-1	External Synchronisation Bus
ESB-2	External Synchronisation Bus

Transmission cables, alarm cable and ESB cables are located on the left side of the cabinet's top front section.

Antenna Cable Connections

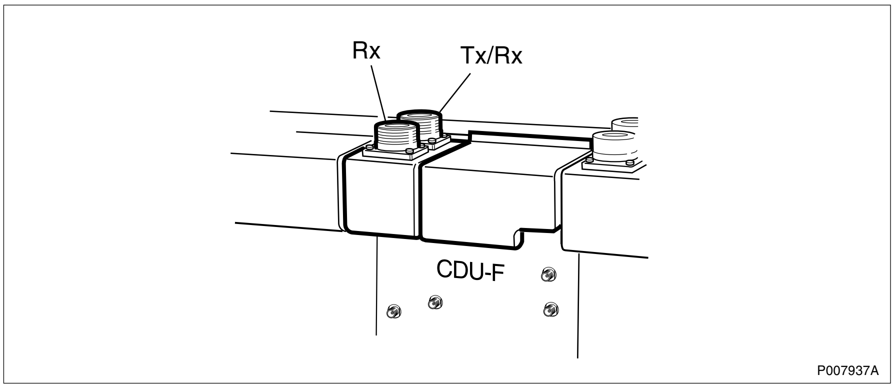

Figure 33 Connection interface CDU-F

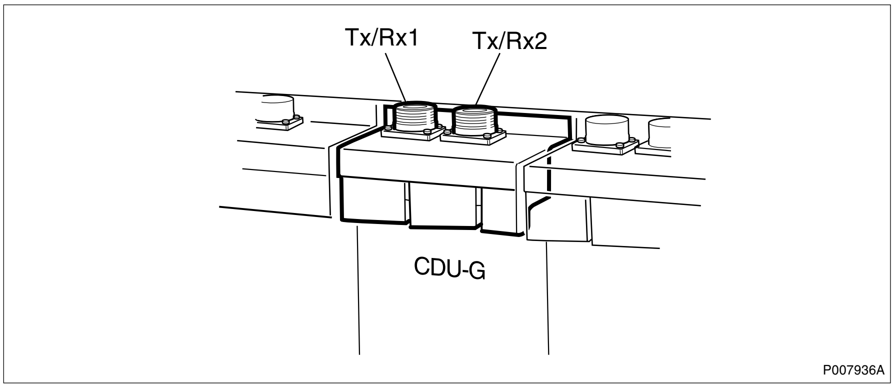

Figure 34 Connection interface CDU-G

Antenna feeders are directly connected to the CDUs. If bias-injector is used, it is connected directly to the CDU and the antenna feeder is connected to bias-injector.

Power and Earthing Connections

Table 51 Power and earthing connections

Connector	Description
+24 V DC	DC-filter +
-24 V DC	DC-filter -
Earth	Earth stud M8
ACCU 1	Mains connection to PSU-AC 1
ACCU 2	Mains connection to PSU-AC 2
ACCU 3	Mains connection to PSU-AC 3
ACCU 4	Mains connection to PSU-AC 4
DCCU 1	-48 V connection to PSU-DC 1
DCCU 2	-48 V connection to PSU-DC 2
DCCU 3	-48 V connection to PSU-DC 3
DCCU 4	-48 V connection to PSU-DC 4

Opto Cable Connections

The optical cable inputs between the RBS 2206 and the BBS 2000 are located on, and immediately below, the FCU, *see Figure 32 on page 91*.

Table 52 Opto cable connections

Connector	Description
FCU-RD	From BBS
FCU-TD	To BBS

Optional Connections

The right part of the cabinet contact field has four pieces of blank panels for optional applications. Blank panels can be exchanged with contact plates in order to equip the area.

5.5 External Alarm and Transmission Interface

5.5.1 Distribution Frame with Overvoltage Protection

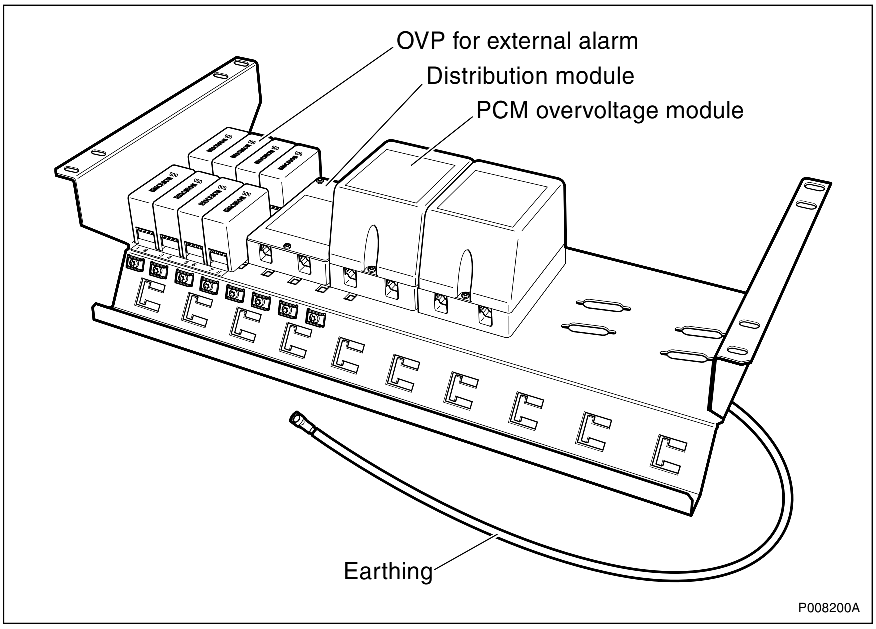

Figure 35 Distribution Frame with Overvoltage Protection

The Distribution Frame (DF) is a connection and Overvoltage Protection (OVP) device for external alarms and PCM-links. The OVP limits the voltage to 100 V relative to ground. The PCM-link can be provided with a balun (balanced/unbalanced transformer).

The DF can be mounted on a wall or in a 19″ frame.

All cables between the DF and the RBS are included. The cable set is available in two versions, 7 m and 15 m.

OVP for External Alarm

It is possible to connect 16 external alarms to the DF. Each alarm connection is provided with over-voltage protection. (One OVP module protects two alarm connections.)

PCM Overvoltage Module

This module contains overvoltage protection for the PCM lines.

If the PCM lines are terminated in equipment outside the RBS equipment room, these lines must be protected by overvoltage protectors (OVP) in the DF. Failure to do so might damage the DXU-21, if a voltage transient is transported along the cable.

RBS 2206 is designed for 100/120 Ω balanced (twisted pair) cable. If 75 Ω unbalanced (coaxial) cable is to be connected, the module must contain a balun card that converts 75 Ω unbalanced to 100/120 Ω balanced line.

A by-pass relay card can be installed in the module to bypass the transmission network during power failure.

Distribution Module

This unit supervises the OVP and controls the by-pass relay if by-pass relay is used. It can also distribute +24 V DC to external transmission equipment.

Earthing

The DF is provided with a short earth cable which is to be connected to the earth collection bar. The DF must be placed close to the earth collection bar, therefore the earth cable must not be extended.

5.5.2 Transmission Adapter (Optional)

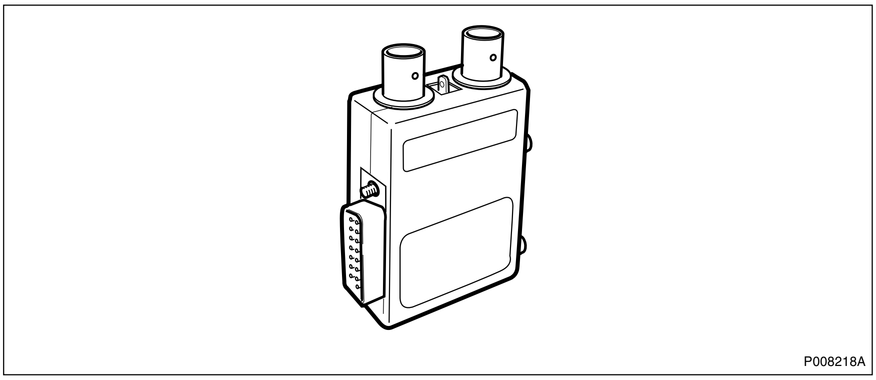

Figure 36 Transmission adapter (TA)

The Transmission Adapter (TA) is a unit that contains a balun (balanced/unbalanced transformer) for transforming 75 Ω unbalanced to 120 Ω balanced cable. It is provided with two BNC connectors for connection of the 75 Ω coaxial cable.

It is intended for mounting directly on the transmission link connector (G-703) on the cabinet’s connection field, *see Figure 32 on page 91*.

5.5.3 Transmission Network Connection

LAPD concentration and LAPD multiplexing can be used to make the transmission resource more efficient.

The DXU is equipped with four transmission ports. It is connected to a 2 Mbit/s PCM signal or to a 1.5 Mbit/s signal. Two types of transmission network standards may occur: 2 Mbit/s PCM with 75 Ω unbalanced lines or 120 Ω balanced lines. The second case is 1.5 Mbit/s PCM balanced 100 Ω lines.

On the top part of the cabinet are connections for optional transmission equipment which is mounted externally. The connections are:

- PCM cables
- +24 V DC
- Blank panels for connectors to Optional Transmission Equipment (OXU)

5.5.4 Transmission Power

RBS 2206 can feed the transmission equipment with +24 V DC. The maximum power output is 250 W.

BBS 2000 can feed the transmission equipment with +24 V DC. If a DC/DC converter is used, the BBS 2000 can deliver -48 V DC. The converter is mounted in the BBS 2000.

Maximum power outputs from the BBS 2000 are given in the table below.

Table 53 Maximum power output

Battery Fuse Unit	Current	Power Output
BFU-21	2 x 12 A	max. 2 x 250 W (+24 V DC) 200 W (-48 V DC)
BFU-22	40 A	max. 800 W (+24 V DC)

5.5.5 Cascading

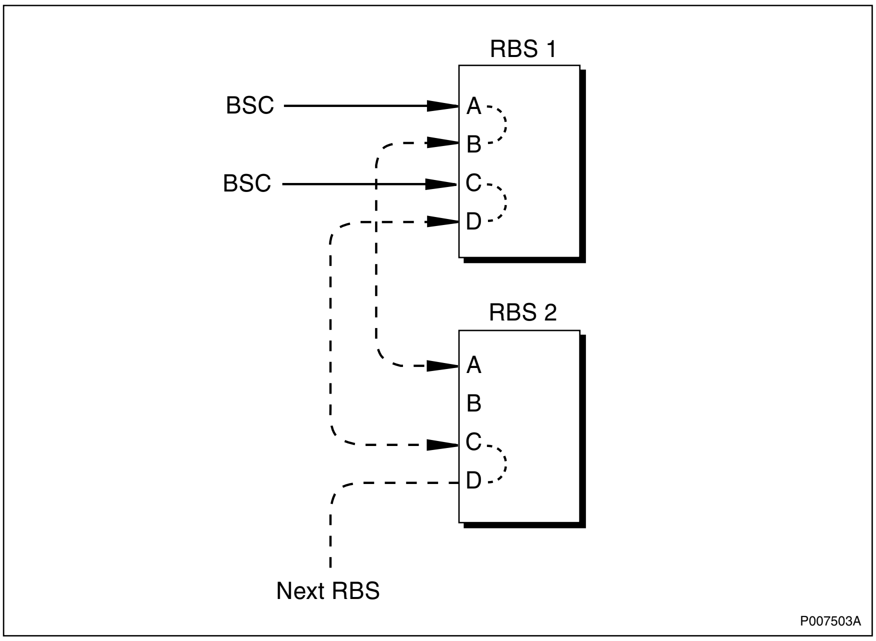

Figure 37 Cascade connection

RBS 2000 can be cascaded. This means that the unused time slots from the BSC are cascaded from the first base station to a second base station, where the second base station can be located at some distance from the first one. Both base stations use the same transmission line to the BSC.

The cable from the previous and to the next base station in the chain is connected through four PCM cables A-D.

5.6 BBS 2000 Rack Description

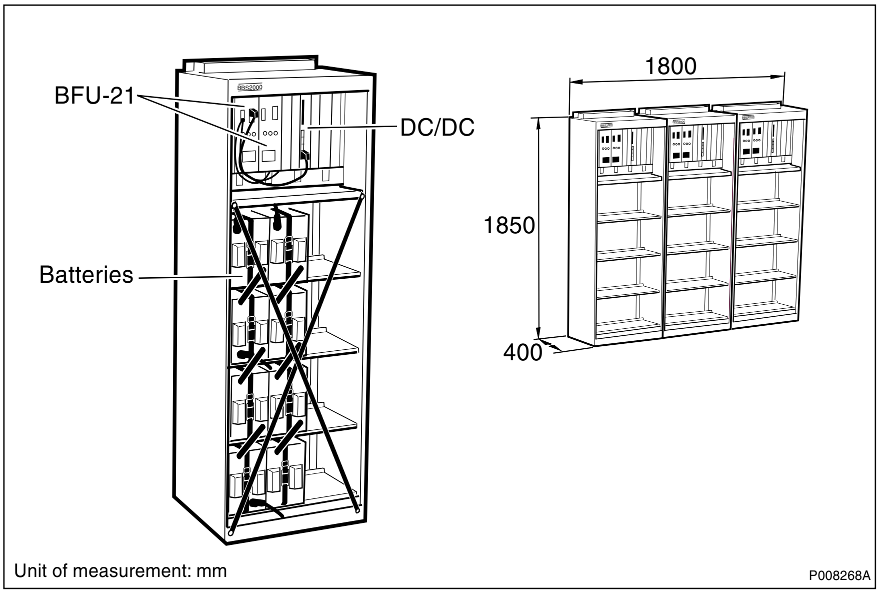

Figure 38 Example of three battery stands

Battery back-up is used to power the site during mains power failure and also to protect the site from short interruptions in the AC mains supply. It is available in an external cabinet.

It is possible to supply external transmission equipment from the battery cabinet. The transmission equipment is provided with power supply longer than the RBS.

In event of mains failure, the batteries in the BBS 2000 will deliver the necessary power to the radio cabinet as well as to the transmission equipment, if used. This enables the radio system to operate during mains failure.

The battery back-up can be delivered for 1, 2, 4, 6 or 8 hours back-up time, depending on the chosen configuration of the RBS.

The BBS can feed +24 V DC or -48 V DC to the TM equipment. The -48 V DC supply requires an internal DC/DC converter in the BBS.

It is possible to share battery back-up between RBS 2202 and RBS 2206.

5.6.1 Converting BBS 2202

If BBS 2202 is used, a conversion kit is needed to run RBS 2206. The battery fuse unit determines which conversion kit should be used:

BFU-21:	product number BMY 201 237/5
BFU-22:	product number BMY 201 237/6

5.6.2 Weights

Table 54 BBS 2000 unit weight

Unit	Weight in kg	Weight in lb.
Battery stand, without batteries	170	375
Battery stand, with 2 batteries	490	1080
Battery stand, with 3 batteries	650	1433

5.6.3 Output Voltage

The voltage range to the RBS cabinet is +20.2 - 29.0 V DC.

Predefined voltage	+27.2 V DC
Battery low voltage limit	+21.0 V DC

5.6.4 BBS Cabinet Hardware

Battery Fuse Unit

The battery fuse unit (BFU) monitors and controls the batteries. It will cut off the load (the RBS) when any of the following conditions occur:

- A mains failure lasts longer than the back-up time. When the battery voltage drops below a preset value, the BFU disconnects the RBS. This is to prevent damaging the batteries by over-discharging. The BFU continues to feed the transmission equipment and/or the DC/DC converter until the voltage has dropped to 20.0 V DC.

- The temperature of the batteries is too high.
- A short circuit occurs between the distribution cables. This will release the circuit breaker in the BFU.

The BFU also supplies voltage through two fuses directly to transmission equipment and/or through the DC/DC converter (optional) to transmission equipment. BFU-21 supplies through two fuses (12 A), BFU-22 supplies through one fuse (40 A).

One BFU is needed for each RBS cabinet.

BFU-21 and BFU-22 differ in their power outputs, *see Table 53 on page 95*.

DC/DC converter (optional)

The DC/DC converter is located in the BBS and converts +24 V DC to -48 V DC.

Battery Blocks

The batteries are for stationary use. They are a sealed lead-acid type, with valve ventilators. The battery is composed of battery blocks in one or more battery strings. One string of +24 V batteries has four 6 V blocks.

Further information regarding the BBS 2000 can be found in:

Power Manual BBS 2000 *K 1556-BZZ 208 06-101*

5.6.5 Cable Connection Interfaces

See Section 5.3.2 +24 V DC Power Supply on page 82.

5.7 Antenna System

This chapter contains information about antenna configurations for outdoor cells.

There are a number of antenna system products available, such as antennas, feeders, jumpers, TMAs and so on. For more detailed information about products, see

RBS Site Solutions homepage:

http://gsmrbs.ericsson.se/gsmsystems/solutions/rbs_site_solutions/index.htm

5.7.1 Tower Mounted Amplifier (TMA)

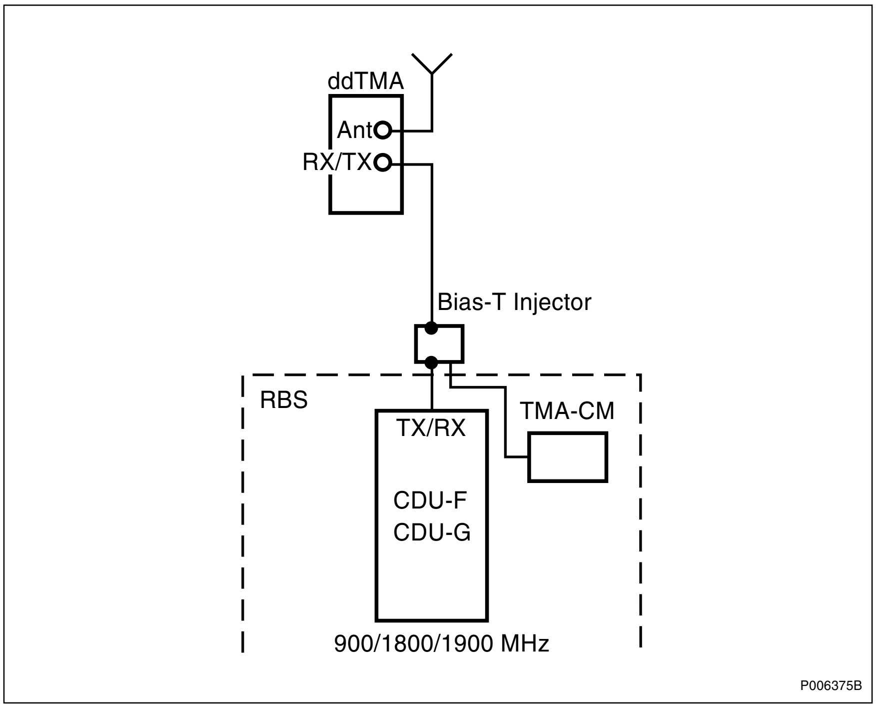

Figure 39 TMA connections for 12 TRX RBSs

Function

The TMA compensates for signal loss in the receiver antenna cables, reduces system noise and improves uplink sensitivity. The TMA can consist of a duplex filter. Duplex is the function that allows communication in two directions (sending and receiving) on the same communication channel.

The TMA used for 12 TRX products is Dual Duplex TMA (ddTMA).

Requirements

The TMA is mounted as close to the antennas as possible in the GSM 900, 1800 and 1900 systems, preferably on the same support. Cable length is approximately 1 m.

Feeder Loss

The GSM 1800 and 1900 receivers are optimized to have a maximum sensitivity with a feeder loss of 4 dB. Feeder loss of less than 4 dB will cause a deterioration of receiver sensitivity if strong interfering signals are present. Feeders with 4 dB loss or more must be selected at sites where strong interfering signals are expected.

It may be necessary to select a feeder with higher loss and calculate the length to obtain a total loss of 4 dB.

Dual Duplex TMA (ddTMA)

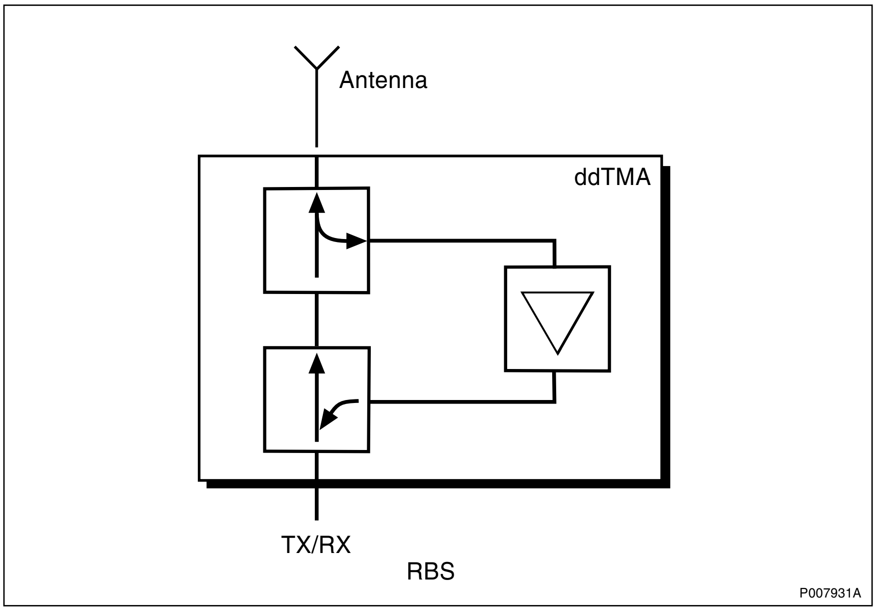

Figure 40 Dual Duplex TMA (ddTMA)

The ddTMA is to be used for GSM 900, for all macro base stations and 1800 or 1900 systems for RBS 2206 and RBS 2106.

A Dual Duplex TMA contains two duplex filters and a low noise amplifier. The first duplex filter splits up the signal path from the antenna into one transmitter and one receiver path. The received signal is amplified in the low noise amplifier. After amplification, the receiver and transmitter paths are combined in the second duplex filter.

The ddTMA is a narrow-band product and is available in a number of versions depending on the frequency band to be used.

A bias-injector is used to feed the ddTMA with 15 V DC.

The unit has two 7/16 socket connectors, see figure below.

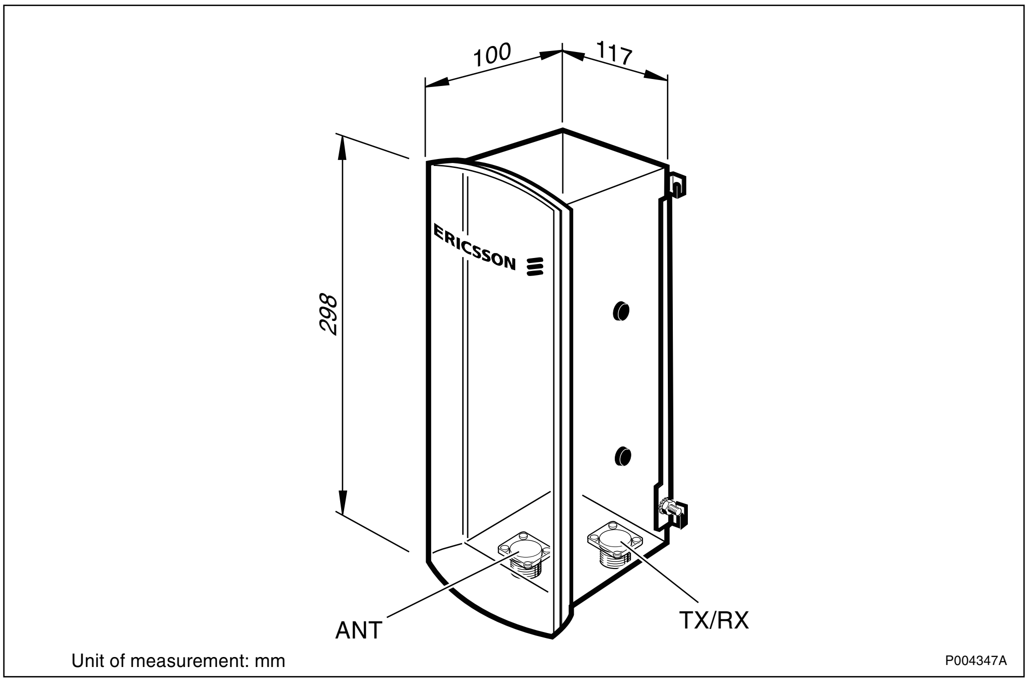

Figure 41 Dimensions of ddTMA

Table 55

Unit	Weight	Dimensions
ddTMA	4 kg without mounting bracket	height 298 mm width 117 mm depth 100 mm

Bias-Injector

The bias-injectors are used to provide the TMA with DC power from the TMA-CM, over the RX/TX feeder cables. The bias-injector is mounted between the antenna feeder and the CDU.

TMA-CM

Six bias-injectors can be connected to one TMA-CM.

The TMA-CM can be mounted either externally, as in the RBS 2202; or internally, as in the RBS 2206.

5.7.2 Antenna System Connections

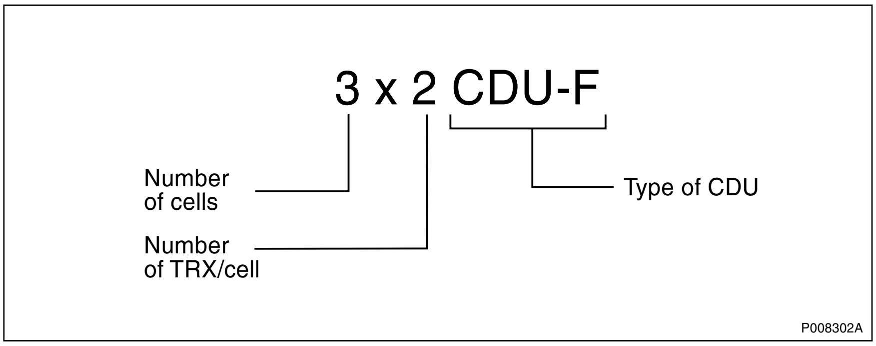

Figure 42 CDU configuration key

The various configurations available for cabinets are described using the following system:

In the example above, the cabinet is fitted with three CDUs, each connected to two TRXs; the total number of TRXs is thus six in this case. The CDU is type CDU-F.

The RF cables between each CDU and its associated dTRUs are standardized and do not normally change. Each CDU uses a set of standard RF wiring patterns for connection between each CDU and the cabinet connection field.

In the figures and tables in the sections that follow, the cabinets shown are fully-equipped. Configurations consisting of a part of the fully-equipped cabinet can also be derived from the following figures and tables.

GSM 900/1800 CDU-F, configurations without TMA

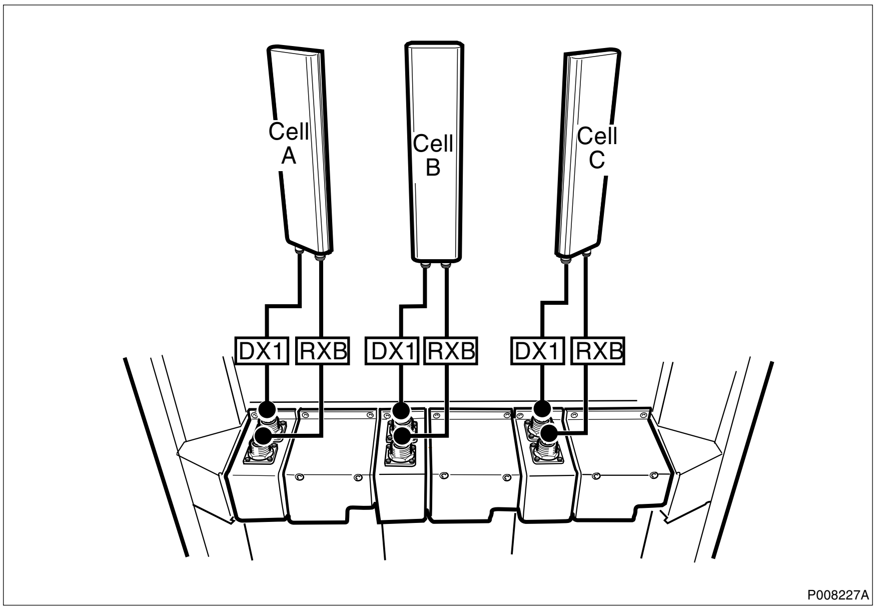

Figure 43 Configuration scheme, 3x2 CDU-F and 3x4 CDU-F

Table 56 3x2 CDU-F and 3x4 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
		RX	RX	CellA:RXB
B	2	TX/RX	TX/RX	CellB:DX1
		RX	RX	CellB:RXB
C	2	TX/RX	TX/RX	CellC:DX1
		RX	RX	CellC:RXB

From the configuration in figure above, the following configurations can be derived:

- 1x2 CDU-F
- 2x2 CDU-F
- 1x4 CDU-F
- 2x4 CDU-F

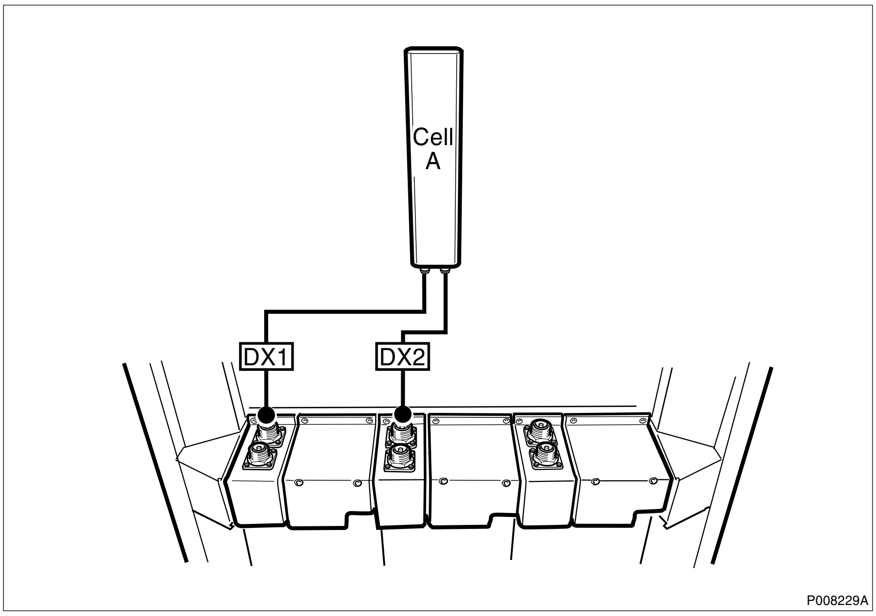

Figure 44 Configuration scheme, 1x8 CDU-F

Table 57 1x8 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
	2	TX/RX	TX/RX	CellA:DX2

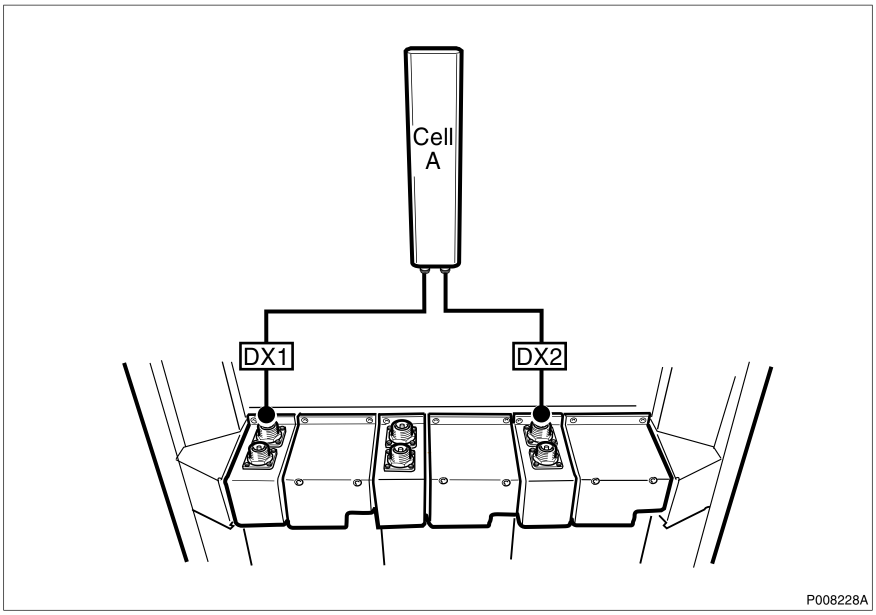

Figure 45 Configuration scheme, 1x12 CDU-F

Table 58 1x12 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
	3	TX/RX	TX/RX	CellA:DX2

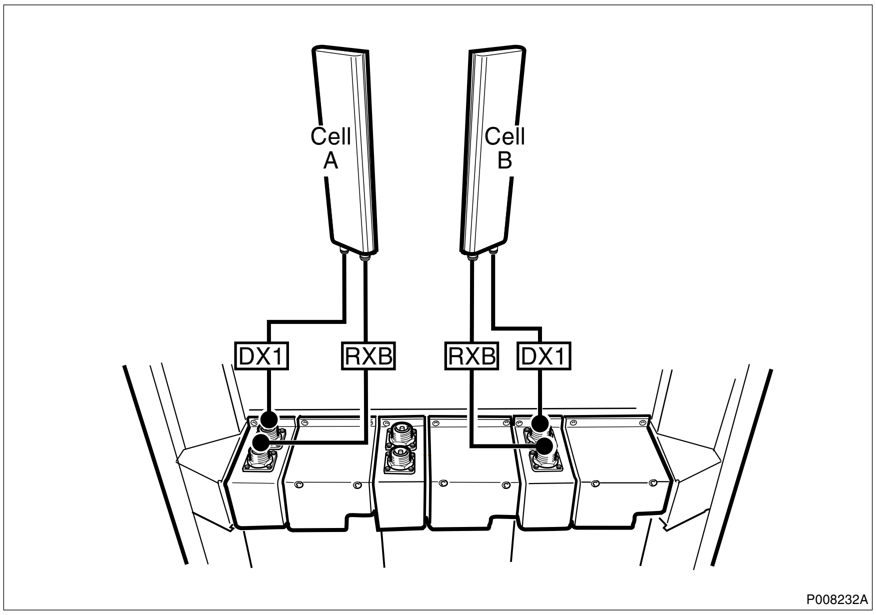

Figure 46 Configuration scheme, 2x6 CDU-F

Table 59 2x6 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
		RX	RX	CellA:RXB
B	3	TX/RX	TX/RX	CellB:DX1
		RX	RX	CellB:RXB

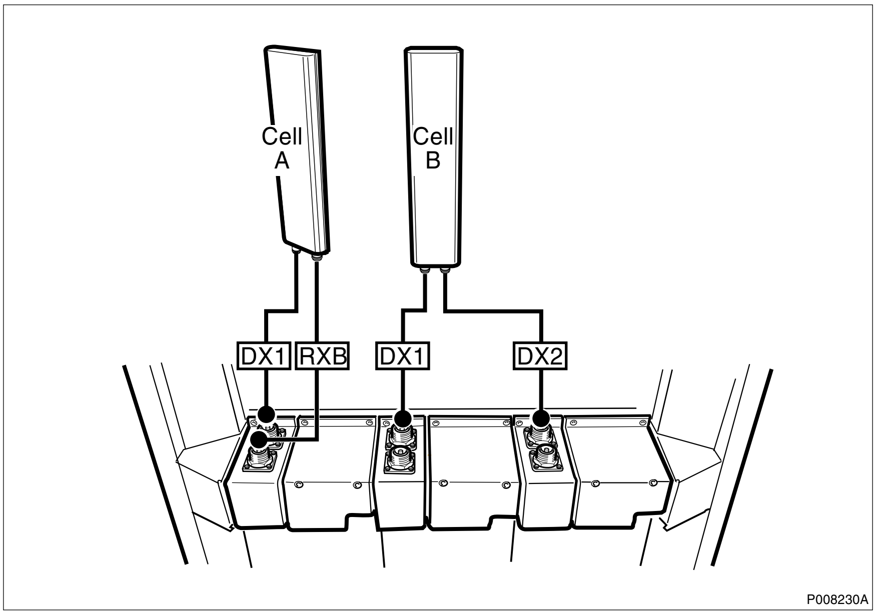

Figure 47 Configuration scheme, 1x4+1x8 CDU-F

Table 60 1x4+1x8 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
		RX	RX	CellA:RXB
B	2	TX/RX	TX/RX	CellB:DX1
	3	TX/RX	TX/RX	CellB:DX2

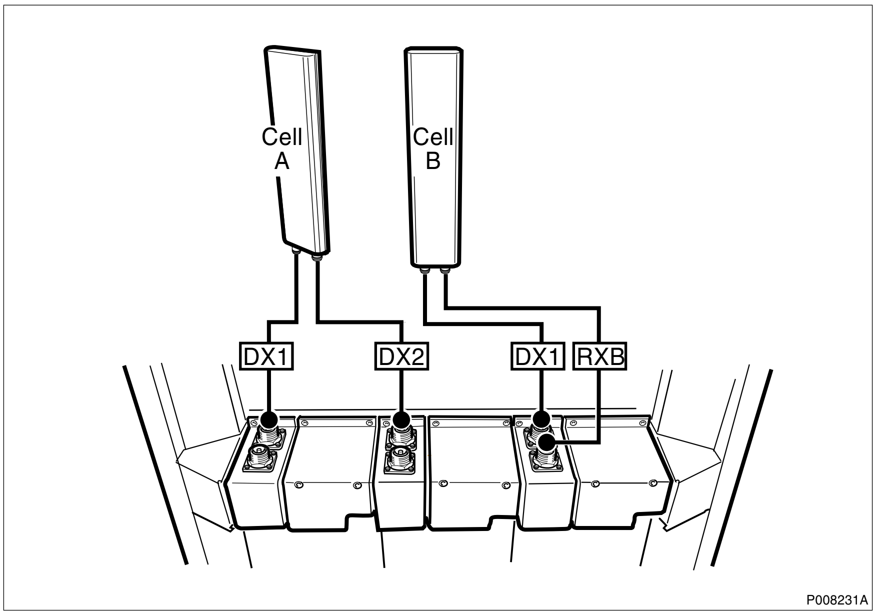

Figure 48 Configuration scheme, 1x8+1x4 CDU-F

Table 61 1x8+1x4 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
	2	TX/RX	TX/RX	CellA:DX2
B	3	TX/RX	TX/RX	CellB:DX1
		RX	RX	CellB:RXB

GSM 900/1800 CDU-F, configurations with TMA

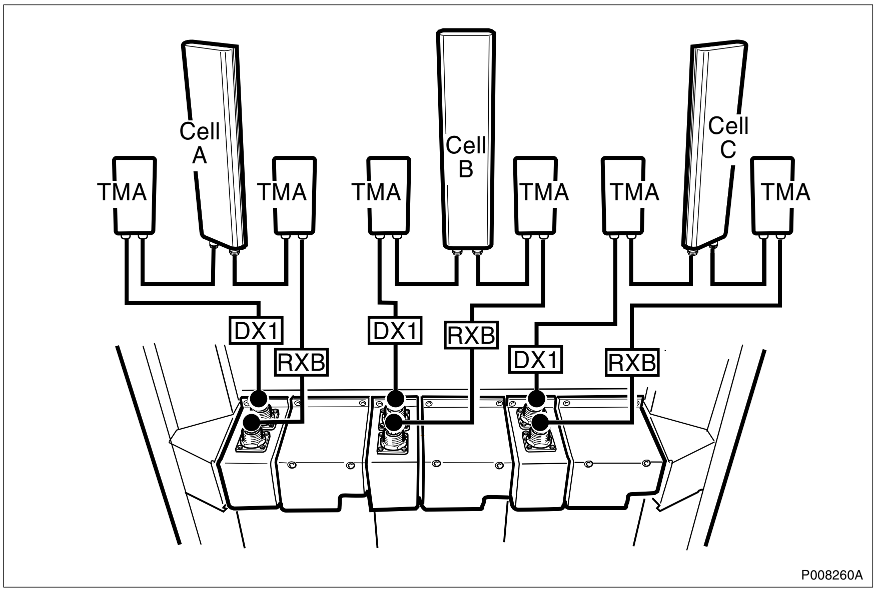

Figure 49 Configuration scheme, 3x2 CDU-F and 3x4 CDU-F

Table 62 3x2 CDU-F and 3x4 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
		RX	RX	CellA:RXB
B	2	TX/RX	TX/RX	CellB:DX1
		RX	RX	CellB:RXB
C	2	TX/RX	TX/RX	CellC:DX1
		RX	RX	CellC:RXB

From the configuration in figure above, the following configurations can be derived:

- 1x2 CDU-F
- 2x2 CDU-F
- 1x4 CDU-F
- 2x4 CDU-F

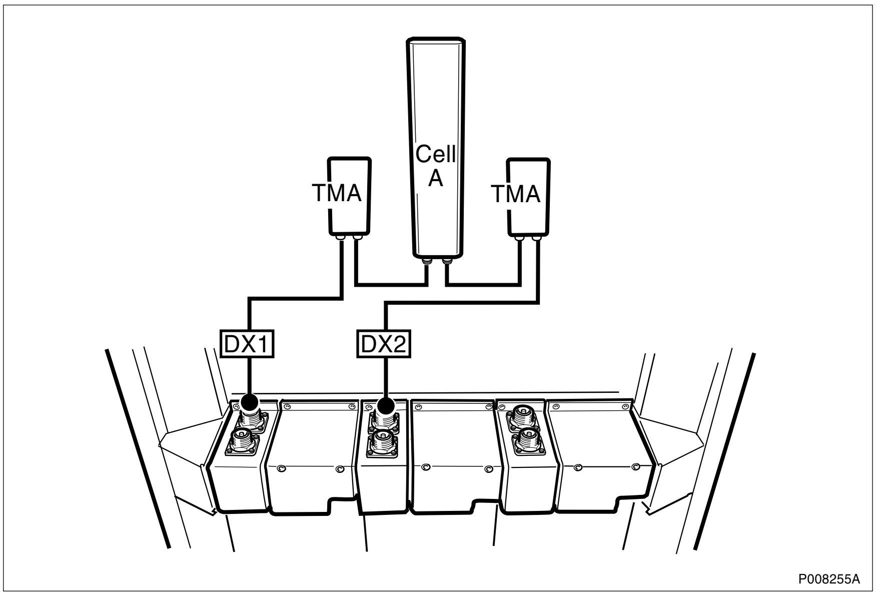

Figure 50 Configuration scheme, 1x8 CDU-F

Table 63 1x8 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
	2	TX/RX	TX/RX	CellA:DX2

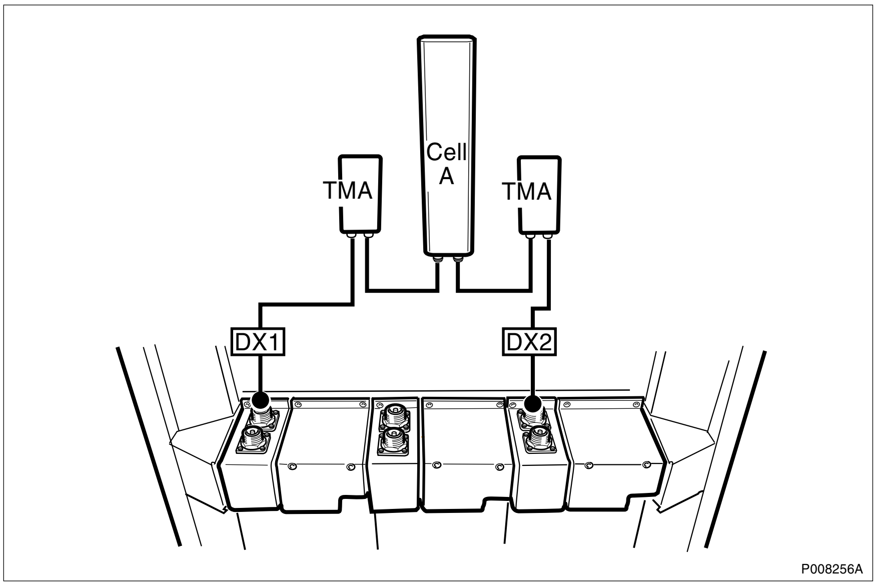

Figure 51 Configuration scheme, 1x12 CDU-F

Table 64 1x12 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
	3	TX/RX	TX/RX	CellA:DX2

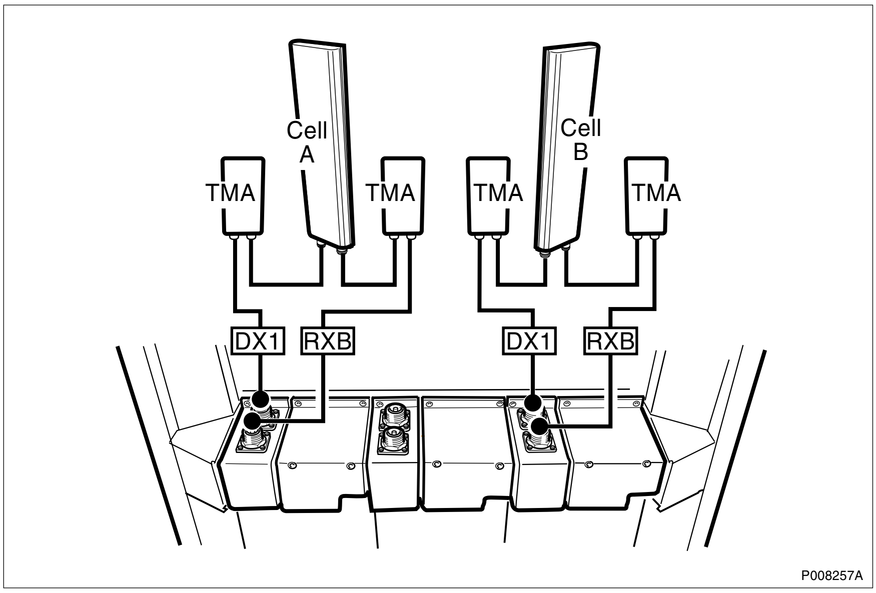

Figure 52 Configuration scheme, 2x6 CDU-F

Table 65 2x6 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
		TX/RX	TX/RX	CellA:RXB
B	3	TX/RX	TX/RX	CellB:DX1
		RX	RX	CellB:RXB

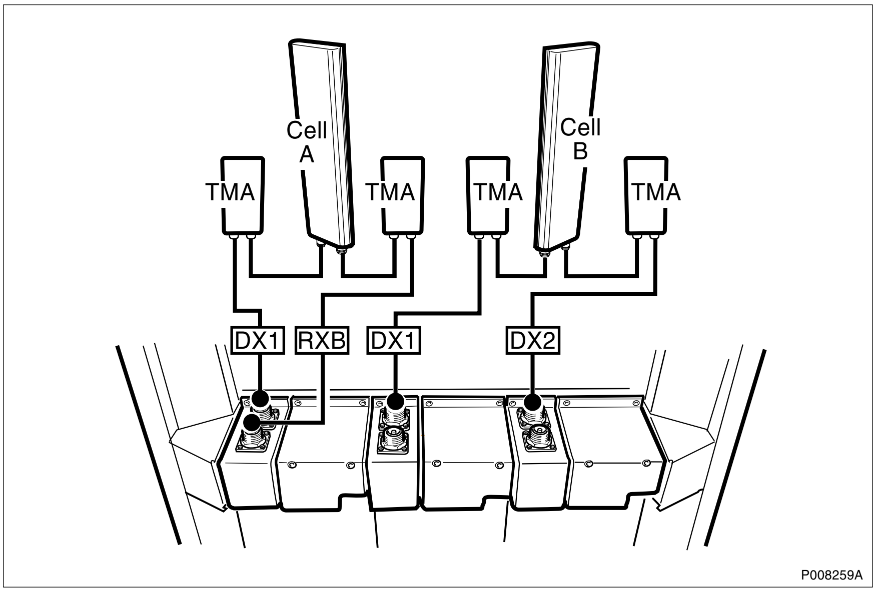

Figure 53 Configuration scheme, 1x4+1x8 CDU-F

Table 66 1x4+1x8 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
		RX	RX	CellA:RXB
B	2	TX/RX	TX/RX	CellB:DX1
	3	TX/RX	TX/RX	CellB:DX2

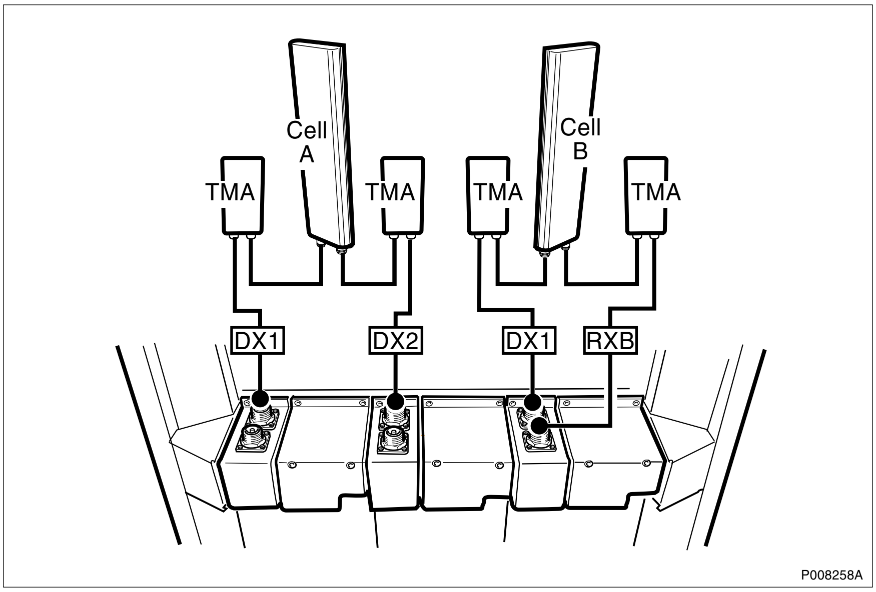

Figure 54 Configuration scheme, 1x8+1x4 CDU-F

Table 67 1x8+1x4 CDU-F

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX	TX/RX	CellA:DX1
	2	TX/RX	TX/RX	CellA:DX2
B	3	TX/RX	TX/RX	CellB:DX1
		RX	RX	CellB:RXB

GSM 900/1800 CDU-G, configurations without TMA

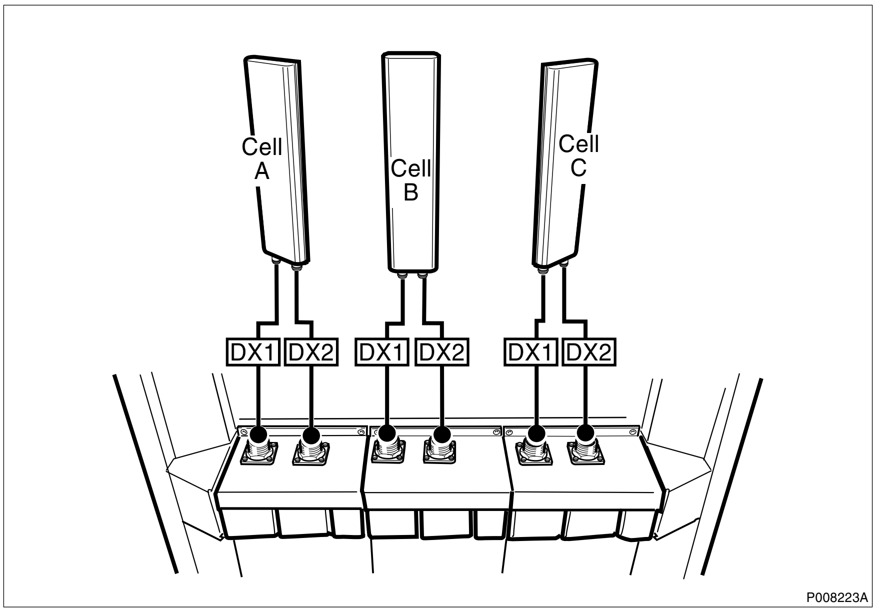

Figure 55 Configuration scheme, 3x2 CDU-G and 3x4 CDU-G

Table 68 3x2 CDU-G and 3x4 CDU-G

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX1	TX/RX	CellA:DX1
		TX/RX2	TX/RX	CellA:DX2
B	2	TX/RX1	TX/RX	CellB:DX1
		TX/RX2	TX/RX	CellB:DX2
C	3	TX/RX1	TX/RX	CellC:DX1
		TX/RX2	TX/RX	CellC:DX2

From the configuration in the figure above, the following configurations can be derived:

- 1x2 CDU-G
- 2x2 CDU-G
- 1x4 CDU-G
- 2x4 CDU-G

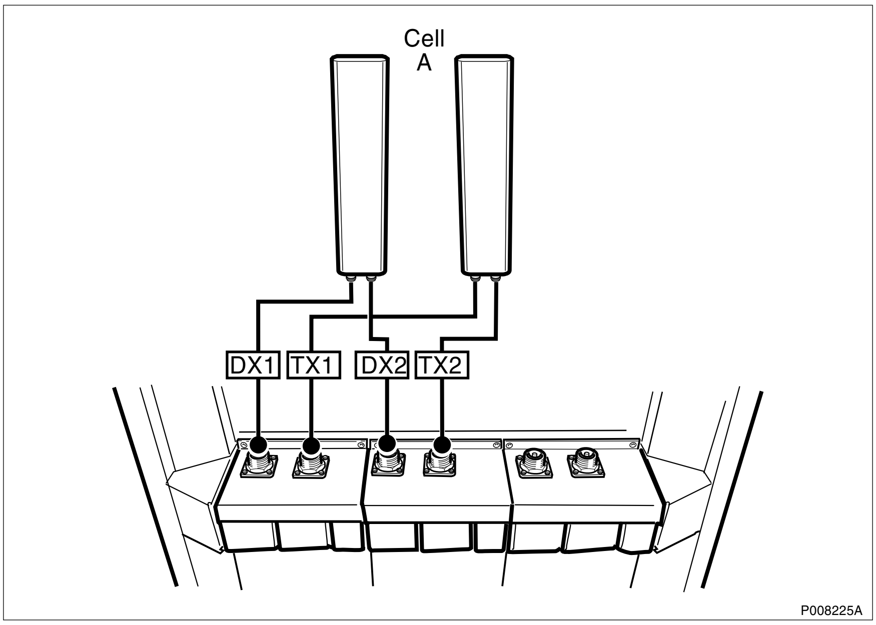

Figure 56 Configuration scheme, 1x8 CDU-G

Table 69 1x8 CDU-G

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX1	TX/RX	CellA:DX1
		TX/RX2	TX	CellA:TX1
	2	TX/RX1	TX/RX	CellA:DX2
		TX/RX2	TX	Cell:ATX2

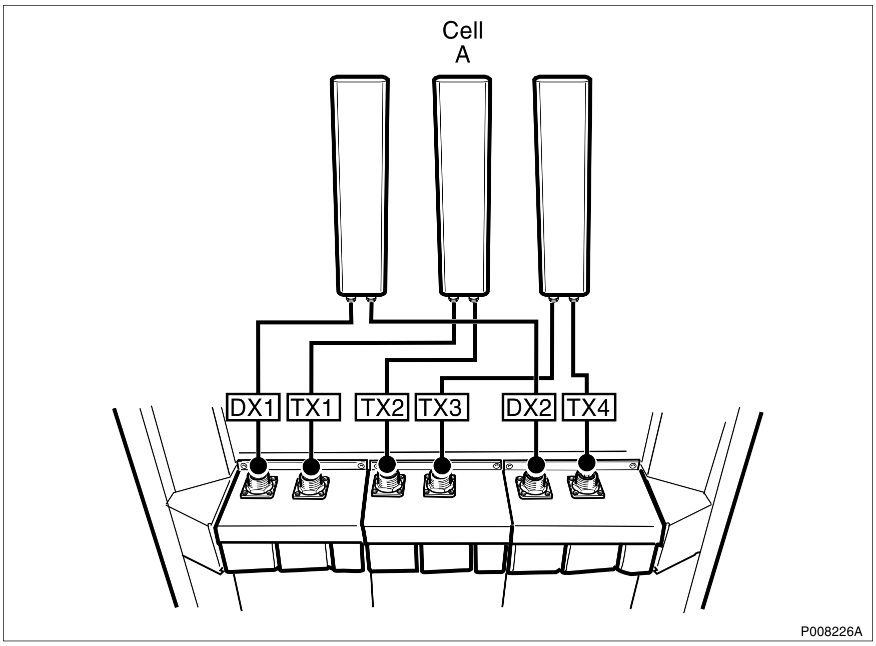

Figure 57 Configuration scheme, 1x12 CDU-G

Table 70 1x12 CDU-G

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX1	TX/RX	CellA:DX1
		TX/RX2	TX	CellA:TX1
	2	TX/RX1	TX	CellA:TX2
		TX/RX2	TX	CellA:TX3
	3	TX/RX1	TX/RX	CellA:DX2
		TX/RX2	TX	CellA:TX4

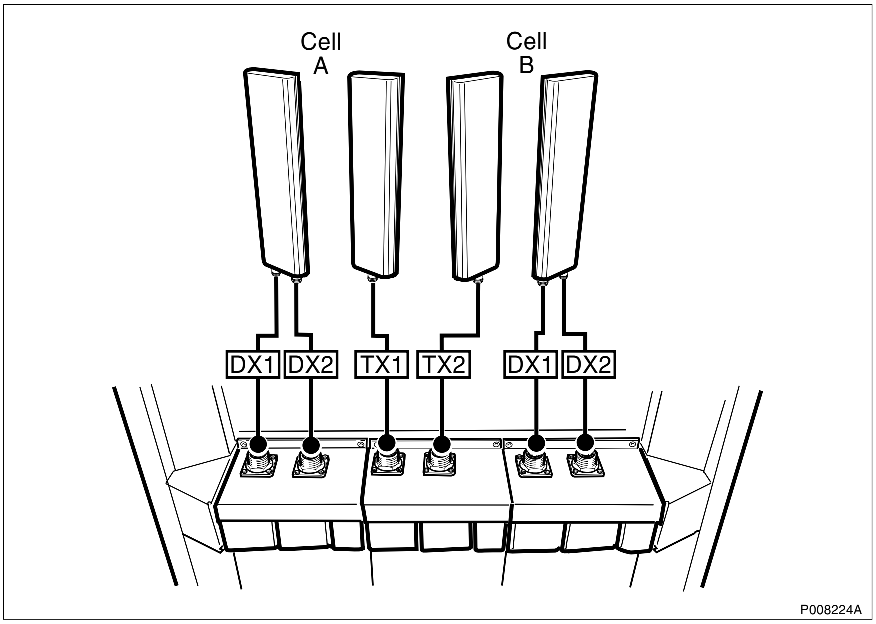

Figure 58

Table 71 2x6 CDU-G

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX1	TX/RX	CellA:DX1
		TX/RX2	TX/RX	CellA:DX2
	2	TX/RX1	TX	CellA:TX1
B		TX/RX2	TX	CellA:TX2
	3	TX/RX1	TX/RX	CellA:DX1
		TX/RX2	TX/RX	CellA:DX2

GSM 900/1800 CDU-G, configurations with TMA

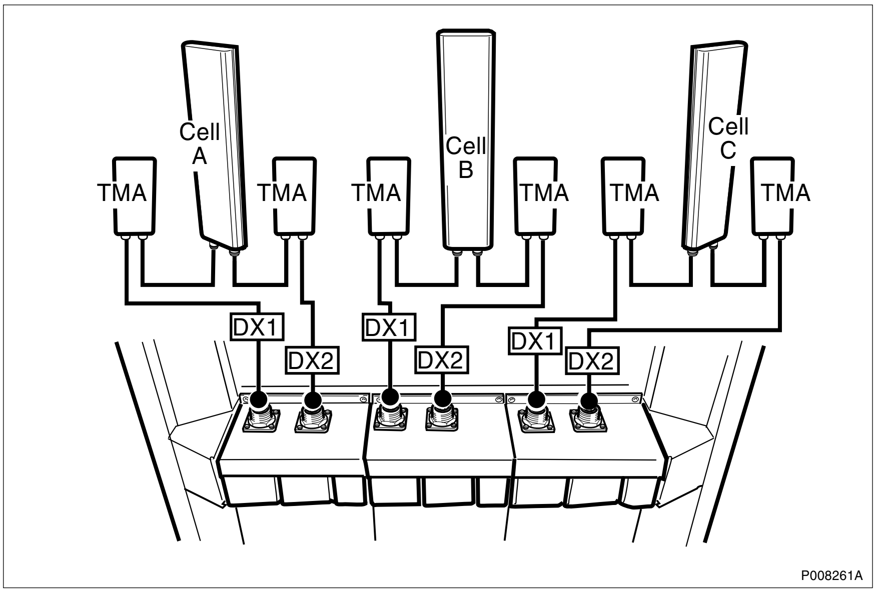

Figure 59 Configuration scheme, 3x2 CDU-G and 3x4 CDU-G

Table 72 3x2 CDU-G and 3x4 CDU-G

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX1	TX/RX	CellA:DX1
		TX/RX2	TX/RX	CellA:DX2
B	2	TX/RX1	TX/RX	CellB:DX1
		TX/RX2	TX/RX	CellB:DX2
C	3	TX/RX1	TX/RX	CellC:DX1
		TX/RX2	TX/RX	CellC:DX2

From the configuration above, the following configurations can be derived:

- 1x2 CDU-G
- 2x2 CDU-G
- 1x4 CDU-G
- 2x4 CDU-G

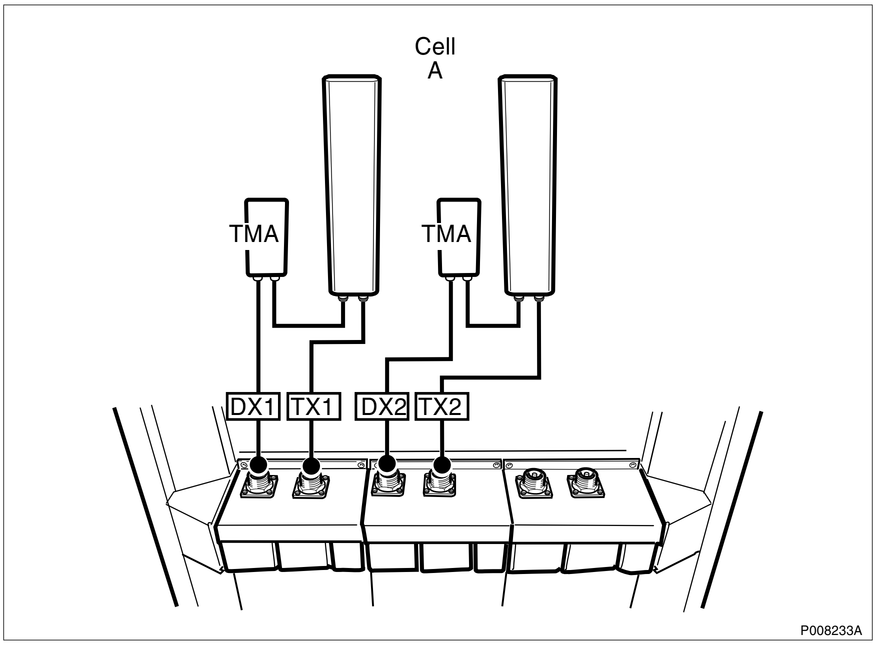

Figure 60 Configuration scheme, 1x8 CDU-G with TMA

Table 73 1x8 CDU-G

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX1	TX/RX	CellA:DX1
		TX/RX2	TX	CellA:TX1
	2	TX/RX1	TX/RX	CellA:DX2
		TX/RX2	TX	Cell:ATX2

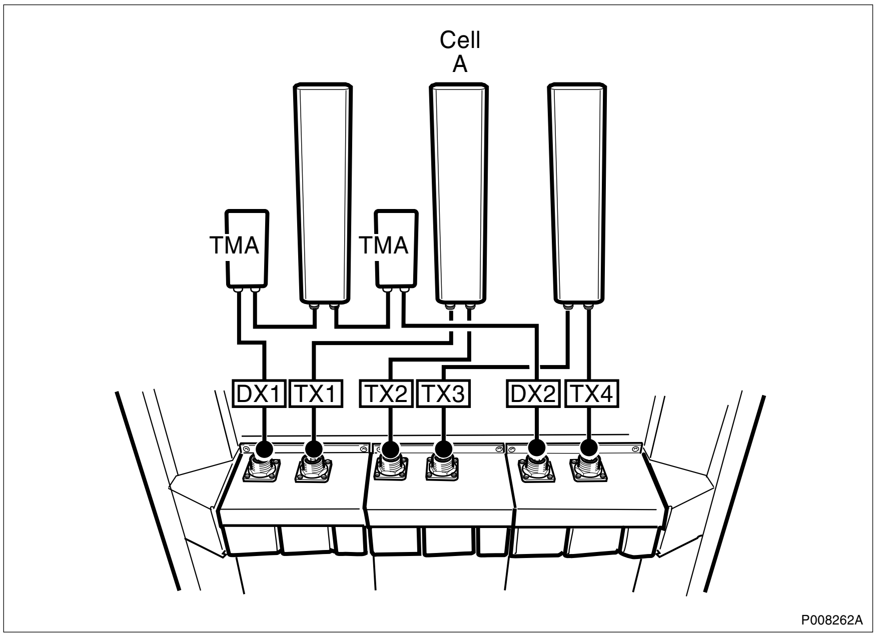

Figure 61 Configuration scheme, 1x12 CDU-G

Table 74 1x12 CDU-G

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX1	TX/RX	CellA:DX1
		TX/RX2	TX	CellA:TX1
	2	TX/RX1	TX	CellA:TX2
		TX/RX2	TX	CellA:TX3
	3	TX/RX1	TX/RX	CellA:DX2
		TX/RX2	TX	CellA:TX4

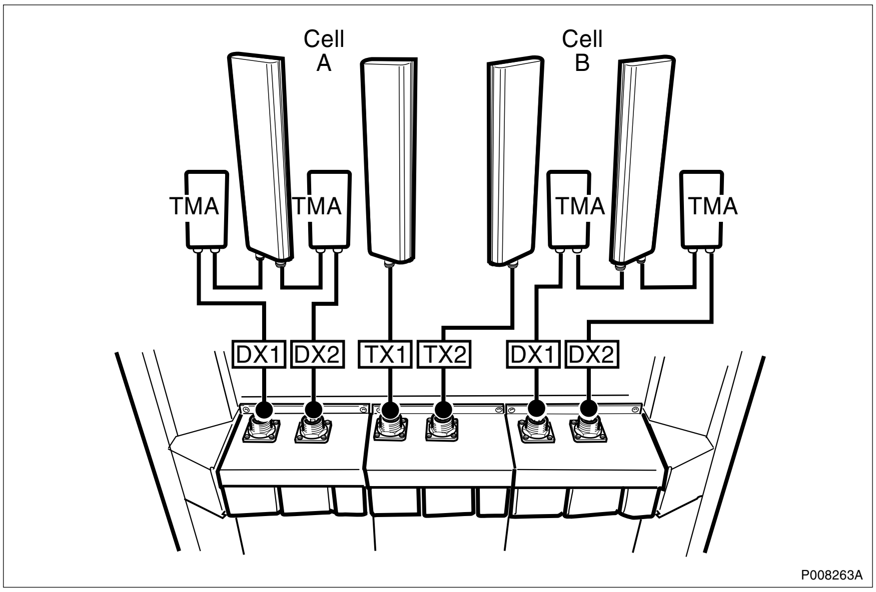

Figure 62 Configuration scheme, 2x6 CDU-G

Table 75 2x6 CDU-G

Cell	CDU	Connection	Signal	Labelling
A	1	TX/RX1	TX/RX	CellA:DX1
		TX/RX2	TX/RX	CellA:DX2
	2	TX/RX1	TX	CellA:TX1
B		TX/RX2	TX	CellA:TX2
	3	TX/RX1	TX/RX	CellA:DX1
		TX/RX2	TX/RX	CellA:DX2

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6 Unit Description, DXU-21

This chapter describes DXU-21. The DXU is a CPU, which acts as an interface between the transmission network and the transceivers. It also extracts timing information from the PCM link and generates a timing reference for the RBS. The DXU also performs supervisory tasks.

The DXU-21 transmission interface has long haul capability and can be run on both 1.544 Mbit/s (T1) and 2.048 Mbit/s (E1) PCM links.

6.1 System Environment

The DXU-21 is designed to work in RBS 2000 Macro radio base stations.

This block diagram shows DXU-21 in the RBS 2206 system environment.

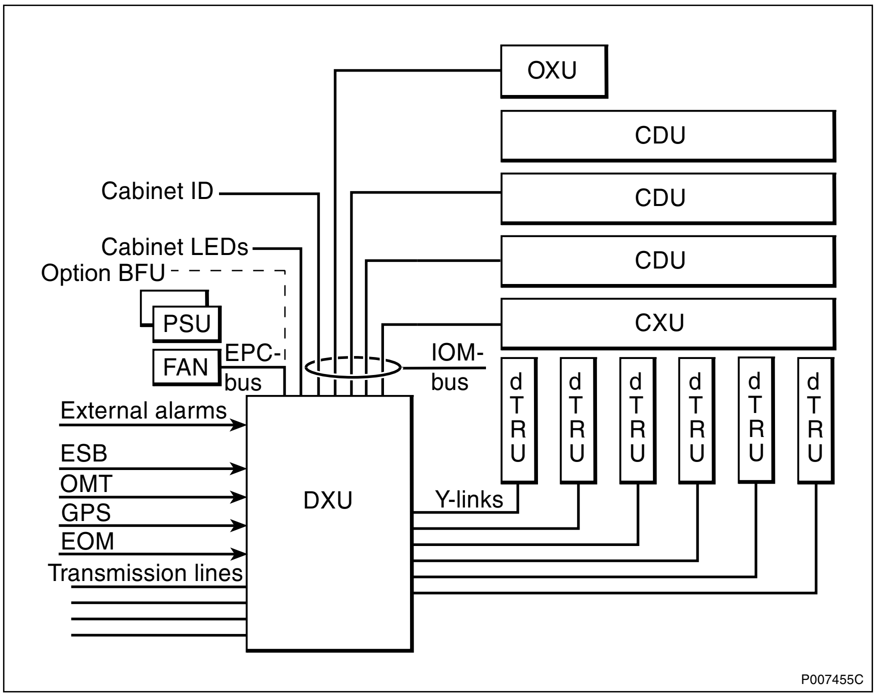

Figure 63 DXU-21 environment

6.2 Block Diagram

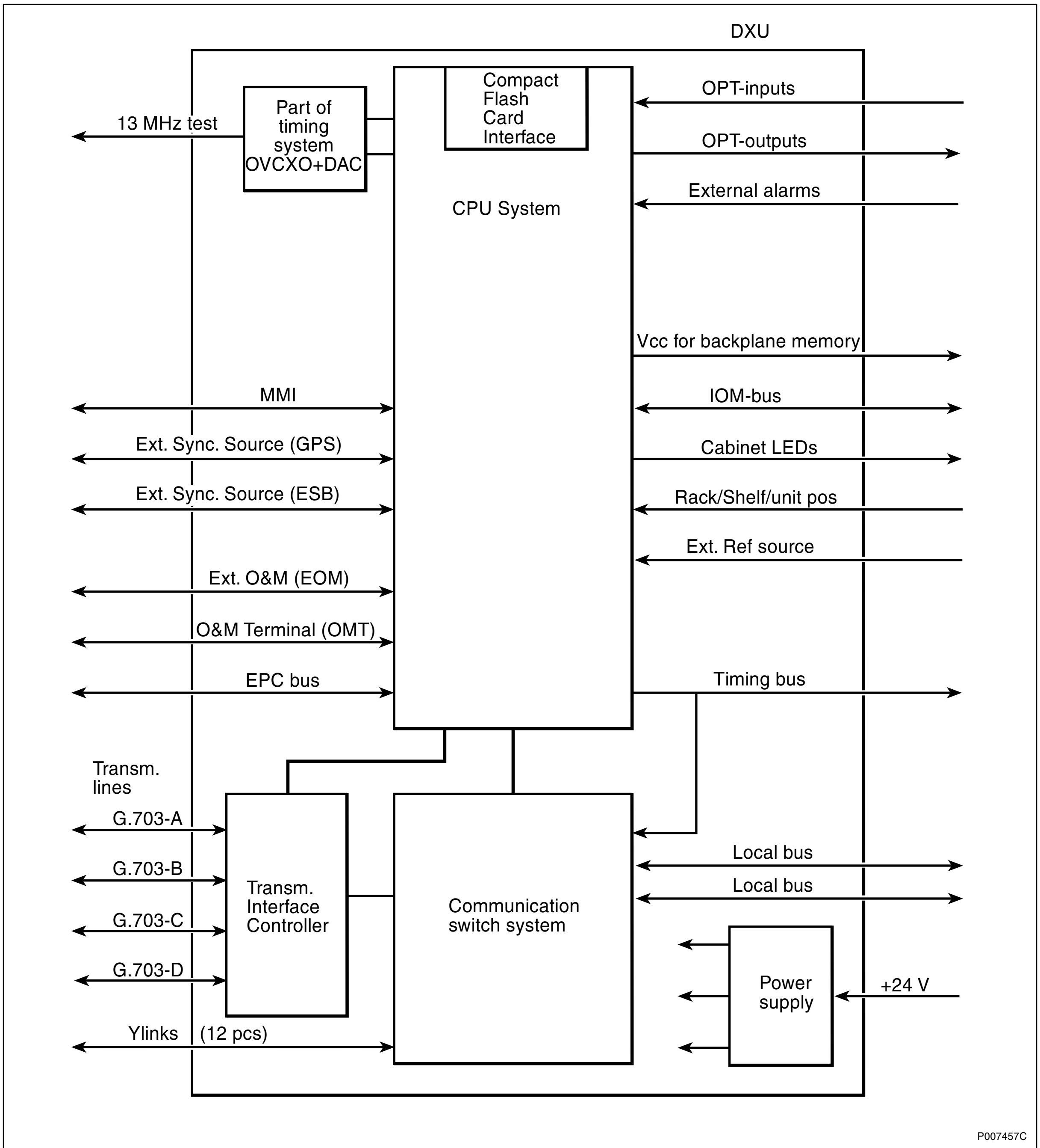

Figure 64 DXU-21, block diagram

Electrically, the DXU-21 consists of the following main blocks:

- CPU system
- Communication switch system
- Transmission interface controller
- Power supply
- Timing system
- Miscellaneous logic

- Compact Flash Card

6.2.1 CPU System

The heart of the DXU-21 is a 32–bit embedded controller with a PPC 405 processor core with interfaces to a wide range of peripherals.

The CPU system consists of:

- I^2C controller
- Ethernet 10/100 Mbit/s (full-duplex) controller, MAC
- SDRAM memory
- FLASH memory
- ASIC GARP
- Compact Flash Card

6.2.2 Communication Switch System

This system block contains circuits that handle traffic between the BSC and the TRUs.

6.2.3 Transmission Interface Controller

This part contains circuits for four transmission links and the transmission interface controller, which controls the traffic for all four transmission links.

The bit rate is SW controlled. Two speeds are available: E1 (2.048 Mbit/s) or T1 (1.544 Mbit/s).

6.2.4 Power Supply

The power supply delivers all the voltages necessary for the DXU-21. The input voltage +24 V DC is supplied through the backplane connectors.

6.2.5 Timing System

The timing system is used for generating a 13 MHz clock signal.

6.2.6 Miscellaneous Logic

This function contains the following:

- System voltage measurement
- Temperature measurement
- Power on reset

6.2.7 Compact Flash Card

The removable Compact Flash Card permits quick and easy change of the SW and IDB in the DXU.

6.3 Functions

The DXU serves as the Central Main CPU node and its main functions are:

- Provides the RBS with an interface to the transport network through four fixed E1/T1 transmission ports.
- Handles incoming traffic, controls and supervises information and sends it to its destination within the RBS.
- Provides frequency reference signals and clock signals for circuits within the RBS.
- Stores and executes RBS SW. SW is stored on a removable flash card.
- Controls the climate and power system.

6.4 External Interfaces

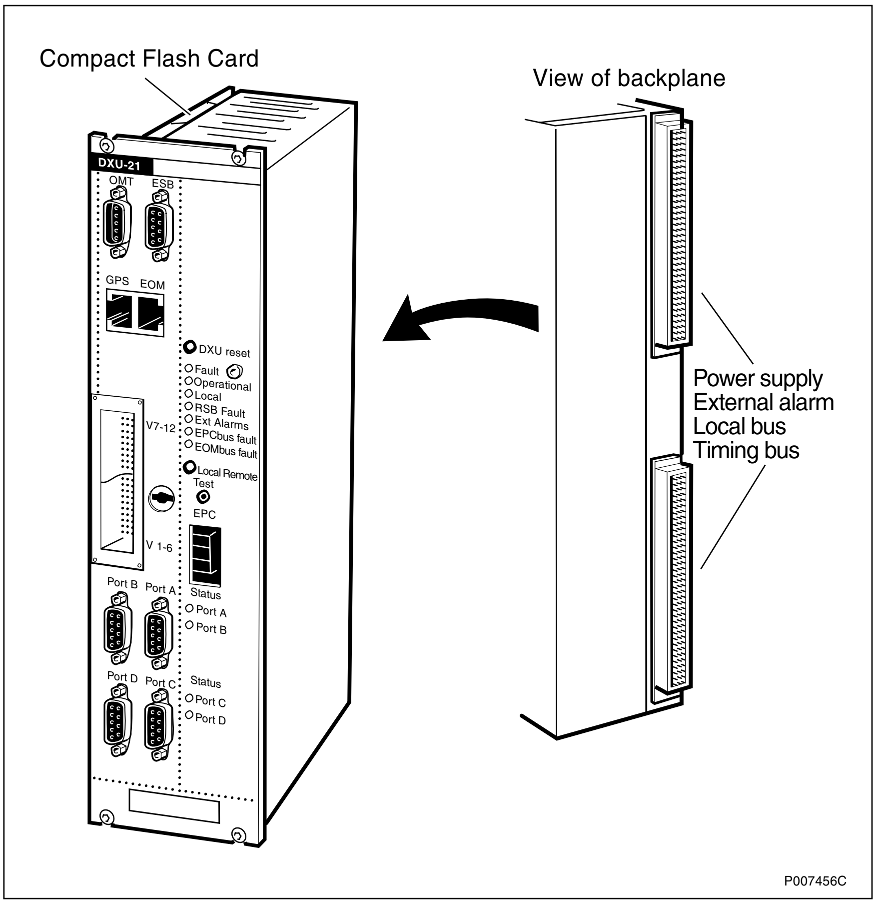

Figure 65 DXU-21, front panel and backplane

G.703 Interface

The four G.703 interfaces are connected to the BSC (Protocol GSM-Abis) or to cascaded base stations. In cascade mode, this interface can control an external bypass relay. Unused time slots can be through-connected to a succeeding base station. The communication speed in E1 interfaces is 2 Mbit/s and in T1, 1.5 Mbit/s.

The DXU is tested for Electro Magnetic Compability (EMC) and complies with the following standards:

- Fast transient test: EN 301 489-1, 0.5 kV
- Surge test: ITU-T K.45

  Test no. 2.1.1.a (CM), basic level: 1.5 kV

  Test no. 2.1.1.b (DM), basic level: 1.5 kV

An EMC environment exceeding the above values requires additional overvoltage protection of the G.703 interface.

External Alarm Inputs

Through this interface it is possible to connect up to 16 binary alarms. This interface is found in the upper backplane connector.

The equipment connected to the terminals should be insulated relay contacts. A closed contact (logic zero) is required to be below 2 kOhm, and an open contact (logic one) is required to be above 100 kOhm.

The current through a closed 0 Ω contact is 1.2 mA.

The alarm contacts connected to the external alarm inputs should be insulated and have a current range above 1.2 mA. The voltage between terminals with an open contact is 24 V DC.

Local Bus

The local bus is a time slot and multidrop bus, where the DXU-21 is the master of the bus. In this DXU, two identical local buses are implemented, with common frame synchronization and clock signals. The interface is accessed through the lower backplane connector. The local bus is used for TRUs and sTRUs.

Timing Bus

This interface is used for distribution of timing information to the TRUs through the backplane. The interface is accessed through the lower backplane connector. The timing bus is only used for TRUs.

External Sync. 0 (Freq. Ref.)

This interface is used for connecting an external frequency reference. It uses a generic synchronization port for the synchronization information.

Optional Output

This interface enables control of up to eight devices, which can be of various types.

These outputs are accessed through the upper backplane connector.

Optional Input

This interface enables connection of up to eight internal cabinet signals, such as alarms.

These inputs are accessed through the upper backplane connector.

IOM-Bus

This interface consists of three individual I^2C ports. It is accessed through the lower backplane connector and is used to communicate with the CDU, CXU and cabinet ID.

An I^2C bus is reserved for reading a memory device which identifies the source for the system.

The interface is accessed through the lower backplane connector.

Y-Links

This interface is used for communication with the dTRUs and sTRUs. The Y-interface consists of 12 separate Y-links.

The Y-links are accessed through connectors located on the front of the DXU.

EPC-Bus (Optical Cable)

This interface is used for communication with the power supply equipment in the RBS, such as PSUs and BFU.

The optical communication interface is accessible through connectors located on the front of the DXU. The connectors are marked "EPC".

The EPC-bus is not used in RBS 2101/2102/2202.

External Sync. 1 (GPS/LMU)

This interface is used for interfacing an external sync./frequency source, such as GPS. It is accessed through a connector of type 8-pin RJ-45, located on the front of the DXU. The connector is marked "GPS".

GPS/LMU

This interface is identical to the serial line used in the interface "External sync. 1".

It is possible to use this interface from the backplane together with the interface "External sync. 0", as an alternative to the GPS interface.

This interface is accessed through the lower backplane connector.

External O&M (EOM)

The EOM bus is designed as a standard Ethernet port and is intended for a site-LAN to communicate with other units on the site. Both half-duplex and full-duplex operation at 10 Mbps and 100 Mbps operation are supported.

The EOM bus is accessed through a connector located on the front of the DXU marked "EOM". The connector is of type 8–pin RJ-45.

OMT

The OMT interface is used for maintenance and supervision purposes.

This interface is accessed on the front of the DXU through a 9–pin female D-sub connector marked "OMT".

ESB

This interface is used to synchronize several transceiver groups in the same cell, for example when one cell is built up by more than one RBS, or one cell is split between two RBSs. Note that a master-slave configuration, as in RBS 2202, is regarded as one transceiver group.

The interface is accessed on the front of the DXU through a D-sub 9–pin male connector marked "ESB".

6.4.1 OMT

The OMT port is used to communicate with the Operation and Maintenance Terminal.

Connectors

The OMT is connected through a 9–pin D-sub female connector.

Electrical

The OMT connection is galvanically separated. All signals use RS 232 levels.

Table 76 The OMT pins and their functions

Pin	Function
1	DCD, looped from DTR (pin 4)
2	RXD, data out of DXU
3	TXD, data into DXU
4	DTR, looped to DCD (pin 1) and DSR (pin 6)
5	Signal ground
6	DSR, looped from DTR (pin 4)
7	RTS, looped to CTS (pin 8)
8	CTS, looped from RTS (pin 7)
9	RI not connected

Note: The connector is configured as a DCE, and thus should be connected to an IBM PC style DTE (such as a computer) with a straight cable.

6.4.2 Test Interface

This interface is used for test purposes only. It consists of a buffered version of the 13 MHz signal from the OVCXO. The signal is sinusoidal shaped and is suited for a coaxial cable load of 50 Ω.

Connectors

The test interface has an SMB connector.

6.4.3 Indicators and Buttons

There are 11 indicators located on the front panel (as shown in the table below) and two buttons for DXU Reset and Local/remote. For further information on indicators, *see chapter Operation and Maintenance Support*.

Table 77 Indicators

Indicator	Colour
Fault	Red
Operational	Green
Transmission OK (port A, B, C, D)	Green (4 pcs)
Local	Yellow
RBS fault	Yellow
External alarm	Yellow
EPC bus fault	Yellow
EOM bus fault	Yellow

6.5 Dimensions and Weight

Table 78 DXU–21 dimensions and weight

Height	227 mm (6 HE x 44.45 mm)
Width	71 mm (14 TE x 5.08 mm)
Depth	240 mm
Weight	2.4 kg
Max. Power Consumption	40 W (typical 30 W)
Max. Heat Generation	40 W

7 Unit Description, dTRU

The dTRU (double Transceiver Unit) is a 2-TRX replaceable unit. A TRX is a transmitter/receiver and signal processing unit which transmits and receives one carrier. There are different versions of dTRU depending on the frequency band and modulation method, that is only GMSK or EDGE.

The dTRU has two transmit antenna terminals and four receive antenna terminals. The dTRU features a built-in hybrid combiner. The hybrid combiner can be used to combine the two transmit antenna terminals to one common terminal.

Two of the receive antenna terminals are used for 2–branch diversity reception. The dTRU is hardware prepared for 4–branch diversity reception via the remaining two antenna terminals.

7.1 Block Diagram

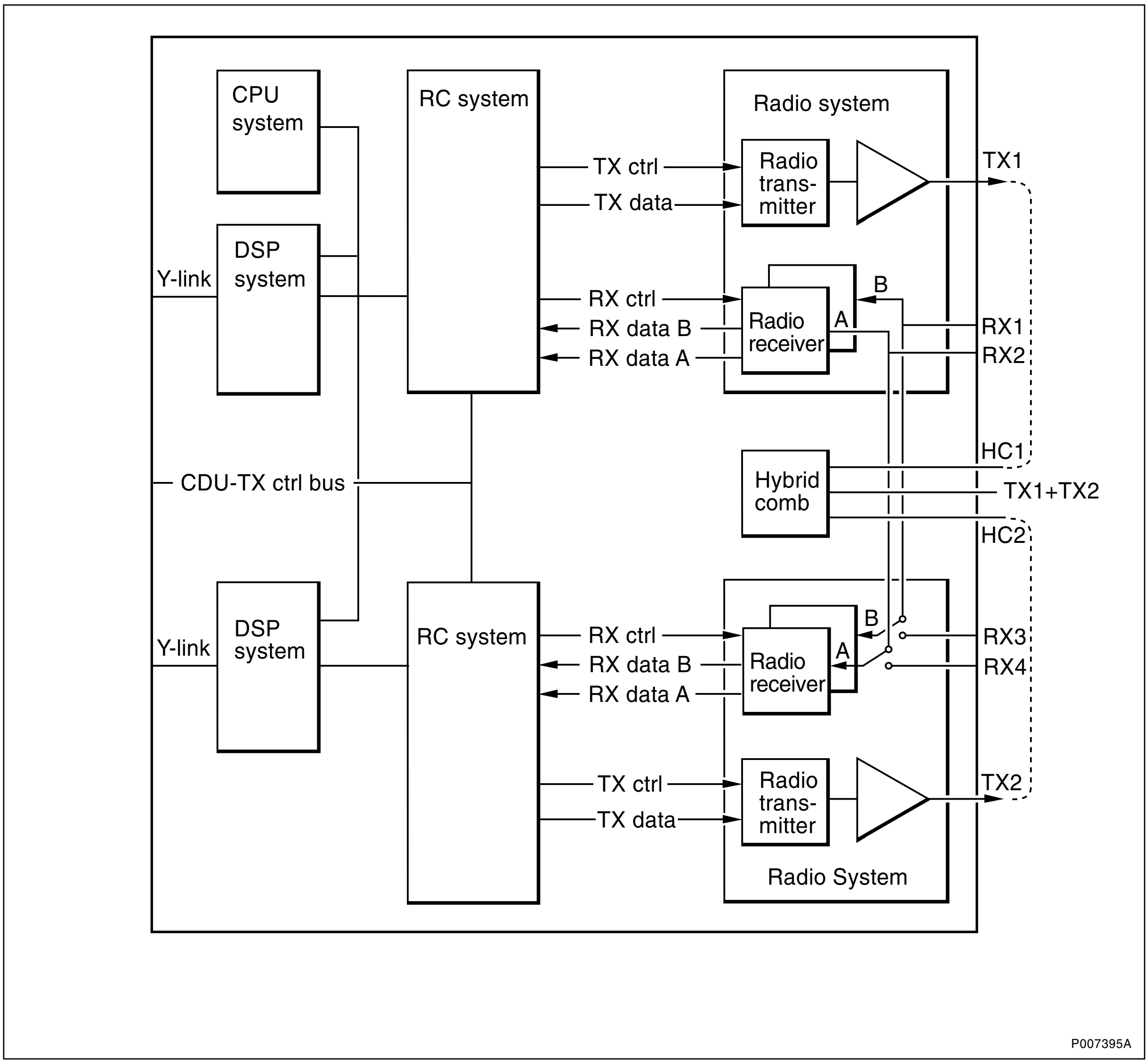

Figure 66 Block diagram dTRU

The TRU consists of the following main blocks:

- CPU-system
- DSP-system
- RC-system
- Radio system

CPU System

The CPU system is a control unit in the RBS. Basically it consists of a CPU, support logic, memory and logic for handling the interfaces.

DSP System

The DSP system performs all baseband signal processing necessary for one TRX. For downlink, this includes Terrestrial Protocol Handling (TPH), encoding, ciphering and burst generation. For uplink it includes equalization, combining, decoding and TPH.

RC System

The Radio Control system is responsible for synchronizing and controlling the different parts of the radio, for modulation and D/A conversion of the data to transmit, for filtering the received radio signal with a channel selective filter and for compensating the receiver and transmitter delays and gain variations.

The Radio Control system is seen by the rest of the RBS as the front end to the radio which can be asked to transmit a burst of data using a selected modulation, or asked to receive a burst using a selected digital filter.

All the time critical radio control functions are performed by the Radio Control system and no computing support is required from the CPU system on a real time basis.

Radio System

Each Radio system contains two radio receivers and one radio transmitter including power amplifiers.

The radio receiver receives RF modulated uplink data from one or two diversity branches and sends it to the Radio Control system.

The radio transmitter generates the RF downlink signal from the modulated baseband signal. It then sends the RF signal to the power amplifier which amplifies the downlink RF signals.

7.2 Functions

The dTRU serves as a distributed main CPU DMCN and its main functions are:

- Transmitting and receiving radio frequency signals – GMSK or 8-PSK modulation
- Signal processing

7.3 External Interfaces

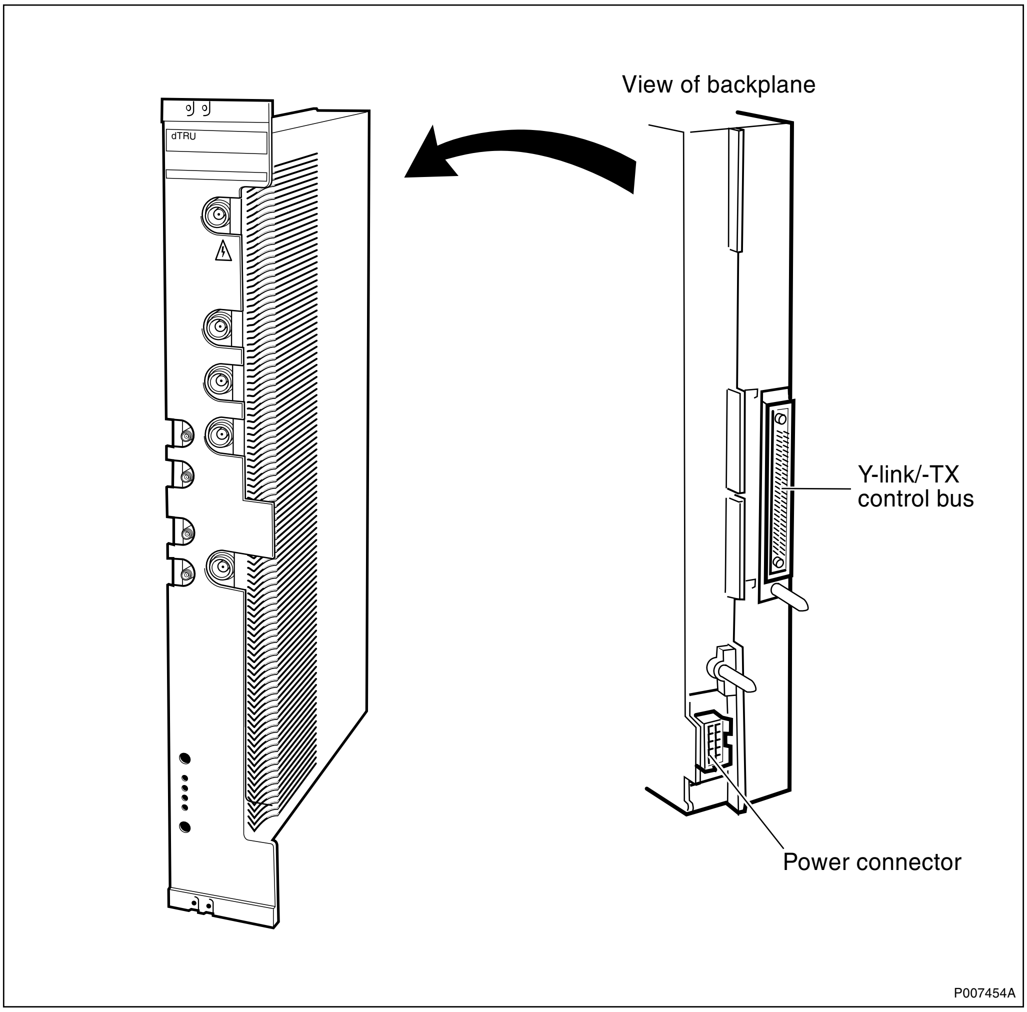

Figure 67 dTRU, front panel and backplane

The dTRU has the following external interfaces:

- CDU-TX control bus, IOM bus
- IOM bus, LEDs and buttons interface
- RX (front)
- TX (front)
- Y-link

7.3.1 Indicators and Buttons

On the front panel there are five indicators (see the following table) and two buttons, one for TRU Reset, and the other for Local/remote mode change.

Table 79 Indicators

Indicator	Colour
Fault	Red
Operational	Green
RF off	Yellow
Local mode	Yellow

7.3.2 The Backplane

The Y-link, CDU-TX control bus, system voltage and connectors are located on the backplane. *See Figure 67 on page 127*.

7.4 Technical Data

Table 80 dTRU technical data

Height	400 mm (9 HE x 44.45 mm)
Width	71 mm (14 TE x 5.08 mm)
Depth	270 mm
Weight	8 kg
Max. power consumption	485 W
Max. heat generation	TBD

8 Unit Decription, CDU-G and CDU-F

This chapter describes the CDU-F and CDU-G for RBS 2206. The Combining and Distribution Unit (CDU) is the interface between Transceivers (TRUs) and the antenna system. The CDU enables several TRUs to share antennas.

A range of CDU types have been developed to support different configurations. Information about which configurations can be built with the various types of CDU is contained in chapter *Radio Configurations, RBS 2206*.

The CDUs can handle GMSK and EDGE.

8.1 CDU Types

A range of CDU types is available. The choice depends on present and future capacity requirements. These factors are considered when selecting CDU type: initial cost, capacity requirements (present and future), number of antennas and frequency hopping capability.

- CDU-G handles one or two dTRUs. Connected to one dTRU, it provides a low capacity, high output power configuration. Connected to two dTRUs, it provides a high capacity, low output power configuration. CDU-G supports both synthesiser and baseband frequency hopping.
- CDU-F handles one to six dTRUs. CDU-F is a high capacity, medium output power configuration that only supports baseband frequency hopping.

8.1.1 CDU-G

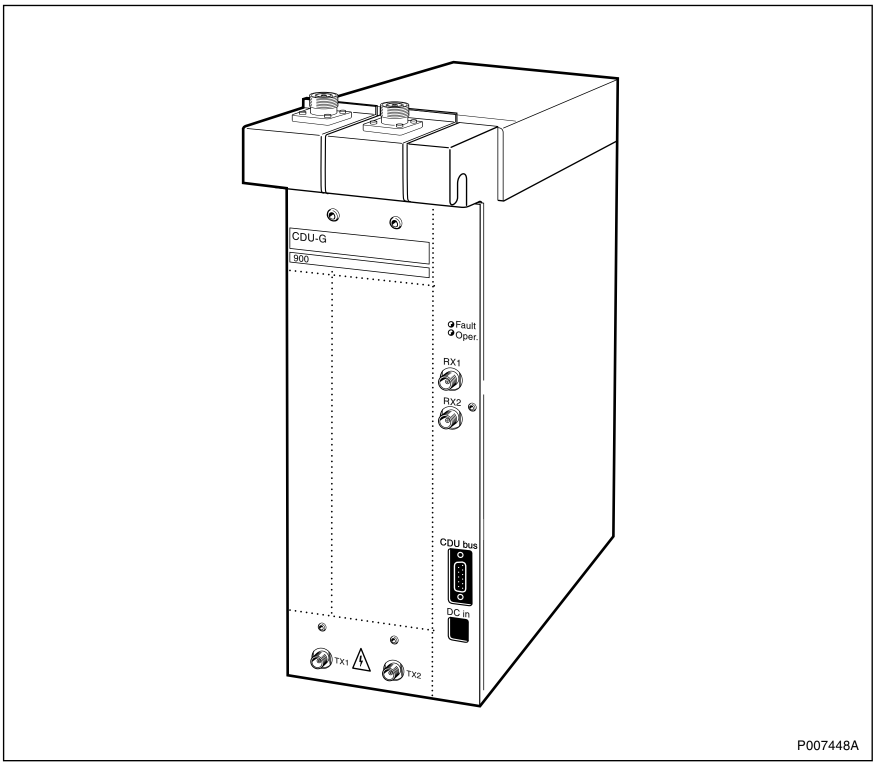

Figure 68 CDU-G

TX Part Description

CDU-G consists of two identical TX chains.

The TX part contains a lowpass filter and a duplex filter. The lowpass filter secures the required reverse isolation. It also reduces spuriouses from the transmitter on the frequencies higher than the TX band. The duplex filter (DPX) allows using a single antenna for both transmitting and receiving.

There is an Measurement Coupler Unit (MCU) between the DPX and antenna connector. The MCU samples forwarded and reflected signals and distributes them to the Measurement Receiver (MR) for antenna return loss monitoring.

RX Part Description

CDU-G consists of two identical RX chains.

The RX parts consist of a filter and a low noise amplifier (LNA). The receiving filter is included in the duplex filter.

Distribution of RX signals is performed in the Configuration Switching Unit (CXU).

Block Diagram

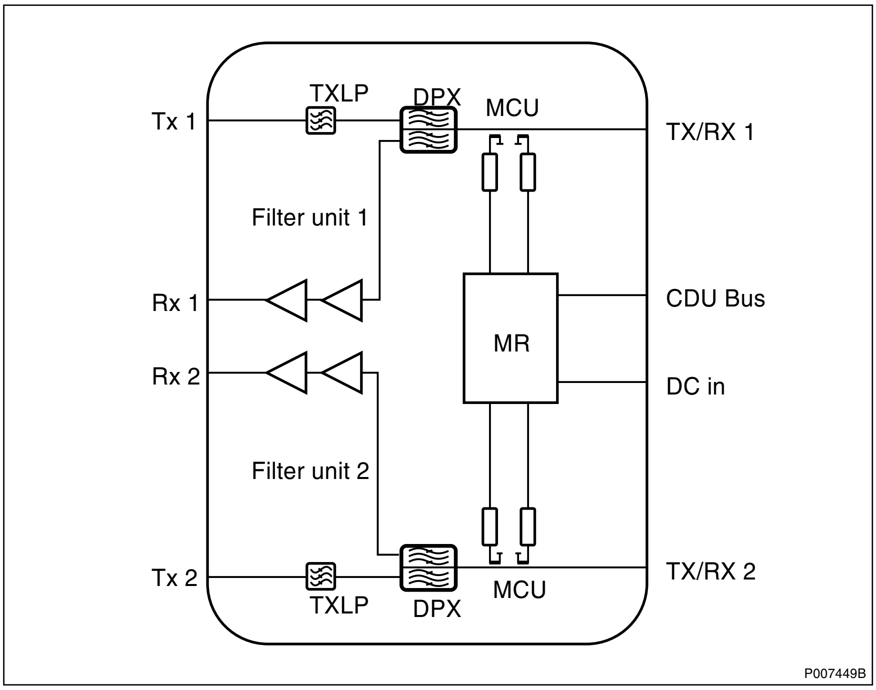

Figure 69   Block diagram of CDU-G

8.1.2 CDU-F

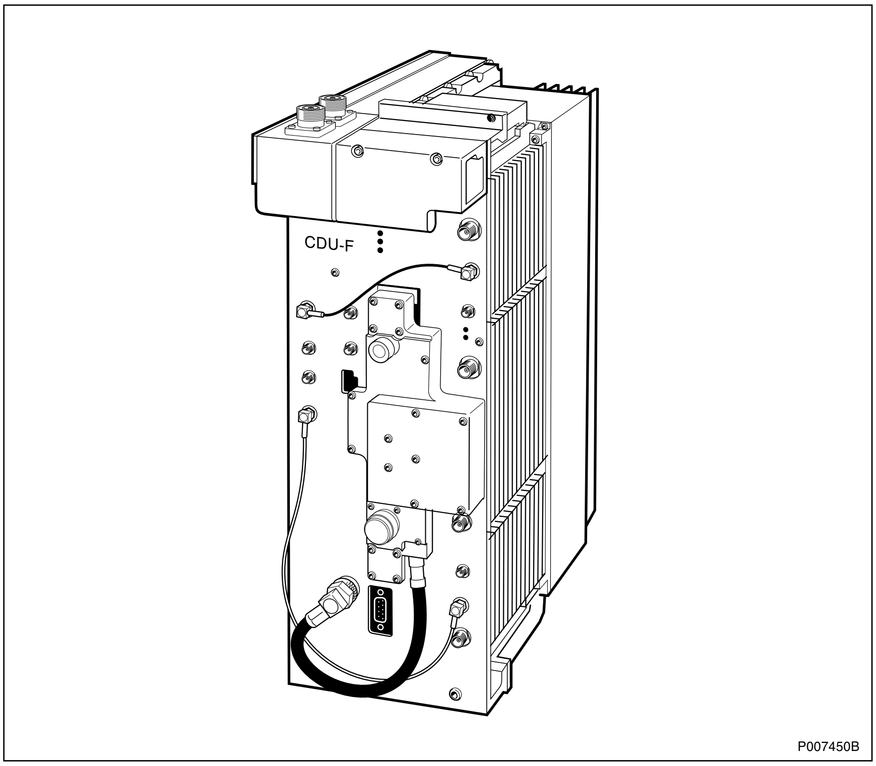

Figure 70 CDU-F

CDU-F has four filter cavities grouped internally two and two. The two filters form a combiner for two TX signals and can be combined with a CNU to a combiner for four signals, or connected to another CDU to form a combining network for six signals.

The combined signals are fed through a lowpass TX filter to a duplex filter. The duplex filter allows the use of a single antenna both for transmitting and receiving. The duplex filter is connected directly to the antenna connector on top of the CDU. The duplex filter also filters the RX signal arriving to the same antenna. This filtered RX signal is amplified in a two-stage low noise amplifier and then filtered in a lowpass filter.

CDU-F also has an extra RX chain for diversity. This extra RX chain is similar to the duplex RX chain.

All necessary connections for the TX combining network are done on the front of the CDU with a Combining Network Unit (CNU).

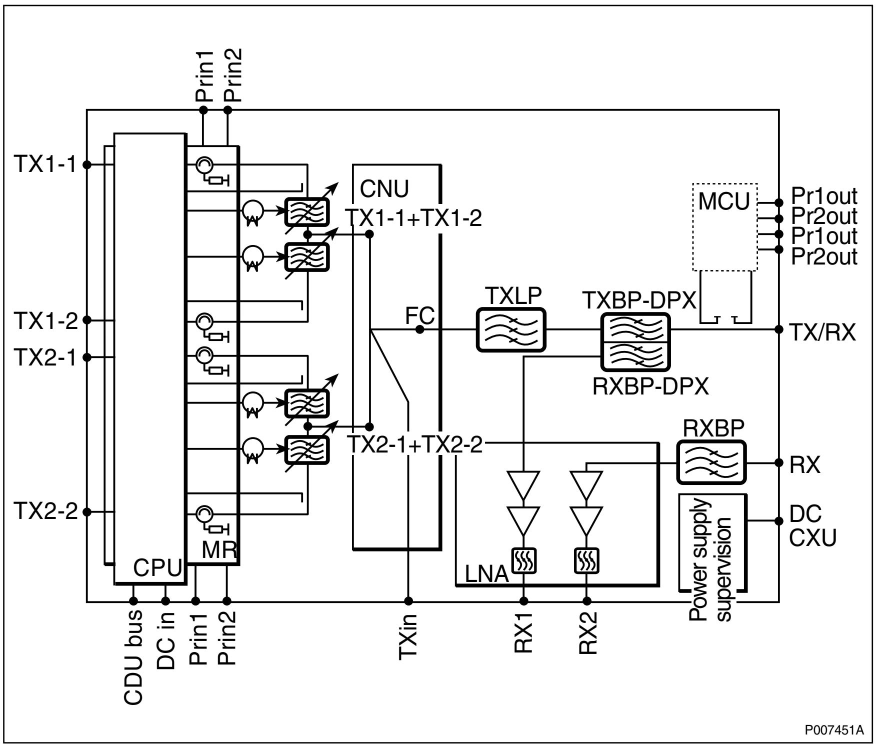

Figure 71 Block diagram of CDU-F

The tuning of the filter cavities is controlled by a measurement receiver and a CPU unit.

A small part of the output and reflected power is distributed by the Measurement Coupler Unit (MCU) to four outputs. The signals are then connected to the Measurement Receiver (MR). The MR used for measuring can be the MR in the same CDU-F or the MR in another CDU-F, depending on the configuration.

The MR measures the input signal to the filter combiners and also the outgoing signal to the antenna. These two signals are used in the CPU to control the stepper motors, one for each filter cavity. Moving parts in the filter cavity, tune the combiner to the correct frequency.

8.2 CDU Functions

Table 81 CDU Functions

Function	CDU-G	CDU-F
Filter Combiner	No	Yes
Hybrid Combiner	No [1)]	No
Frequency Hopping		
Baseband Hopping	Yes	Yes
Synthesizer Hopping	Yes	No
RF Filtering	Yes	Yes
RX preamplifier	Yes	Yes
Antenna system supervision and support	Yes	Yes

[1)] Hybrid combiner is located outside the CDU.

8.3 External Interfaces

CDUs have the following external interfaces:

- Common antenna connector for transmitter and receiver signals
- Common antenna connector for receiver signals (CDU-F only)
- Input ports for transmitter signals
- Output ports for receiver signals
- Output ports for forward power (CDU-F only)
- Output ports for reflected power (CDU-F only)
- Input ports to MR for forward power (CDU-F only)
- Input ports to MR for reflected power (CDU-F only)
- CDU-Bus
- System Voltage

8.3.1 Indicators

CDUs have two indicators:

Table 82 CDU indicators

Indicator	Colour
Fault	Red
Operational	Green

8.4 Technical Data

Table 83 CDU-F

Dimension	CDU-F	CDU-G
Height	400 mm (9 HE x 44.45 mm)	400 mm (9 HE x 44.45 mm)
Width	142 mm (28 TE x 5.08 mm)	142 mm (28 TE x 5.08 mm)
Depth	239 + 90 mm [1)]	239 + 90 mm [1)]
Weight CDU-F	15 kg	15 kg
Max. power consumption	70 W	30 W
Max. heat generation	70 W	30 W

[1)] The upper part protrudes 90 mm.

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9 Unit Description, CXU-10

The Configuration Switch Unit (CXU) is a unit that distributes the RX signals from the CDU to the dTRU within the same RBS. The CXU supports both GMSK and 8-PSK. One CXU can support up to three CDUs. To configure the CXU, six switches can be set to connect different CDUs with different dTRUs. A block diagram of the CXU is shown in.

The CXU is a dual band product, which means it can be used for both 900 MHz and 1800 MHz.

The CXU is positioned between the CDU and the dTRU, intended for 12 TRX cabinets.

9.1 Block Diagram

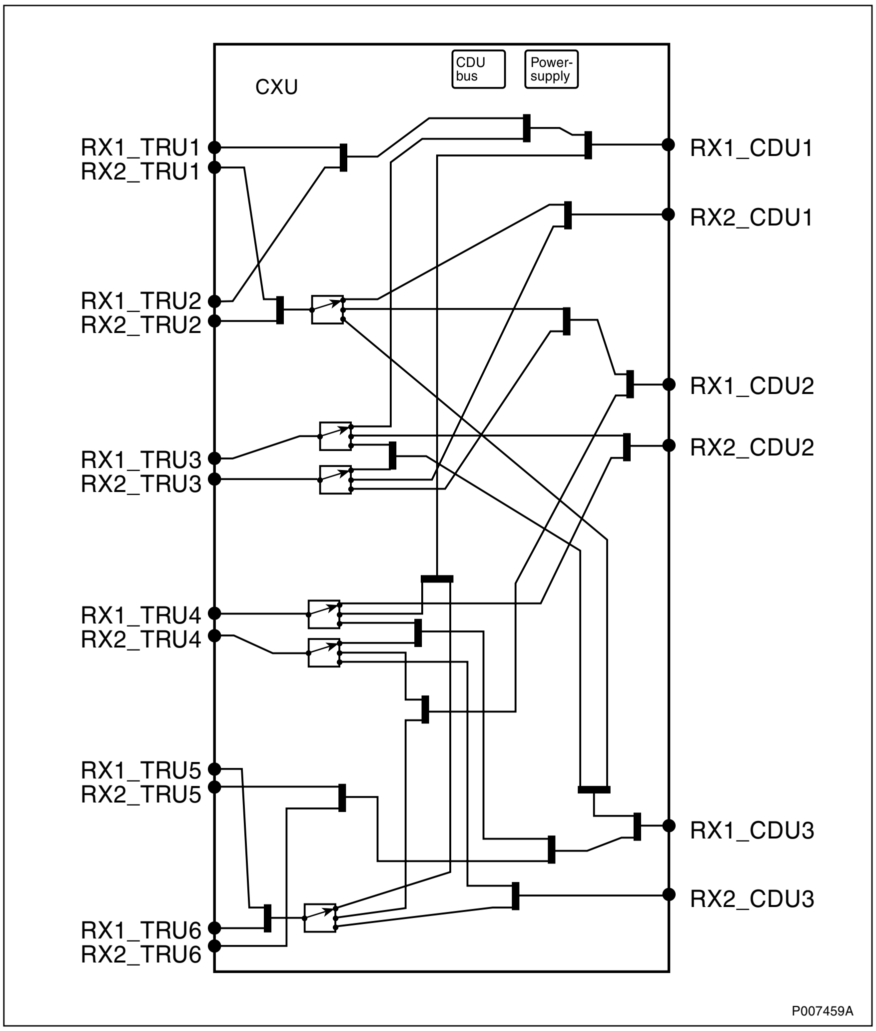


Figure 72 Block diagram of the CXU

9.2 Functions

The CXU has six different switches. By setting those switches into different positions, the CXU can be configured to connect radio signals from a specific CDU to a specific receiver input on a dTRU.

The CXU is also connected to a CDU-bus. By sending data through the CDU-Bus, the switches can be set to fulfil one of six supported configurations.

Inside the CXU there are also some splitters to distribute the incoming RX-signals to the switches and in some cases directly to an out port.

The RF cables between CDU and CXU are supervised in the CXU. The RF cables between CXU and dTRU are supervised in the dTRU.

The CDU-bus cable is monitored by the DXU.

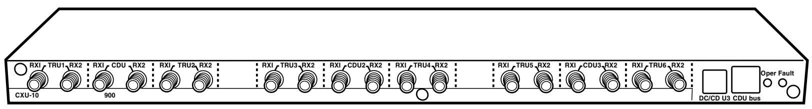
9.3 External Interfaces

The CXU has the following connectors:

- Six inputs for RX signals from the CDU
- Twelve output ports for RX signals to dTRU
- CDU-bus connector for alarm and configuration settings
- Power supply connector

The CXU has the following indicators:

- Operational – green
- Fault – red



P007458A

Figure 73 CXU-10, external interfaces

9.4 Technical Data

Table 84 Technical data

Height	22 mm
Width	482.6 mm
Depth	120 mm 1)
Weight	2 kg
Max. power consumption	10 W

1) The CXU protrudes 40 mm in front of the magazine.

10 Unit Description, FCU-01

The Fan Control Unit (FCU) controls and supervises the fans in the RBS 2206. It is the MMI for the fans, that is, it has indicators for fan status information. The FCU is connected to the EPC-bus that handles communication for the climate and power function in the RBS.

The interface towards the EPC-bus consists of an optical fibre interface.

The interface towards each fan consists of one variable DC voltage output for the power feed and one alarm input.

10.1 Functions

The FCU receives information on the EPC-bus about the required DC voltage level for each fan. It feeds each fan with the required DC voltage level. If no DC level is received, the DC level for the fans will be equal to the FCU input voltage, minus a maximum voltage drop of 0.7 V.

If the normally closed circuit in the fan is opened, the indicator "Fan fault" for that fan is illuminated, and an alarm is sent through the EPC-bus.

The FCU compares the DC level for each fan with the required DC level. If these do not match, the indicator "FCU fault" is illuminated, and an alarm is sent through the EPC-bus.

If the communication on the bus no longer is defined, the indicator "EPC bus fault" is illuminated, and an alarm is sent through the EPC-bus.

10.2 External Interfaces

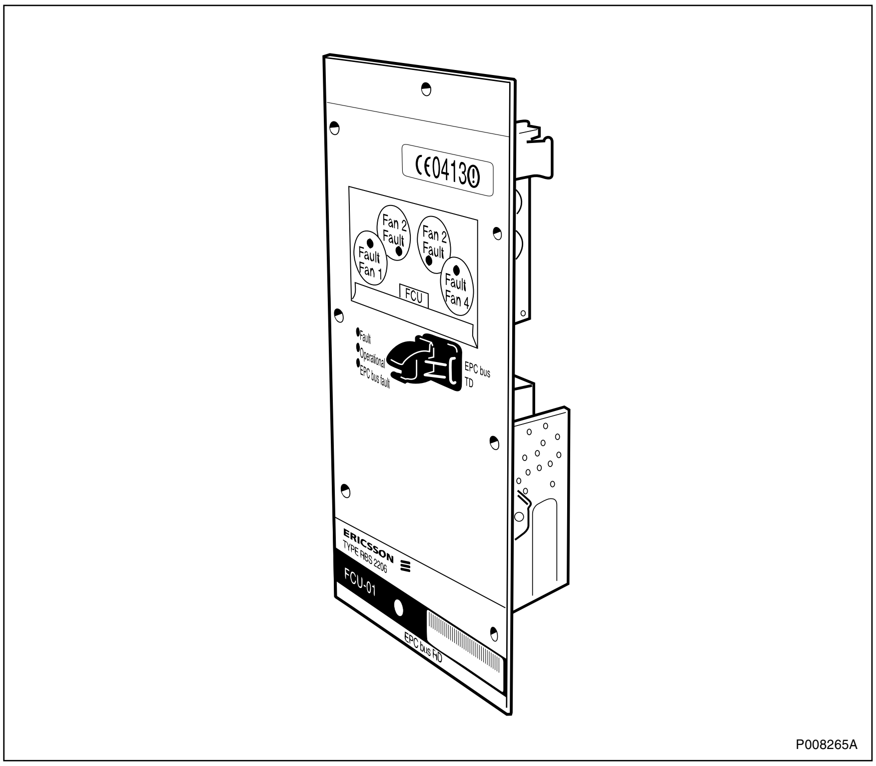


Figure 74 FCU-01

The FCU has the following external interfaces:

- Power in
- EPC-bus in
- EPC-bus out
- Fan power and alarm (1 – 4)

10.3 Indicator

The FCU has seven LED indicators that show the status of the FCU, its communication and fan status.

Table 85 Indicator

Indicator	Colour
Fault	Red
Operational	Green
EPC-bus fault	Yellow
Fan 1 fault	Red
Fan 2 fault	Red
Fan 3 fault	Red
Fan 4 fault	Red

10.4 Electrical Data

10.4.1 Input Data

Table 86 Input data

Nominal Input Voltage	+24.0 V DC
Input Voltage Range	+19.0 to +29.0 V DC
Non-Destructive Voltage	0.0 to +32.0 V DC
Input Power	4 x 45 W

10.4.2 Output Data

Table 87 Output data

Output Voltage	Zero and 9 - 28.3 V DC
Output Current	Min. 1.8 A between 9 - 28.3 V DC

10.4.3 Fan Alarm

There is one alarm signal for each fan. The alarm circuit is normally closed.

An open circuit indicates that the fan speed is too low. The fan has an open collector interface.

Table 88 No alarm

Alarm pos. U_{pos}	5 - 30 V DC
Alarm neg. U_{neg}	< U_{pos} - 2.4 V DC
Current I_{no_alarm}	5 - 20 mA

Table 89 Alarm

Alarm pos. U_{pos}	5 - 30 V DC
Alarm neg. U_{neg}	< 2 V DC
Current I_{alarm}	< 5 mA

10.4.4 Dimensions and Weight

Table 90 FCU-01 dimensions and weight

Height	195 mm
Width	98 mm
Depth	45 mm
Weight	0.5 kg

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11 Unit Description, DC-Filter 01

The DC-filter is the interface for +24 V DC supply to the cabinet. It distributes +24 V DC to the Internal Distribution Module (IDM).

11.1 Functions

The DC-filter has the following functions:

- EMC filter
- Capacity for incoming power cables between 70 – 150 mm^2
- Protection for incoming cables from pulling forces
- Power connection for internal distribution

11.2 External Interfaces

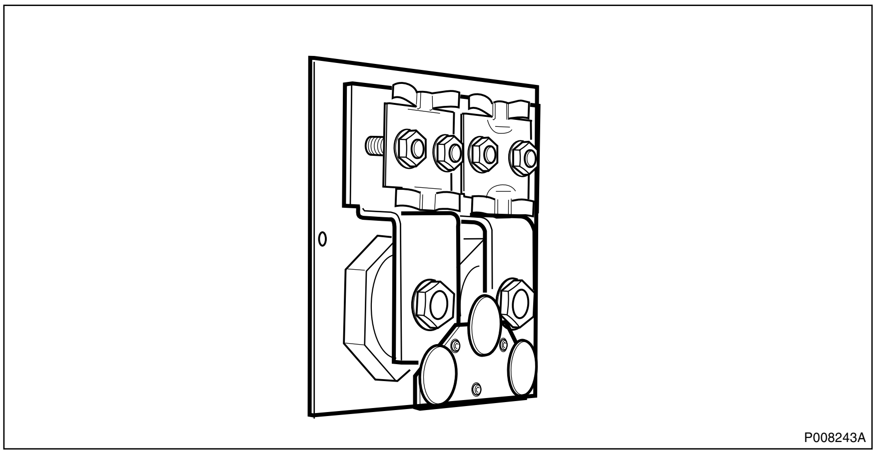

Figure 75 DC-filter

The DC-filter has the following external interfaces:

- Two input terminals for 70 – 150 mm^2
- Pull-relief clamps for incoming power cables with diameter 14 – 26 mm
- Two output cables with area 70 mm^2

11.3 Input Data

Table 91 Input data

Input Voltage	Nominal +24 V DC Range 20.0 - 29.0 V DC
Non-Destructive Range	0.0 - +32.0 V DC
Max. Input Current	183 A

11.4 Dimensions and Weight

Table 92 FCU-filter-01 dimensions and weight

Height	293.5 mm
Width	164 mm
Depth	70 mm
Weight	6 kg (incl. cables)

12 Unit Description, PSU 1200 W

This chapter describes the Power Supply Unit (PSU) which is available in two versions: PSU AC and PSU DC.

The PSUs constantly regulate and deliver 1200 W off power over the whole output range from 22 to 29 V DC.

12.1 PSU AC

The PSU rectifies the incoming AC power to the regulated DC voltage required.

12.1.1 Block Diagram

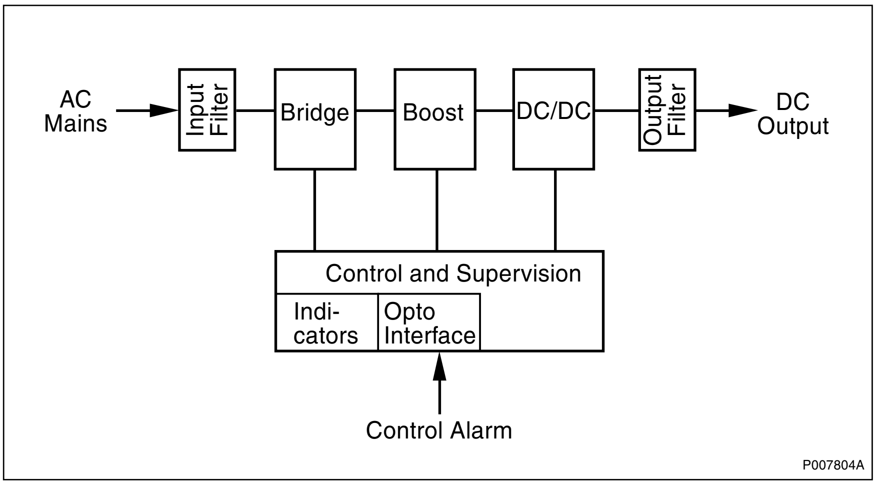

Figure 76 PSU AC block diagram

The PSU AC consists of the following main units:

- Input filter (EMC filter)
- Bridge
- Boost converter
- DC/DC converter
- Output filter (EMC filter)
- Control and supervision circuits

Input Filter

The incoming sine voltage first passes through an internal fuse and then the input filter, where it is filtered to prevent unwanted signals from being radiated from the PSU.

Bridge

The bridge rectifies the incoming AC.

Boost Converter

Draws a sinusoidal input current in phase with the input voltage, enabling the power supply to have a high power factor and low distribution on input current. The output from the boost converter is 400 V DC.

DC/DC Converter

A phase-shifted, soft-switched, full-bridge converter that converts the incoming 400 V DC to 24 V DC output voltage.

The output provides constant power regulation, rather than the more common current limited, and delivers 1200 W over the whole output range from 22 to 29 V DC.

Control and Supervision Circuits

The control and supervision circuits support:

- load sharing between parallel units
- remote on/off
- alarms

The output voltage can be adjusted between 22 to 29 V DC. The control and supervision is achieved through an optical signal interface connector on the front of the PSU.

Output Filter

The output voltage is filtered to prevent unwanted signals from being radiated from the PSU.

12.1.2 Functions

The PSU AC has the following functions:

- Communication
- Handling alarms
- Voltage adjustment
- Power limitation

Communication

The PSU communicates with its superior unit (DXU) through an optical interface. The PSU is controlled and supervised through this interface. In the event of communication failure, the PSU continues working with default values.

Alarms

The following alarms are detected in the rectifier and are then forwarded to the DXU and an indicator is illuminated on the PSU front:

- Rectifier failure

- Input mains fault
- Input undervoltage
- Input overvoltage
- Output overvoltage hardware alarm
- Output overvoltage software alarm
- High internal temperature
- Power limit
- Short circuit/overload for more than one minute

Voltage Adjustment

The desired value of the output voltage of the rectifier is set by the ECU function in the DXU. The PSU has a default value of 27.2 V. The DXU adjusts the individual PSU voltage to maintain the required system voltage.

Load sharing is achieved by the DXU function when using more than one PSU, load sharing of parallel PSUs is achieved by adjusting the individual voltages to each PSU in the system.

Output voltage from the PSU is adjusted to between 26.2 V and 28.5 V depending on battery temperature.

Power Limitation

When the temperature exceeds the permissable value, the PSU reduces power and an alarm is sent to the DXU. Output power increases when the temperature drops, and the alarm is reset.

When the output power of the rectifier reaches 1200 W, the rectifier limits its power by reducing its output voltage to maintain a constant output power. The output current increases to a maximum of 60 A even in the event of short circuits.

12.1.3 External Interfaces

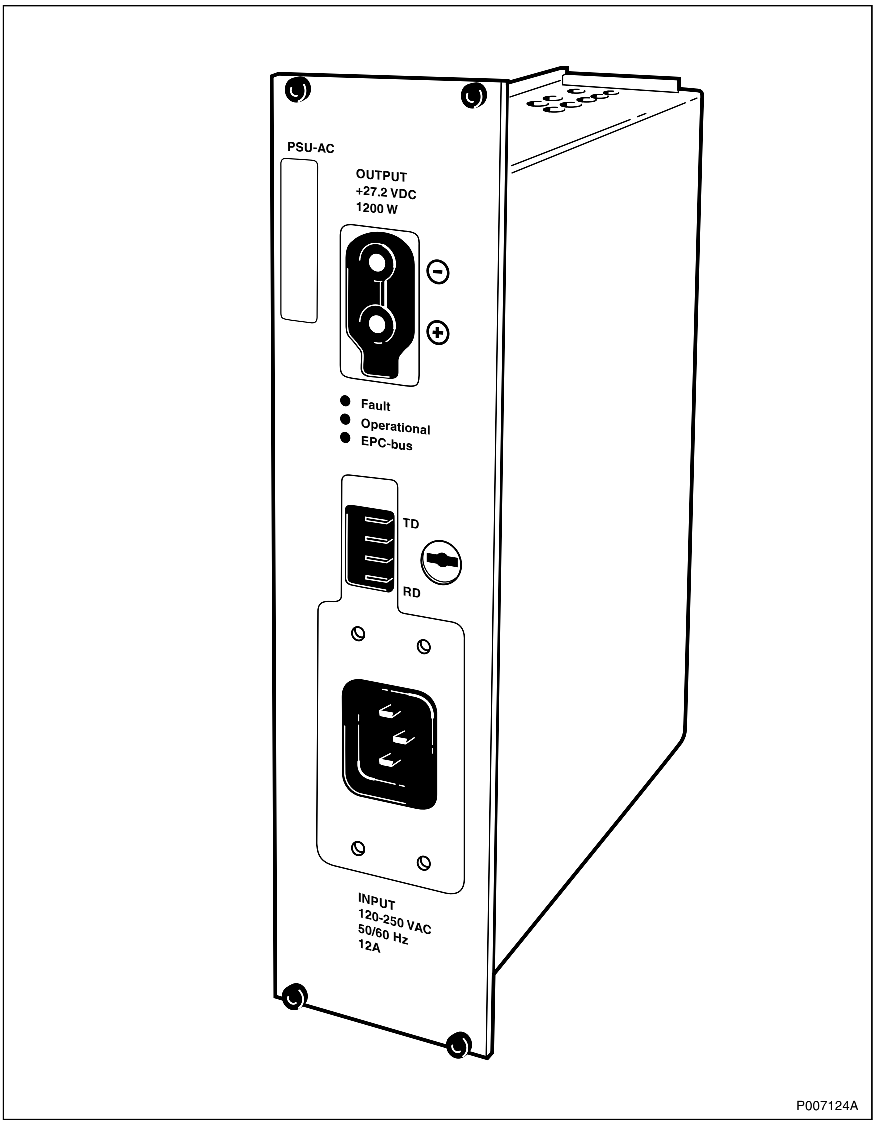

Figure 77 PSU AC

The PSU has the following external interfaces, all located on the front:

- input 120 – 250 V AC
- output +27.2 V DC
- EPC Bus (Opto)

Note: The PSU has no backplane connections.

12.1.4 Indicators

There are three indicators located on the front panel:

Table 93

Indicator	Colour
Fault	Red
Operational	Green
EPC bus fault	Yellow

12.1.5 Input Data

Table 94 Input data

Nominal input voltage	120 to 250 V AC
Permitted variation input voltage	108 [1] to 275 V AC
Frequency	45-65 Hz
Current **Inrush current**	< 8A (at 180 - 275 V AC) <12 A (at 108 - 140 V AC) < 30 A peak
Internal fuse **Efficiency** **Power factor**	15 A (slow) > 83% $\cos \varphi > 0.95$
Non-destructive voltage **Pulses < 20 ms**	0 - 300 V AC 300 V AC
Max. power consumption	1446 V A
Max. heat generation	246 W

[1] 90 V AC with reduced output power.

12.1.6 Output Data

Table 95 Output data

Nominal output voltage	+24 V DC
Preset output voltage	+27.2 ±0.1 V DC
Voltage range	+22 to +29 V DC
Ouput power (108 - 275 V)	1200 W
Output power (90 - 108 V)	1000 W
Output current at 27.2 V DC	36.8 A at 90 - 108 V AC 44.1 A at 108 - 275 V AC

12.1.7 Dimensions and Weight

Table 96 PSU Dimensions and weight

Height	262 mm
Width	61 mm
Depth	225 mm
Weight	3.3 kg

12.2 PSU DC

The PSU DC converts incoming voltage ranging from -39 V to -72 V DC to the regulated DC voltage that is required.

12.2.1 Block Diagram

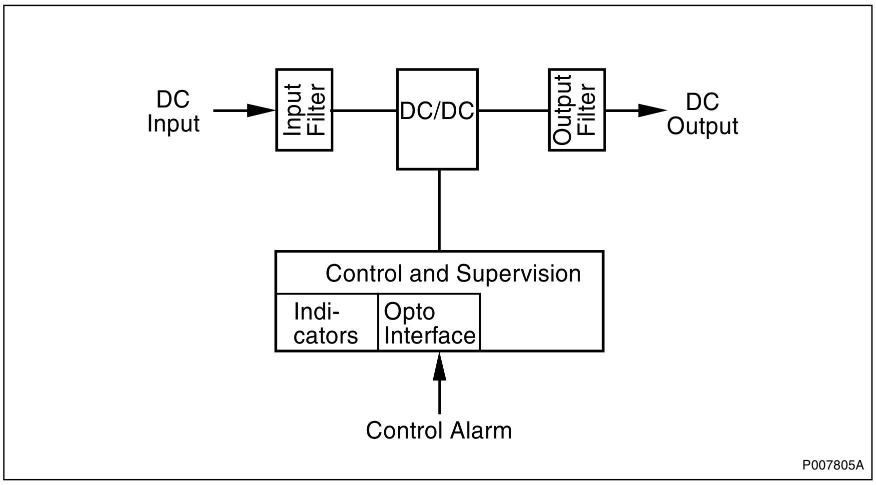

Figure 78 PSU DC block diagram

The PSU DC consists of the following main units:

- Input filter (EMC filter)
- DC/DC Converter
- Output filter (EMC filter)
- Control and supervision circuits

Input Filter

The incoming voltage first passes through the input filter, where it is filtered to prevent unwanted signals from being radiated from the PSU.

DC/DC Converter

A phase-shifted, full-bridge converter that converts the DC into a square wave, which is then fed into the primary side of the transformer. The converter limits the current in case of overload.

In the transformer, the voltage is converted to a 24 V AC square wave, and this wave is rectified to DC through a diode rectifier.

The output provides constant power regulation, rather than the more common current limited, and delivers 1200 W over the whole output voltage range from 22 to 29 V.

Output Filter

Filters the output voltage is to prevent unwanted signals from being radiated from the PSU.

Control and Supervision Circuits

The control and supervision circuits support:

- load sharing between parallel units
- remote on/off
- alarms

The output voltage can be adjusted between 22 V to 29 V DC. The control and supervision is achieved through an optical signal interface connector on the front of the PSU.

12.2.2 Functions

The PSU DC has the following functions:

- Communication
- Handling Alarms
- Voltage adjustment
- Power Limitation

Communication

The PSU communicates with its superior unit (DXU) through an optical interface. The PSU is controlled and supervised through this interface. In the event of communication failure, the PSU continues working with default values.

Alarms

The following alarms are detected in the converter and are then forwarded to the DXU, and an indicator is illuminated on the PSU front:

- Converter failure
- Input fault
- Input undervoltage
- Input overvoltage
- Output overvoltage hardware alarm
- Output overvoltage software alarm
- High internal temperature
- Power limit
- Short circuit/overload for more than one minute

Voltage Adjustment

The desired value of the output voltage of the rectifier is set by the ECU function in the DXU. The PSU has a default value of 27.2 V. The DXU adjusts the individual PSU voltage to maintain the required system voltage.

Load sharing is achieved by the DXU function when using more than one PSU, load sharing of parallel PSUs is achieved by adjusting the individual voltages to each PSU in the system.

Output voltage from the PSU is adjusted to between 26.2 V and 28.5 V depending on battery temperature.

Power Limitation

When the temperature exceeds the permissable value, the PSU reduces the power and an alarm is sent to the DXU. Output power increases when the temperature drops, and the alarm is reset.

When the output power of the converter reaches 1200 W, the converter limits its power by reducing its output voltage in order to maintain a constant output power. The output current increases to a maximum of 60 A even in the event of short circuits.

12.2.3 External Interfaces

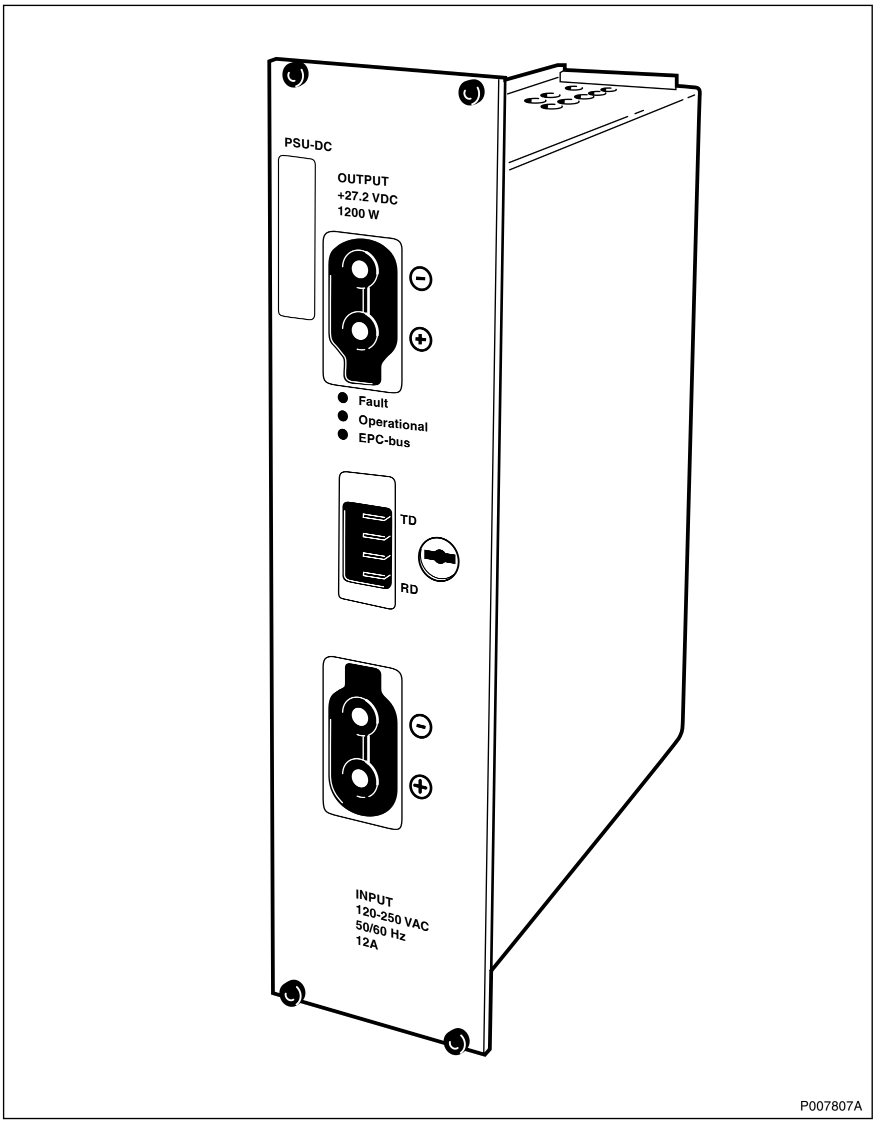

Figure 79 PSU DC

The PSU has the following external interfaces, all located on the front:

- input -48/-60 V DC
- output +27.2 V DC
- EPC Bus (Opto)

Note: The PSU has no backplane connections.

12.2.4 Indicators

There are three indicators located on the front panel:

Table 97

Indicator	Colour
Fault	Red
Operational	Green
EPC bus fault	Yellow

12.2.5 Input Data

Table 98 Input data

Nominal input voltage	(-48) - (-60) V DC
Permitted variation input voltage	(-39) - (-72) V DC
Input Current **Inrush current**	< 36 A < 200 A
Efficiency	> 85%
Non-destructive voltage	0 - (-75) V DC
Max. power consumption	1411 W
Max. heat generation	211 W

12.2.6 Output Data

Table 99 Output data

Nominal output voltage	+24 V DC
Factory set value	+27.2 ±0.1 V DC
Voltage range	22.0 - 29.0 V DC
Output power	1200 W
Output current at 27.2	44.1 A
Output current at short circuit	< 60 A

12.2.7 Dimensions and Weight

Table 100 DC-DC Converter dimensions and weight

Height	262 mm
Width	61 mm
Depth	225 mm
Weight	3.1 kg

13 Unit Description, ACCU/DCCU

This chapter describes the AC Connection Unit (ACCU) and the DC Connection Unit (DCCU). They distribute primary power to the PSUs. There is only one ACCU or DCCU in the cabinet, depending on the type of incoming power.

13.1 ACCU

The ACCU consists of a box with:

- Terminal block for incoming AC cables
- Eight-pole main switch (disconnecting device)
- One EMC filter
- Four cables to the PSUs

13.1.1 Functions

The ACCU has the following functions:

- Termination of incoming AC mains cables
- Disconnecting incoming AC mains
- EMC filtering

13.1.2 External Interfaces

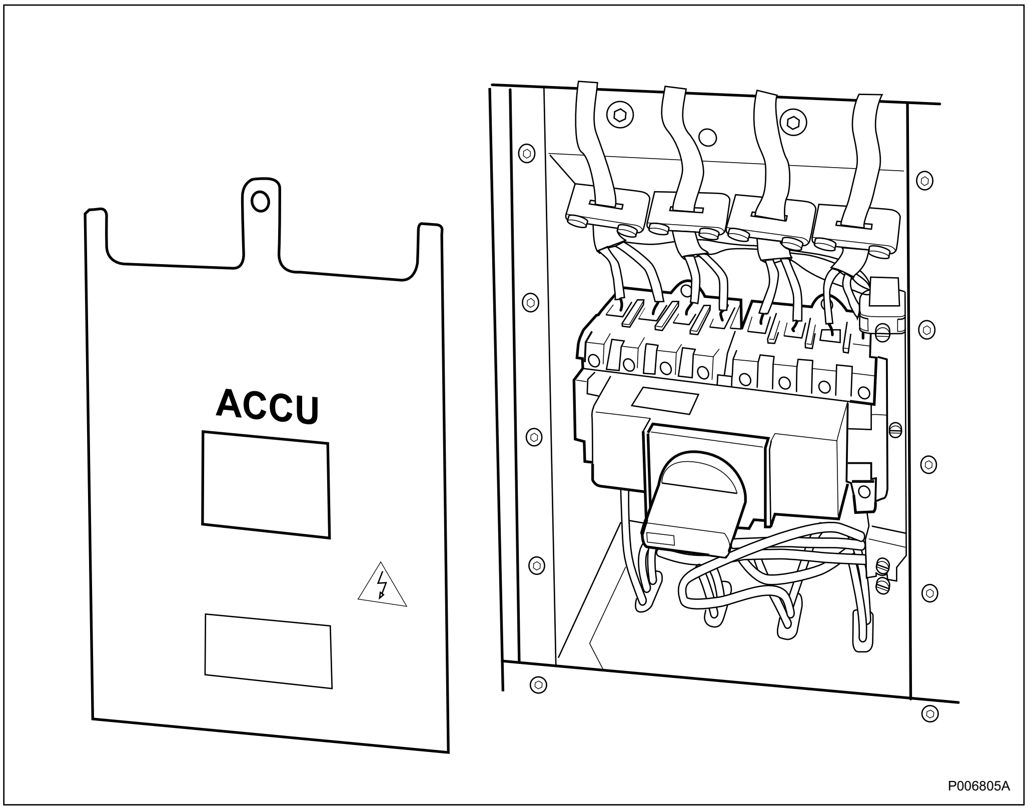

Figure 80 ACCU

The ACCU has the following interfaces:

- Terminal block for incoming AC mains cables
- Four outgoing cables to the PSUs

Input Data

Table 101

Frequency	45 - 65 Hz
Voltage	90 - 275 V AC
External fuses	4 pcs, max. 16 A
Cable diameter	8.5 - 12.5 mm
Conductor area	1.5 - 2.5 mm^2
Number of conductors	3 (L, N, PE)

Output Data

Four cables with connectors according to IEC 320 and matching the PSU AC inlet.

Table 102

Conductor area	1.5 mm^2
Number of conductors	3 (L, N, PE)

13.1.3 Dimensions and Weight

Table 103

Height	293.5 mm
Width	141 mm
Depth	60 mm
Weight	5 kg

13.2 DCCU

The DCCU consists of a box with:

- Terminal block with incoming DC cables
- Eight-pole main switch (disconnecting device)
- A feed-through capacitor filter
- Four cables to the PSUs

13.2.1 Functions

The DCCU has the following functions:

- Termination of incoming DC supply cables
- Disconnecting incoming DC supply
- EMC filtering

13.2.2 External Interfaces

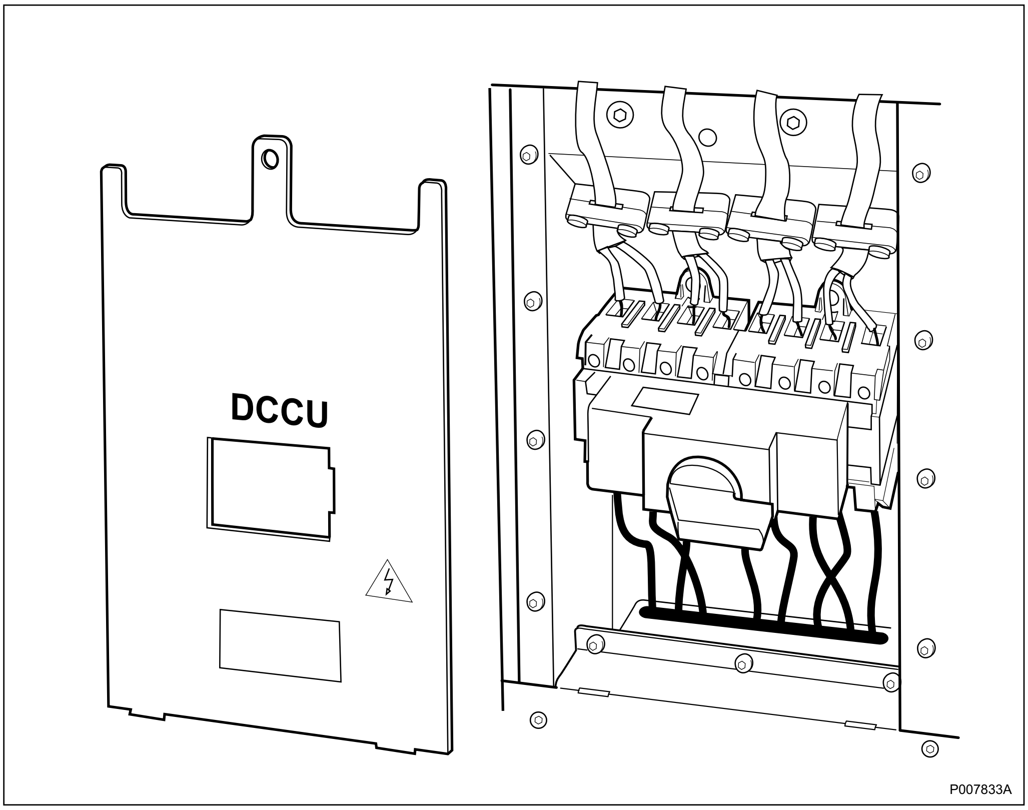

Figure 81 DCCU

The DCCU has the following interfaces:

- Terminal block for four incoming DC supply cables
- Four outgoing cables to the PSUs

Input Data

Table 104 Input data

Voltage	- (40 - 72) V DC
External fuses	4 pcs, max. 40 A
Cable diameter	4.5 - 7 mm
Conductor area	6 - 10 mm^2
Number of conductors	2

Output Data

Four cables with connectors matching the PSU DC inlet.

Table 105

Conductor area	6 mm^2
Number of conductors	2

13.2.3 Dimensions and Weight

Table 106

Height	293.5 mm
Width	141 mm
Depth	60 mm
Weight	5 kg

14 Unit Description, IDM

This chapter describes the internal Distribution Module that distributes +24 V DC to all DC powered units in the RBS. Distribution circuits are protected by circuit breakers.

The IDM consists of a unit with 21 circuit breakers, four PSU cables and connectors to the different DC powered units.

14.1 Functions

The IDM has the following functions:

- Distributes power to all DC powered units.
- Provides fused power distribution to the DC powered units.
- Provides a manual connect or disconnect function of all DC powered units.
- Monitors the system voltage (+24 V DC).

14.2 External Interfaces

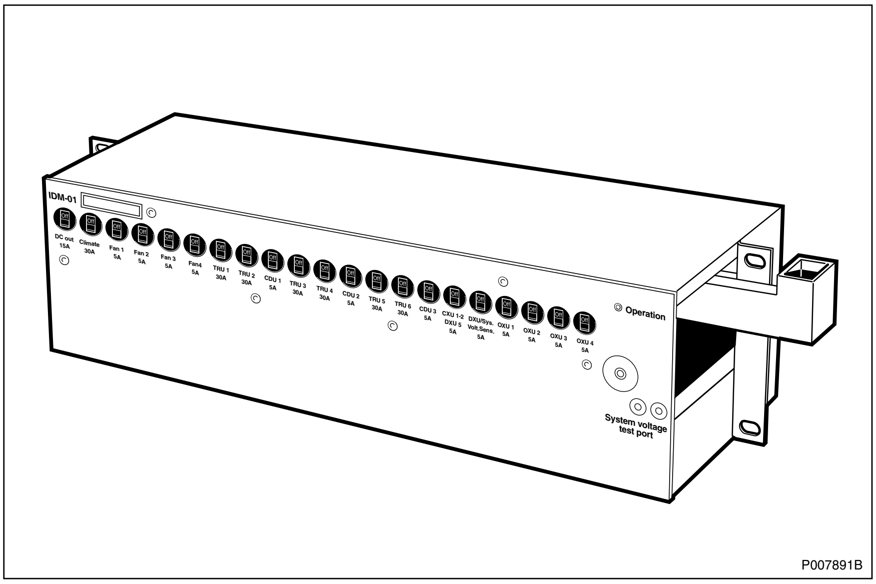

Figure 82 The IDM

The IDM has the following external interfaces:

- Four PSU cables
- Battery connection (positive)
- Battery connection (negative) and earth connection
- System voltage test port
- ESD wrist-strap connector
- Power distribution connectors (see table below)

Table 107

Connector	Function
P3	DC out
P4	Climate unit
P5	Fan 1 - 4
P6	TRU 1
P7	TRU 2
P8	CDU 1
P9	TRU 3
P10	TRU 4
P11	CDU 2
P12	TRU 5
P13	TRU 6
P14	CDU 3
P15	CXU 1
P16	CXU 2
P17	OXU 5
P18	DXU/System voltage sensor/OXU 1 - 4
P19	Test connector
P20	Indicator

14.3 Indicators and Buttons

Located on the front panel are one green indicator and 21 circuit breakers. The function of the circuit breakers can be read on the front panel.

Table 108 Indicators and buttons

Indicator	Colour
Operational	Green

14.4 Input Data

Table 109 Input data

Input voltage	Nominal 24 V DC Range +20.0 - 29.0 V DC
Non-destructive range	0.0 - +32.0 V DC
Input power	4800 W

14.5 Output Data

Maximum voltage drop from the input to the output of the IDM is 0.3 V DC.

Table 110 Circuit breaker capacity

Circuit Breaker	Capacity	Qty
CXU 1 - 2, OXU 5	5A	1
Fan 1 - 4	5A	4
OXU 1 - 4	5A	4
DXU	5A	1
CDU 1 - 3	5A	3
DC out	15A	1
TRU 1 - 6	30A	6
Climate unit	30A	1

14.6 Dimensions and Weight

Table 111 Dimensions and weight

Height	133 mm
Width	483 mm
Depth	80 mm
Weight	5 kg

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15 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, 4 and 13 on BCCH
- Broadcast of System Information 5, 5bis, 5ter and 6 on SACCH (SACCH Filling)
- Broadcast of System Information 7, 8, 13, 16 and 17 on BCCH Extended

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

15.1 References

/GSM:04.06/

/GSM:04.08/

/GSM:05.02/

/GSM:05.03/

/GSM:05.10/

/GSM:08.58/

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 Concepts

BCCH Extended	Paging, Immediate Assign and System Information 7, 8, 13, 16 and 17 may share the same TDMA frame mapping, see /GSM:05.02:6.5.1/ and /GSM:05.02:7: table 2 of 7/

15.3 Functions

15.3.1 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

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.

15.3.2 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, 8, 13, 16 and 17 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, 13, 16 and 17

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.

15.3.3 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 tables define the System Information type used depending on TC (Transaction Capabilities) /GSM:05.02:6.3.1.3/. For TC=0, System Information type 1 is sent. If type 1 is not loaded from the BSC, type 3 is sent.

For TC=4, System Information type 13 is sent. If type 13 is not loaded from the BSC, type 3 is sent or, if loaded, System Information 2ter is sent. If both System Information 2ter and 13 are loaded, they are sent every second time.

Table 112 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
2	3	3	3	3
3	4	4	4	4
4	13 (3)	13 (3)	13 (3)	2ter, 13
5	2	2bis	2ter	2bis
6	3	3	3	3
7	4	4	4	4

Table 113 The BCCH Extended System Information schedule

TC	Type
2	17
3	8
0	13
6	16
7	7

The BCCH Extended blocks only exist if System Information 7, 8, 13, 16 and 17 are loaded.

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

15.3.4 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.

15.3.5 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.

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 114 on page 164.

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 115 on page 165.

Table 114 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 115 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.

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16 Common Control Channel Handling

"Common Control Channel Handling" denotes the RBS resources utilised for traffic on the Common Control channel.

16.1 References

/GSM:04.08/

/GSM:08.58/

/GSM:05.02/

/GSM:05.03/

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 Function

16.2.1 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
- EMLPP priority information in the PAGING_REQUEST

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.

The following messages are used for scheduled transmission of IMSI and TMSI is made with:

- 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 16.2.4 on page 169.

16.2.2 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. The following messages are used for scheduled transmission of IA and IAR:

- 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 16.2.4 on page 169.

If two IAs are received in one IMMEDIATE_ASSIGN_COMMAND message from the BSC, they will be queued together and sent after each other.

16.2.3 Immediate Assignment Sent

By means of IMMEDIATE ASSIGNMENT SENT procedure the RBS indicates to the BSC, if ordered, when an IMMEDIATE_ASSIGNMENT or IMMEDIATE_ASSIGNMENT_EXTENDED is sent on air interface.

The RBS supports handling of IMMEDIATE_ASSIGNMENT_SENT messages.

In case the element "Mobile Identifier" is present in the IMMEDIATE_ASSIGNMENT_COMMAND from the BSC, the IMMEDIATE_ASSIGNMENT_SENT message is sent on Abis as soon as the corresponding IMMEDIATE_ASSIGNMENT or IMMEDIATE_ASSIGNMENT_EXTENDED message has been sent on air interface. The following information is included:

- Element "Channel Number" indicating the channel on which the IMMEDIATE_ASSIGNMENT or IMMEDIATE_ASSIGNMENT_EXTENDED message was transmitted on.
- Element "Mobile Identifier" as received in the IMMEDIATE_ASSIGNMENT_COMMAND from the BSC.

However, if more than one IA is sent in the same IMMEDIATE_ASSIGNMENT_EXTENDED message on air interface, the same number of IMMEDIATE_ASSIGNMENT_SENT messages should be sent on Abis.

16.2.4 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
- Transmission of system information 7, 8, 13, 16 and 17

Handling of Paging is covered in the 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:

a) SYSTEM_INFORMATION

b) IMMEDIATE_ASSIGNMENT

- /GSM:04.08:9.1.18/
- /GSM:04.08:9.1.19/

c) IMMEDIATE_ASSIGNMENT_REJECT

- /GSM:04.08:9.1.20/

d) IMMEDIATE_ASSIGNMENT for Paging Group

e) IMMEDIATE_ASSIGNMENT_REJECT for Paging Group

f) PAGING_REQUEST

If no messages are queued for transmission:

- IMSIs, TMSIs and IAs stored for retransmission (see 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 section Dummy Paging below).

- The CCCH queue system is used for system information 7, 8, 13, 16 and 17 for transmisstion on BCCH extended.

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.

If Extended paging is used, IAs originating from two different paging groups may be packed into the same IMMEDIATE_ASSIGNMENT_EXTENDED message.

A maximum of four unique IARs can be packed into one IMMEDIATE_ASSIGNMENT_REJECT message.

If Extended paging is used, IARs originating from different paging groups may be packed into the same 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.

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
- Paging reorganization

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 section Administration below.

Page mode extended makes it possible for the RBS to transmit pagings (IMSIs or TMSIs) or immediate assigns for a certain paging group when the next but one paging group is scheduled /GSM:04.08:3.3.2.1/.

The "Page Mode" element (of the PAGING_REQUEST or IMMEDIATE_ASSIGNMENTs messages), set to extended Paging, is sent as an indication to the MS to be prepared to handle extended Paging as described above. The allowed use of extended page mode is defined (in percentage) by means of configuration parameter DRX_DEV_MAX, see MAX, see section Administration below.

On receipt of an IMMEDIATE_ASSIGN_COMMAND* with page mode set to Paging reorganization, RBS uses Page Mode "Paging reorganization" in all of the following air interface messages:- IMMEDIATE ASSIGNMENT-IMMEDIATE ASSIGNMENT REJECTED-IMMEDIATE ASSIGNMENT EXTENDED-PAGING REQUEST 1–3, including dummy paging.

TRS uses Page Mode "Paging reorganization" until an IMMEDIATE ASSIGNMENT COMMAND* message is received with page mode set to normal paging or extended paging. The TRS then swaps page mode from "Paging reorganization" to normal operation, which means that normal paging or extended paging is used.

If an IMMEDIATE_ASSIGN_COMMAND* is received with page mode set to 'Same as before' the page mode is not changed.

Note: It should be made clear that it is the L3 immediate assign message carried within the IMMEDIATE_ASSIGN_COMMAND that contains the page mode parameter.

Retransmission of Messages

A copy of a transmitted IMSI, TMSI and IA is stored for retransmission (IARs are not stored for retransmission).

An IMSI or TMSI, or an IA stored for retransmission is discarded, depending on the setting of parameter BS_PA_MFRMS (see section Administration below) as specified below:

- BS_PA_MFRMS < = 3
  - The IMSI/TMSI/IA is discarded if it has not been retransmitted within two schedulings of its paging group
- BS_PA_MFRMS > 3
  - The IMSI/TMSI/IA 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 options/CR, see section Administration below.

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:

Table 116 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 options/CR	ON, OFF	Automatic retransmission of pagings and immediate assigns in use (ON), or not in use (OFF).
CCCH options/IPT3	ON, OFF	Paging request type 3 used (OFF) or not used (ON).
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).

16.2.5 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/.

16.3 Operational Conditions

16.3.1 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
- (v) The use of 4-27 paging groups is supported

The paging queue length varies between 6 and 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.

16.3.2 Immediate Assign

Max. number of elements in the IA queue = 10 and in the IAR queue = 10, in the IAPGQ = 3 and in the IRPGQ = 4.

16.3.3 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
- IAPGSs, number of elements = 3

16.3.4 Channel Request by MS

The RBS can receive and perform acceptance checks, corresponding to full RACH capacity. The RBS can report accepted channel requests, as CHANNEL_REQUIRED messages, corresponding to 37 % of the requests on full RACH load.

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17 Physical Channel Handling

"Physical Channel Handling" covers the traffic services provided by the physical layer in the RBS for the air interface.

17.1 References

/GSM:05.02/

/GSM:05.03/

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 Functions

17.2.1 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

17.2.2 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

SACCH/TH	Slow Associated Control Channel, half rate traffic
SCH	Synchronization 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
TCH/FD	Traffic Channel, full rate, uni-directional, multislot configuration.
SACCH/M	Slow Associated Control Channel, full rate traffic, multislot configuration.
SACCH/MD	SACCH/MD is defined as the downlink part of SACCH/M
PBCCH	Packet Broadcast Control Channel
PCCCH	Packet Common Control Channel
PACCH	Packet Associated Control Channel
PTCCH/D	Packet Timing Advance Control Channel, downlink
PTCCH/U	Packet Timing Advance Control Channel, uplink
PRACH	Packet Random Access Channel
PDTCH	Packet Data Traffic Channel

17.2.3 Supported Channel Combinations

The following channel combinations are supported /GSM:05.02:6.4/:

Circuit Switched

- (i) TCH/F + FACCH/F + SACCH/TF
- (ii) TCH/H(0,1) + FACCH/H(0,1) + SACCH/TH(0,1)
- (iv) FCCH + SCH + BCCH norm. + BCCH ext. + CCCH
- (v)
  - a) FCCH + SCH + BCCH norm. + BCCH ext. + 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

- (viii) TCH/F + FACCH/F + SACCH/M
- (ix) TCH/F + SACCH/M
- (x) TCH/FD + SACCH/MD

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.

Note: Channel Combinations (vi) can only be configured for TN=2, 4, 6.

Packet Switched

- (xi) PBCCH + PCCCH + PDTCH + PACCH + PTCCH
- (xii) PCCCH + PDTCH + PACCH + PTCCH
- (xiii) PDTCH + PACCH + PTCCH

Each channel combination for packet data is transmitted on PDCH (the physical channel).

17.2.4 Channel Coding

Channel Coding (downlink) is performed according to:

/GSM:05.03:3/	Traffic Channels
/GSM:05.03:4/	Control Channels
/GSM:05.03:5/	Packet Switched Channels

17.2.5 Channel Decoding

Channel Decoding (uplink) is performed according to:

/GSM:05.03:3/	Traffic Channels
/GSM:05.03:4/	Control Channels
/GSM:05.03:5/	Packet Switched Channels

17.2.6 Interleaving

Interleaving (downlink) is performed according to:

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

/GSM:05.03:5/	Packet Switched Channels

17.2.7 De-interleaving

De-interleaving (uplink) is performed according to:

/GSM:05.03:3/	Traffic Channels
/GSM:05.03:4/	Control Channels
/GSM:05.03:5/	Packet Switched Channels

17.2.8 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

17.2.9 Multiplexing

Multiplexing of bursts into TDMA frames is performed according to:

/GSM:05.02/	Table 1/
/GSM:05.02/	Table 2/
/GSM:05.02/	Table 3/
/GSM:05.02/	Table 4/
/GSM:05.02/	Table 5/
/GSM:05.02/	Table 6/
/GSM:05.02/	Table 7/

18 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.

18.1 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.

18.2 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.

18.3 Functions

18.3.1 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.

18.3.2 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)

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.

18.3.3 Full Rate Speech

Full 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/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.

18.3.4 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.

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.

18.3.5 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.

18.3.6 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/.

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.

18.4 Operational Conditions

18.4.1 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/.

18.4.2 Full Rate Data

Transparent data services supported:

- 14.4 kbits/s
- 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:

- 14.4 kbits/s
- 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/.

18.4.3 Half Rate Speech

The round-trip delay for a half rate speech channel, introduced by the BTS, is less than 63 ms.

The values are including additional delay due to the measuring method as described in /GSM 11.20:7.2.6, table 7–2b/.

18.4.4 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/.

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19 Packet Data Services

This chapter covers packet data services, including handling of the link, GSL, between RBS and PCU, as well as Terrestrial Link Supervision (TLS) and Link Quality Supervision.

19.1 References

/GSM:05.02/CCITT G.821/	CCITT Blue book, rec G.821 Vol III - Fascicle III.5 "Digital Networks, digital sections and digital line systems"

19.2 Functions

19.2.1 Terrestrial Link Supervision for GSL

This function is used when the PDCH is activated, primarily to supervise that a correct PCU frame synchronization is maintained downlink, and that the received frame type is expected. The function decides when the connection is considered lost. TLS supervision can be controlled using a flag indicating supervision on/off, according to the cases below.

TLS on active subchannel is set on:

Terrestrial link used for PDCH traffic.

Terrestrial link supervision is active.

TLS on active subchannel is set off:

Terrestrial link used for PDCH traffic.

No supervision.

If, for an activated channel, disturbances on the link between RBS and PCU result in a connection lost decision, a CONNECTION FAILURE message with cause value remote PCU failure is also sent to the BSC. This is done only when the "TLS active" flag is indicating supervision on.

19.2.2 PCU-RBS LInk Quality Supervison

The Link Quality Supervision function evaluates and reports the Terrestrial Channel link quality for a specified period of time.

Measurements are made on the frames received from PCU, and are related to the 16 kbit/s link.

Just a subset of the bits are known in advance, for example, synchronization bits. Bit error measurements are only taken on these bits to form an equivalent set of measuring counters.

Results of measurements are added to the ACTIVE measuring counters.

19.2.3 Packet Data

Upon reception of a CHANNEL ACTIVATION message from the BSC, the startup of the GSL is initiated.

The RBS initiates the setup and synchronization of the GSL, by issuing PCU frames of type "synchronization". Upon reception of PCU frames of type "synchronization" by RBS, the GSL is established.

Upon reception of an RF CHANNEL RELEASE from the BSC, Idle pattern is started to be transmitted to the PCU. The GSL is stopped and the RBS-PCU connection is released.

Upon reception of a PCU frame of type "synchronization", RBS associates the downlink FN counter with the Air FN, and returns these values in the next PCU frame of type "synchronization" to the PCU.

RBS supervises the frame synchronization of the GSL by checking the PCU frames of type "traffic".

To minimize the downlink delay between the Air interface and the PCU, RBS continuously monitors, and if necessary adjusts, the alignment between the Radio Blocks sent on Air Interface and the PCU Frames received on GSL.

The procedure runs autonomously as long as the GSL is active.

To minimize the uplink delay between the Air interface and the PCU, RBS measures the difference in time between reception from Air interface and transmission to PCU, and performs necessary adjustments.

The procedure runs autonomously as long as the GSL is active.

20 Call Control

The Call Control function defines the RBS functions related to call establishment and call control on the air interface.

20.1 References

/GSM 04.04/

/GSM 04.06/

/GSM 04.08/

/GSM 05.02/

/GSM 05.05/

/GSM 05.10/

/GSM 08.58/

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

20.2 Channel Activation

Purpose

To prepare a dedicated channel for use and start up reception and transmission on associated channels. /GSM 08.58:4.1/

Preconditions and Initiation

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]
- (viii) TCH/F + FACCH/F + SACCH/M
- (ix) TCH/F + SACCH/M
- (x) TCH/FD + SACCH/MD

Packet Switched

A 52–multiframe is supported for PDCH.

The following channel combinations /GSM:05.02/ can be transmitted on PDCH (the physical channel):

- (xi) PBCCH + PCCCH + PDTCH + PACCH + PTCCH
- (xii) PCCCH + PDTCH + PACCH + PTCCH
- (xiii) PDTCH + PACCH + PTCCH

Note: All logical channels (except PTCCH) are transparent for the BTS.

Supported channel numbers /GSM 08.58:9.3.1/

- Bm + ACCHs (Associated Control Channels)
- Lm + ACCHs
- SDCCH/8 + ACCH
- SDCCH/4 + ACCH (TN=0)
- PDCH

Supported activation types /GSM 08.58:9.3.3/

- Immediate Assign
- Normal Assign
- Asynchronous Handover
- Multislot configuration
- Packet Channel
- Initial activation

Supported channel modes /GSM 08.58:9.3.6/

TCH/F	Signalling
TCH/H	Signalling
TCH/FS	Full rate speech, GSM speech alg. Ver 1
TCH/FS	Full rate speech, GSM speech alg. Ver 2
TCH/HS	Half rate speech
SDCCH	Signalling

For the non-transparent service

TCH/F14.4	Full rate data 14.4 kbit/s non-transparent
TCH/F9.6	Full rate data 9.6 kbit/s non-transparent
TCH/H4.8	Half rate data 4.8 kbit/s non-transparent

For the transparent service

TCH/F14.4	Full rate data 14.4 kbit/s 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

TCH/F2.4	Full rate data 600 bit/s transparent
TCH/F2.4	Full rate data 1200/75 bit/s (1200 network >MS, 75 MS >network) transparent
TCH/F	Signalling, Bi-directional (not allowed on channel combination ix)

TCH/FS	Full rate speech, GSM speech alg. Ver 1, Bi-directional
TCH/FS	Full rate speech, GSM speech alg. Ver 2, Bi-directional
TCH/F14.4	Full rate data 14.4 kbit/s non-transparent, Bi-directional
TCH/F9.6	Full rate data 9.6 kbit/s non-transparent, Bi-directional
TCH/H4.8	Half rate data 4.8 kbit/s non-transparent, Bi-directional
TCH/F9.6	Full rate data 9.6 kbit/s transparent, Bi-directional
TCH/F4.8	Full rate data 4.8 kbit/s transparent, Bi-directional
TCH/F2.4	Full rate data 2.4 kbit/s transparent, Bi-directional
TCH/F2.4	Full rate data 1.2 kbit/s transparent, Bi-directional
TCH/F2.4	Full rate data 600 bit/s transparent, Bi-directional
TCH/F2.4	Full rate data 1200/75 bit/s transparent, Bi-directional

TCH/FS	Full rate speech, GSM speech alg. Ver 1, Uni-directional
TCH/FS	Full rate speech, GSM speech alg. Ver 2, Uni-directional
TCH/F14.4	Full rate data 14.4 kbit/s non-transparent, Uni-directional
TCH/F9.6	Full rate data 9.6 kbit/s non-transparent, Uni-directional

TCH/H4.8	Half rate data 4.8 kbit/s non-transparent, Uni-directional
TCH/F9.6	Full rate data 9.6 kbit/s transparent, Uni-directional
TCH/F4.8	Full rate data 4.8 kbit/s transparent, Uni-directional
TCH/F2.4	Full rate data 2.4 kbit/s transparent, Uni-directional
TCH/F2.4	Full rate data 1.2 kbit/s transparent, Uni-directional
TCH/F2.4	Full rate data 600 bit/s transparent, Uni-directional
TCH/F2.4	Full rate data 1200/75 bit/s transparent, Uni-directional

TCH/H4.8	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 600 bit/s transparent
TCH/H2.4	Half rate data 1200/75 bit/s (1200 network >MS, 75 MS >networ) transparent

Note: TCH/F4.8 non-transparent is only hardware supported.

Classification (see section Concepts) of elements, common for all activation types

Channel Identification	Ignored
BS Power	Optional
MS Power	Required
BS Power Parameters	Rejected
MS Power Parameters	Rejected
Physical Context	Rejected

Immediate Assign /GSM 08.58:4.1/

The optional elements for Immediate Assign are:

Encryption Information	Rejected
Handover Reference	Rejected

Timing Advance	Required

Normal Assignment /GSM 08.58:4.1/

The optional elements for Normal Assignment are:

Encryption Information	Optional
Handover Reference	Rejected
Timing Advance	Required
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 Broadcast.

Asynchronous Handover /GSM 08.58:4.1/

The optional elements for Asynchronous Handover are:

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 by the SACCH FILLING INFORMATION MODIFY procedure described in Broadcast.

Multislot configuration (secondary channels) /GSM 08.58:4.1/

The activation for the multislot configuration procedure is in accordance with /GSM 08.58:4.1/.

Encryption Information	Optional
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 Broadcast.

The function is initiated when a CHANNEL_ACTIVATION / GSM 08.58:4.1/ message is received from BSC.

Packet Channel

The following actions are taken by the RBS:

- Start scheduling the PDCH multiframe on Air interface. No power is transmitted (except for PTCCH downlink) and no LAPDm links are inititated.
- Initiate establishment of GSL.
- Send CHANNEL_ACTIVATION_ACKNOWLEDGE to BSC.

- Set Dedicated Resource Channel state = Activate.

Description

In order to activate a channel between MS and RBS, the RBS receives an idle traffic channel from BSC in a Channel_Activation message. This message contains the reason for the activation (immediate assignment, normal assignment, asynchronous handover, multislot configuration), the identification of the channel to be used (channel no.) and a complete description of the channel (full/half rate, speech/data, coding/rate adaption, hopping sequence, encryption key, and so forth).

If the activation of the channel is successful, the RBS answer is Channel_Activation_Acknowledgement. Otherwise, if the channel for some reason cannot activate, the answer is a Channel_Activation_Negative_Acknowledgement.

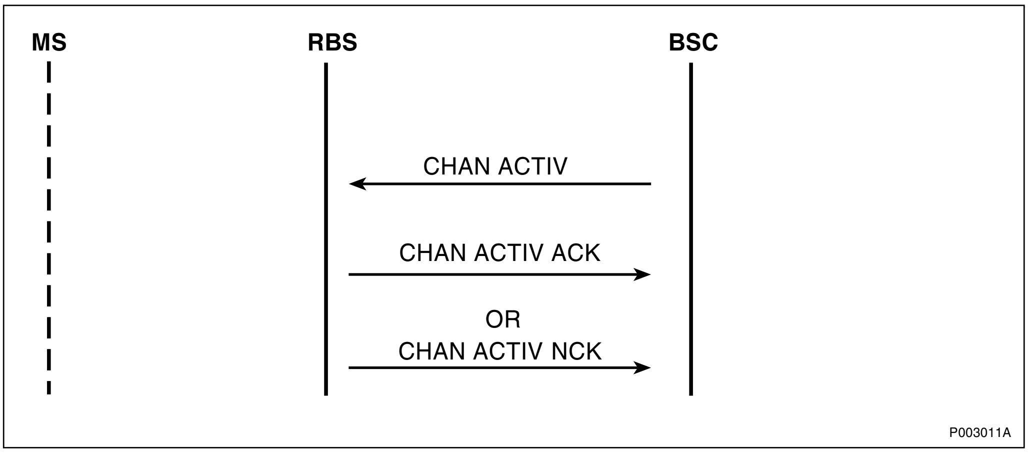

Figure 83 Channel activation message

20.3 Adaptive Frame Alignment

Purpose

To ensure that the burst received in the RBS from an MS is in time alignment.

Precondition and initiation

See Channel Activation above.

Description

This function ensures that the burst received in the RBS from an active MS at different distances from the RBS, is 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/

Example

An MS is very close to an RBS. It is allocated on TS3 and only using this time slot for the call. During the call, the MS moves away from the RBS causing the information sent from the RBS to arrive at the MS later and later. The answer from the MS also arrives later and later at the RBS. This function prevents the delay becoming so long as to cause TS3 to overlap onto TS4, thus disturbing another call.

The function is terminated when the dedicated Resource Channels enter state IDLE.

There are three different kinds of Adaptive Frame Alignment:

1. Access Delay Measurement

From the start of normal burst reception on a dedicated channel, the RBS measures the Access Delay on all received bursts. These values are used at the calculation of a new ordered TA value to the MS, see Dynamic Time Alignment.

2. Initial Time Alignment

At start of downlink SACCH transmission, an initial ordered TA value (received at channel activation) is used in the L1 header of the SACCH block.

3. 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 normal bursts that are received since the last calculation (one SACCH reporting period)
- The actual used (by MS) TA value which is received in L1 header /GSM 04.04:7.2/ of the uplink SACCH block
- The previous/unit 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.

20.4 Asynchronous Handover Detection

Purpose

To detect access bursts (in a handover situation).

Preconditions and Initiation

See Channel Activation above.

Description

When the RBS is taking over the communication, in a handover situation, it has no information of the distance to the MS and consequently no Timing Advance information. The MS transmits access bursts. These burst are kept very short (only 8 bits of information) in order to prevent disturbing another call. This function measures the delay of handover access burst received by the RBS and sets the Timing Advance. The information is included in the

Physical_Information message to MS and the Handover_Detection message to BSC. /GSM 08.58:4.3/

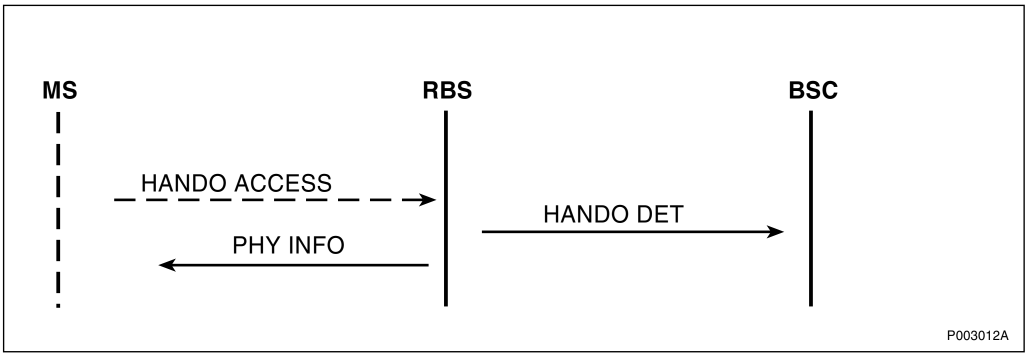

Figure 84 Physical information message

There are some criterias that have to be fulfilled if the Handover Access messages shall be accepted.

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.
- 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 shall be repeated.

If no correct frame is received from the MS, transmission of Physical information shall be repeated.

Example:

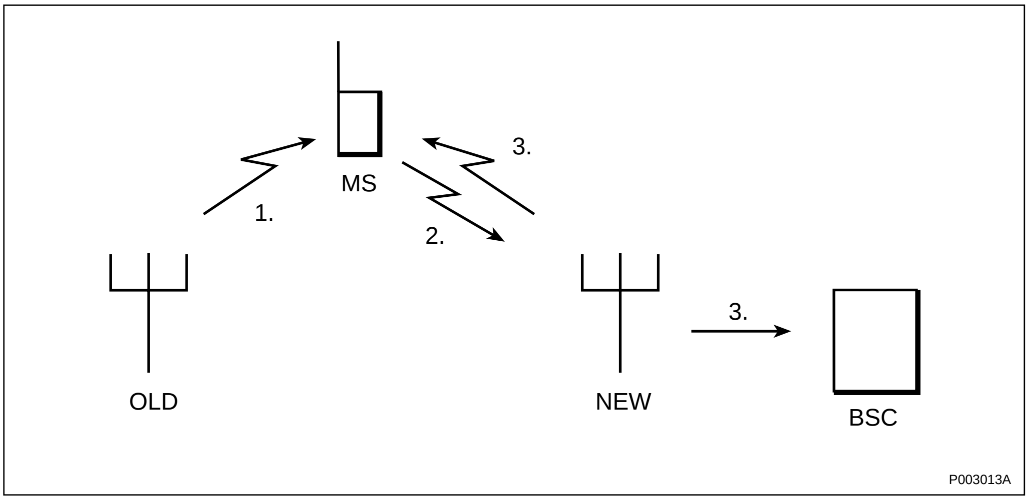

Figure 85 Transmission of physical information

1. BSC sends a message to the MS through the old RBS containing information about the frequency and time slot to change to. This information is sent over FACCH.

2. The MS tunes to the new frequency, and transmits handover access bursts in the correct time slot. The access bursts are small enough to be sent without any Timing Advance information and do not disturb any other call.

3. (This function) RBS detects the handover access bursts and measures the delay. The delay gives information about the Timing Advance which is included in the Physical Information to the MS and the Handover Detection message to BSC.

20.5 RF Channel Release

Purpose

To release a radio channel which is no longer needed.

Precondition and Initiation

See Channel Activation above.

The function is initiated when the RBS receives a Channel_Release message from BSC.

Description

All traffic and signalling on a group of dedicated logical channels are stopped, and all associated resources are released. After having released the channel, or if the channel is already released, the RBS sends an RF_Channel_Acknowledge message to BSC /GSM 08.58:4.7/.

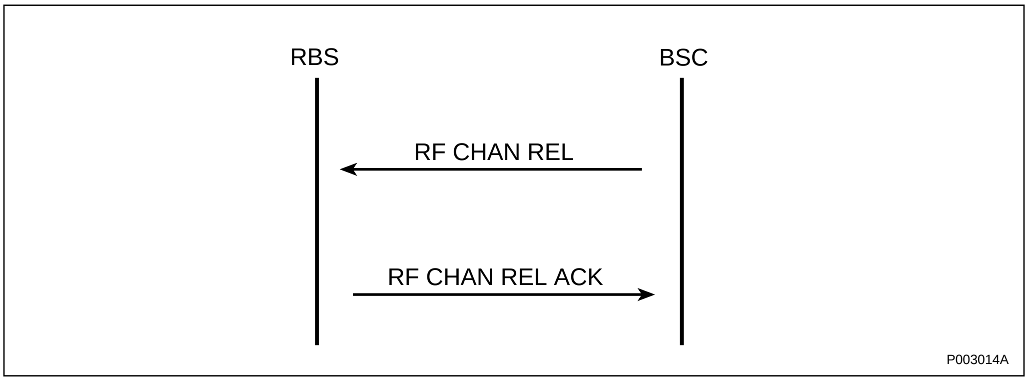

Figure 86 RF channel release

20.6 Deactivate SACCH

Purpose

To stop transmission on SACCH of the addressed channel group.

Precondition and Initiation

See Channel Activation above.

The function is initiated when the RBS receives a Channel_Release message from BSC.

Description

The RBS immediately stops all transmission on SACCH of the addressed channel group. /GSM 08.58:4.6/

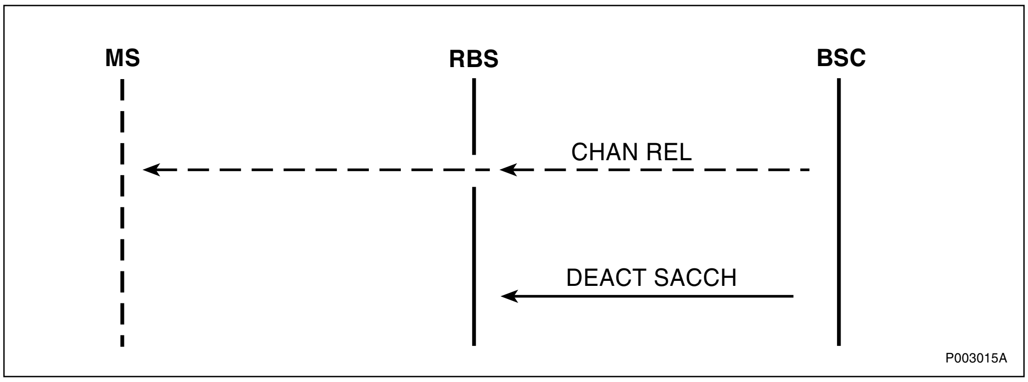

Figure 87 Deactivate SACCH

20.7 Link Establish Indication

Purpose

To establish a link layer connection between MS and network.

Precondition and Initiation

Channel combination supported is defined in section Channel Activation above /GSM 04.06:5.4.4/.

The Link Establish Indication function is applicable for:

- SAPI-0 on SDCCH and FACCH
- SAPI-3 on SDCCH and FACCH/T

There are two cases of establishment as described in /GSM 04.06:5.4.1/:

- Normal establishment
- Contention resolution establishment

The function is initiated when the RBS receives an SABM from MS.

Description

The following procedure is used by RBS to indicate to BSC that a link layer on the air interface has been established by an initiative from the MS. After reception of a first SABM an indication (ESTablish INDication) is sent to the BSC that a link layer on the radio path has been established in multiframe mode.

It is the MS that takes initiative of the establishment. This is done when the mobile, for example, wants to send a measurement report to the network.

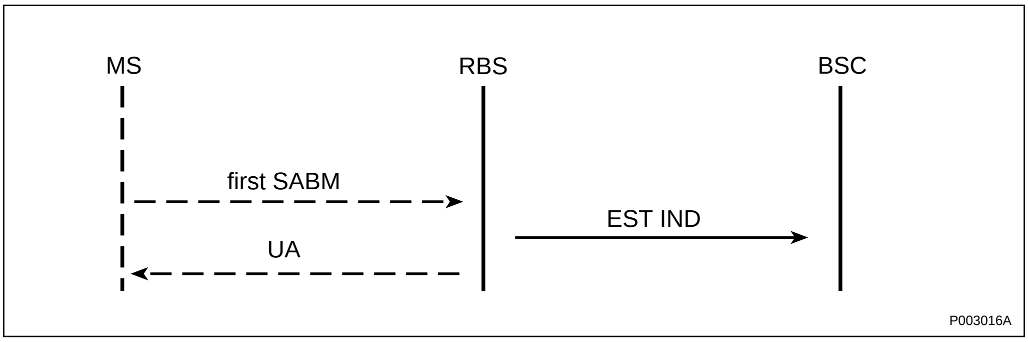

Figure 88 Link establish indication

The Normal Establishment is utilized 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 utilized for SAPI-0 links only (in conjunction with an immediate assign).

An attempt to establish an SAPI-3 link is rejected (Disconnect Mode response to MS if the SAPI-0 link is not established).

Messages queued for transmission are lost if the link is re-established.

- Collision cases are treated as specified in Technical Specification / GSM 04.06/
- Fault handling related to the link establish procedure is in accordance with /GSM 04.06:5.4.4/

- The link establishment procedure is in accordance with /GSM 08.58.3.1/ and /GSM 04.06:5.4.1/

20.8 Link Release Indication

Purpose

To release a link layer connection between MS and the network.

Precondition and Initiation

Channel combination supported is defined in section Channel Activation above.

The Link Release Indication function is applicable for:

- SAPI-0 on SDCCH and FACCH
- SAPI-3 on SDCCH, SACCH/T and SACCH/M

The function is initiated when the RBS receives a DISC frame from MS.

Description

The following procedure is used by RBS to indicate to BSC that a link layer on the air interface has been released by an initiative from the MS (disconnect). The MS sends a DISC frame on a link layer connection in multiframe mode. Multiframe mode means that an answer UA (unnumbered acknowledgment) is required. The RBS then sends a RELease INDication message to BSC to confirm the release of the link layer. It is the mobile that takes initiative for the release. This is used when the signalling between MS and network is done and the link is no longer needed.

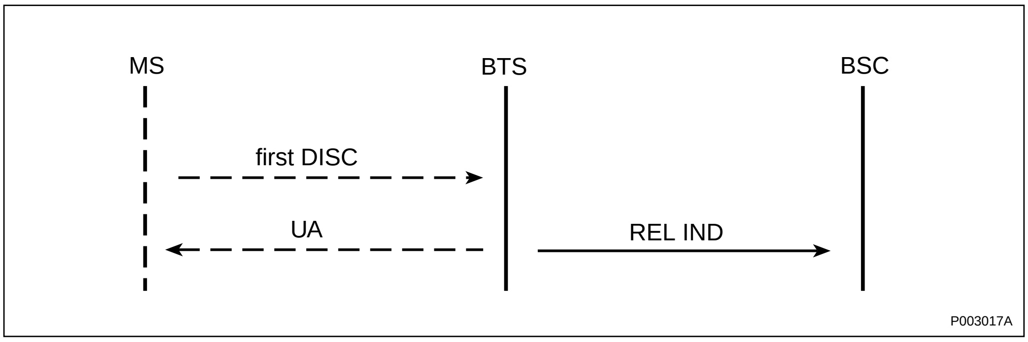

Figure 89 Link release indication

- The link release procedure is in accordance with /GSM 08.58:3.3/, /GSM 08.58:8.3.9/ and for RELease INDication with /GSM 08.58:8.3.9/.
- Collision cases are treated as specified in Technical Specification GSM 04.06.
- Fault handling related to the link release procedure is in accordance with /GSM 04.06:5.4.4/.

20.9 Link Establishment Request

Purpose

To establish a signal link between MS and network.

Precondition and Initiation

Channel combinations supported are defined in section Channel Activation above.

This function is applicable for:

- SAPI-3 links on SDCCH, SACCH/T and SACCH/M

The function is initiated when the RBS receives an ESTablish REQuest from BSC.

Description

The following procedure is used by BSC to request the establishment of a link layer connection in multiframe mode on the air interface / GSM 08.58:3.2/.

The procedure starts when the RBS receives an ESTablish REQuest message from BSC. RBS then establishes the link by sending an SABM frame. Upon reception of the acknowledgment (UA-frame) from MS, RBS sends an ESTablish CONFirm message to BSC. It is the network (BSC) that takes initiative for the establishment. Measurement reports are one type of message which can be sent on the signal link.

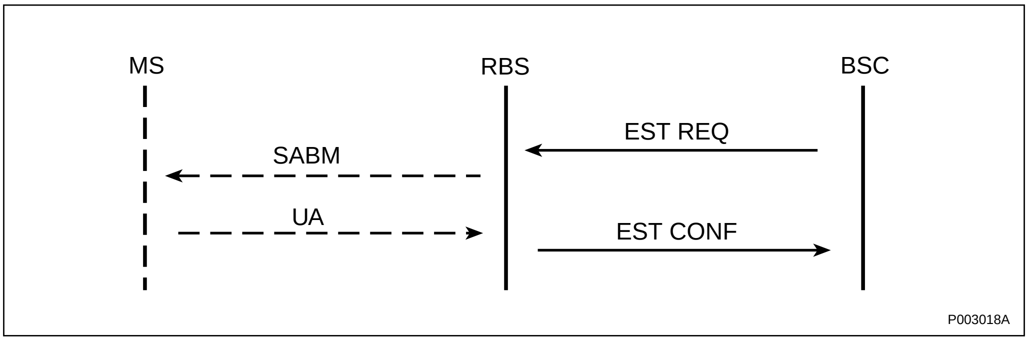

Figure 90 Link establishment request

Messages queued for transmissions are lost if the link is re-established. When the link is established, an ESTablish CONFirm /GSM 08.58:3.5/ is to be sent to the BSC.

- The Link Establishment procedure is in accordance with / GSM 08.58:3.2/ and /GSM 04.06:4.1/.
- Fault Handling related to the link establishment procedure is in accordance with /GSM 04.06:5.4.1/.

20.10 Link Release Request

Purpose

To release a signal link between MS and network.

Precondition and Initiation

Channel combinations supported are defined in section Channel Activation above.

This function is applicable for:

- SAPI-3 links on SDCCH, SACCH/T and SACCH/M

The function is initiated when a RELease REQuest is sent from BSC to RBS.

Description

The following procedure is used by BSC to request the release of a link layer connection on the air interface in multiframe mode / GSM 04.06:5.4.4/.

The procedure starts when the RBS receives a RELease REQuest message from BSC. RBS then sends a DISC (disconnect) frame to MS. When it has received the acknowledgment (UA- or DM-frame), RBS sends an RELease CONFirm message to BSC.

It is the network (BSC) that takes initiative for the release. This is used when the signalling between MS and network is done and the link is no longer needed.

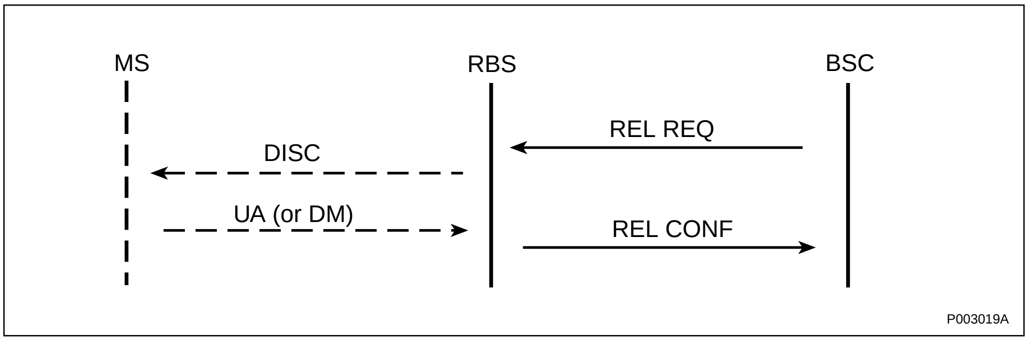

Figure 91 Link release request

Messages queued for transmissions are lost if the link is re-established. When the link is established, an ESTablish CONFirm /GSM 08.58:3.5/ is to be sent to the BSC.

- The Link Release procedure is in accordance with / GSM 08.58:3.4/ and /GSM 04.06:5.4.4/.
- Fault Handling related to the link establishment procedure is in accordance with /GSM 04.06:5.4.4/.
- The RBS supports Normal Release as well as Local Release / GSM 04.06:5.4.4.4/.

20.11 Transparent Message Transmission

Purpose

To send transparent layer 3 information between MS and the network.

Precondition and Initiation

Channel combinations supported are defined in section Channel Activation above.

This function is applicable for:

- SAPI-0 on SDCCH and FACCH
- SAPI-3 links on SDCCH, SACCH/T and SACCH/M

The function is initiated when the RBS receives a DATA REQUEST from BSC.

Description

The following procedure is used by BSC to send a layer 3 message to MS in acknowledged mode /GSM 08.58:3.5/. The message is sent through the RBS on the layer 2 link (the RBS is not affected by the message).

The function is initiated when a Data Request is received from BSC. The message contains the complete layer 3 message to be sent in acklowledged mode. The RBS sends the layer 3 message in accordance with /GSM 08.58:3.5/ to the MS inside an I (information field)-frame.

Transparent transmission in acknowledge mode requires that multiframe mode /GSM 08.58:3.1,3.2/ has been established. With multiframe mode means that an answer is needed. In this case an RR-frame (receiver ready) is sent back as a confirmation to the RBS.

The message is in this case sent from network (BSC) to MS. One example when this is used is for sending of SMS-message to the mobile.

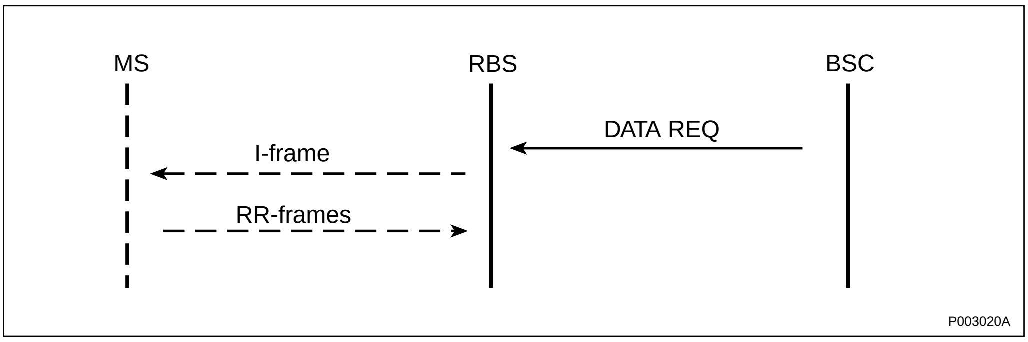

Figure 92 Transparent message transmission

Transmission of SAPI-0 messages has higher priority than SAPI-3 messages. A separate queue for SAPI-3 messages (Short Message Service) exists.

20.12 Transparent Message Reception

Purpose

To send transparent layer 3 information between MS and the network.

Precondition and Initiation

Channel combination supported is defined in section Channel Activation above.

This function is applicable for:

- SAPI-0 on SDCCH and FACCH
- SAPI-3 links on SDCCH, SACCH/T and SACCH/M

The function is initiated when the RBS receives an I-frame from MS.

Description

The following procedure is used when the MS sends a transparent layer 3 message to RBS. The message is forwarded to the BSC. The message is sent through the RBS on the layer 2 link (the RBS is not affected by the message).

The RBS receives an I-frame containing the layer 3 message. When the message is received, an acknowledge (RR-frame) is sent back to the MS. RBS sends a Data Indication message to BSC. The message contains the received transparent layer 3 message from MS.

The message is in this case sent from mobile to network (BSC). One example when this is used is for sending an SMS-message to another subscriber.

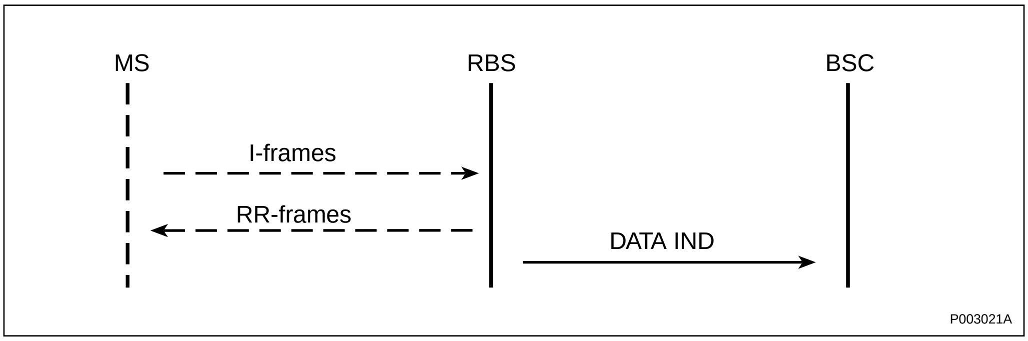

Figure 93 Transparent message reception

Transparent transmission in acknowledge mode requires that multiframe mode /GSM 08.58:3.1,3.2/ has been established. With multiframe mode means that an answer is needed. In this case an RR-frame (receiver ready) is sent back as a confirmation to the MS.

20.13 SACCH Info Modify

Purpose

To modify the SACCH information on an individual channel. The information from RBS is filtered so the unwanted data is removed.

Precondition and initiation

Channel combinations supported are defined in section Channel Activation above.

This function is initiated when the RBS receives a SACCH INFO MODIFY from BSC.

Description

This procedure is used by the BSC to modify the SACCH filling information (System Information) sent on an individual SACCH channel. For this purpose, the RBS receives a SACCH INFO MODIFY message from BSC. The SACCH filling information as given in the SACCH INFO MODIFY message shall be used on the indicated channel until the channel is released or the information is changed by another SACCH INFO MODIFY message.

The SACCH is used both uplink and downlink. On the uplink, the MS sends measurements on its own RBS (signal strength and quality) and neighbouring RBS (signal strength). On the downlink, the MS receives information concerning what transmitting power to use.

20.14 LAPDm

Purpose

To provide a reliable signalling link.

Precondition and initiation

Channel combinations supported are defined in section Channel Activation above.

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.
SACCH/M	Unacknowledged mode is supported.

SAPI-3

SAPI-3 is used for SMS point-to-point. The following channels are supported:

SDCCH	Acknowledged mode is supported.
SACCH/T	Acknowledged mode is supported.
SACCH/M	Unacknowledged mode is supported.

Description

LAPDm (Link Access Procedure on the Dm-channel) is a protocol that operates at the data link layer of the OSI structure. It receives service from the physical link (layer 1) and provides services to the net (layer 3).

The LAPDm function denotes the overall functionality included in the LAPDm protocol and the radio link layer management procedures. LAPDm confirms to /GSM 04.06/.

This function is used to send signalling information in between MS and RBS on the air interface.

20.15 Channel Reactivation

Purpose

To reactivate an already activated, dedicated channel resource with new parameters.

Precondition and Initiation

The function is initiated when a CHANNEL_ACTIVATION / GSM 08.58:4.1/ message is received from BSC.

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]
- (viii) TCH/F + FACCH/F + SACCH/M
- (ix) TCH/F + SACCH/M
- (x) TCH/FD + SACCH/MD

Supported channel numbers /GSM 08.58:9.3.1/

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

- SDCCH/8 + ACCH

Supported reactivation 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/H	Signalling
TCH/FS	Full rate speech, GSM speech alg. Ver 1
TCH/FS	Full rate speech, GSM speech alg. Ver 2
TCH/HS	Half rate speech
SDCCH	Signalling

For the non-transparent service

TCH/F14.4	Full rate data 14.4 kbit/s non-transparent
TCH/F9.6	Full rate data 9.6 kbit/s non-transparent
TCH/H4.8	Half rate data 4.8 kbit/s non-transparent

For the transparent service

TCH/F14.4	Full rate data 14.4 kbit/s 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
TCH/F2.4	Full rate data 600 bit/s transparent
TCH/F2.4	Full rate data 1200/75 bit/s (1200 network >MS, 75 MS >network) transparent
TCH/F	Signalling, Bi-directional (not allowed on channel combination ix)
TCH/FS	Full rate speech, GSM speech alg. Ver 1, Bi-directional
TCH/FS	Full rate speech, GSM speech alg. Ver 2, Bi-directional

TCH/F14.4	Full rate data 14.4 kbit/s non-transparent, Bi-directional
TCH/F9.6	Full rate data 9.6 kbit/s non-transparent, Bi-directional
TCH/H4.8	Half rate data 4.8 kbit/s non-transparent, Bi-directional
TCH/F14.4	Full rate data 14.4 kbit/s transparent, Bi-directional
TCH/F9.6	Full rate data 9.6 kbit/s transparent, Bi-directional
TCH/F4.8	Full rate data 4.8 kbit/s transparent, Bi-directional
TCH/F2.4	Full rate data 2.4 kbit/s transparent, Bi-directional
TCH/F2.4	Full rate data 1.2 kbit/s transparent, Bi-directional
TCH/F2.4	Full rate data 600 bit/s transparent, Bi-directional
TCH/F2.4	Full rate data 1200/75 bit/s transparent, Bi-directional

TCH/FS	Full rate speech, GSM speech alg. Ver 1, Uni-directional
TCH/FS	Full rate speech, GSM speech alg. Ver 2, Uni-directional
TCH/F14.4	Full rate data 14.4 kbit/s non-transparent, Uni-directional
TCH/F9.6	Full rate data 9.6 kbit/s non-transparent, Uni-directional
TCH/H4.8	Half rate data 4.8 kbit/s non-transparent, Uni-directional
TCH/F14.4	Full rate data 14.4 kbit/s transparent, Uni-directional
TCH/F9.6	Full rate data 9.6 kbit/s transparent, Uni-directional
TCH/F4.8	Full rate data 4.8 kbit/s transparent, Uni-directional
TCH/F2.4	Full rate data 2.4 kbit/s transparent, Uni-directional

TCH/F2.4	Full rate data 1.2 kbit/s transparent, Uni-directional
TCH/F2.4	Full rate data 600 bit/s transparent, Uni-directional
TCH/F2.4	Full rate data 1200/75 bit/s transparent, Uni-directional

TCH/H4.8	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 600 bit/s transparent
TCH/H2.4	Half rate data 1200/75 bit/s (1200 network >MS, 75 MS >network) transparent

Note: TCH/F4.8 non-transparent is only hardware supported.

Classification (see section Concepts) of elements, common for all activation types

Channel Identification	Ignored
BS Power	Optional
MS Power	Required
BS Power Parameters	Rejected
MS Power Parameters	Rejected
Physical Context	Rejected

Normal Assignment /GSM 08.58:4.1/

The optional elements for Normal Assignment are:

Encryption Information	Optional
Handover Reference	Rejected
Timing Advance	Required
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 Broadcast.

Multislot configuration (secondary channels) /GSM 08.58:4.1/

The reactivation for the multislot configuration procedure is in accordance with /GSM 08.58:4.1/.

Encryption Information	Optional
Handover Reference	Rejected
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 Broadcast.

Description

The RBS receives a Channel_Activation message from BSC, in order to reactivate an already activated channel between MS and RBS. The RBS reactivates the channel with new parameters. /GSM 08.58:4.6/

During the reactivation, information flows are not interrupted.

If the reactivating of the channel is successful, the RBS answers with Channel_Activation_Acknowledgement. Otherwise, if the channel for some reason cannot activate, the answer is a Channel_Activation_Negative_Acknowledgement.

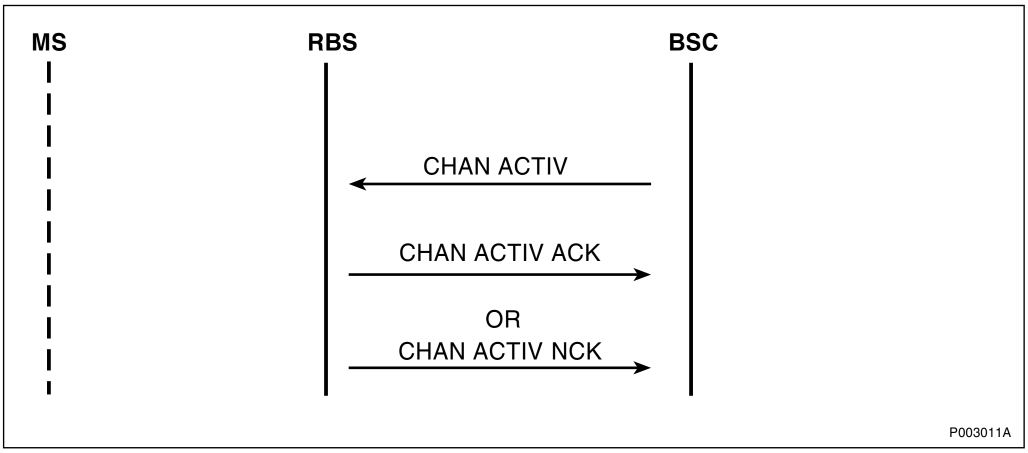

Figure 94 Channel reactivation

20.16 Power Information

Purpose

To change output power on the air interface between RBS and MS.

Precondition and Initiation

Transparent transmission in acknowledged mode requires that multiframe mode has been established.

The function is initiated when a DATA REQUEST message containing information element Power Information is received by the RBS.

Description

By means of the POWER INFORMATION element, the transmission power of the RBS and the MS is immediately changed. It is an optional part of the DATA REQUEST message on Abis. /GSM 08.58:8.3.1/ The power information element contains the new power levels to be used by the RBS (BS Power Level) and the MS (MS Power Level) on the air interface.

The RBS will immediately, without waiting for the next measurement period, change output power to BS Power Level. The MS Power Level will be sent to the MS in the L1 header on SACCH as soon as possible.

If the RBS receives a value that would result in a setting below the lowest allowed level, the power is set to the lowest allowed level.

The function is terminated when Power Information has been acknowledged according to the LAPDm protocol.

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21 GPRS, Physical Link Layer

General Packet Radio Services (GPRS) is a packet switched service. The service provides:

- Efficient use of scarce radio resources
- Fast set-up/access time
- Efficient transport of packets in the GSM network

21.1 References

/GSM:04.04/

/GSM:04.60/

/GSM:05.02/

/GSM:05.03/

/GSM:05.10/

/GSM:05.08/

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

21.2 Concepts

PCU Frame	A PCU Frame is transported on Abis interface and contains an RLC/MAC Block and control information.
Radio Block	A Radio Block is transported on air interface and contains an RLC/MAC Block and a BCS.
RLC/MAC Block	An RLC/MAC Block contains a MAC Header and an RLC Data or an RLC/MAC Control Block as defined in /GSM:04.60:10/.

21.3 Functions

21.3.1 Radio Block Transmission

Purpose

Radio Block Transmission specifies the functionality for downlink transport of RLC/MAC Block.

Preconditions and Initiation

The function is initiated by a PCU frame of type PCU-DATA-IND, received on Abis GSL interface.

Description

The RBS receives a PCU Frame on Abis interface and checks for errors. The RLC/MAC Block and the control information channel mode, coding scheme and power level is extracted from the PCU frame.

A radio block is created by encoding the RLC/MAC Block according to the given coding scheme /GSM:05.03:5/. The information of channel mode is stored to be applied on the next block uplink / GSM:05.02:6.3.2.2.1/.

The Radio Block is transmitted by four normal bursts on air interface using the received power level.

21.3.2 Radio Block Reception

Purpose

Radio Block Reception specifies the funtionality for uplink transport of RLC/MAC Block.

Preconditions and Initiation

The function is initiated by a PCU frame of type PCU-DATA-IND, received on Abis GSL interface.

Description

The RBS receives a Radio Block (four normal bursts) on air interface and performs demodulation according to the previously stored channel mode. Deinterleaving and channel decoding is performed according to received steal flags /GSM:05.03:5/.

The RBS performs the following PDCH measurements on a block basis:

- Block quality
- CRC
- RX level
- Access delay

A PCU Frame is created, consisting of the RLC/MAC Block and the PDCH measurement. The PCU Frame is then transmitted on Abis Interface.

21.3.3 Access Burst Reception

Purpose

Access Burst Reception specifies the functionality for uplink transport of Random access.

Preconditions and Initiation

The function is initiated by a PCU frame of type PCU-DATA-IND, received on Abis GSL interface.

Description

The RBS receives four access bursts and performs demodulation according to the previously stored channel mode. Channel decoding is performed according to /GSM:05.03:5.3.1/. The RBS performs the following PDCH measurements produced per access burst by the decoder:

- Burst quality
- Frame quality
- CRC
- Access delay

A PCU Frame is created, consisting of the four decoded access bursts and the PDCH measurements. The PCU Frame is then transmitted on Abis Interface.

21.3.4 Continuous Timing Advance Update

Purpose

Continuous Timing Advance Update specifies the functionality for updating of the timing advance values, using the logical channel PTCCH/U and PTCCH/D scheduled on PDCH according to /GSM:05.02/.

Preconditions and Initiation

The function is inititated when a CHANNEL_ACTIVATION message with element "Activation Type" = Packet Channel is received on Abis RSL interface.

Description

The RBS receives an access burst on PTCCH/U on air interface. The access burst is demodulated, decoded /GSM:05.03:5.2/ and the timing advance value is determined. The timing advance value is updated in the next PTCCH downlink block following the access burst. PTCCH downlink block is according to /GSM:04.04:7.4f/.

The RBS performs coding /GSM:05.03:5.2/ and transmits the PTCCH downlink block on nominal power by four normal bursts on PTCCH/D.

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22 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.

22.1 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.

22.2 Concepts

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

22.3 Functions

22.3.1 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)

- (v) FCCH+SCH+BCCH+CCCH+SDCCH/4(0..3)+SACCH/C4(0..3)
- (vii) SDCCH/8(0..7) + SACCH/C8(0..7)
- (viii) TCH/F + FACCH/F + SACCH/M
- (ix) TCH/F + SACCH/M
- (x) TCH/FD + SACCH/MD

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.

22.3.2 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 Base Station Power Control, 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

22.3.3 Base Station Power Control at Channel Reactivation

SeeSection 22.3.1 on page 217.

22.4 Operational Conditions

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

23 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.

23.1 References

/GSM:08.58/

/GSM:05.08/

/GSM:05.02/

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

23.2 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.

23.3 Functions

23.3.1 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. The RBS also performs speech quality measurements on these channels. Measurements on channel combinations, (i), (ii), (iii) (only HW support), (v), (vii), (viii), (ix) and (x) are supported, /GSM:05.02:6.4/.

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 117 Frame calculation

Channel Combination	RXQUAL_FULL, RXLEV_FULL	RXQUAL_SUB, RXLEV_SUB
(i), (viii), (ix)	All TCH and SACCH frames (96 TCH, 4 SACCH)	8 SID + 4 SACCH
(x)	Channel measurements are unspecified.	
(ii)	All TCH and SACCH frames (48 TCH, 4 SACCH)	TCH/S: 8 SID + 4 SACCH
		TCH/Data: 10 SID + 4 SACCH
(iii)	All TCH and SACCH frames (96 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/.

The Speech Quality Index, SQI, is an index which shall be a measurement of the subjective speech quality of the uplink speech. The algorithm to obtain the index uses BER and FER measurements over a defined period of frames, excluding DTX, as input.

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

23.3.2 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.

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.

23.4 Operational Conditions

The measurements of R.M.S. signal level 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.

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24 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.

24.1 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.

24.2 Functions

24.2.1 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)

/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 (GSM speech alg. version 1), uni-directional
- TCH speech, full rate (Speech full rate version 2), uni-directional
- TCH speech, full rate (GSM speech alg. version 1), bi-directional
- TCH speech, full rate (Speech full rate version 2), bi-directional
- TCH speech, half rate
- TCH data, 14.4 kbit/s, non-transparent, uni-directional
- TCH data, 9.6 kbit/s, non-transparent, uni-directional
- TCH data, 4.8 kbit/s, non-transparent (Only half rate supported)
- TCH data, 14.4 kbit/s, non-transparent, bi-directional
- TCH data, 9.6 kbit/s, non-transparent, bi-directional

For all other Channel Modes, the DTXd indicator is ignored, since the DTX function is not applicable.

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)
- (viii) TCH/F + FACCH/F + SACCH/M
- (ix) TCH/F + SACCH/M
- (x) TCH/FD + SACCH/MD

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 (as a flag) in the full rate RTH-SPEECH-IND/RTH-E-SPEECH-IND, half rate RTH-SPEECH-IND and RTH- IDLE SPEECH-IND frames to the RTC. To detect if a full rate RTH-SPEECH-IND/RTH-E-SPEECH-IND or half rate RTH-SPEECH-IND frame (received from the RTC) contains speech or comfort noise parameters /GSM:06.32 / or /GSM:06.42/, RBS analyses the SID code word /GSM:06.12:5.2/, /GSM:06.62:5.3/ or / GSM:06.22:5.3/.

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 will instead be according to /GSM:06.31:5.1.2/, /GSM:06.41:5.1.2/ or /GSM:06.81:5.1.2/.

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)

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.

24.2.2 DTX Uplink

The DTXu indicator (of element Channel Mode) in the CHANNEL_ACTIVATION or MODE_MODIFY messages from the BCS is ignored, since the RBS is always prepared to handle uplink DTX.

The uplink DTX function is supported for the following services:

- TCH speech, full rate (GSM speech alg. version 1)
- TCH speech, full rate (Speech full rate version 2)
- TCH speech, half rate (GSM speech alg. version 1)
- TCH speech, full rate (GSM speech alg. version 1) bidirectional
- TCH speech, full rate (Speech full rate version 2) bidirectional

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

To detect if a speech frame (received from MS) contains speech or comfort noise parameters, RBS analyses the SID code word /GSM:06.12:5.2/, /GSM:06.62:5.3/or /GSM:06.22:5.3/. An indication of comfort noise parameters (SID flag), is sent in the full rateRTH-SPEECH-IND/RTH-E-SPEECH-IND or half rate RTH-SPEECH-IND frames to the RTC.

Full Rate

During periods of silence, RTH-SPEECH-IND with the silence indicator (SID) set to "3" are sent to the RTC in case when GSM speech alg. version 1 are used.

If, during periods of silence, Speech full rate version 2 are used, RTH-SPEECH-IND frames are sent to the RTC with the BFI set.

Half Rate

During periods of silence, RTH-SPEECH-IND frames are sent to the RTC with the BFI set.

25 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
- Synthesizer hopping

25.1 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.

25.2 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.
Synthesizer 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.

25.3 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]

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 118 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

25.4 Operational Conditions

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

26 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).

26.1 References

/GSM 04.08/	GSM 04.08 (phase 2) version 4.7.0
/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.

26.2 Start Encryption at Channel Activation

Purpose

To initiate encryption mode on a dedicated logical channel.

Precondition and initiation

The function starts encryption if element "Encryption Information" is provided in the "CHANNEL_ACTIVATION" message.

Element "Encryption Information" is optional when the Channel Activation types are:

- Normal Assign
- Asynchronous Handover
- Synchronous Handover
- Multislot Configuration

Element "Encryption Information" is not supported for Channel Activation type "Immediate Assign".

Access burst, which is received from MS at handover access, is not deciphered.

- Supported channel numbers: /GSM 05.02:6.4/
- Bm + ACCH
- Lm + ACCH
- SDCCH/8 + ACCH
- SDCCH/4 + ACCH (and TN=0)

This function is initiated during the set up of an encrypted channel between MS and RBS. The BSC controls initiation of encryption mode.

Description

To set up a dedicated logical channel, encryption mode has to be set. The RBS supports two encryption modes, "No encryption shall be used"and "encryption" (encrypted by a specific GSM encryption algorithm), see /GSM 08.58/. The RBS receives information of which encryption mode to use, from BSC in a Channel_Activation message containing "Encryption Information" (via ABIS RSL interface). This command starts the function, and the traffic channel is encrypted according to chosen algorithm.

The function is terminated when a "Channel_Activation_ Acknowledge" is sent to BSC.

26.3 Encryption Mode Change

Purpose

This function is used to change the encryption mode (key and algorithm) on an established dedicated channel.

Precondition and initiation

Encryption Mode change is defined in the section above.

This function is initiated when RBS receives an Encryption Command from BSC.

Description

The RBS starts deciphering when the encryption command is received. A Ciphering Mode Command is sent to start the encryption at the MS. The MS then sends a Ciphering Mode Complete /GSM 04.08:-9.1.10/ as an acknowledgement to the RBS.

When the RBS receives a Ciphering Mode Complete, the encryption is initiated in the network, and a DI (Data Indication) is sent back to the BSC.

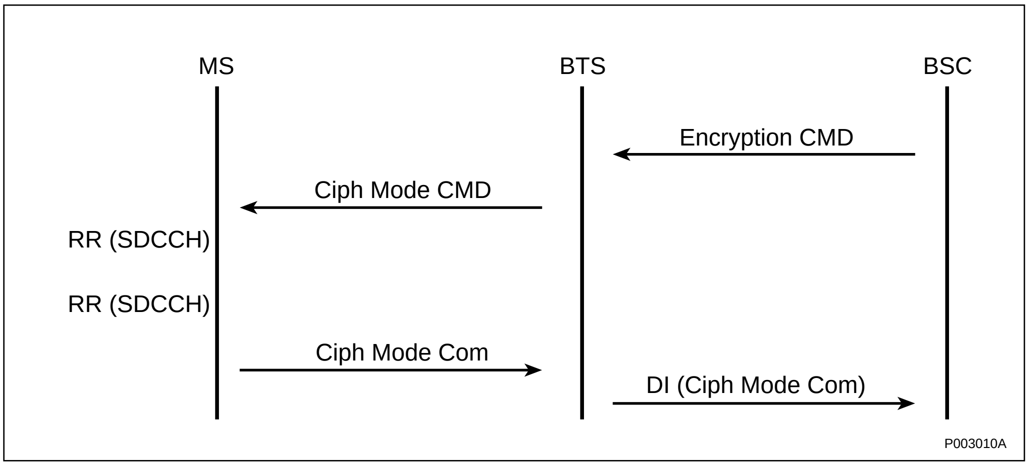

Figure 95

26.4 Encryption Mode Change at Mode Modify

Purpose

This function is used to change the encryption mode (key and algorithm) on an active dedicated channel group.

Preconditions and initiation

Encryption is either activated or deactivated.

The function is initiated when the RBS receives a MODE_MODIFY_COMMAD message from BSC.

Description

The message (MODE_MODIFY_COMMAD) contains the new key and algorithm to use. The ciphering key and algorithm identifier can be changed to any valid value.

If "Algorithm Identifier" is "No encryption shall be used", the RBS updates the key by clearing the stored key and ciphering is stopped / GSM 04.08:3.4.7/.

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27 Mode Modify

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

27.1 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.

27.2 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)
- (viii) TCH/F + FACCH/F + SACCH/M
- (ix) TCH/F + SACCH/M
- (x) TCH/FD + SACCH/MD

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, GSM speech alg. ver 1
TCH/FS	Full rate speech, GSM speech alg. ver 2
TCH/F14.4 NT	Full rate data 14.4 kbit/s non-transparent
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
TCH/F2.4	Full rate data 1200/75 bit/s transparent

TCH/F2.4	Full rate data 600 bit/s transparent

Any transition between the following full rate, multislot, Channel Modes is supported:

TCH/F	Signalling, Bi-directional (not allowed on channel combination ix)
TCH/FS	Full rate speech, GSM speech alg. ver 1 Bi-directional
TCH/FS	Full rate speech, GSM speech alg. ver 2 Bi-directional
TCH/F14.4 NT	Full rate data 14.4 kbit/s non-transparent, Bi-directional
TCH/F9.6 NT	Full rate data 9.6 kbit/s non-transparent, Bi-directional
TCH/F14.4	Full rate data 14.4 kbit/s transparent, Bi-directional
TCH/F9.6	Full rate data 9.6 kbit/s transparent, Bi-directional
TCH/F4.8	Full rate data 4.8 kbit/s transparent, Bi-directional
TCH/F2.4	Full rate data 2.4kbit/s transparent, Bi-directional
TCH/F2.4	Full rate data 1.2 kbit/s transparent, Bi-directional
TCH/F2.4	Full rate data 1200/75 bit/s transparent, Bi-directional
TCH/F2.4	Full rate data 600 bit/s transparent, Bi-directional
TCH/FS	Full rate speech, GSM speech alg. ver 1 Uni-directional
TCH/FS	Full rate speech, GSM speech alg. ver 2 Uni-directional
TCH/F14.4 NT	Full rate data 14.4 kbit/s non-transparent, Uni-directional
TCH/F9.6 NT	Full rate data 9.6 kbit/s non-transparent, Uni-directional
TCH/F9.6	Full rate data 9.6 kbit/s transparent, Uni-directional
TCH/F4.8	Full rate data 4.8 kbit/s transparent, Uni-directional

TCH/F2.4	Full rate data 2.4 kbit/s transparent, Uni-directional
TCH/F2.4	Full rate data 1.2 kbit/s transparent, Uni-directional
TCH/F2.4	Full rate data 1200/75 bit/s transparent, Uni-directional
TCH/F2.4	Full rate data 600 bit/s transparent, Uni-directional

Any transition between the following half rate Channel Modes/ GSM:08.58:4.2/ is supported:

TCH/H	Signalling
TCH/HS	Half rate speech
TCH/H4.8	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 kbit/s transparent
TCH/H2.4	Half rate data 600 bit/s transparent

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

Mode change between secondary channels are supported.

The Mode Modify message has one optional element:

"Encryption information".

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.

27.3 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.

28 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.

28.1 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.

28.2 Functions

28.2.1 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)
- (viii) TCH/F + FACCH/F + SACCH/M
- (ix) TCH/F + SACCH/M
- (x) TCH/FD + SACCH/MD

RBS actions:

- Storage of MS power level

- Order MS to set the commanded power level

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/.

28.2.2 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.

28.2.3 MS Power Control at Channel Reactivation

SeeSection 28.2.1 on page 237.

EN/LZT 720 0008 R1A
2001-06-26

29 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

29.1 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.

29.2 Functions

29.2.1 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

- (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)
- (viii) TCH/F + FACCH/F + SACCH/M

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.

29.2.2 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 section 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 an 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.

29.2.3 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:

- 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)

29.3 Operational Conditions

29.3.1 SMS MT/MO P-P

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

29.3.2 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.

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30 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.

30.1 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.

30.2 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

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

30.3 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.

30.4 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 119 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.

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31 Synchronization

The purpose of this 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.

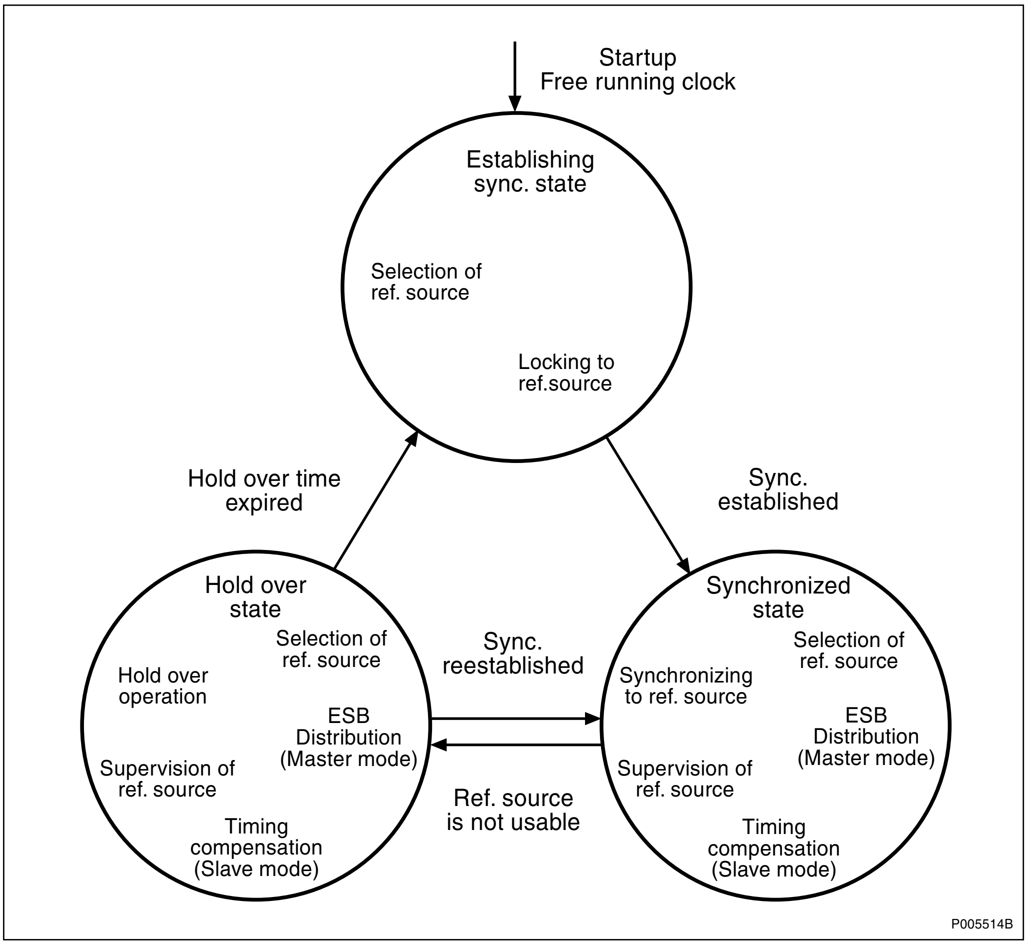

Figure 96 Synchronization function states

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 one of the two PCM interfaces in the transport network interface or from another RBS via the External Synchronization Bus, ESB.

The optional synchronization reference is taken from an optional synchronization function in the RBS.

The three possible sources for synchronization are handled in the same way by the synchronization function. The BSC is able to request that either the transport network, the optional synchronization function or another RBS to be used for synchronization.

The synchronization function can have three different modes:

- Stand-alone

In this mode the RBS uses an incoming PCM-reference or the optional reference as synchronization reference. The RBS is not synchronized with any other RBS.

- Master

  In this mode the RBS uses an incoming PCM-reference or the optional reference as synchronization reference. The generated timing is also distributed to other RBSes in the RBS cluster via the ESB.

- Slave

  In this mode the RBS uses another RBS as synchronization reference. The RBS is synchronized with another RBS, configured as Master, in the RBS cluster via the ESB.

The mode is set by BSC. Default mode is internally set to Stand-alone.

The Master and Slave modes are used to synchronize RBSes within an RBS cluster with each other. The different RBSes within the RBS cluster work together according to the master and slave logic, see the figure below. One of the RBSes is selected as master by the BSC, and the other RBSes in the RBS cluster are configured as slaves. The master RBS synchronizes towards the PCM-reference or the optional reference. The slave RBS(es) synchronizes towards the master RBS via the ESB.

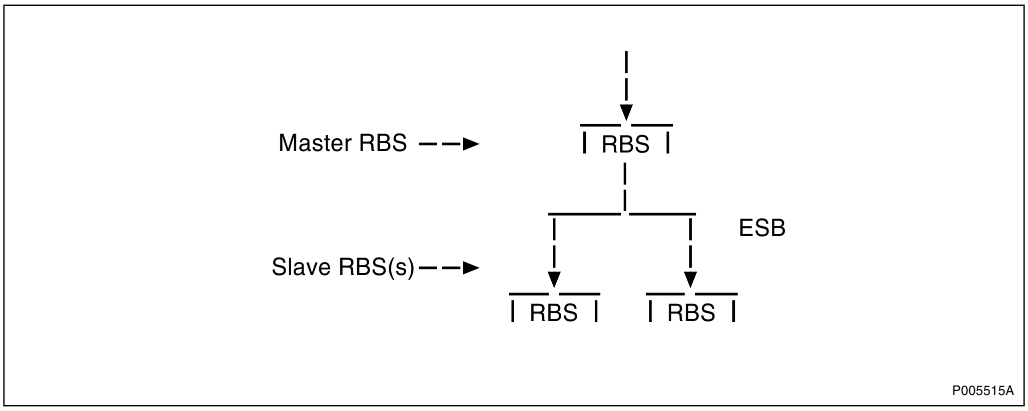

Figure 97 Master slave logic of RBSes

31.1 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

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

31.2 Concepts

Locking	The process of acquiring a phase lock to the reference

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
External Synchronization Bus (ESB)	A bus for distribution of synchronization information between RBSes in an RBS cluster
RBS cluster	Two or more RBSes connected together via an External Synchronization Bus

31.3 Synchronizing to the Reference Source

Purpose

The short-term stable oscillator built into the RBS needs to have a long-term stable synchronization reference. The function provides the RBS with the long-term synchronization source.

Precondition and Initiation

The function is initiated by two separate events:

- Synchronization established
- When synchronization is re-established after hold-over operation

Description

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.

Termination

The function is terminated by three separate events:

1. The executive reference source is considered faulty by the supervision function.
2. The control values of the RBS short-term frequency source of the TU are persistently at limit values.
3. Reconfiguration of TF mode to Slave.

Note: It is not possible to change TF mode to Slave in enabled state.

Operational Conditions

Synchronization is reached as noted below from function initiation.

Cold start	Transmission network or other RBS as source	5 minutes
	Optional frequency source	10 minutes
	For both network and optional	
RBS is synchronized and Reset command received on ABIS	Transmission network, Optional frequency source or other RBS as source	10 seconds
RBS is synchronized and Start command after Function Change is received	Transmission network, Optional frequency source or other RBS as source	30 seconds
Warm start	Transmission network, Optional frequency source or other RBS as source	90 s when there is not jitter in the synch. source

31.4 Selection of the Reference Source

Purpose

The purpose is to increase the system's air time; that is to say, the possibility to use different synchronization sources decreases the possibility for system failure caused by lack of a synchronization source.

Precondition and Initiation

The PCM reference must be marked available in order to be considered for selection. The function is initiated by one of the following events:

- Start-up of RBS
- "Hold-over expired time" is reached (see Hold-over Operation)
- Synchronization reference source is re-established in Hold-over state
- At TF (Timing Function) configuration
- When locking to the reference source is terminated without successful locking

Description

The function decides which reference source is to be used for synchronization; that is to say, PCM interface, optional reference or other RBS. The choice depends on the type of equipment installed and parameters received at TF configuration according to the table below. Units equipped with an optional reference source will always use this option as default. By a command over A-bis it is possible to change between the optional reference source (if installed) and the PCM interface.

Table 120

TF Config. Parameters		Selected Synch. Source Type	
TF Mode	TF Synch. Source Type	Optional Synch. HW	No Optional Synch. HW
Not defined	Not defined	Optional	PCM
Master/ Stand-alone	Not defined	Optional	PCM
	PCM	PCM	PCM
	Internal	Optional	PCM [1)]
Slave	Does not care	Other RBS	Other RBS

[1)] Rejected by the Capability Conformance Check function.

If the transport network is used for synchronization, the executive reference is taken from PCM interface A at start-up of the RBS on condition that interface A is available for synchronization and is fault free. Otherwise PCM interface B is selected if it is available and fault free.

The executive reference may change from one of the PCM interfaces to the other when signal on the executive reference is lost (AIS, LOF or LOS condition on the selected executive reference, see function Supervision of Reference Source), provided that a signal is detected at the other interface and that the other reference is marked "available".

The function is terminated when a new executive reference source has been selected or if the executive PCM reference regains its synchronization signal before a reselection is attempted or if a reselection is made to another synchronization source. There is no momentary change in phase or frequency of the RBS caused by reselection of synchronization source.

31.5 Hold-Over Operation

Purpose

If the reference signal is considered not to be usable, the RBS cannot use its values for regulation of the internal oscillator. The Hold-over operation function keeps the RBS synchronized for a period of time even though the reference signal is not present.

Precondition and Initiation

The function is initiated when the reference signal is not usable.

Description

The function when initiated freezes the control panel parameters for the internal oscillator at the present value, meaning that the oscillator frequency is kept constant except for ageing and temperature drift. The RBS will still be considered as synchronized and the supervision of the reference source will continue. After 5 minutes lack of reference signal known as "Hold-over entered time" a fault is sent to the BSC reporting the lack of reference source. This fault actually implies for an ITU-T G.703 2048 kbit/s system that the reference on both PCM-A and PCM-B is not usable. If the RBS has not regained its synchronization either by re-establishment or reselection within 60 minutes (when TF mode is master and stand-alone) and within 15 minutes (when TF mode is slave), it is reported to the BSC which orders the RBS to disable all radio transmission. This maximum time for the internal oscillator to guarantee synchronization quality is known as "Hold-over expired time". The function is terminated when the reference source is considered as usable or after "Hold-over expired time".

31.6 Supervision of Reference Source

Purpose

The function should decide if the reference source is to be considered as usable or not. This is done by supervision of the synchronization source as well as the quality of the synchronization signal.

Precondition and Initiation

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

Description

Depending on if the PCM interface or the Optional reference source or another RBS is used as a reference, the following criteria are used for evaluation of the reference source.

PCM interface as reference:

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

Optional reference source:

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

Other RBS as reference:

- Interruption.
- Correct and continuous frame number.
- Illegal high wander characteristics. The limit is specified in /G.823/.
- Illegal high relative frequency deviation. The limit is 0.1 ppm.

The outcome of this continuous supervision of the reference is either that the reference is usable or not. The function terminates when "Hold-over expired time" ends in "Hold-over state".

31.7 Locking to the Reference Source

Purpose

The function supervises the locking process and limits the time for locking to the reference source.

Precondition and Initiation

The function is initiated when a locking attempt to a reference source is made.

Description

The function checks that the control values for the internal source have stabilised to within a range not including the highest and lowest values, with a margin. Depending if the PCM interface or the Optional reference source or another RBS is used as a reference, the following criteria are used for evaluation of the locking process.

Locking to the PCM interface:

- PCM-reference presence (detected by physical interface)
- Time, a time-out 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 time-out set at initiation
- The value of the oscillator control signal

Locking to other RBS:

- ESB synchronization presence
- Time; a time-out set at initiation
- The value of the oscillator control signal

The time-out, which is 6 minutes, is in both cases used to disqualify a locking attempt that takes too long. A fault is sent to the BSC at time-out, but the internal source will still try to lock an available reference. Limited functionality is reached within 4 minutes from function initiation. Calls can be established but performance criteria are not fulfilled, that is to say, the risk of dropped calls is higher. The function terminates when synchronization is established.

31.8 FN-Offset

Purpose

The purpose is to improve handover performance. If one RBS is configured for several cells and handover is done between two cells controlled by the same RBS, the handover execution time will be longer if the two cells are synchronized together.

Precondition and Initiation

The function is initiated by a request from the BSC.

Description

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, the condition is that all timeslots must be disabled. Configuration of one timeslot will reconfigure all the others. The configuration is carried out by the Functionality Administration function.

31.9 ESB Distribution

Purpose

This function defines that the timing information is distributed on the ESB interface, when TF mode is defined or changed to master.

Precondition and Initiation

The function is initiated by two separate events:

- At TF enable when TF mode is defined to master
- At TF configuration in enabled state when TF mode is changed to master

Description

The timing information is distributed on the ESB interface and the ESB measurement loop is closed. The function is terminated when TF state is changed from enabled, or TF mode is changed from master.

31.10 Timing Compensation

Purpose

This function displaces the internal timing bus towards the ESB with the TF compensation value received at TF configuration.

Precondition and Initiation

At TF configuration when TF mode is defined to Slave.

Description

The timing difference between different carriers within a cell shall be less than 1/4 bit in the air (920 ns). To fulfil this requirement the following delays must be compensated for:

- the distribution delay on the external synchronization bus
- the transmitter chain delay (delays in transmitter, combiner, feeder and antenna)

The BSC/OSS operator defines one RBS in the RBS cluster to master and the others to slave(s). For each slave the OMT operator also calculates and defines a TF compensation value. The TF compensation value is forwarded to the slave(s) at TF configuration.

The operator uses the following formula to calculate the TF compensation value, TF_{cv}, for each slave:

TF_{cv} = master t_{txd} – slave t_{txd} – t_{esb}

t_{esb} is the distribution delay on the external synchronization bus between the master and the slave. There can be different delays for each slave. Elements that affect this delay are cable length(s), cable type, cabinet type and the RBS-cluster topology.

t_{txd} is the transmitter chain delay (delays in transmitter, combiner, feeder and antenna). There can be different delays for each RBS.

A positive value on the TF_{cv} indicates that the internal timing bus is delayed relative to the ESB. A negative value indicates that the internal timing bus is advanced relative to the ESB.

The RBS also adopts the frame number from the ESB and distributes it on the internal timing bus. The function terminates when TF mode is changed from Slave.

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32 Radio Reception

Radio reception defines the function to receive an RF signal from the air interface and restore the bit stream. Diversity is used to improve the sensitivity on the receiver. It is achieved by having two antennas, and by that means take advantage of two or more receiver paths.

32.1 References

For GSM 900 and GSM 1800:

/GSM 05.04/	GSM Requirements 05.04 Phase 2
/GSM 05.05/	GSM Requirements 05.05 Phase 2

For GSM 1900:

The references PCS: 4-6 are chapters in the document: Volume 1, PCS 1900 Physical Layer 1 Specification marked: JTC(AIR)94.08.01-231R3

/PCS 4/	Modulation
/PCS 5/	Radio Transmission and Reception
/PCS 6/	Radio Subsystem Link Control

32.2 Radio Reception

Purpose

To receive an RF signal and restore the bit stream that constitutes a burst.

Precondition and initiation

The ATSR must be in traffic. The reception initiates when the ATSR is taken into traffic.

Description

The RBS receives an RF signal from the MS on the air interface. First the signal is filtered in order to isolate the targeted MS signal from other transmission. Then the signal is amplified and finally demodulated. In the demodulation phase the bit stream that constitutes a burst is restored.

The GSM 900 specification of Receiver characteristics is found in /GSM 05.04/ and /GSM 05.05/.

The GSM 1900 specification of Receiver characteristics is found in /PCS 4/, /PCS 5/ and /PCS 6/.

32.3 Diversity

Purpose

To improve sensitivity on received signal.

Precondition and initiation

The Air Time Slot Resources (ATSR) must be configured for diversity. The diversity initiates when the ATSR is taken into traffic.

Description

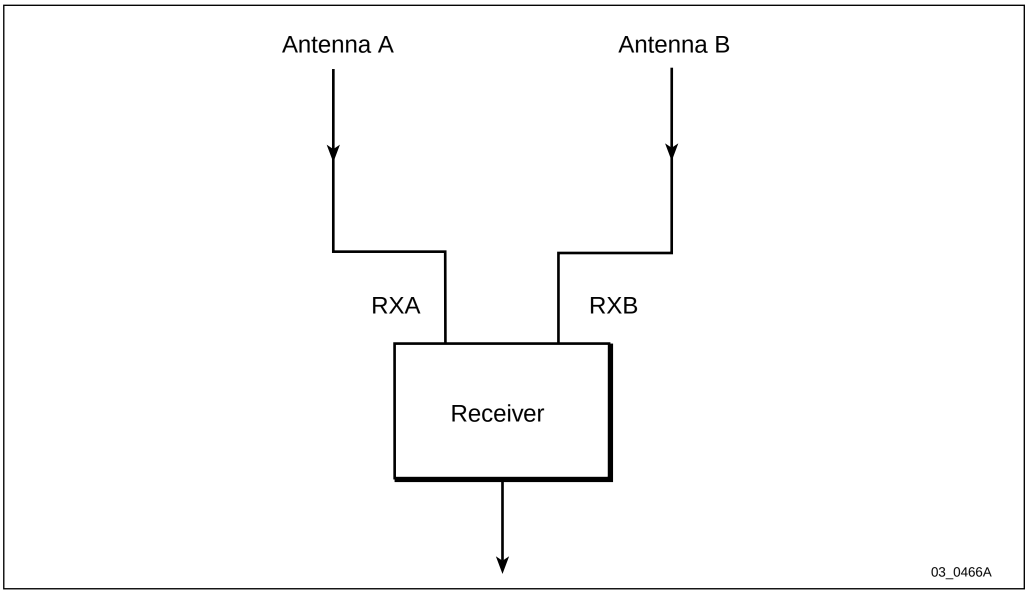

Figure 98 Diversity

One way to improve your performance on received signal is by using diversity. This can be achieved by using two reception channels that are independently influenced by fading. Both of the two insignals from the antennas are combined in the receiver. The receiver uses the weaker signal together with the stronger signal, with a factor proportional to SNR (Signal to Noise Ratio) on each antenna.

33 Radio Transmission

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

33.1 References

GSM 900 and GSM 1800

/GSM:05.02/	GSM Requirements 05.02 Phase 2 version 4.6.0
/GSM:05.04/	GSM Requirements 05.04 Phase 2 version 3.1.2
/GSM:05.05/	GSM Requirements 05.05 Phase 2 version 4.13.0
/GSM:05.08/	GSM Requirements 05.08 Phase 2 version 4.6.0
/GSM:05.10/	GSM Requirements 05.10 Phase 2 version 4.2.0

GSM 1900

/GSM:05.02/	GSM Requirements 05.02 Phase 2 version 4.6.0

The references /JTC:1/ – /JTC:8/ are chapters in the document:

Volume 1, PCS 1900 Physical Layer 1

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

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

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

33.2 Concepts

Base Transceiver Station (BTS), defined in the chapter "Radio Configuration, RBS 2000 Macro".

Radio Base Station (RBS), defined in the chapter the "Radio Configuration, RBS 2000 Macro".

Combining system and filtering is the interface between transmitters and the antenna system. The functions of the system are:

- Antenna system supervision support
- RF filtering
- Duplex filtering

The TX reference point X is defined as the point where the TX antenna signal crosses the RBS border, that is, the connector for the antenna feeder. See Figure 99 on page 260.

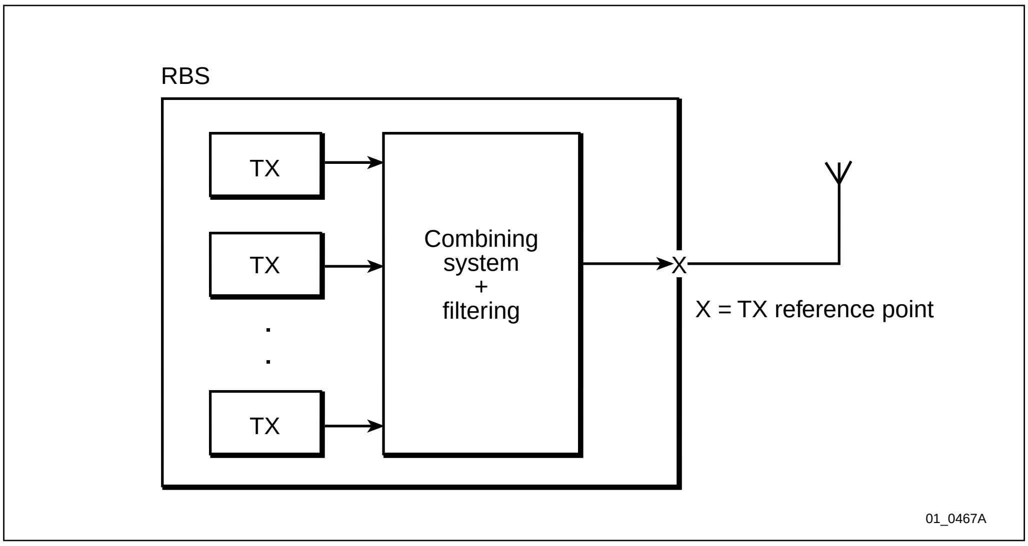

Figure 99 TX reference point X

When the RBS comprises an antenna mounted equipment, the TX reference point is the antenna mounted equipment part antenna connector. See Figure 100 on page 261.

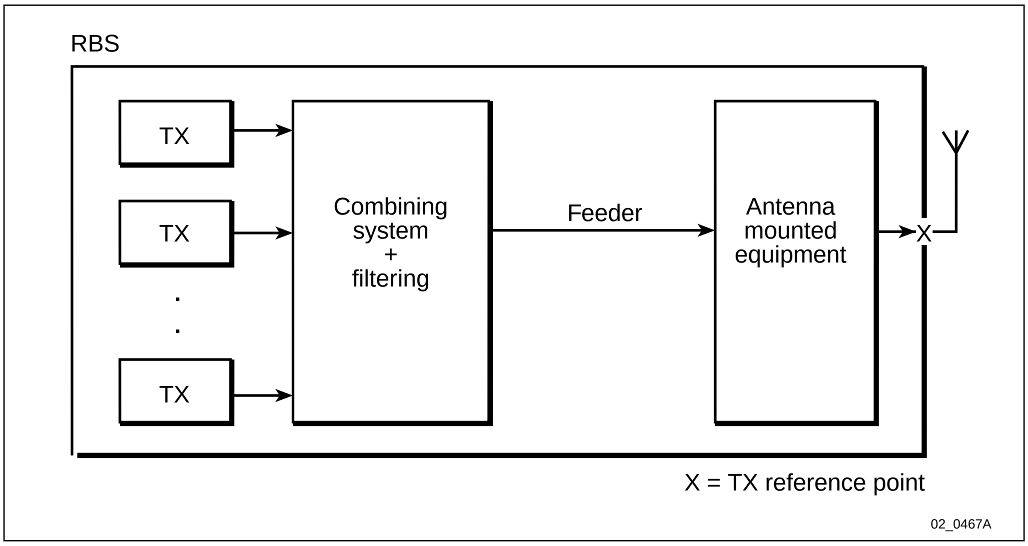

Figure 100 TX reference point X with antenna mounted equipment

33.3 Functions

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 /JTC:4/ for GSM 1900.

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

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

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 /JTC: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/.

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 or for transmitters configured for DTX.

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

SW Power Boost

In order to improve downlink performance, a BTS, without Filter Combiner,can be configured for TX diversity.

Note: Only the following macro configurations are supported: RBS 2101, RBS 2102 and RBS 2202 with configurations 1x2, 2x2, 3x2, CDU-A for 900 MHz, CDU-A with TMA for 1800 MHz and 1900 MHz.

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 some 3 dB.

SW Power Boost is initiated when the master transmitter is configured on A-bis to a nominal power value 2 dB or higher than the maximum nominal power defined for the TX, and no Operation and Maintenance Link is established to the slave transmitter. The slave is the next transmitter in the same antenna system.

Faults from one of the two TX instances will result in that a class 2 fault, TX Diversity fault, is reported from the TX via fault reports over A-bis.

33.4 Operational Conditions

Frequency band

Transmitters for the GSM 900 band are capable of operating in the extended GSM 900 frequency band, 925 – 960 MHz.

The combining system supports the primary GSM 900 band, 935 – 960 MHz or the extended GSM 900 frequency band, see /GSM:05.05:2/ depending on equipment.

Transmitters for the GSM 1800 band operate in the GSM 1800 frequency band, 1805 – 1880 MHz. See /GSM:05.05:2/.

Transmitters for the GSM 1900 band operate in the GSM 1900 frequency band, 1930 – 1990 MHz. See /JTC:5.1/.

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, and 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 /JTC:5.3.3/ for GSM 1900.

Output power

The output power is measured at the TX reference point, see Section 33.2 Concepts on page 260.

The output power is configuration dependent and is described in the chapter "Radio Configuration, RBS 2000 Macro".

Dynamic power reduction

The transmitter can control the output power as defined by the base station power control function.

Frequency hopping

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

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34 Frequency Allocation Support

The FAS function measures the interference level on a number of frequencies, specified by the operator. The measurements are performed on idle channels or idle burst positions.

The TRXC:s execute the FAS function independently of each other (however all TRXC:s don’t have to be used). Thus it is here described only how the FAS function works on one TRXC.

FAS measurements can start when the TRXC has been configured with a list of FAS frequencies. Measurements are performed during one or several FAS measurement periods.

Each FAS measurement period is started and stopped by Abis O&M messages. During the FAS measurement period the TRXC shall handle the measurement of the signal levels, on all specified frequencies, once every 15:th second and accumulate the result in one histogram for each frequency.

The result of the measurements is reported on Abis O&M interface on request as calculated median and percentile values for each frequency. The number of times each frequency has been measured on is also reported.

34.1 References

/GSM:05.05/

34.2 Concepts

Percentile value: The proportion of samples in a distribution.

An example: The 90 percentile value for a distribution is the value for which 90 percent of the samples have a value equal to or less than the percentile value.

34.3 Functions

34.3.1 FAS configuration

A Frequency List is received on Abis O&M interface containing maximum 150 frequencies to measure on. The frequencies are coded in a way that can be interpreted as ARFCN:s with a value ranging from 0 until 1023. This value range is accepted (The BTS can however only measure on frequencies for which it has capability). The relation between frequencies and ARFCN:s is specified in /GSM:05.5:1.1/.

The FAS support capability and the number of frequencies transferred are checked.

All eventually on-going measurements are stopped.

Measurement result are cleared.

34.3.2 Start measurement

FAS measurement will be started by O&M message. Old measurement results are Optionally cleared.

34.3.3 Stop measurement

FAS measurement will be stopped either by directed O&M message, or by receiving a new configuration.

34.3.4 FAS measurement

The FAS measurements are performed according to the following:

4. A FAS measurement is done every 15:th second. During that FAS measurement interval the signal strength of each frequency in the frequency list is measured once.
5. During the first 10 seconds of the FAS measurement interval, only idle channels will be measured on, then all available resources are used.
6. If the configuration includes frequencies, for which the TRXC lacks capability to measure on, they are neglected.
7. The measurements are done on idle traffic channels, TCH/F and TCH/H , and on the idle positions in active TCH/F.
8. Frequency hopping is supported, but limited to a maximum of 63 frequencies. Measurements on frequencies belonging to the own TRXC only take place when reception is scheduled for these frequencies (On idle bursts).
9. Measurements are started on a, from one FAS measurement interval to another, sliding position in the FAS frequency list (To avoid that some frequencies may be underrepresented if there isn’t always time to measure on them all).
10. The measurements are as equally distributed as possible over all available time slots
11. The measurements are as equally distributed as possible in the multiframe structure, except for active channels where the positions are fixed.
12. The signal strength of each frequency is measured during one burst, in the same way and with the same resolution as in active channel measurement. Not more than four bursts are used for FAS measurements on one time slot during one SACCH measurement period.
13. The result of the measurements are stored in a histogram consisting of 64 counters for each frequency, one counter for each signal level. The number of times a specific signal level has been measured is accumulated in the corresponding counter.

34.3.5 Measurement reporting

Measurements are reported on request by O&M messages.

The TRXC will, for each frequency measured upon, calculate the median value, the percentile value according to the percentile parameter and the number of measurements done on the frequency.

The result of the calculations sent on Abis O&M link in ”FM Reports”. If a frequency has not been measured upon, i.e. if a number of measurements equals zero, the median and percentile signal strength values are reported as zero.

34.4 Operational Conditions

At least one timeslot on TCH must be enabled. Measurements can only be performed on enabled timeslots configured as TCH/F or TCH/H. The RX must also be enabled.

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35 Restart and Recovery

The "Restart and Recovery" function allows the RBS or a specific Replaceable Unit, RU, (see Section Concepts below) to be started or restarted in a controlled manner. Restart occurs with installation, repair or reset. The restart and recovery function is used with:

- power on
- spontaneous reset (watchdog, software fault, memory fault)
- reset button
- BSC ordered reset

The restart and recovery function determines whether a unit is capable of being brought into operation and, if needed, prepares the unit for operation. If the unit cannot be brought into operation, then the restart and recovery function identifies the reason for the operator using the base station's visual indicators.

35.1 References

If a reference is made to a function described in another chapter, please refer to the table of contents to locate the relevant information.

35.2 Concepts

RU	Replaceable Unit An RU is the smallest unit that can be handled on site or in a repair centre and about which information can be retrieved via OMT or BSC.
Main RU	Main Replaceable Unit A main replacable unit contains one or more processors, to which software can be downloaded from the BSC. A Main RU is classed either as CMRU or DMRU, see below.
Sub RU	Sub Replaceable Unit A Sub RU is always connected to a superior Main RU. This connection is used for the retrieval of equipment information. A Sub RU does not normally have a processor. An RU with a processor that is not loadable is also classed as a Sub RU.
Passive RU	Passive Replaceable Unit A Passive RU has a very low level of intelligence and is independent of the processor system, for example, it has no connection for O&M communication. In the RBS 2000, for example, the cables are Passive.

CMRU	Central Main Replaceable Unit An RBS has one CMRU.
DMRU	Distributed Main Replaceable Unit A Main RU is distributed if it is subordinated to the CMRU.

35.3 Function

35.3.1 Purpose

The entire RBS is brought into operation in a controlled manner. The sequence of events is given below.

35.3.2 Description

The sequence of actions initiated is summarized below:

1. start CMRU-processor
2. start DMRU-processor
3. start Sub RU-processor (if any)
4. start CMRU basic functions
5. start DMRU basic functions
6. start Sub RU basic functions
7. conditional RBS DB(Data base)load
8. read parameters for OM bus
9. define OM address
10. link establish functions for Sub RUs connected to DMRU
11. link establish functions for Sub RUs connected to CMRU
12. update RBS database for Sub RUs connected to CMRU
13. link establish functions for all expected DMRUs
14. update RBS database for all expected DMRUs
15. update RBS database for Sub RUs connected to DMRU
16. wait for expected Passive RUs
17. internal configuration
18. check RBS operational ability
19. set fault indicator on all DMRUs with faults
20. set operation indicator on all DMRUs with no faults
21. set fault indicator on all Sub RUs with faults
22. set fault indicator on all DMRUs with faults
23. bring CMRU into remote operation

24 bring DMRU into remote operation

Start processor:

- If the checksum for the updated application software is correct, the updated application is chosen as application software.
- If the RU is a DMRU without non-volatile memory, the DMRU must retrieve software from the CMRU.
- If database parameters are not useable, are inaccessible or out of range, default values are used instead.

Termination of start processor:

Terminated when the updated application software has started correctly, or with a new reset. If there are problems in starting updated application software, then the base application is chosen as application software.

35.4 Operational Conditions

35.4.1 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 Functions*. All of the visual indicators associated with a 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.

35.4.2 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 be taken into remote mode. Depending on the reason for restart, certain actions must be taken during start up, which results in various start-up times. Restart time after BSC ordered reset is less than 8 seconds if all RUs are preloaded with software with correct revision and a correct RBS DB is installed. For all other restart cases with a heated oscillator, restart time of the whole RBS is about half a minute. For the restart case with a cold oscillator (power on), restart time of the whole RBS is about 5 minutes. For information of the temperature influence on start up time and the delay caused by the environment control unit, see chapter *Unit Description, ECU*.

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36 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.

36.1 Concepts

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.
Software file	The software necessary for a class of Main RU and its loadable Sub-RUs. A software file contains application software.
CMRU	Central Main Replaceble Unit. An RBS has exactly one CMRU. In the RBS 2000 Macro hardware architecture, the DXU is the CMRU. In the RBS 2000 Micro hardware architecture, the DXB is the CMRU.

DMRU	Distributed Main Replaceble Unit. A Main RU is said to be distributed if it is subordinated to the CMRU.
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 or may not have a direct signalling link to the BSC.
RU	Replaceble Unit. An RU is the smallest unit that can be handled on site or in a repair center and of which information can be retrieved via OMT or BSC.
Sub-RU	A Sub-RU 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. Note that an RU with a processor that is not loadable, is classified as a Sub-RU. In the RBS 2000 hardware architecture, for example the CDUs are Sub-RUs.

36.2 Functions

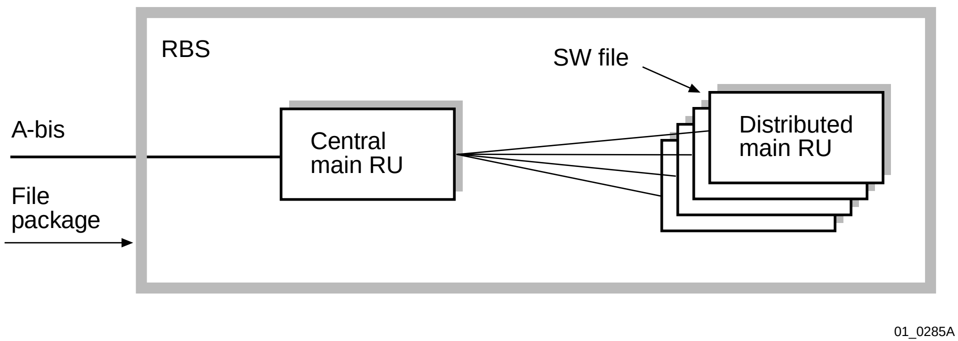

Figure 101 Overview of function change

36.2.1 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, that is, 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.

36.2.2 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.

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

36.2.3 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.

During software download to the central Main RU, appropriate software files are transferred internally to the distributed Main RUs.

Only the software files, appropriate to a specific Distributed Main RU, which are not already loaded on that RU are transferred. The software files transferred are stored directly in the non volatile memory of a Distributed Main RU.

36.2.4 Start Required

On completion of the internal distribution of software files, the RBS informs the BSC that a restart of the RBS is necessary to activate the new software.

36.2.5 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 chapter *Restart and Recovery* followed by configuration and enabling as specified in chapter *Functionality Administration*.

At start-up (in START_CF_CMD), negotiation will take place between BTS and BSC. The BTS sends a NEGOTIATION REQUEST message to the BSC including a list of valid IWDs supported by the BTS. A set of IWDs is chosen by the BSC in NEGOTIATION REQUEST ACK message and is sent to the BTS which adapts to the selected IWDs. This backward compability function introduces the possibility to connect a BTS (R8) to a BSC (R7). It is also possible to run a BSC (R8) with a BTS (R7), and with BTS (R8) in either R7 mode or R8 mode.

A BSC (R7) will answer with a reject message, NEGOTIATION_REQUEST_NAK, to the NEGOTIATION_REQUEST message as it is not supported by BSC (R7). The BTS will then adapt to IWDs according to BSC (R7) when a NEGOTIATION_REQUEST_NAK message is received.

36.3 Operational Conditions

36.3.1 Operation and Maintenance

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

36.3.2 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, that is, 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.

37 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.

37.1 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.

37.2 Concepts

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.
RU	Replaceble Unit. An RU is the smallest unit that can be handled on site or in a repair center and of which information can be retrieved via OMT or BSC.
AO	Application Object. An abstract subclass of MO, which provides part of the functionality of a BTS
MO	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. See also Figure 102 on page 278.
SO	Service Object. An abstract subclass of MO, which provides service functions for a set of MO instances including itself.

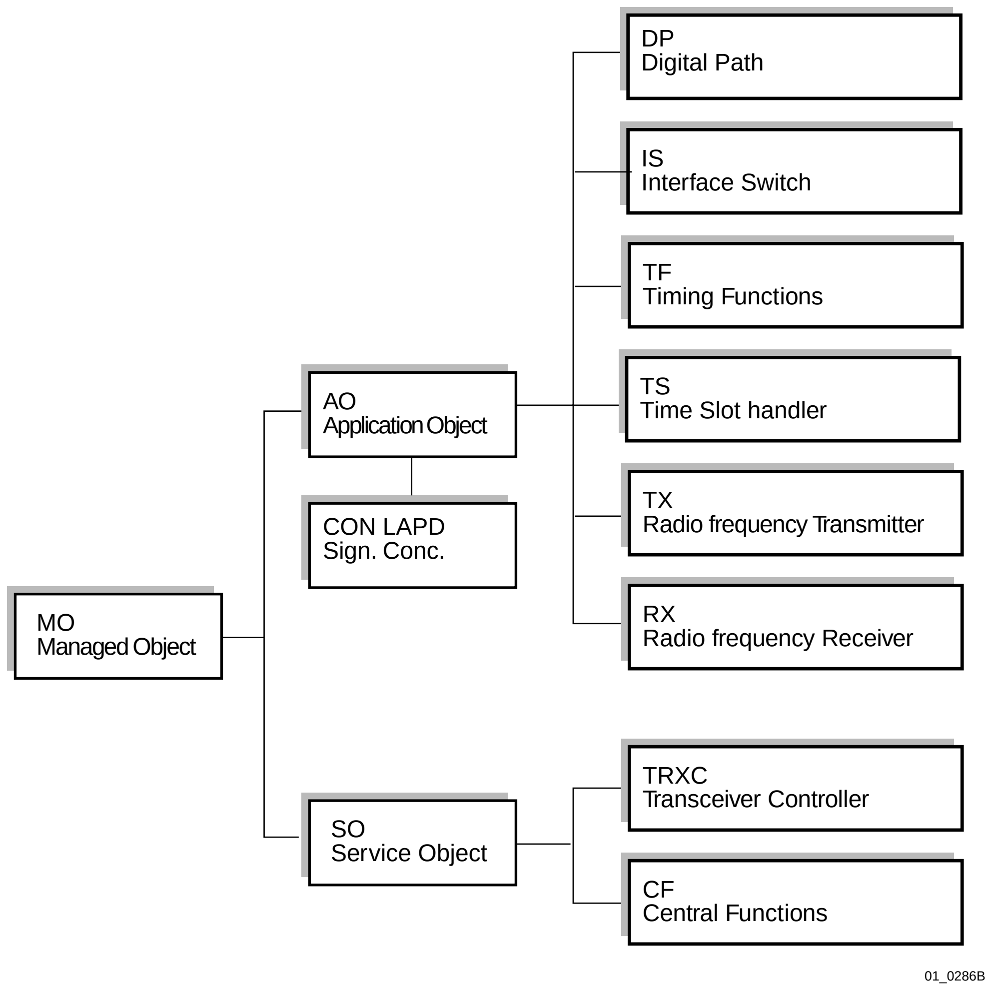

Figure 102 Managed Object classification

37.3 Functions

37.3.1 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

37.3.2 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 the checks are all 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.

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.

37.3.3 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 downlink Precondition Test

This is a general function which is implicitly used by all functions initiated on the Abis O&M interface. It is performed after the general Format Check. The function must not be explicitly refered to.

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 timeout 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

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.

After a timeout the message is retransmitted. A maximum of 2 retransmissions are performed. After 3 timeouts (including 2 retransmissions) Layer 3 supervision is terminated.

37.4 Operational Conditions

37.4.1 Operation and Maintenance

The visual indicators relevant to Functionality Administration are described within the context of Operation and Maintenance Support.

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38 Operation and Maintenance Support

Operation and Maintenance Support defines RBS functions related to:

- Buttons
- Visual indicators
- Change from Local to Remote Mode and vice versa
- Loop Control
- RF Loop Test Supervision
- Calender Time
- RSSI Temperature Compensation
- Max Cooling

38.1 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.

38.2 Concepts

CMRU	Central Main RU. The CMRU belongs to the RU type Main RU. The RBS is physically connected to the BSC via a CMRU. There is only one CMRU in each RBS. In the RBS 2000 architecture, the DXU is the CMRU
DMRU	Distributed Main RU. A Main RU is said to be distributed if it is subordinate to the central main RU, CMRU.
EDMRU	Energy DMRU. An EDMRU is a DMRU that handles the energy control functionality of an RBS cabinet.
Extension Cabinet	In a multiple cabinet configuration, the Extension Cabinet is the cabinet without the SO CF. The Extension Cabinet is connected to a master cabinet and cannot operate without the master cabinet.
ILO	In Local Operation (Op. State). When the RBS, CMRU or DMRU is in the state "local operation" the instance can be operated from the OMT.
IRO	In Remote Operation (Op. State), the RBS, DXU, TRU or ECU has a link established to the BSC.
IU	In Use (Op. State). When RBS, DXU or TRU is in state "In Use" the instance is

	configured and enabled to fulfil its purpose.
Local Configuration	When a RU reads necessary information from its database and a signal is sent when it is ready.
Main RU	Contains one or more processors, to which SW can be downloaded from the BSC. A main RU is either central or distributed. A main RU may or may not have a direct signalling link to the BSC.
Master Cabinet	In a multiple cabinet configuration, the Master Cabinet is the cabinet with the SO CF. In this document a Master Cabinet is considered to be equal to a stand-alone cabinet.
MO	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 relationship with a physical unit in the RBS and the MO comprises either both HW and SW or SW only.
RFU	Ready For Use (Op. State). When in operational state "Ready For Use" the instance is started by the BSC with the correct SW.
RSSI	Received Signal Strength Indicator
RU	Replaceable Unit. An RU is the smallest unit that can be handled on site or in a repair centre and of which information can be retrieved via OMT or BSC.
SO	Service Object. A Service Object is an abstract subclass of MO. An SO instance carries service functions for a set of MO instances, including itself. The Service functions include Layer 2 termination and Layer 3 distribution. They may also include HW supervision and SW handling.
Sub-RU	A sub-RU is always connected to a superior main RU. This connection is used for retrieval of equipment information. A

	sub-RU does not normally have a processor. It should be observed that a RU with a processor that is not loadable is classified as a sub-RU.
TDMRU	Transceiver DMRU. A TDMRU is a DMRU that handles transceiver functionality.

38.3 Buttons

Purpose

To be able to reset, to start test operation function and to change between local and remote mode.

Preconditions

For the CPU Reset-button and the Test-button there are no precondition requirements. For the Local/Remote-button, see Section 38.4 Change RU to Local Mode on page 285 and Section 38.5 Change RU to Remote Mode on page 286. The functions are initiated when the buttons are pushed.

Description

CPU Reset:

A CPU Reset button can be found on the CMRU, TDMRU and EDMRU (DXU, TRU and ECU). When the CPU Reset button is pushed the unit itself and all its sub units will be reset.

Local/Remote:

A Local/Remote button can be found on the CMRU and TDMRU (DXU and TRU). The Local/Remote button is used to change RU mode to Local or Remote. For further description of the Local/Remote button, see Section 38.4 Change RU to Local Mode on page 285and Section 38.5 Change RU to Remote Mode on page 286.

Test:

Test buttons can be found on the TDMRU (TRU). The Test function is not used.

38.4 Change RU to Local Mode

Purpose

To change from Remote Mode to Local Mode which means to release and stop the layer 2 communication links on Abis interface and to disable MO TX and MO TS if they were enabled.

Preconditions and Initiation

The RU operational state should be IRO, RFU and IU. The RU Mode should be Remote. The function is initiated when the Local/Remote button on RU is pushed.

Description

The Local Mode Indicator starts flashing to indicate that a change of RU mode is in progress. The Operational indicator is turned off if applicable, see Section 38.15 Operational Indicator on page 292 and the Local/Remote button is disabled.

The subfunction Local Mode in Progress is performed, seeSection 38.24 Local Mode in Progress on page 299. After this the Local Mode indicator is turned on, the Operational Indicator is handled see Section 38.15 Operational Indicator on page 292 and the Local/Remote button is enabled.

In the case of SW Power Boost with the RU configured to implement the master TX, the following also applies:

The TDMRU that implements the slave TX, enters state remote mode in progress without trying to establish OML. MO TX on the slave is disabled if it was enabled.

The following will occur when the function terminates:

- The Local Mode Indicator is turned on.
- The Operational Indicator indicates RU operational mode according to description.
- The TX Not Enabled indicator is turned on.
- An external condition class 1, called Toggle Information is raised.

Limitations: The status of the external condition, Toggle Information, is stored in RAM that is not affected by SW reset. During start, the Toggle Information is set if the Local/Remote button is set to Local.

38.5 Change RU to Remote Mode

Purpose

To establish a link towards the BSC.

Preconditions and Initiation

The RU Operational State should be ILO and the RU Mode should be Local. The function is initiated when the Local/Remote button is pushed.

Description

An RU cannot be changed to Remote Mode until the local configuration on the RU has been performed.

The Local Mode Indicator starts flashing to indicate that a change of RU mode to Remote is in progress and the Operational Indicator is handled, see Section 38.15 Operational Indicator on page 292.

The layer 2 communication links (the links concerning the SO) on the Abis interface enters a state where they await a link establishment attempt by BSC. By acknowledgement of such attempt, the link will become established (refer to the Terrestrial Link Handling functionality).

The RU mode is changed to Remote immediately after the link towards the BSC is established.

The external condition class 1, called switch information, is ceased. The ceased external condition is not reported to the BSC.

When the RU has entered Remote Mode the function terminates and the Local Mode indicator is turned off.

38.6 Change RU to Remote Mode Cancel

Purpose

To cancel a change to Remote Mode when a change of RU mode from Local to Remote is in progress.

Preconditions and Initiation

The RU mode should be "Change to remote mode in progress". The function is initiated when Local/Remote button on RU is pushed.

Description

If the Local/Remote button is pushed during a change from Local to Remote Mode (the Local Mode Indicator will be flashing during the change of RU mode), the attempt of changing RU mode to Remote is interrupted. The Local/Remote button is then disabled.

The layer 2 communication links (links concerning the SO) on Abis interface are released and stopped by RBS (refer to Terrestrial Link Handling Functionality) if they were started.

The Local Mode Indicator is turned on, the Operational Indicator is handled, see Section 38.15 Operational Indicator on page 292 and the Local/remote button is enabled.

At the termination of the function the Local Mode Indicator will be turned on, the Operational Indicator will indicate the RU operational mode according to description and an external condition class 1, called Toggle Information is raised.

38.7 Change SW Power Boost Slave RU to Local Mode

Purpose

To switch the slave RU from Remote Mode to Local Mode

Preconditions and Initiation

The RU operational state should be IRO, RFU and IU. The RU mode should be remote. The function is initiated when the Local/Remote button on TDMRU (TRU) is pushed.

Description

The Local Mode indicator starts flashing to indicate that a change of RU mode is in progress. The Operational indicator is turned off if applicable, see Section 38.15 Operational Indicator on page 292, and the

Local/Remote button is disabled. When RU mode is changed to local for the slave RU, a TX diversity fault is raised on the master AO TX. A FAULT_REPORT message is sent to BSC on Abis interface. RU mode is changed to local and Abis communication with BSC via the master RU is stopped. When Local Mode has been entered, the slave MO TX is disabled if it was enabled, and the TX NOT ENABLED indicator is turned on. After this, the Local Mode indicator is turned on, the Operational indicator is handled (see Section 38.15 Operational Indicator on page 292), and the Local/Remote button is enabled.

The following will occur when the function terminates:

- The Local Mode indicator is turned on.
- The Operational indicator indicates RU operational mode according to description.
- The TX NOT ENABLED indicator is turned on.
- RU operational state = ILO.

38.8 Loop Control

Purpose

To test the transmission network by looping all traffic back to the BSC.

Preconditions and Initiation

The MO state should be Disabled and the RU Mode Remote. The Loop Control is initiated by the Loop Control command on the Abis interface.

Description

The Loop Control procedure is a part of the automatic loop test of speech/data links. The Loop Test can be opened or closed on command from the BSC. When the test loop is closed all traffic is looped back to the BSC in order to test the transmission network. The test loop is controlled by MO TS. The Loop Control is terminated when Loop Control Complete is sent on the Abis interface.

38.9 RF Loop Test Supervision

Purpose

To test the radio equipment during traffic.

Preconditions and Initiation

The RU Mode should be Local or Remote. The RF Loop test Supervision is initiated when the application SW is started.

Description

The radio equipment is tested during traffic by a radio loop test function. The test procedure is described by the Supervision and Selftest functionality.

The supervision parameters are defined by the IDB or the OMT. The supervision parameters define supervision status (active/inactive) and test interval. Each parameter has a default value. When the test loop is activated the test is continuously repeated with the defined test interval. The supervision is terminated at deactivation from the Operation and Maintenance Terminal.

Detected faults at RF Loop Test are handled by the Diagnostics and Fault handling functionality.

The default values are:

Supervision status:	active
Test interval:	5 minutes

38.10 Calendar Time Request

Purpose

To update the system time.

Preconditions and Initiation

The RU Mode should be Remote. The Calendar Time Request function is initiated five seconds after the OML for CF has been established, and when RU Mode is switched from Local to Remote.

Description

All main RUs handle a real time clock which is internally used within the RUs as the system time. The system time is updated by the Calendar Time elementary procedure on Abis interface. Calendar time is distributed to all main RUs. System time is then updated for those RUs. Calendar time is periodically requested and updated while layer 2 communication link is established. The request interval is 24 hours. The Calendar Time request function is terminated when OML for SO CF is released and stopped and when RU Mode is switched from Remote to Local.

38.11 RSSI Temperature Compensation

Purpose

To be able to update the RSSI temperature compensation value.

Preconditions and Initiation

Applicable for any RBS operational state. The TDMRU (TRU) Mode should be Local or Remote. The RSSI Temperature Compensation is initiated by the Internal Configuration function in the Restart and Recovery sequence.

Description

The loss in the receiver path varies with the temperature. In order to get a more accurate estimate of the loss, the temperature for the receiver will be measured continuously. The temperature level is then used for update of the RSSI temperature compensation value. The RSSI compensation value will not be updated more frequently than every 10th second.

38.12 Max Cooling

Purpose

To control the fans to make them perform their maximum available cooling when certain supervised values have reached certain levels.

Preconditions and Initiation

Applicable for any operational state. The TMRU (TRU) mode could be either Local or Remote. The function is initiated by the Internal Configuration function in the Restart and Recovery sequence.

Description

After the initiation, the TDMRU (TRU) temperature as well as the current transmitter maximum output power are continuously supervised. This supervision is performed for each TDMRU (TRU). Depending on the supervised values, the general fan speed regulation (see Climate Protection Functionality) is superimposed by the Max Cooling function. The Max Cooling function is carried out per cabinet. The Max Cooling can have the following two states:

- ON = Maximum Cooling
- OFF = General Fan Speed regulation

Maximum Cooling means that the fans are controlled to perform their maximum available cooling. General Fan Speed regulation means that Maximum Cooling is switched off and the fans are controlled by a local algorithm.

The Maximum Cooling states are calculated from the supervised entities in the following way:

Max Cooling will have the state ON if at least one of the following conditions is fulfilled:

- At least one of the supervised TDMRUs (TRUs) has a temperature that exceeds the critical temperature (CT).
- The maximum output power of at least one transmitter is limited because of overtemperature handling.

Max Cooling will have the state OFF if both of the following conditions are fulfilled:

- All of the supervised TDMRUs (TRUs) have a temperature that is a constant value lower than the critical temperature (CT).
- None of the transmitters has its maximum output power limited because of overtemperature handling.

Max Cooling will control the fans in the following cases:

- At function initiation.

- At a Max Cooling state change.
- After an EDMRU (ECU) reset.

The Max Cooling state will not be updated more frequently than every 30th second.

If Max Cooling fails the fault is logged but no further action taken within the scope of this function.

38.13 Fault Indicator

Purpose

To indicate if there are any faults in the RU the indicator is located on.

Preconditions and Initiation

Applicable for any operational condition. The function is initiated when the SW is started.

Description

The Fault Indicator is controlled from the Diagnostics and Fault Handling Functionality and from the Restart and Recovery Functionality. When the RU is reset in any way the handling of the indicator is terminated.

Limitations:

When the CU of a CDU-D has detected lost communication to both its superior RUs, the CU restarts according to the Restart and Recovery functionality. Flashing of the fault indicator is then not used for the CU.

Colour:	Red
Position:	Main RUs (DXU, TRU, ECU) and sub RUs (CDU, PSU, BFU).
ON:	One or more faults are detected in the RU.
FLASHING (0.5 Hz):	- Running on Base Application OR - For DMRUs and Sub RUs (TRU, ECU, CDU, BFU, PSU); The RU has detected lost communication to superior RU.

Note: The flashing state may not be used for Sub RUs without a processor.

OFF:	No fault is located to the RU.
Priority	ON has a higher priority than FLASHING. If the conditions for two states are fulfilled, the one with the highest priority will control the indicator.

38.14 BS Fault Indicator

Purpose

To indicate if there are any faults in the RBS.

Preconditions and Initiation

Applicable for any operational condition. The function is initiated when the SW is started.

Description

The BS Fault indicator is controlled from the Diagnostics and Fault Handling functionality and from the Restart and Recovery functionality. When the RU is reset in any way the handling of the indicator is terminated.

Colour:	Yellow
Position:	CMRU (DXU)

States of the indicator:

ON:	One or more faults are detected in the RBS.
OFF:	No faults are detected in the RBS.

38.15 Operational Indicator

This section also includes operational states, remote operational indication and operational information.

Purpose

To indicate if the RU is considered Operational/not Operational, if BSC initiated configuration is in progress, if SW is being received or if restart is pending after SW download.

Preconditions and Initiation

Set Operational Indicator:

Applicable for any operational condition. The function is initiated when the SW is started.

Remote Operational Indication:

The RU operational state should be IRO, RFU and IU and the RU mode should be Remote. The function is initiated by OPERATIONAL_INFORMATION on the Abis interface.

Operational Information:

The MO state should be "not reset" and the RU mode should be Remote. The function is initiated by OPERATIONAL_INFORMATION on the Abis interface.

Description

The Operational indicator is controlled from the Diagnostics and Fault handling functionality, Restart and Recovery functionality and Function Change Functionality. The indicator is turned off 2-10 seconds after the SW has started. When the RU is reset in any way the handling of the indicator is terminated.

For description of the Remote Operational Indication function and Operational Information function see the parts of this section called "Operational States" (part "RU in Remote Mode").

Colour:	Green
Position:	Main RUs (DXU, TRU, ECU) and Sub RUs (PSU, BFU, CDU).

States of the indicator

ON:	The RU is considered Operational.

FLASHING (0.5 Hz):

- Configuration activity initiated from the BSC, (which may take more than 10 seconds to complete) in progress OR
- SW is being received OR
- Restart pending (after SW download).

OFF	The RU is considered Not Operational.
Priority	FLASHING has a higher priority than ON and OFF. ON has a higher priority than OFF. If the conditions for two states are fulfilled, the one with the highest priority will control the indicator.

Operational States

Table 121 Operational States

RU in Remote Mode	RU in Local Mode
The state of the operational indicator on CMRU and TDMRU is determined upon the operational mode of the MOs associated to the RU. The operational indicator on the EDMRU is only controlled locally and is described by the Diagnostics and Fault Handling Functionality.	The master cabinet is considered Operational if SO CF and at least one SO TRXC are considered free from class 1 HW faults and Local Configuration has been performed.
The MO operational mode is reported by the BSC with the OPERATIONAL_INFORMATION message. An MO is internally taken out of operation at reset (refer to the Function Change Functionality) or when its associated RU is taken into Local Mode.	A Sub-RU is considered Operational if there are no class 1 faults on the RU. The Extension Cabinet (if there is any) is considered operational if at least one SO TRXC is considered free from class 1 HW faults and Local Configuration has been performed.
The Master Cabinet is considered operational if SO CF, at least one SO TRXC, at least one AO RX and at least one AO TS are considered operational by the BSC, set by the message OPERATIONAL _INFORMATION to each MO.	The Remote Operational Indication function is terminated when OPERATIONAL_INFORMATION_ACCEPT is sent on the Abis interface.
The TDMRU is considered Operational when SO TRXC, AO RX and at least one AO TS are considered Operational by the BSC, set by the message OPERATIONAL_INFORMATION to each MO. In the case of SW Power Boost configuration the OPERATIONAL indicator on the TDMRU implementing the slave TX is on when the indicator on the master TDMRU is on. Otherwise, the indicator is off.	
The Remote Operational Indication function and the Operational Information function are terminated when OPERATIONAL_INFORMATION_ACCEPT is sent on the Abis interface.	

Note: The CMRU and the TDMRU is considered Not Operational during change of RU Mode. The EDMRUs and sub-RUs are always in Local Mode. Only the CMRU and the TDMRUs can be in Remote Mode.

38.16 Tx Not Enabled Indicator

Purpose

To indicate that TX is not enabled.

Preconditions and Initiation

Applicable for any operational condition. The function is initiated when the SW is started.

Description

The TX Not Enabled indicator is controlled from Functionality Administration functionality and from Restart and Recovery functionality. The TX Not Enabled indicator is on until the BSC has changed MO State for TX to enabled. When the TX is disabled or reset by the BSC or auto-disabled by the RBS the indicator is turned on. When the RU is reset in any way the handling of the indicator is terminated.

Colour:	Yellow
Position:	TDMRU (TRU)

States of the indicator

ON:	TX is not enabled
OFF	TX is enabled

38.17 Local Mode Indicator

Purpose

To indicate the current RU Mode.

Preconditions and Initiation

Applicable for any operational condition. The function is initiated when the SW is started.

Description

After a restart, the indicator is on until the Local Remote handling starts (refer to the Restart and Recovery functionality). When the RU is reset in any way the handling of the indicator is terminated.

Colour:	Yellow
Position:	CMRU (DXU) and TDMRU (TRU).

States of the indicator

ON:	RU Mode is Local.
FLASHING (0.5 Hz):	Change of RU mode is in progress:

- Waiting for layer 2 A-bis communication to be established OR.
- Waiting for confirmation that the layer 2 A-bis communication has been released.

OFF	RU Mode is Remote.

– For a TDMRU that is configured to implement a slave TX in a SW Power Boost configuration:

The RU is remote via the TDMRU that implements the master TX.

For description of changing an RU to Local Mode, see Section 38.4 Change RU to Local Mode on page 285.

Limitations:

The Local Mode indicator will not indicate when the layer 2 A-bis communication with the BSC is lost when the RU Mode is Remote.

38.18 External Alarms Indicator

Purpose

To indicate if any external alarm defined by the operator is active.

Preconditions and Initiation

Applicable for any operational condition. The function is initiated when the SW is started. The functionality is initiated when the RBS DB has been read during the start-up sequence (refer to Restart and Recovery functionality).

Description

The External Alarms indicator indicates if any external alarm defined by the operator is active. The External Alarm Indicator is controlled from External Alarms functionality and from Restart and Recovery functionality. When the RU is reset in any way the handling of the indicator is terminated.

Colour:	Yellow
Position:	CMRU (DXU)

States of the indicator

ON:	Any external alarm connected to an inlet in this cabinet is active.
FLASHING (0.5 Hz):	Any external alarm connected to an inlet in an extension cabinet is active.
OFF	No external alarm connected to an inlet in any cabinet is active.

38.19 DC Disconnected Indicator

Purpose

To indicate if the DC is disconnected.

Preconditions and Initiation

Applicable for any operational condition. The function is initiated by the HW when the RU is started.

Description

The DC Disconnect indicator indicates if the DC is working properly or not. If the environmental requirements are not fulfilled, the power to the rest of the RBS is switched off. The DC Disconnect indicator is controlled from the Climate protection functionality and from Restart and Recovery functionality. When the RU is reset in any way the handling of the indicator is terminated.

Colour:	Yellow
Position:	EDMRU (ECU)

States of the indicator

ON:	The environmental requirements are not fulfilled and thus the power to the rest of the RBS is switched off.
OFF	The environmental requirements are fulfilled.

38.20 Battery Mode Indicator

Purpose

To indicate if the RBS is running on battery backup.

Preconditions and Initiation

Applicable for any operational condition. The function is initiated by the HW when the RU is started.

Description

The Battery Mode indicator indicates if the RBS is running on mains power supply or battery backup. The Battery Mode indicator is controlled from Power Supply functionality and from Restart and Recovery functionality. When the RU is reset in any way the handling of the indicator is terminated.

Colour:	Yellow
Position:	EDMRU (ECU)

States of the indicator

ON:	Battery power supply fully or partly used.
OFF	Mains power supply. No battery power is used.

38.21 Bat Disconnected Indicator

Purpose

To indicate if the battery is disconnected.

Preconditions and Initiation

Applicable for any operational condition. The function is initiated by the HW when the RU is started.

Description

The Bat Disconnected indicator indicates if the battery is connected or not. The Bat Disconnect indicator is controlled from Power Supply functionality and from Restart and Recovery functionality. When the RU is reset in any way the handling of the indicator is terminated.

Colour:	Yellow
Position:	Sub RU with battery fuse control (BFU).

States of the indicator

ON:	Battery disconnected.
OFF	Battery connected.

38.22 AC Fault Indicator

Purpose

To indicate if the AC Supply is faulty.

Preconditions and Initiation

Applicable for any operational condition. The function is initiated by the HW when the RU is started.

Description

The AC Fault indicator indicates if the AC Supply is faulty or not. The AC Fault indicator is controlled from Power Supply functionality and from Restart and Recovery functionality.

Colour:	Yellow
Position:	EDMRU (ECU)

States of the indicator

ON:	One or more phases are faulty.
OFF	No AC fault.

38.23 Test Result Indicators (not used)

There is a yellow Test Result indicator on each TDMRU (TRU).

The indicators are turned off 2-10 seconds after the SW has started.

38.24 Local Mode in Progress

Local Mode in Progress is a subfunction.

Purpose

To change RU mode from Remote to Local.

Preconditions and Initiation

The RU mode should be "Change to Local Mode in progress". The subfunction will be initiated when a change of RU mode to Local mode has been initiated.

Description

An external condition class 1, called switch information, is raised on the RU.

A Fault Report message is sent to the BSC on the Abis interface to inform the BSC that the unit is taken into Local operation. The RU mode for the cabinet is changed to Local when the Abis fault report procedure is terminated.

When Local Mode has been entered, the layer 2 communication links in Abis interface concerning the SO are released and stopped by RBS (refer to the Terrestrial Link Handling functionality).

On the TRU, the MO TX and MO TS are disabled if they were enabled. The TX Not Enabled indicator is turned on.

The function is terminated when the layer 2 communication links on Abis interface concerning the SO has been released and stopped and Local mode has been entered.

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39 Installation Data Handling

Information about specific areas regarding either the RBS as a whole or each of the Replaceable Units, RUs, is stored in a database in the RBS. The purpose of the database is to handle information and provide efficient help within the following areas:

- General operation and maintenance
- Fault diagnostics
- Fault localisation
- Traceability

The database mainly contains configuration data valid for the RBS as a whole and for individual RUs.

Of course, the database that handles this information is not public but it is at least partly accessible for:

- The operator who accesses the database via the OMT
- The BSC which reaches the database via the Abis interface
- Other functions within the RBS

39.1 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.

OMT functions related to Installation Data Handling functions are described within the context of Operation and Maintenance Terminal.

39.2 Concepts

ARAE	Antenna Related Auxiliary Equipment Auxiliary equipment affecting the antenna functionality, e.g. active antennas.

39.3 General

The RBS database is stored in the CMRU which is a part of the RBS. Some parts of the content of the RBS database are relevant for specific RUs and those parts are stored in the Main RUs and sub-RUs.

The Installation Data Handling functions provide basic access to the content of the RBS database. As mentioned above, it is at least partly accessible for:

- the operator via the OMT
- the BSC via the Abis interface
- other functions within the RBS

39.4 Database Information Handling Elements

Several Database Information Handling elements are found in the RBS and RU databases. The most important ones are described below.

39.4.1 Elements Found in the RBS Database

RBS External Alarms

Specifies the alarm identity, alarm data, alarm severity and alarm criterion for each external alarm.

Access:	BSC via the Abis interface (in fault reports and hardware information) Operator via the OMT

RBS ARAE Supervision

Specifies the affected functionality, fault class and antenna instance number of each auxiliary fault.

Access:	Operator via the OMT

RBS Transmission Interface Configuration

Stores configuration information for the transmission interface and the TEI for the CMRU.

Access:	Operator via the OMT

RBS Configuration Identifier

Identifies the overall RBS configuration.

Access:	Operator via the OMT

39.4.2 Elements Found in the RBS and RU Databases

RU Type

Describes the RU type and the RU instance in detail.

Access:	Operator via the OMT

RU Identity

Includes product number, revision and serial number of the RU.

Access:	BSC via Abis (in fault reports and hardware information) Operator via the OMT

RU Physical Position

Identifies the location of the RU at a site, including information about cabinet, rack, shelf and slot.

Access:	BSC via the Abis interface (in fault reports and hardware information)
	Operator via the OMT

39.4.3 Elements Found in the RU Database

RU Specific

Includes the parameters specific to an RU. These parameters are dependent on the hardware design.

39.5 Functions

There are a number of functions and services connected to the Installation Database Handling. Some examples follow:

39.5.1 Read/Install the RBS Database

The entire RBS database can be both read and written. These functions are used when the RBS database needs to be transferred between the OMT and the RBS.

39.5.2 Read Hardware Information

This function makes it possible for the BSC to read detailed information from the hardware installed in the RBS, for example:

- Product number
- Revision
- Serial number
- Physical position

39.5.3 Read Information Element

This function allows the RBS to read information elements in the RU and RBS databases.

39.5.4 Write Information Element

This function makes it possible for the RBS to write information elements in the RU and RBS databases.

39.6 Operational Conditions

A reading of the entire RBS database from the RBS to the OMT takes less than four minutes.

An installation of the entire RBS database, from the OMT to the RBS, takes less than four minutes.

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40 Self Test and Supervision

Self Test comprises an initial boot test and X-bus receiver test. The initial boot test is performed during the start-up of an RU, in order to test the functionality of the hardware required for the execution of the application software. The X-bus receiver test is performed at TX configuration if TX is configured for SW Power Boost, in order to test the X-bus receiver on the master TX and slave TX.

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 Diagnostics and Fault Handling function for further processing.

40.1 References

If a reference is made to a function described in another chapter please refer to the table of contents to locate the relevant information.

40.2 Concepts

CRC	Cyclic Redundancy Check (CRC code). The CRC code is often called polynomial code.

40.3 Self Test

40.3.1 Boot Test

Purpose

The Boot test is an initial test function that determines the functionality of the RBS hardware. The test ensures that the application software can be started in the processor.

Preconditions and Initiation

The Boot test is carried out before any normal application processes are started. The function Restart and Recovery invokes the test.

Description

Invoked by the function Restart and Recovery the processors are tested implicity by the memory test.

Read/write memories are tested before any other functions. These tests are fast and destructive to the contents of the memory and control the two alternate states of a memory bit are tested.

Memory of non-volatile character such as flash and eprom is tested checksums. The checksum must include the whole content of the memory, but does not include unused memory with predefined values to save time and start-up.

Finally, HW functions controlled by the processor, which are necessary to start the application software and which do not disturb other processes or associated HW are finally tested.

The Boot Test returns a state that indicates failure or success. However, the test will terminate permanently if a Read/Write-memory failure is detected. This causes a reset of the processor. The function can be upgraded remotely by replacing parts of the boot software.

40.3.2 X-Bus Receiver Test

Purpose

To detect any faults on the X-Bus before the SW Power Boost is started.

Preconditions and Initiation

Initiated by the functionality administration when an AO TX instance that is configured for SW Power Boost is enabled.

Description

The X-Bus receiver on the master TX and slave TX is tested by sending a test message on the X-Bus. It is terminated by reporting the outcome of the test.

40.4 Supervision of Memory

Purpose

Controlling the correctness of the memory contents.

Preconditions and Initiation

The Boot Test is carried out before any normal application processes are started. The function Restart and Recovery invokes the test.

Description

There are two kinds of memory, Read/Write memory and a Read only memory.

The Read/Write memory is supervised by parity checking. A parity bit is added to the data and is chosen so that the number of 1 bits in the data is even (or odd). For example, when using even parity the data 1011001 becomes 101101011 and the data 10110001 becomes 101100010. Parity bits are added when writing data to the memory and these bits are checked when reading the same data from the memory. If the parity bits are not even (or odd) a fault has occurred in the data.

The read only memory (and memory of non-volatile character such as Flash and EEPROM) is supervised by continuous control checksum (CRC-32). When copying a data burst from a non-volatile memory to a volatile memory both the original data burst and the copy must be checked. If a fault is detected the fault is reported to the fault handling functions.

EN/LZT 720 0008 R1A
2001-06-26

40.4.1 Supervision of Buses

Purpose

The purpose of this function is to check the integrity of the data on the buses.

Preconditions and Initiation

The function is automatically initiated at the start of the functions driving and receiving information on the buses.

Description

Receive and transmit bus supervision encompasses buses between three or more RUs or major functional blocks. The address or data buses of the processors are not supervised by this specific function. The supervision of the buses is achieved by comparison of data sent to the bus driving function with the information on the bus, and by control information embedded in the data. The function looks for expected traffic on the bus. Traffic must be generated in absence of normal traffic. Disturbances are reported to fault handling for filtering and fault detection.

40.4.2 Supervision of Cables

Purpose

To detect removal of a cable.

Preconditions and Initiation

Initiates automatically at start of application software.

Description

All cables between the RUs are supervised. Removal of a cable during operation is always detected by one of the following conditions:

- No current in the cable
- Missing logical signal
- Missing traffic message

It is possible to disable and enable the fault reporting for the cables listed below using the OMT.

- CDU TRU PFWD cables
- CDU TRU PREF cables
- FU CU PFWD cables
- FU CU PREF cables

When the OMT is disconnected, the fault reporting is always enabled.

40.4.3 Supervision of Application Program

Purpose

Supervises the application software. If the execution of the software fails (for example a cyclic loop) the function exception processing interrupts the execution.

Preconditions and Initiation

Initiates automatically at start of application software.

Description

The main processor supervises the operation of the sub-processors by the regular reception of signals from the sub-processors. When no normal operation signals are generated dummy signals will be generated instead. Dummy signals generated from a subprocessor, tell the main processor that the sub processor is still in an operational state.

The main processor receives exceptions from a number of sources such as arithmetic overflows, I/O interrupts, system calls and when no operational or dummy signals from the sub-processors are generated. When the processor detects one of these exceptions it disables interrupts and forces execution of a software exception processor (called the handler) located at a fixed address. The handler saves the contents of the processor, including the context of the program counter, the current operating mode (user or supervisor) and the status of the interrupts (enabled or disabled). These contents are saved so it can be restored when the execution has been serviced. When an exception occurs, the CPU loads the Exception Program Counter (EPC) register with a location where execution can restart after the exception has been serviced.

40.4.4 Supervision of DMRU Loadfiles

Purpose

The function investigates that loadfiles are correctly stored in CMRU memory.

Preconditions and Initiation

The CMRU application software is loaded and activated. The function is then activated when the CMRU detects loadfiles in the DMRU that are expected in the CMRUs non-volatile memory. These are then transferred from the DMRU to the CMRU.

Description

The loadfiles in the non-volatile memory of the CMRU are supervised by continuous comparison of checksum. Detected errors are reported to the function Diagnostics and Fault Handling. The checksum comparison on each supervised loadfiles is performed with 5–minute intervals. This supervising function has low system priority and is performed as a background activity.

40.4.5 Radio Transmission and Reception

Purpose

The transceiver is tested during traffic by a radio test loop function. The purpose is to detect a faulty transceiver by detecting an error in the signal strength or in the number of bit errors.

Preconditions and Initiation

The test requires two unused ATSR (AirTime Slot Resources) separated by three timeslots. The radio test loop function is initiated when the application software is started and is activated every fifth minute and is performed only if resources are available.

Description

The transceiver is tested by sending a dummy burst to the transmitter unit and looped back internally to the radio receiver unit. The test is performed in two steps, a primary test and, if necessary, a retest if the primary test fails. All loops are performed on the diversity channels A and B and the results from these channels are combined. A fault report is issued if at least one channel indicates an error. All transceivers are tested.

The output power to the antenna is turned off for the ATSR used in the loop. The primary test issues one dummy burst. The signal level of the looped burst for both the A- and B-channel returning to the receiver unit is compared with the sent burst and must exceed a lowest level. The number of detected bit errors must be less than a maximum permitted level. If the test is passed, the test is terminated and no fault is indicated.

If the primary test fails, a retest is performed. This test issues a preconfigured number of dummy bursts, and for each of these bursts, the looped signal level must exceed the lowest level. If the lowest lewel is not exceeded, the test is terminated and a fault is indicated.

The presence of an interferer is detected by measuring the mean signal level of all the looped bursts. This is done for both the A- and B-channels. If the signal exceeds a maximum defined level, an interferer is considered present.

If no interferer can be detected a final test of the bit error rate is conducted. If the number of bit errors exceeds a maximum permitted number a fault is reported. If all configured retests have failed and not recovered, the transceiver is blocked by the BSC.

40.4.6 Transmitter Antenna

Purpose

Transmitting characteristics are monitored in order to detect if an antenna has been damaged.

Preconditions and Initiation

Initiates when the signalling multiplexing application is started in the CMRU and when the corresponding application handling the signalling endpoints on the DMRUs, are started.

Description

The relation between the reflected power and the output power can be described by the voltage standing wave ratio (VSWR). The more reflection the higher value of the VSWR. At no reflection at all the value of VSWR will be equal to 1 and at total reflection the value of VSWR will be very large. The higher value of the VSWR the higher value of the return loss.

There are two kinds of return loss the Tx feeder return loss and the Tx feeder normal return loss. The Tx feeder Return loss, that is, the RF attenuation between the RBS cabinet and the antenna (the cable and cable connections) including an ALNA/TMA shall be in the interval 0-4 dB. The Tx feeder normal Return loss, that is the total attenuation from the RBS cabinet and to the antenna and back to the cabinet (that is, the attenuation at the cable to the antenna and from the antenna, cable connections, ALNA/TMA, and the antenna). The attenuation should be ≤-14dB if the Tx feeder loss is ≤ 2dB and ≤-18dB if the Tx feeder loss > 2dB. If VSWR is too high a message is sent to the fault handling. It is possible to set two disturbance parameters from the OMT.

The two disturbance VSWR levels are in the range of 1.5-2.8. Allowed alarm level VSWR values are: 1.5, 1.6, 1.7, 1.8, 2.0, 2.2, 2.5, 2.8. The transmitter at the TRU measures the VSWR signal and if the signal is to high it may be harmful to the power amplifier. If the VSWR signal is too high the transmitter may reduce or turn off its output power.

40.4.7 Receiver Antenna

This is described within the context of Diversity Supervision

40.4.8 Layer 2 Data Link Transmission

Purpose

To check the number of aborted and erroneous frames received by the CMRU from the DRMUs.

Preconditions and Initiation

Initiated when the signalling multiplexing application is started in the CMRU and when the corresponding application handling the signalling endpoints in the DMRUs is started.

Description

Signal messages between the CMRU and the endpoints of the DMRUs are supervised by the following events and conditions:

- Number of aborted frames received
- Number of error frames received

Aborted frames are those frames ended by an abort flag sequence. Erroneous frames have the following conditions:

- A CRC-error (Cyclic Redundancy Code, CRC-16).
- Frames shorter than 4 bytes.
- Frames longer than the maximum frame length (260 bytes).
- Not ended on byte boundary.
- Data loss caused by lack of buffers or memory access problems.

Disturbances are generated such that all malfunctions related to these are detected and can be pinpointed by diagnostics, without generating false alarms.

This supervision is performed with internal links using HDLC type transmission.

40.4.9 Supervision of LAPD Concentration

Purpose

The purpose is to supervise the length of concentrator uplink message queues. A fault report is sent when an overflow occurs.

Preconditions and Initiation

The supervising function is initiated when the LAPD concentrator is started.

Description

The purpose of LAPD concentration is to reduce the number of required physical links between the BSC and the RBS on the Abis interface. This is achieved by letting a number of DMRUs use the same subrate for LAPD signalling on A-bis. To accomplish this, the CMRU shall concentrate LAPD uplink messages from a number of DMRUs onto one physical link to the BSC.

The LAPD concentration function is modelled on A-bis with a managed object, AO CON, which is supported by the RBS.

The supervising function checks the concentrator uplink queues in the CMRU. If the maximum queue time for a message is exceeded, the oldest message in the queue shall be removed when a new is inserted. The fault criteria is set to generate a fault when the message queue is more than 70% full, or when the message is discarded due to queue overflow. Fault messages are not removed. The queue time is calculated using the total number of bytes in the queue and the transmission speed between the BTS and the BSC. The maximum queue time is set to 120 ms. That corresponds to 960 bytes at a transmission speed of 64 kbps.

40.4.10 Supervision of Environmental Conditions

Purpose

Controlling the climate in the BTS.

Preconditions and Initiation

Initiates automatically at application software start.

Description

All BTS have inbuilt fans, which may run at four different speeds full, middle, low and stop. The main task of the fans is to circulate the air in the BTS and replace old, warm air with new, cooler air. The RBS 2102 and 2101 has a climate system with a control unit that controls the temperature and the humidity of the RBS. The control unit is divided into three units:

ECU	The ECU supervises the climate unit, handles the alarms and controls the FCU.
CCU	The CCU controls the climate unit independently, but in case of abnormal function the ECU can disconnect the climate unit and override the CCU, (emergency stop).
FCU	The FCU is a speed control of the magazine fans and a distributor of their alarms.

The climate unit consists of among other things a heater, temperature- and humidity sensors, a compressor and a condenser. The compressor will start at an initial temperature of 32°C and will stop when the temperature falls to 25°C. If the enclosure temperature falls below 10°C, the heating unit will be switched on and it will be switched off when the temperature rises above 15°C.

The cabinet heating up time to > 0°C depends on the ambient temperature and the time the cabinet has been shut down. However, the heating up time shall not exceed 2 hours under any circumstances.

40.4.11 Power Conditions

Purpose

Supervises the units used for energy control and the power level of the AC and DC power.

Preconditions and Initiation

Initiates automatically at activation of the application software.

Description

Supervises the units used for energy control. Detects faults in those units for example power supplies, internal or external batteries, fans, cooler, heater or climate sensors. Supervises the power level for AC power and DC power. AC mains failure is detected.

40.4.12 Synchronization Sources

Purpose

Supervise the ability of the transmitter and the receiver to lock to the reference frequency.

Preconditions and Initiation

Initiated when the application software is started. The faults associated are installed in the fault handling function at initiation.

Description

Frequency generators of the transmitter and receiver are supervised for adequate locking to the reference frequency. Failure to lock within time generates a disturbance. Ability to stay locked to reference is monitored until a new frequency is set. Disturbances are reported to fault handling for filtering and eventually fault detection. The supervision of the frequency source is restarted each time a new frequency is set.

40.4.13 Tower Mounted Amplifier

Purpose

Supervises the functionality of the TMA.

Preconditions and Initiation

Initiates automatically at application software start.

Description

The faults associated are installed in the fault handling function at initiation. The functionality of the TMA is supervised by measuring the power consumption of the TMA. A disturbance is generated if the power consumption is outside a predefined interval.

Two different disturbance levels are used: Degraded or Faulty.

40.4.14 Supervision of Door Alarm

Purpose

Detection of opening the cabinet door or the mounting base door.

Preconditions and Initiation

Automatically at application software start.

Description

A disturbance is generated when the cabinet door or the mounting base door is opened. The disturbance is reported to the fault handling for filtering and eventual fault detection. When raising a fault, there is a short filtering time to avoid contact bouncing. It takes approximately 5 minutes after the fault has been deactivated (that is to say the door has been closed) for the fault message to cease. The fault is reported as External Condition Fault. This function is valid for the outdoor cabinets only.

41 Diagnostics and Fault Handling

"Diagnostics and Fault Handling" supervises the handling of faults and disturbances detected by the "Selftest and Supervision" function.

Fault handling performs the following:

- Filters spurious disturbances. (Disturbances are events which may indicate a fault only under certain conditions)
- Evaluates the underlying fault cause
- Determines the impact of a fault
- Localizes 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

41.1 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.

Maintenance functions related to Diagnostics and Fault Handling are described within the context of Operation and Maintenance Terminal.

The visual indicators relevant to Diagnostics and Fault Handling are described within the context of Operation and Maintenance Support.

41.2 Concepts

AO	Application Object. An AO is an abstract subclass of MO. AO provides a part of the functionality of a GSM BTS. The functionality is specified for each concrete descendant class. An AO instance has O&M communication with BSC on Layer 3 via a SO instance.
Disturbance	An event which may indicate a fault only under certain conditions.
Fault map	Information about a ME fault status is stored in fault maps capable of indicating the presence or absence of all possible faults for a ME.
HWU	An Hardware Unit (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 a processor).
ME	Managed Entity. A HWU, RU, SO or AO.
MO	Managed Object. The BSC manages the O&M of the RBS via the A-bis O&M

	Interface. The RBS equipment is seen as a set of MOs by the BSC. (This is a way of describing the RBS in a functional-oriented way. 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	Replaceable Unit. An RU is the smallest unit that can be handled on site or in a repair center and of which information can be retrieved via OMT or BSC.
SE	Supervised Entity. It is the lowest level in the RBS hardware model. A SE is a property, which is supervised. Examples on SEs are communication fault on a bus and interruption on a PCM reference.
SO	Service Object. A SO is an abstract subclass of MO. A SO instance carries service functions for a set of MO instances, including itself. The service functions include Layer 2 termination and Layer 3 distribution. They may also include HW supervision and SW handling.

41.3 Fault Detection

Purpose

This function detects hardware and functionality faults in the RBS system. The RBS always supervises itself, even without traffic.

Preconditions and initiation

The selftest and supervision function has detected a disturbance.

Description

The fault detection function is processed by the following subfunctions; fault filtering, fault evaluation and fault classification. These subfunctions are described below in detail. The types of faults that are detected are specified within the context of “Selftest and Supervision”.

41.3.1 Fault Filtering

Purpose

The purpose of the subfunction is to determine whether a fault is present or absent, see figure below, and the nature of the fault.

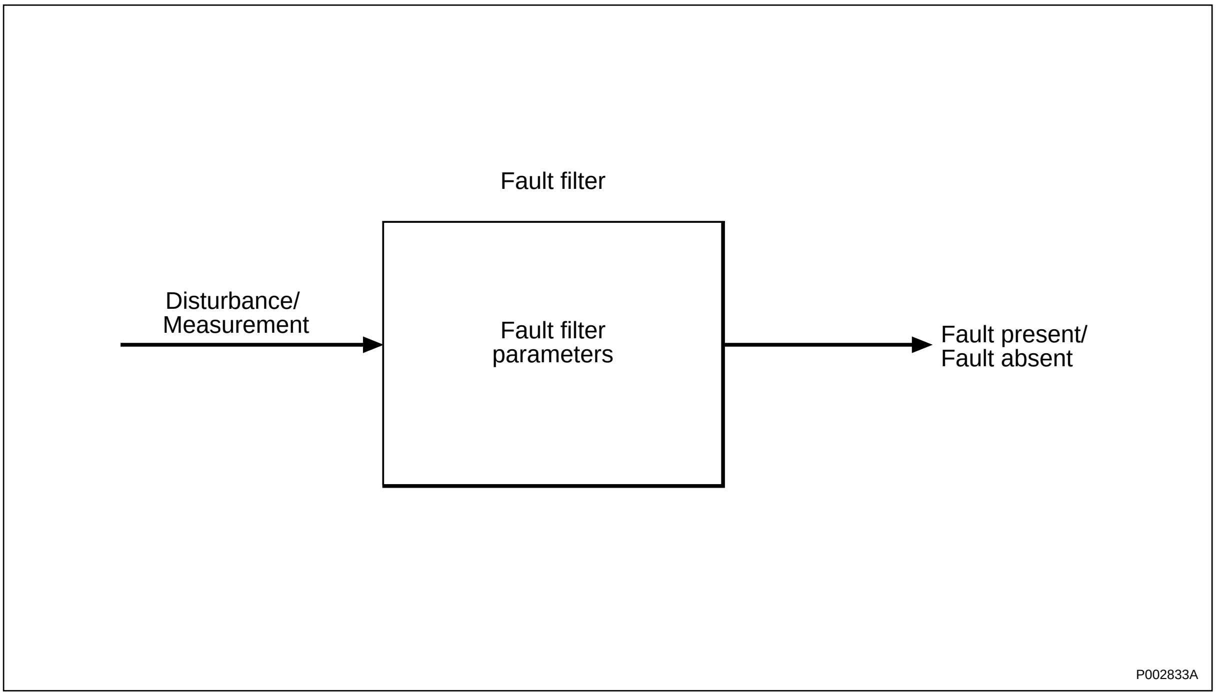

Figure 103 Fault Filter

Preconditions and initiation

The selftest and supervision function has detected a disturbance.

Description

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. Each fault has its own specified fault filter parameters. For example, the following parameters (or combinations of parameters) may be used for the filter function:

- 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

41.3.2 Fault Evaluation

Purpose

Detected faults are evaluated to determine the underlying fault.

Preconditions and initiation

A change in fault status for HWU or a RU.

Description

This function evaluates the input fault maps and tries to find out the actual fault cause. This is done by analyzing faults reported on a low level (specified hardware units) and mapping them to a high level (RUs and MOs), thus taking the complete fault situation into account.

41.3.3 Fault Classification

Purpose

The fault classification subfunction decides the severity of the fault, whether it affects functionality of the MO or not and also if the fault is internal or external.

Preconditions and initiation

The fault filtering function or the fault evaluation has detected or ceased a fault.

Description

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

41.4 Fault Localization

Purpose

This function is used to localize a detected fault to possible faulty RU.

Preconditions and initiation

The fault detection function has found a change in fault status for a RU.

Description

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 this is visually indicated as specified within the context of Operation and Maintenance Support.

41.5 Local Action

Purpose

When a fault is detected for a SE it may be necessary to minimize the effect of the fault. It is called a local action.

Preconditions and initiation

The fault detection function has detected a fault for a SE.

Description

The impact of certain faults can sometimes be minimized by local actions. This is done automatically by the RBS.

Permitted actions are:

- Re-initiation
  - Certain faults can sometimes be cleared by re-initiating the offending hardware. For example, if a communication circuit behaves unexpectedly, it is reinitiated. 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 overheated, 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.

41.6 Fault Reporting

Purpose

This function reports MO faults to the BSC.

Preconditions and initiation

The fault detection function and the fault localization function reports new fault status for a MO. Both functions must have been completed before start of this function.

Description

The RBSs automatically informs the BSC of each change in the fault status. The old fault status is compared with the new fault status. If the fault status has changed for MO, a fault report procedure is initiated on A-bis. 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 time.

41.7 Fault Logging

Purpose

All fault changes are logged in the SW log with timestamp.

Preconditions and initiation

A fault has been raised or ceased by the fault filtering function and fault classification function.

Description

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.

41.8 RBS Diagnostics

Purpose

The purpose of this function is to make conclusions about where the original fault source is located.

Preconditions and initiation

The fault detecting function has reported a change in fault status for a HWU.

Description

The diagnostics function has access to fault maps for the whole RBS, not only for a MO. The RU fault map has information about which information SE(s) that has reported a fault. If there is any fault at the RBS, this function will switch on "BS Fault Indicator". If this function can pinpoint the fault to a RU with 100% probability, it will switch on the Fault Indicator on that RU. If the fault affects functionality and the RU is not in remote mode then the Operational Indicator on the RU will be switched off.

42 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.

42.1 References

/G.703/

/G.704/

/GSM:11.20/

/GSM:05.05/

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

42.2 Concepts

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).
MO	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.
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.
Timeslot 0	The timeslot 0 multiframe structure is defined in /G. 704/.
CMRU	Central Main Replaceble Unit. An RBS has exactly one CMRU. In the RBS 2000 hardware architecture, the DXU is the CMRU.

DMRU	Distributed Main Replaceble Unit. A Main RU is said to be distributed if it is subordinated to the CMRU.
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 or may not have a direct signalling link to the BSC.
Passive RU	A passive RU is an RU with a very low level of intelligence. It is independent of the processor system, for example, it has no connection for O&M communication. In the RBS 2000, for example the cables are Passive RUs.
RU	Replaceble Unit. An RU is the smallest unit that can be handled on site or in a repair center and of which information can be retrieved via OMT or BSC.
Sub-RU	A Sub-RU 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. Note that an RU with a processor that is not loadable, is classified as a Sub-RU. In the RBS 2000 hardware architecture, for example the CDUs are Sub-RUs.

42.3 Functions

42.3.1 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.

42.3.2 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.

Configurations possible to display, comprise all RBS 2000 products and the configurations as specified for each product.

The following RU and connections are graphically displayed:

- DXU
- TRU
- ECU
- CDU
- Local bus
- CDU bus
- Number of antenna systems (1 or 3)

- Display RBS software revisions, display RU software revisions for all Main RUs, see Section 42.3.16 Replaceable Unit on page 329.
- 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 42.3.16 Replaceable Unit on page 329).

The functions above are normally used for:

- General purpose (display RBS configuration)
- Maintenance (display RBS software revisions)
- Installation (display TEI/RU list)

42.3.3 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. If the OMT is connected remotely an RBS address can be given in order to select one of several RBSes connected in a multidrop chain. Also a timeslot, which the OMT uses when established, is given by the operator. The RBS is scanning for remote OMT link establishment on all 64 kbit/s timeslots on PCM-A. If the RBS software does not support scanning for remote OMT link establishment on all timeslots, the operator has to use TS23, which is the default value. 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 for general purpose use.

42.3.4 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	Install the IDB from the RBS to the OMT.
Cable mounting list	Display a cable mounting list based upon information from the IDB.
Site specific data	Site specific data , that is IDB information that is changeable from the OMT, is displayed, copied to any file medium to the IDB in the OMT.
Save	Copy the IDB from the OMT to any file medium, for example a floppy disk or a hard disk.
Open	Copy the IDB from any file medium to the OMT.
Inventory list	An inventory list, containing RU data, based upon information from the IDB, is displayed, saved on file medium or printed.
Configure	Generate a new configuration.
Reconfigure	Copy data from the old IDB to the new.
Modify	Increase or decrease the number of activated RUs in the IDB.

The functions above are for general purpose use.

42.3.5 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 output can be displayed or directed to file (output stored in a file on the OMT).

The functions above are normally used at

- installation (display/define external alarm setup)
- site acceptance (monitor external alarms status)

The fault status for all inlets defined for auxiliary faults can be monitored.

42.3.6 ARAE Supervision Parameters

The following user functions, related to the ARAE, are available in the OMT:

- Auxiliary Faults are possible to define for each alarm inlet.
- The alarm inlets can be used for both External Alarms and for ARAE Supervision.
- The definition of the ARAE Supervision Parameters is displayed.
- Monitor ARAE fault status.

The output can be displayed or directed to file (output stored in a file on the OMT).

42.3.7 Modify TN O&M Values

This function modifies the Transport Network O&M parameters in the IDB. There are three TN O&M parameters in the TNOM_information element that are possible to modify:

TNOM_use. Indicates if TN O&M functionality is activated or not.

TNOM_timeslot. Indicates which 64 kbit/s timeslot on the PCM link to use for TN O&M communication.

TNOM_nodeid. Holds the identity of the BTS node in the TN O&M network.

42.3.8 Display TN O&M Values

This function displays the value of the TN O&M parameters, which are stored in the TNOM_information element in the IDB (see parameters above).

42.3.9 Calibration of Optional Reference Oscillator

This function is used to calibrate the optional reference oscillator.

42.3.10 Cable Loss

The following user function, related to Cable loss, is available in the OMT:

- Define cable loss, defines cable and feeder loss values.
- Display cable loss, displays cable and feeder loss values.

42.3.11 ALNA/TMA Parameters

The following functions, related to ALNA/TMA parameters are available in the OMT.

- Define ALNA/TMA parameters.

  In OMT state LOCAL and in OMT state CONNECTED, it is possible to define values for the following:

  – Current Supervision Limits

  - Current Supervision Limit Low
  - Current Supervision Limit High

It is possible to define values for the following parameters only in OMT state LOCAL:

– RX Group Delay

– Loss

– RX Frequency Range

  - RX Frequency Low
  - RX Frequency High

- Display ALNA/TMA parameters, displays any of the following parameters associated with ALNA/TMA:

  – Current Supervision Limits

    - Current Supervision Limit Low
    - Current Supervision Limit High

  – RX Group Delay

  – Loss

  – RX Frequency Range

    - RX Frequency Low
    - RX Frequency High

42.3.12 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.
- Set Network_topology value.

  Sets Network_topology value for stand alone or cascade connection of RBSs.
- Display Network_topology value.

  Displays whether the network topology of the RBSs is stand alone or cascade connection.
- Define TF Compensation Value

This function makes it possible for the operator to define (or redefine) the IDB parameter RBS TF Compensation Value.

- Display TF Compensation Value

  The IDB parameter RBS TF Compensation Value (in ns) is displayed.

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.
- Modify PCM Receiver Sensitivity

  Sets the individual PCM Receiver Sensitivity values for an E1 transmission interface. The values are defined and referred as parameters PCM-A-REC-SENS and PCM-B-REC-SENS in the IDB.

  Exception: A DXU which uses the PRACT transmission circuit does not support the PCM Receiver Sensitivity values.

- Display PCM Receiver Sensitivity

  Displays the individual PCM Receiver Sensitivity values for an E1 transmission interface. The values are defined and referred as parameters PCM-A-REC-SENS and PCM-B-REC-SENS in the IDB.

  Exception: A DXU which uses the PRACT transmission circuit does not support the PCM Receiver Sensitivity values.

The following user functions, related to the /DS1/ 1544 kbit/s PCM network, are available in the OMT:

- Modify LBO values for transmission interface.

  Sets the individual LBO values for a T1 transmission interface. The values are defined and referred as parameters LBO-A and LBO-B in the IDB.

  Exception: A DXU which uses the PRACT transmission circuit does not support the LBO values.

- Display LBO values for transmission interface.

  Displays the individual LBO values for a T1 transmission interface. The values are defined and stored as parameters LBO-A and LBO-B in the IDB.

Exception: A DXU which uses the PRACT transmission circuit does not support the LBO values.

- Modify FDL use values for transmission interface.

  Sets the individual Facility Data Link (FDL) use values for a T1 transmission interface. The values are defined and referred as parameter "FDL_use" in the IDB.

  Exception: A DXU which uses the PRACT transmission circuit does not support the FDL_use.

- Display FDL use values for transmission interface.

  Displays the individual FDL use values for a T1 transmission interface. The values are defined and stored as parameter "FDL_use" in the IDB.

  Exception: A DXU which uses the PRACT transmission circuit does not support the 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)

42.3.13 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.

42.3.14 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 time slots.
- Switch off Measurement Reports, switch off Measurement Reports for one or several time slots.

The functions above are normally used during

- maintenance (switch on/off QIU, Monitor maintenance data)
- installation (switch on/off Measurement Reports)

42.3.15 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
- Display channel combination, display the channel combination of MO Timeslot

The functions above are normally used for maintenance.

42.3.16 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)

42.3.17 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 at

- Site acceptance (monitor current fault status)
- Maintenance (display fault info)

42.3.18 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 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 kbps.

42.4 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 within the context of Installation Data Handling.

43 External Alarms

43.1 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.

43.2 Concepts

External Alarm	An alarm that originates from a source defined by the customer. The alarm is reported over A-bis transparently through the RBS. An example is a fire alarm.
Auxiliary Faults	Detected by supervision of auxiliary equipment.
Auxiliary Equipment	Equipment connected to the RBS but normally situated outside the RBS cabinet.
Alarm Inlet	The binary inlet to which the supervised equipment is connected. Used for both Auxiliary Faults and External Alarms.
Alarm Setup	The parameter definition for the alarm inlets, which is set by OMT.
Basic Character Set	A subset of the CCITT International Alphabet No 5, International Reference Version. See table below:

Table 122 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} - $5A_{hex}$
_	$5F_{hex}$

43.3 Function

Purpose

This function facilitates external alarms reported via the RBS. Example of this is "fire alarm".

Each active alarm will activate one common indicator light, which will be deactivated when there is no alarm active.

Preconditions and initiation

The external alarms function is started by the restart and recovery function.

Description

The following parameters are associated with each supervised external alarm:

Inlet Number	1–16. Defines which inlet the external alarm source equipment is connected to.
Inlet Usage	"Auxiliary Fault", "External Alarm" or "Not Defined". The default alarm setup is that alarm inlets are "Not Defined".
Alarm Identity	The numeric identity of a specific external alarm within the RBS.
Alarm Severity	There are two possible severity classifications, "Level 1" or "Level 2". 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. The basic character set , that is presented in Concepts, should be used. The alphanumeric string associated with each external alarm may contain a maximum of 62 characters.
Fault Activation Criteria	The way in which the external alarm is activated, either by breaking or closing the circuit on the external alarm inlet.

The RBS supervises each configured external alarm. An external alarm is filtered, i.e. 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.

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 can request this information from the RBS via A-bis.

43.4 Operation and Maintenance

Purpose

Maintenance functions related to external alarms are described within the context of Operation and Maintenance Terminal.

The visual indicators relevant to external alarms are described within the context of Operation and Maintenance Support.

Capabilities

The Capabilities of the different Radio Base Stations are shown in the table below:

Table 123 Maximum Number of external alarms defined by the customer

Radio Base Station	External Alarm, maximum
RBS 2101	8
RBS 2102	16
RBS 2103	16
RBS 2202	16
RBS 2302	8(1)

(1) In case of three cascaded RBS 2302, thew maximum number of External Alarms is 16.

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44 Handling of Auxiliary Equipment

A number of customer defined, antenna related auxiliary equipment can be supervised by the RBS. The raising of an auxiliary fault is, after analysis in the RBS, reported to the BSC. Depending on what severity the operator has defined for the fault, the concerned MO could be taken out of operation.

44.1 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.

44.2 Concepts

Auxiliary Equipment	Equipment connected to the RBS but normally situated outside the RBS cabinet.
ARAE	Antenna Related Auxiliary Equipment. Examples are boosters and active antennas.
Auxiliary Faults	Detected by supervision of auxiliary equipment.
External Alarms	Binary alarms that are reported over Abis transparently through the RBS. An example is fire alarm.
Alarm Inlet	The binary inlet to which the supervised equipment is connected. Used for both Auxiliary Faults and External Alarms.
Alarm Setup	The parameter definition for the alarm inlets, which is set by OMT.

44.3 Function

The following ARAE supervision parameters are associated with each auxiliary fault:

Inlet number	1–16. Defines which inlet the Auxiliary Equipment is connected to.
Inlet usage	"Auxiliary Fault", "External Alarm" or "Not defined". The default alarm setup is that all alarm inlets are ’Not Defined’, which means that they have no effect on fault reports for auxiliary equipment, external alarms or fault indicators.
Fault activation criteria	Either closing or breaking the sensor loop.

If inlet usage is set as "Auxiliary Fault", the following fault information parameters are also set:

Affected functionality	RX and/or TX

Fault class	There are two possible severity classifications
Antenna instance number	Defines the physical antenna

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 configuration auxiliary fault. An auxiliary fault is filtered, that is, must remain in a new state a fixed period of time (approximately 3 seconds) before the BSC is notified.

The detected fault is reported by sending of a fault report for the concerned MO(s) over the Abis interface according to the "Diagnostic and Fault Handling" function. Which MO class and instance to report the fault on, is derived from the ARAE supervision parameters, receiver diversity configuration and radio configuration.

The BSC will then take the affected MO(s) out of operation, if appropriate.

44.4 Operational Conditions

44.4.1 Operation and Maintenance

Maintenance functions related to auxiliary faults are described within the context of Operation and Maintenance Terminal.

The visual indicators relevant to auxiliary faults are described are described within the context of Operation and Maintenance Support.

44.4.2 Capabilities

The alarm inlets are used both for external alarms and supervision of ARAE faults.

The capabilities of the different Radio Base Stations are shown in the table below:

Table 124 Maximum number of auxiliary faults defined by the customer

Radio Base Station	Auxiliary Faults, Maximum
RBS 2101	8
RBS 2102	16
RBS 2103	16
RBS 2202	16

45 Climate Protection

The "Climate Protection" function:

- Supervises and maintains the internal temperature and humidity 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.

RBS configurations with one or more cabinets are handled.

45.1 Concepts

External	Outside the RBS cabinet
Internal	Inside the RBS cabinet
Temperature	In this chapter, shaded air temperature
Normal range	Is internal temperature within +5 °C to +45 °C
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	Is stated in relevant product chapter
Normal Condition, safe function and non-destruction	Are defined within the context of Enviromental Capability
User	In this chapter, any unit that needs power from the cabinet power system in order to function.

45.2 Functions

45.2.1 Climate Control by Air Conditioning

Operational Conditions

This function requires AC power and an internal temperature above 0 °C.

Description

This function maintains the internal temperature by an internally circulated air system (separated from the external environment). The internally circulated air will pass through an active cooling unit which has the capacity to lower the internal air temperature below the external environmental temperature.

45.2.2 Climate Control by Heat Exchanging

Operational Conditions

This function is available when the system voltage is present and the internal temperature is above 0 °C.

Description

This function maintains the internal temperature by an internally circulated air system (separated from the external environment). The internally circulated air will pass through a heat exchanger which cools down the internal air to a temperature just above the external environmental temperature.

45.2.3 Climate Control by Forced Air

Operational Conditions

This function is available when the system voltage is present and the internal temperature is above 0 °C.

Description

This function maintains the internal temperature by filtering external air and forcing it through or passing the units. By continuously replacing the warmed air with air of a lower temperature and using controlled air speed, the internal temperature will be kept within working range.

45.2.4 Heating

Operational Conditions

This function is available with low internal temperature and AC power.

The function is only used in products specified for external temperature ranges whose lower limit is below +5 °C.

Description

The heating function uses a combination consisting of a heating element and fans to force the heated air through the RBS air channel system. The heating function controls the internal temperature to above normal operation low limit.

45.2.5 Climate Supervision

The internal temperature and humidity of the air in the RBS are measured by sensors and kept within working ranges.

The following parameters are measured:

- The internal temperature outside the normal range
- The internal temperature outside the safe function range
- The internal relative humidity raised above the upper limit for safe function, see note below.

Administration

- The internal temperature in the RBS cabinet is readable.
- The internal realative humidity in the RBS is readable. See note below

Note: The humidity function is not needed for RBSs designed for indoor use according to ETSI 3.1.

45.2.6 Reliability

The cooling Climate Protection is available when the temperature is within the specified external normal condition range. Alarm reporting and administration are available within the safe function range.

The Heating function is available when the temperature is above the specified external normal condition low limit and up to an internal temperature of +5 °C. Alarm reporting and administration are available within the safe function range.

45.2.7 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.

When starting or restarting the RBS, actions are first taken to free the internal surfaces from condensation.

There are a number of startup scenarios, based on the internal temperature at the moment of startup:

- The internal temperature within the safe function range
  - The RBS power system and the user are connected
- The internal temperature is below the lower limit for safe function low limit
  - The internal temperature is increased by heating to above the lower limit for safe function. 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.

45.2.8 Power Disconnection

The users are disconnected from the DC power when the internal temperature falls below the lower limit for safe function.

The users are reconnected to the DC power when the internal temperature has raised 5°C above the lower limit for safe function.

46 EMC Capabilities

This specification 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.

The internal EMC capabilities of RBS 2000 and interference appearing on antenna ports are not covered by this chapter.

46.1 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. EN 61000–3–2, EMC part 3, section 2

   limits for harmonic current emissions, 1995

8. EN 61000–3–3, 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. EN 61000–4–2, 1995

   Electrostatic discharge requirements

10. EN 61000–4–4, 1995

    Electrical fast transient/burst requirement

11. EN 61000–4–5

    Surge Immunity Requirements

12. EN 61000–4–8, 1993

Power frequency magnetic fiels immunity tests

13. EN 61000–4–11

    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.

46.2 Concepts

External signal line - outdoor systems

	Cable or lead longer than 1 metre 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
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	Continous 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	Continous 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 occuring should be confined to a small number of external line interface circuits.

46.3 Capabilities

46.3.1 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

46.3.2 Conducted Emission

Table 125 Voltage fluctuation on AC power supply leads

Basic standard	EN 61000-3-3
Limit	Set by Table II in EN 61000-3-3

Table 126 Harmonics on AC power supply leads

Basic standard	EN 61000-3-2
Limit	Set by Table 1 in EN 61000-3-2

Table 127 Interference on AC power supply leads

Basic standard	EN 55 022
Limit	Class B

Limit standard	VDE 0878, Conducted emission, part 1
Limit	Class B

Table 128 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 129 Interference on signal and telecommunication lines

Basic standard	CISPR/G(sec) December 1993

46.3.3 Radiated Emission from Enclosure

Table 130 Electric field emission

Basic standard	EN 55 022
Limit	Class B

Table 131 Magnetic field emission

Limit standard	VDE 0878, Magnetic emission, part 1
Limit	Class B

46.3.4 Conducted Immunity on AC Input Power Ports

Table 132 Fast transient test

Basic standard	EN 61000-4-4
Test level	4 kV common mode between all lines and cabinet ground reference
Performance	Criteria B

Limit standard	ETS 300 342-2
Test level	4 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

Table 133 Surge test

Limit standard	ETS 300 342-2
Test level	2 kV common mode between all lines and cabinet ground reference [1)] 1 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 134 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 135 Voltage dips and interruptions on AC ports

Basic standard	EN 61000-4-11
Performance	Criteria A for a complete system

46.3.5 Immunity on DC Input/Output Power Ports

Table 136 Fast transient test

Basic standard	EN 61000-4-4
Test level	2 kV common mode between all lines and cabinet ground reference
Performance	Criteria B for a complete system

Limit standard	ETS 300 342-2
Test level	2 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

Table 137 Surge test

Limit standard	ETS 300 342-2
Test level	1 kV common mode between line and cabinet ground reference 0.5 kV differential mode, between line and line
Performance	Criteria A for a complete system Criteria TT for transmitter units Criteria TR for receiver units

Table 138 RF common mode test

Limit standard	ETS 300 342-2
Test level	3 V(rms)
Performance	Criteria A for a complete system Criteria CT for transmitter units Criteria CR for receiver units

46.3.6 Immunity on Telecommunication and External Signal Lines

Table 139 Fast transient test

Basic standard	EN 61000-4-4
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 140 Surge test 1.2/50 pulses

Limit standard	EN 61000-4-5
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

Table 141 Surge test 10/700 pulses

Limit standard	EN 61000-4-5
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 142 Power induction test

Basic standard	ITU-T K.20
Test level	600 V(rms) common mode
Performance	Criteria A(K.20)

Table 143 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

46.3.7 Radiated Immunity of Enclosure Port

Table 144 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 145 Immunity of 50/60 Hz magnetic fields

Basic standard	EN 61000-4-8
Test level	10 A/m, 50/60 Hz
Performance	Criteria A

46.3.8 Electro-static Discharges

Table 146 Immunity of enclosure port

Basic standard	EN 61000-4-2
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

47 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.

47.1 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.

/GSM 08.54/	GSM Technical Specification 08.54

All ITU-T references refer to the White Book (ITU=International Telecommunications Union).

47.2 Concepts

CMRU	Central Main Replaceble Unit. An RBS has exactly one CMRU. In the RBS 2000 hardware architecture, the DXU is the CMRU
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 or may not have a direct signalling link to the BSC.
RU	Replaceble Unit. An RU is the smallest unit that can be handled on site or in a repair center and of which information can be retrieved via OMT or BSC.
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.

Table 147 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 104 on page 351
Upstream	The path for information from the MS to the BSC, see Figure 104 on page 351
Linear Cascade Chain	A cascade of RBS:s according to Figure 104 on page 351

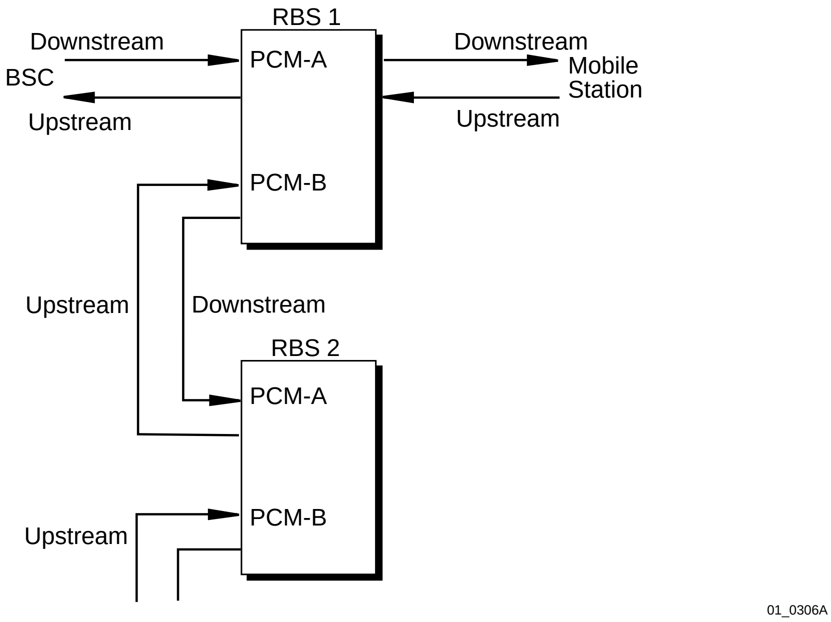

Figure 104 Upstream and Downstream

For further information, see ITU-T G.704 White Book.

47.3 Functions

47.3.1 Layer 1 Termination 2048 kbit/s

The function is initiated during restart of DXU.

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 or 120 ohm selectable 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 subsection Section 47.3.2 on page 352.
- Detection of fault conditions, alarm states, and consequent actions. This includes detection of:
  - LOS (Loss Of Signal)
  - LOF (Loss Of Frame alignment)
  - 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 Operation and Maintenance below)

Two PCM paths are supported: PCM-A and PCM-B.

47.3.2 Layer 1 Synchronization

Synchronization of layer 1 is either derived from one of the incoming PCM paths or taken from a free running oscillator. A PCM path

- with LOF (Loss Of Frame alignment), LOS (Loss Of Signal), AIS (Alarm Indication Signal) or
- that is “not available for synchronization” according to a parameter in RBS DB

cannot be used as reference source.

The synchronization of layer 1 is in one of three 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 -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

3. Neither PCM-A nor 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 B outgoing.

The default setting of PCM-A and PCM-B is:

PCM-A: “Available for synchronization”

PCM-B: “Not available for synchronization”

The parameters can be modified from OMT. The new setting is activated immediately. Thus, the updated parameters are used when the selection of synchronization source is performed.

47.3.3 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 the section Severely Errored Seconds Supervision.

This condition is set instead of ERATE when quality supervision including CRC-4 is used.

CSES ceases

More than N non-SES detected consecutively.

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.

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.

47.3.4 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.

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.

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.

The number of unavailable seconds for each direction is reported after each BI.

47.3.5 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 148 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

  - 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

47.3.6 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).

47.4 Operational Conditions

47.4.1 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 within the context of 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.

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48 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.

48.1 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.

Transmission references :

- ANSI T1.403-1989
- AT&T T1.5 Service (TR 62411) Dec. 1990
- Bellcore TR-NWT-000499 Apr. 1992

48.2 Concepts

CMRU	Central Main Replaceble Unit. An RBS has exactly one CMRU. In the RBS 2000 hardware architecture, the DXU is the CMRU
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 or may not have a direct signalling link to the BSC.
RU	Replaceble Unit. An RU is the smallest unit that can be handled on site or in a repair center and of which information can be retrieved via OMT or BSC.
Extended superframe format	The content and structure of the F-bit is described in the figure below. This figure is included to ease the understanding of the functions Layer 1 Termination and Supervision of Transmission Faults.

Table 149 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)

Downstream	The path for information from the BSC to the MS, see Figure 105 on page 363.
Upstream	The path for information from the MS to the BSC, see Figure 105 on page 363.
Linear Cascade Chain	A cascade of RBS:s according to Figure 105 on page 363.

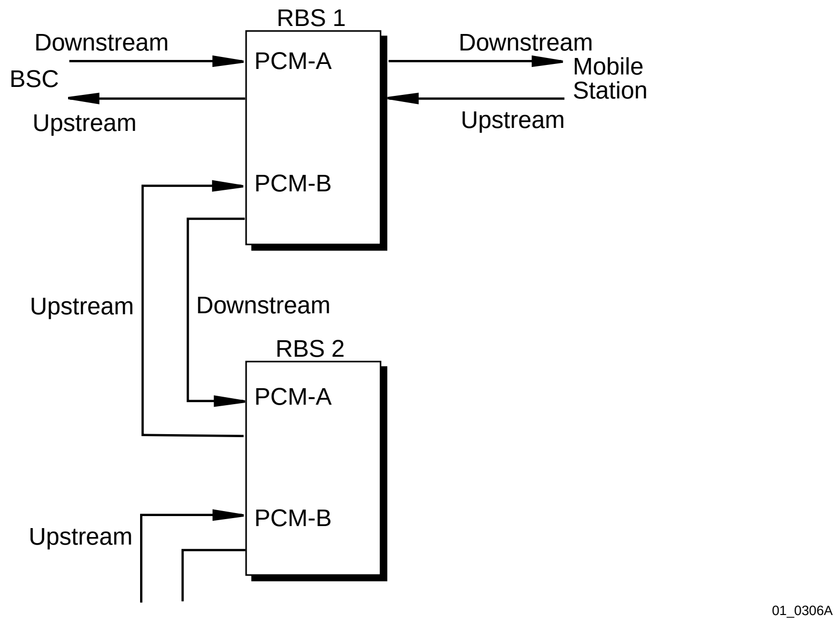

Figure 105 Upstream and Downstream

48.3 Functions

48.3.1 Layer 1 Termination DS1 1544 kbit/s

The function is initiated during restart of DXU.

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 ohm, resistive).
- Frame structure according to ANSI T1.403, ESF. T option only, see Table 149 on page 362. 8 traffic bits in all frames in the ESF.
- Line coding B8ZS according to AT&T section 4.2.2. (ref. 4). B8ZS is the only technology to provide 64 kb/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 6.4(2)) is transmitted. The Data Link is used for RAI (Remote Alarm Indication, "Yellow Alarm") information in both directions. See Table 149 on page 362.
- Frame alignment and CRC-6 procedures according to ANSI T1.403, 24-frame ESF.

- Input jitter and wander tolerance according to AT&T Accunet T1.5 Service 1990 (TR 62411). This tolerance is valid for PCM-A and PCM-B respectively. The tolerance of relative phase differance (that is, phase differance between PCM-A and PCM-B) is 56 UI_{PTP}
- 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 (Loss Of Frame), LOS (Loss Of Signal), ERATE (Excessive error RATE), AIS (Alarm Indication Signal, “Blue Alarm”), and RAI (Remote Alarm Indication). It also includes a consequent action. The consequent action for the faults LOF, LOS, ERATE, AIS and UAST (UnAvailable STate) 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.

48.3.2 Layer 1 Synchronization

Synchronization of the outgoing signals (on the transport network interface) is according to AT&T T1.5 Service (TR 62411) dec. 1990, chapter 6 “Synchronization and Timing”.

Synchronization of layer 1 is either derived from one of the incoming PCM paths or taken from a free running oscillator. A PCM path

- with LOF (Loss Of Frame alignment), LOS (Loss Of Signal), AIS (Alarm Indication Signal) or
- that is “not available for synchronization” according to a parameter in RBS DB

cannot be used as reference source.

The synchronization of layer 1 is one of four states:

1. Both PCM-A and 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.

2. 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.

3. 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.

4. Neither PCM-A nor 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 B outgoing.

The default setting of PCM-A and PCM-B is:

PCM-A: “Available for synchronization”

PCM-B: “Not available for synchronization”.

The parameters can be modified from OMT. The new setting is activated immediately. Thus, the updated parameters are used when the selection of synchronization source is performed.

48.3.3 Supervision of Transmission Faults

The supervision is initiated during restart of DXU.

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 (Exessive 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.

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 (that is 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.

48.3.4 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 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 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.

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 (193 bits) is either lost or duplicated.

The SF counter is incremented 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 incremented 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 incremented 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

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 events:

- N1 CRC-6 errors or
- 1 LOF or
- 1 LOS or
- 1 AIS

The upstream counter is incremented 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.

48.3.5 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
  - 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

48.3.6 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).

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49 Terrestrial Link Handling

This function specification 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.

49.1 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.

49.2 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.

49.3 Function

49.3.1 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/.

49.4 Operational Conditions

49.4.1 Operation and Maintenance

Maintenance functions relating to definition of layer 2 address (TEI) are described within the context of Operation and Maintenance Terminal.

49.4.2 Capabilities

Not applicable.

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50 Channel Distribution Function

This function specification 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.

50.1 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.

50.2 Concepts

Channel	A channel is a 16, 32 or 64 kbit/s connection between two entities connected to the switch (see Figure 106 on page 376). 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.

RSL	Radio Signalling Link. Layer 2 communication link for traffical 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.

50.3 Functions

The CDF (Channel Distribution Function) switches channels between the entities connected to the switch. See figure below:

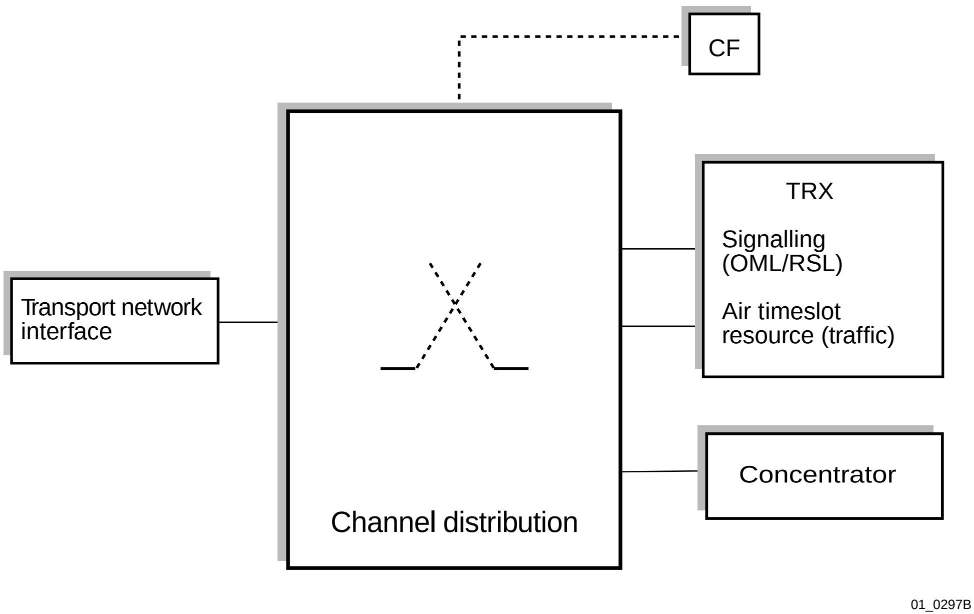

Figure 106 Channel distribution function (CDF)

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.

Configuration includes set-up 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 subtimeslots 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 62 (2x31) timeslots for a 2 Mbit/s system and 48 (2x24) timeslots for a 1.5 Mbit/s system. This corresponds to two PCM lines.

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, i.e. 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 the table below. The ICPs for timeslots 25—31 are only valid for 2 Mbit/s systems.

Table 150

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

The range 256—351 defines the concentrator.

The ranges 512—575 and 640—711 define the TRXs.

Table 151

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

50.3.1 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.

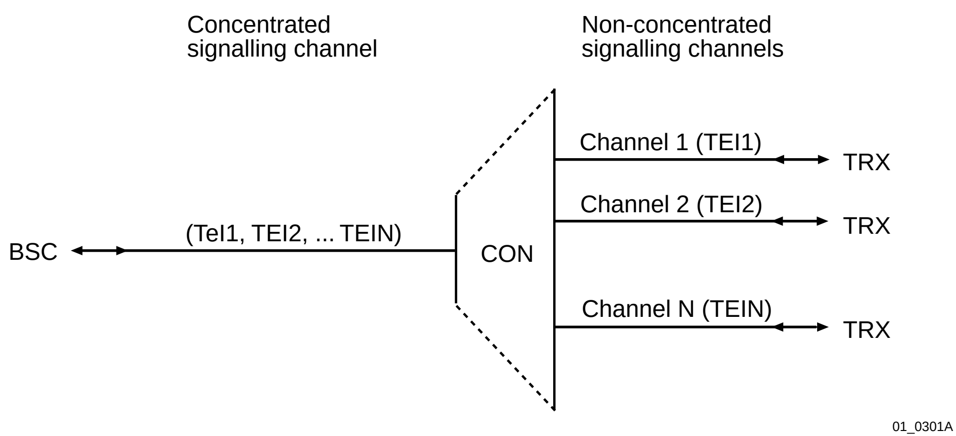

Figure 107 One N:1 concentrator Connection Group (CG)

Messages are sent forward to their destinations without adding, deleting or changing information.

The concentrator is configured by A-bis commands as described within the context of 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 within the context of Selftest and Supervision. If a new message is received 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 bitrate for the concentrated channels is limited to 64 kbit/s, i.e. LAPD concentration and LAPD multiplexing can not be combined.

50.3.2 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 except TN O&M channel 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.

Timeslot for TN O&M is considered as occupied and is not scanned in CF scanning procedure.

The function is terminated when the layer 2 link to CF is established or when CMRU enters Local mode.

50.3.3 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.

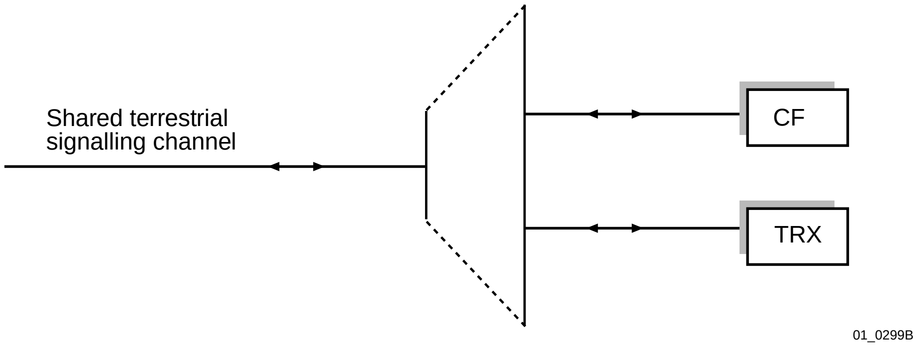

Figure 108 Sharing terrestrial signalling channel

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.

50.3.4 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) and port B towards the next RBS etc.

Only RBSs supporting multidrop can be included in the multidrop connection chain. The figure illustrates the case with three RBSs.

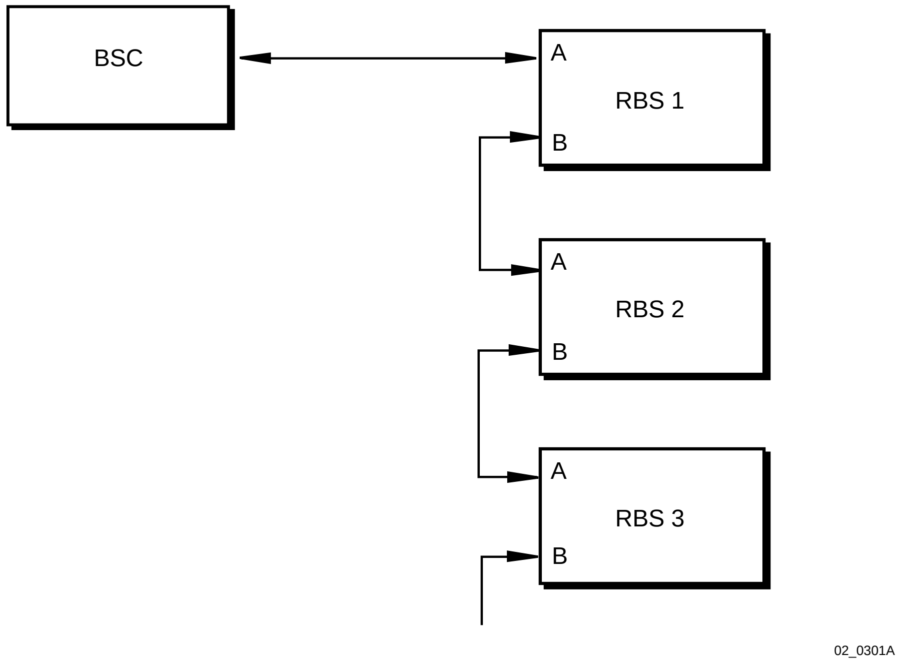

Figure 109 Linear Cascade Connection

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 subtimeslots are configured in the IS or used for the CF or remote OMT link or used for DXX communication.

If, for example, ICP 7 is used in the IS configuration, the whole timeslot 2 is considered to be used by the current RBS.

The figure below 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.

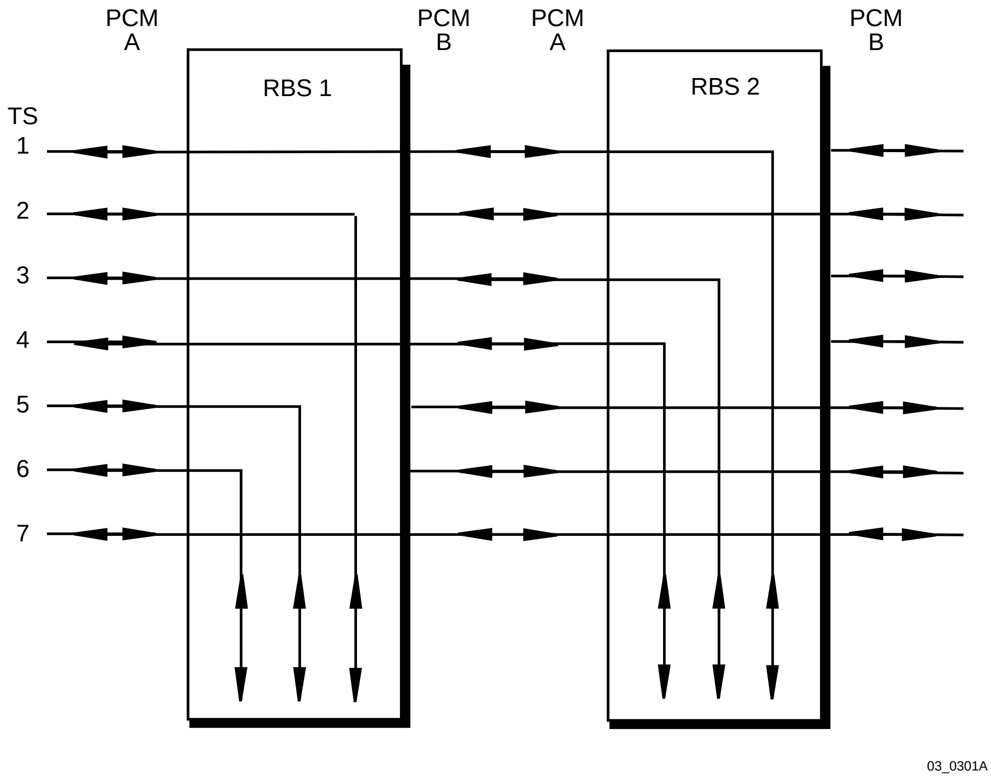

Figure 110 Multidrop example

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 (DXX line loop back) at PCM-B, the RBS transmits idle pattern on all timeslots not dedicated for the RBS itself on PCM-A output presuming that PCM-A is not in loop mode. Idle pattern is transmitted until the loop mode on PCM-B is left.

When entering loop mode (DXX line loop back) at PCM-A, idle pattern is transmitted on PCM-B output presuming that PCM-B is not in loop mode. Idle pattern is transmitted until the loop mode on PCM-A is left.

Idle pattern is not transmitted on timeslot for the TN O&M channel.

The function is terminated when the parameter Network Topology is set to not indicate multidrop.

50.3.5 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 by other functions. The timeslot is in use when it:

- is configured in the IS (subchannels with bitrate other than 64 kbit/s, TN O&M timeslots, traffic functions)
- carries the CF link
- is scanned for the CF link

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

The remote OMT link uses a protocol based on LAPD. The TEI value used is 0 and the SAPI value used in the range 20 - 30.

50.4 Operational conditions

50.4.1 Operation and maintenance

Not applicable.

50.4.2 Capabilities

The maximum number of concentration groups is 12 and the concentration ratios 1:1 to 12:1 (this is only valid for RBS).

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 (PCM-A) path can be used for communication towards the BSC.

A maximum of five RBSs can be connected in a linear cascade chain.

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51 Transport network O&M functions-DXX Support

51.1 Introduction

This Function Specification covers RBS functions for Transport Network Operation and Maintenance.

The functions are divided into two groups with Transport Network Operation and Maintenance generic functions including:

- Enabling and detection of TNOM protocol
- Allocation of TNOM time slot

and DXX specific functions including:

- Node identity
- Node access control
- Node real time control
- Current alarm report
- Alarm history report
- G.821 Performance reports
- Fault masks
- Loop-back
- Node inventory
- DXX protocol handling

With Transport Network O&M and “DXX support” in RBS 2000, it is possible to connect an RBS to DXX without using a DXX transport module.

In the Figure 111 on page 386, an example of how the functionality “DXX support” can be used in a network is shown.

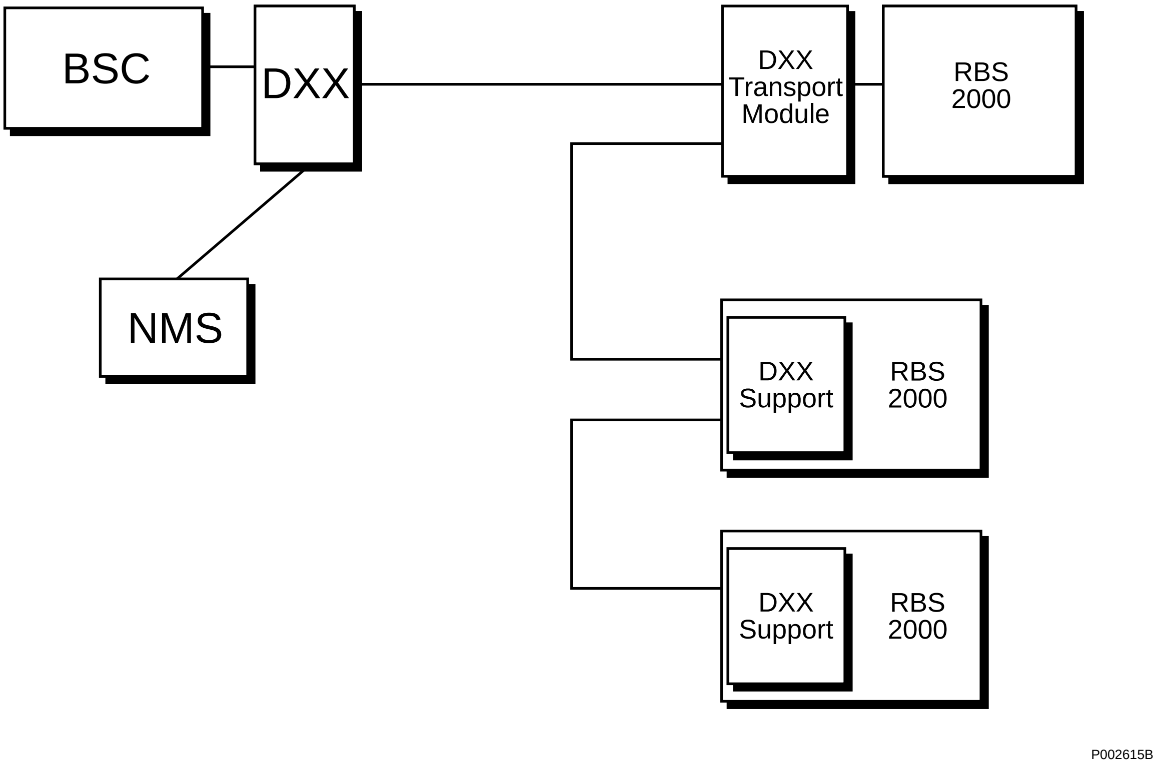

Figure 111 Example of DXX support in an RBS 2000 network.

The RBS 2000 nodes including the DXX support functions will be visible as nodes in DXX/NMS, and the layer 1 transmission in the RBS nodes will be supervised from NMS. The DXX support provides early warnings in case of faults and degradation of the trunks, enabling the operator to take actions at an early stage. The functions are described in Section 51.4 on page 388

DXX uses specified layer 3, and layer 7 protocols for the transport network O&M. The layer 2 protocol used is LAPB. The protocols used are described in Section 51.4 on page 388.

51.2 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.

All ITU-T references refer to the White Book (ITU = International telecommunications Union).

[TIH_E1]	Function group Transmission Interface Handling G.703 2048 kbit/s.
[TIH_T1]	Function group Transmission Interface Handling DS1 1544 kbit/s.
[X.25]	ITU-T Recommendation X.25, interface between DTE and DCE.

51.3 Concepts

In Figure 112 on page 387, the nomenclature for DXX is stated.

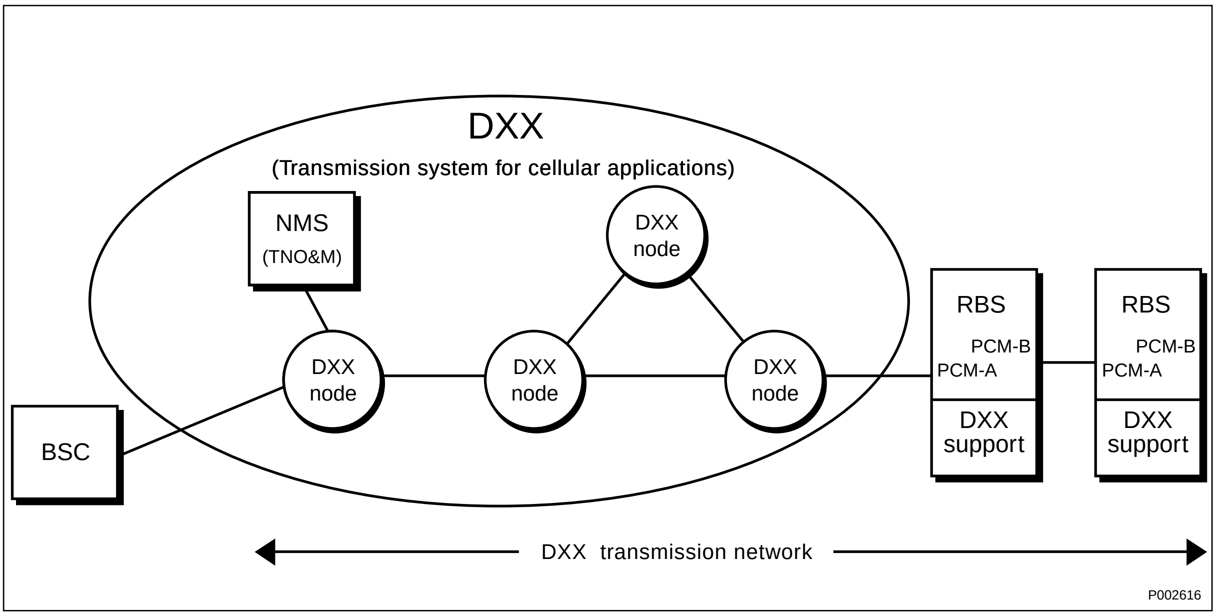

Figure 112 DXX terminology.

DXX	DXX is a transmission system for cellular applications. It includes O&M and switching functionality (among others). The O&M centre is named NMS.
DXX node	A node in the DXX system.
DXX support	DXX support is O&M functions in RBS 2000 intended for DXX. DXX support is a portion of the functionality in a DXX transport module.
DXX transport module	A DXX node suitable to fit in the RBS 2000 cabinet.
NMS	The Network management system in DXX. Hence, NMS is TN O&M for DXX.
TN O&M	Centrally located management system for transport networks and transmission equipments in general, such as digital cross connectors, line terminals, multiplexors and microwave links.
RBS2000–DXX O&M	The protocols used between an RBS with DXX support and a DXX node with RBS support.

51.4 Functions

51.4.1 Enabling and detection of TNOM protocol

This function is initiated when the parameter TNOM_use in the RBS database is set to on.

This function is used to control the enabling and disabling of the Transport Network O&M functions in RBS 2000. The parameter TNOM_use stored in RBS DB is used for this.

When the function is disabled no management timeslot is dedicated for the Transport Network O&M functions. Instead the timeslot will be used by BSS for internal use i.e. for traffic and signalling.

When is enabled the Transport Network O&M functionality is active, and will work as described in this function specification. The first received message after the function has been enabled is detected and enables the protocol stack for the received protocol if recognized.

If the protocol is not recognized no protocol stack is enabled. This functionality can be regarded as an auto detection of TNOM protocol type.

51.4.2 Allocation of TNOM timeslot

This function is initiated during restart of the DXU if the parameter TNOM_use in RBS DB is already set to ON, otherwise the function is initiated when the parameter is set to ON.

The communication between RBSes or RBS and DXX is performed on a 64 kbit/s timeslot in the PCM link. The PCM link is either 2048 or 1544 kbit/s.

This function allocates a 64 kbit/s timeslot for the TN O&M management channel. When RBS is configured as stand alone, one timeslot with the same timeslot number is allocated for both PCM-A and PCM-B. When RBS is configured in cascaded chain , the same timeslot number is used for PCM-A and PCM-B. A full 64 kbit/s timeslot is used, thus not supporting FDL or spare bits in TS 0 to be used.

The TNOM timeslot number is stored in RBS DB.

The TNOM timeslot has priority to the access of timeslots within RBS. Timeslot used for TNOM will be removed from available timeslots shown in capabilities.

51.4.3 DXX Node identity

This function is initiated during restart of the DXU if the parameter TNOM_use in RBS DB is already set to ON, otherwise the function is initiated when the parameter is set to ON.

This function sets and changes the Node id for the RBS. The RBS node has a unique node identity (a node number) for communication with the DXX network and for appearance in the NMS. The node identity is stored in RBS DB and has not to be the same as RBS TEI value.

The node identity can be set and changed from the OMT, as well as from the DXX. No one has priority on the parameter , i.e. the last value set is the valid node id.

51.4.4 DXX Node access control

This function is initiated during restart of the DXU if the parameter TNOM_use in RBS DB is already set to ON, otherwise the function is initiated when the parameter is set to ON.

The RBS support a node access control that is used to limit access rights to the node from DXX. This function maintains the node access registers.

The value for node access possible to set from DXX are 1 to 65535 for limited access rights. If the node access list is empty (i.e. it does not contain any non-zero access control id) then all management operations are allowed. If the node access control list contains one or more non-zero access id:s then only the Invokes (requests) having the access id which can be found in the node access list are processed.

The RBS node will always respond on an invoke containing the node access id equal to zero.

51.4.5 DXX Real time control

This function is initiated during restart of the DXU if the parameter TNOM_use in RBS DB is already set to ON, otherwise the function is initiated when the parameter is set to ON.

This function controls the administration of “Real time of node” and “Relative time of unit” clocks.

It is possible from DXX to set a real time clock (Real time of node). This clock is used for time stamps in alarm and performance reports. The real time clock is used with a relative clock counter (Relative time of unit), that is used to make time-stamps on individual fault events.

The real time of node counter has the possible values between 0 and 4 294 967 295. The relative time of unit counter has the same value range. Both counters are incremented by one every 10 ms, where the real time counter can be reset by NMS command while the relative counter is free running.

51.4.6 DXX Current alarm report

This function is initiated during restart of the DXU if the parameter TNOM_use in RBS DB is already set to ON, otherwise the function is initiated when the parameter is set to ON.

This function sends Alarm reports from RBS to DXX upon requests. The DXX polls the RBS asking for changes in fault events , and request reports if the fault event condition has changed since the last poll.

Alarm reports can be sent for monitored faults such as Loss Of Signal (LOS), Loss Of Frame (LOF), Alarm Indication Signal (AIS), Remote Alarm Indication (RAI) etc. the fault conditions supervised are related to PCM-A, PCM-B and common parts respectively.

The reports uses the Real time of node for time stamps and the individual faults uses the Relative time of unit for their time stamps. See Section 51.4.5 on page 389.

The fault conditions monitored within the common parts of the RBS are:

- Flash check sum error

  A problem has been found when saving parameters to the non-volatile memory.

- Reset

  There has been a unit reset (detected always after the power-up of the unit), and the TN O&M functions has restarted. The reset is reported as a delta alarm event. With delta alarm event means an event has occurred but is still not active.

The fault conditions monitored within the interfaces PCM-A and PCM-B of the RBS are:

- Rx signal missing (LOS)

  According to [TIH_E1] and [TIF_T1].

- Frame alignment lost (LOF)

  According to [TIH_E1] and [TIF_T1].

- Rx signal AIS

  According to [TIH_E1] and [TIF_T1].

- BER 10^{-3} (ERATE)

  According to [TIH_E1] and [TIF_T1]. When CRC-4 is enabled the CSES is used in accordance with [TIH_E1].

- Remote Alarm Indication (RAI)

  According to [TIH_E1] and [TIF_T1]

- Loop - Mux/Demux back to line

  This status is activated when the DXX loop is activated. Rx data is looped back to the interface transmitter.

- G.821 limit event

  This fault will be activated as a delta event when at least one G.821 performance limit has been exceeded in a 15–minute period. See also Section 51.4.8 on page 391. With delta alarm event means an event has occurred but is still not active.

- G.821 Unavailable state (UAST)

  This signal will be activated when the state of the signal becomes unavailable. The fault will be deactivated when the state becomes available again. Unavailable state is declared at the onset of 10 consecutive SES. These 10 seconds are considered to be part of the unavailable time.

- Fault masked/test

  This fault will be activated when the interface fault mask setting is ON (all interface faults will be cleared).

- Rx Buffer slip/BUFIN (Slip)

  This fault is only used for E1. The fault is activated if one or more buffer slips have been detected during the last hour. A slip is defined as where one frame (0.125 ms) is either lost or duplicated.

- Status for CSU line loop back, LLB (T1)

  This message is only used for T1. It indicates that the CSU line loop back is activated.

- Status for CSU payload loop back, PLB (T1)

  This message is only used for T1. It indicates that the CSU payload loop back is activated.

51.4.7 DXX Alarm history report

This function is initiated during restart of the DXU if the parameter TNOM_use in RBS DB is already set to ON, otherwise the function is initiated when the parameter is set to ON.

This function sends Alarm history reports to DXX. The reports are sent from RBS to DXX upon request. The fault conditions are described in Section 51.4.5 on page 389.

The RBS maintains an alarm history in its alarm event log which is a ring buffer for 100 latest alarm events. The alarm events are:

alarm on, alarm off and delta (combined alarm on and off).

The delta alarm event type is used when an alarm is turned on and off within a short period, i.e. an alarm has occurred but is not still active.

51.4.8 DXX G.821 Performance reports

The following statistics are provided in G.821 performance reports:

- Total Time (TT)
- Available Time (AT)
- Severely Errored Seconds (SES)
- Errored Seconds (ES)
- Degraded Minutes (DM)
- Number of CRC errors from far end (CRCE)
- Number of seconds when RAI has been received (RAI)
- Number of Code Violation (CV)
- Number of CRC block errors (CRC)
- Number of faulty Frame Synchronization Word (FSW)
- Number of lost Frame Synchronization (FS)
- Number of Rx Buffer slip (BUFIN)

Each of the statistics are supported by two groups of registers and two groups of counters providing the performance data. The registers and counters can be read and reset.

They are:

- Counters for current 15 minutes report
- Registers for previous 15 minutes report
- Counters for current 24 hours report
- Registers for previous 24 hours report

The information of the 15 minutes counters and registers are sent together in one report. The information of the 24 hours counters and registers are sent together in another report.

G.821 limits alarm

An alarm is activated when at least one G.821 performance limit has been executed in a 15–minute period. The performance limits can be changed from DXX.

The G.821 Performance limits supervised are:

- Limit for Severely Errored Seconds (SES), with the values between 0 and 900.
- Limit for Errored Seconds (ES), with the values between 0 and 900.
- Limit for CRC-E, with the values between 0 and 65000.
- Limit for Remote Alarm Indication (RAI), with the value between 0 and 900.

G.821 Performance basic statistics counters

For limited statistics a number of counters are reported with a performance counter value. The counters can be read and reset on request.

The following counters are supported:

- Total Time (TT)
- Available Time (AT)
- Severely Errored Seconds (SES)
- Errored Seconds (ES)
- Degraded Minutes (DM)

Description of performance data

AT	Available time is the total time (TT) minus unavailable time (UAT). A period of unavailable time (UAT) begins at the onset of 10 consecutive SES. These 10 seconds are considered to be

part of the unavailable time. A new period of available time begins at the onset of 10 consecutive seconds with no SES detected. These 10 seconds are considered to be part of the available time.

SES

A severely errored second (SES) is a second with at least one of the following events.

For E1 system:

- At least N1 CRC errors (when CRC is used)

- At least N4 Faulty FSW (when CRC is not used)

- Loss of frame alignment (LOF)

- Loss of signal (LOS)

- Alarm indication signal (AIS)

and for T1 system:

- At least N1 CRC errors

- Loss of frame alignment (LOF)

- Loss of signal (LOS)

- Alarm indication signal (AIS)

The default values N1 and N4 are stated in, and the SES is performed in accordance with [TIH_E1] and [TIH_T1].

ES

An error second (ES) is a second with at least one of the following events:

For E1 system:

- At least 1 CRC errors (when CRC is used)

- At least 1 Faulty FSW (when CRC is not used)

- Loss of frame alignment (LOF)

- Loss of signal (LOS)

- At least one slip

- Alarm indication signal (AIS)

- At least N1 CRC errors

- Loss of frame alignment (LOF)

- Loss of signal (LOS)

- At least one slip

	- Alarm indication signal (AIS) The SES is performed in accordance with [TIH_E1] and [TIH_T1].
DM	One minute interval with one of the following but not SES or UAT: For E1 system: - 123 CRC errors (when CRC is used) - 2 faulty FSW (when CRC is not used) and for T1 system: - 52 CRC errors
CRCE	Numbers of CRC errors from far end is indicated by the E-bit in time slot 0. Only used when the node is configured for CRC-4.
RAI	Number of seconds when Remote Alarm Indication (RAI) has been received.
CV	Number of line code errors (when the line code has been violated). This is not reported when the CRC-4 is used (enabled).
CRC	Number of Cyclic Redundancy Check (CRC) block errors detected.
FSW	Numbers of faulty frame synchronization words. One count every time one or more faulty bits in frame alignment word has been detected.
FS	Numbers of lost frame alignment. One count every time the frame synchronization is lost.
BUFIN	Number of detected buffer slips on the receiver interface (Rx).

51.4.9 DXX Fault masks

This function is initiated during restart of the DXU if the parameter TNOM_use in RBS DB is already set to ON, otherwise the function is initiated when the parameter is set to ON.

This function maintains fault mask filters, making it possible to inhibit fault reporting. Two type of fault masks do exist;

- Fault freezing, and
- Fault masks

Fault freezing

It is in RBS possible to set a fault mask to freeze fault monitoring of a specified block at a specified period of time. The blocks are PCM-A, PCM-B and Common parts (SW faults). The time out value is 0 to 10 000 000 seconds.

With the fault freezing activated the fault status of the RBS is frozen, i.e. the faults are neither updated nor reset. Fault monitoring is enabled automatically after the time-out time has expired or immediately by the management operation where the time-out time is set to zero.

Fault masks

It is possible from DXX to mask all faults from an RBS or from a specific interface (i.e. prevent the interface from generating alarms). It is also possible from DXX to specify certain individual fault masks.

When the fault mask is active the potential faults are neither supervised, nor reported, except for an alarm indicating that the fault mask is enabled.

The following attribute (status) have individual fault masks possible to enable/disable on interface basis (PCM-A and PCM-B).

- AIS inhibit (also called AIS Failure fault mask):

  When ON, a received AIS failure does not generate an alarm. This parameter is OFF as a default.

- RAI inhibit (also called RAI fault mask):

  When ON a received RAI does not generate an alarm. This parameter is OFF as default.

The AIS inhibit or RAI inhibit does not generate the fault mask alarm.

51.4.10 DXX Loop back

This function is initiated during restart of the DXU if the parameter TNOM_use in RBS DB is already set to ON, otherwise the function is initiated when the parameter is set to ON.

This function controls line loop in the RBS interface PCM-A and PCM-B, to be used for test purposes. The line loop, loops back all timeslots except the TNOM timeslot. The timeslot 0 (for E1) and F bit (for T1) are not looped back either. This loop is referred to as “DXX line loop” or “DXX loop back to interface”.

The “DXX line loop” does not necessarily maintain the timeslot integrity. During “DXX line loop”, the timeslots do keep their position in the primary rate (1.5 or 2 Mbit/s) frame. Hence, incoming timeslot 17 has to be outgoing timeslot 17.

The delay in the RBS can be different for different timeslots. Hence, timeslots that come in to the RBS in the same frame do not have to be in the same frame when they leave the RBS.

The “DXX line loop” is controlled from DXX individually for PCM-A and PCM-B. The loop is possible to set with a timeout value to release the specific loop. The timeout value is between 1 and 65 000 minutes, in steps of 1 minute.

Both CSU line loop back and CSU payload loop back have higher priority than the DXX line loop. This means that the DXX loop will be suspended when CSU loops (PLB or LLB) is activated. When CSU loop is deactivated, the DXX loop is resumed again.

51.4.11 DXX Node inventory

This function is initiated during restart of the DXU if the parameter TNOM_use in RBS DB is already set to ON, otherwise the function is initiated when the parameter is set to ON.

This function maintain the RBS node inventory and settings of the transmission interface parameters. The parameters controlled from BSS cannot be modified from DXX.

It is from DXX possible to make a node inventory in order to view the HW and SW status of the DXU, as well as the interface parameter settings.

Node inventory

Hardware types and software types and versions (revisions) can be retrieved by request from DXX.

The SW type and version is the type and version for the specific DXX support software (not for the RBS software).

The HW type inventory include RBS-E1 and RBS-T1.

Transmission interface parameter settings

It is also possible from DXX to get the parameter settings for the transmission interface in the RBS.

The parameter settings that can be fetched are:

- Status of TS0 Sa bits “1” or “0”.
- CRC4 ON or OFF.
- TN O&M timeslot allocation.
- Type of interface selected. The interface options are: E1 long-haul, E1 short-haul, T1 long-haul, T1 short-haul, and E1 external HDSL modem.
- Alarm fault filter parameters (see Section 51.4.9 on page 394).
- Performance limit parameters (see Section 51.4.8 on page 391).

51.4.12 Administration of TNOM generic functions

The TNOM generic functions are administrated from the OMT by use of the parameters TNOM_use, TNOM_timeslot and TNOM_nodeid.

Application Parameters

TNOM allocationThe parameter used for the Transport Network O&M Timeslot allocation is: TNOM_use

The valid range of the parameter is:ON (Auto)OFF

TNOM timeslotThe parameter used for the Transport Network O&M Timeslot allocation is:TNOM_timeslot

The valid range of the parameter is:1–31 for E11–24 for T1

TNOM node IdThe parameter used for the Transport Network O&M Node Id allocation is:TNOM_nodeid

The valid range of the parameter is:1–65534

The parameters can be modified from the OMT. The parameter TNOM_nodeid can be modified from DXX as well. The new settings are activated immediately.

51.4.13 Administration of DXX specific functions

The DXX specific functions are maintained via the interface 'RBS2000–DXX O&M'.

Application Parameters

The parameters used for the Node identity function are handled by:Object 50 (SUBRACK_INVENTORY)

The parameters used for the Node access control are handled by:Object 44 (NAC_OBJECT)

The parameters used for the Real time control function are handled by:Object 44 (RTC_OBJECT)

The parameters used for the Current alarm report are handled by:Object 6 (CURRENT _ALARMS)Object 40 (SUBRACK_STATE)Object 41 (NODE_STATE)

The parameters used for the Alarm history report are handled by:Object 7 (ALARM_HISTORY)

The parameters used for the G.821 performance report are handled by:Object 23 (G.821_OBJECT)

The parameters used for the Fault mask function are handled by:Object 27 (FLM_OBJECT)Object 228 (IFM_OBJECT)

The parameters used for the Loop back function are handled by:Object 227 (LL_OBJECT)Object 226 (CONTROLS_TIMEOUT)

The parameters used for the Node inventory function are handled by:Object 2 (UNIT_IDENT)Object 17 (INTERFACE_LOCKING)Object 18 (INTERFACE_MODULE)Object 50 (SUBRACK_INVENTORY)Object 230 (HDLC_MODE)Object 240 (TS0B4..B8_OBJECT)Object 243 (TS0B1_OBJECT)

51.4.14 DXX Protocol Handling

This function is initiated during restart of the DXU if the parameter TNOM_use in RBS DB is already set to ON, otherwise the function is initiated when the parameter is set to ON.

The DXX protocol is implemented as four layers in the ISO OSI layer model, layer 1,2,3 and 7. These layers correspond to physical link layer, data link layer, network layer, and application layer respectively.

A message that is received at PCM-A in RBS is processed according to layer 1, 2 and 3. In layer 3, the destination node id is housed. If the current RBS is the destination node, the message is sent to layer 7. If the RBS is in topology ’Cascaded chain’ and not the destination node, the message is sent to the next RBS via PCM-B. The same is valid in the other direction receiving data on PCM-B.

Fault handling

- Layer 2 (Data link layer)Faults in data within the data link layer are handled in accordance with the ITU-T specification X.25. [X.25].
- Layer 3 (Network layer)Faults in data within the network layer are checked regarding to fixed header values, data length and data check sum. Faulty messages are discarded. New messages will be sent from NMS based on time-outs in its application layer.
- Layer 7 (Application layer)Faults in data within the application layer are handled according to the following:
  - An RO-Reject is sent from RBS to DXX (an agent to a manager) if the command is not reasonable enough to give either an RO-Result or an RO-Error. The fault status can be one or more of the following: Parameter error, Context error, Functional error or Unknown object.
  - An RO-Reject is sent from RBS to DXX (an agent to a manager) if the command is reasonable enough to give an answer but when at least one of the operation is not OK.

51.5 Operational conditions

51.5.1 Operation and Maintenance

Maintenance data such as enabling of the TNOM function, selection of timeslot for the TNOM management channel and selection of node identity can be set by the OMT. This is described within the context of Operation and Maintenance Terminal.

The values of the node identity can also be set by the NMS in DXX.

All other functions are operated from DXX using the ’RBS2000–DXX O&M’ interface (protocol).

52 BTS Parameter Limitations

This document 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 document.

52.1 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.

52.2 References

- 6/155 19–HSC 103 12 Uen

  Abis O&M Interface, Part II, Procedures
- 5/155 19–HSC 103 12 Uen

  Abis O&M Interface, Part I, Model
- 3/1551–APT 210 09 Uen

  Translation of Abis O&M IWD Parameters - BSC Command Parameters

52.3 Parameters

The parameters listed in this document are extracted from the Data Elements listed in the Abis O&M IWD document (see reference 1). This document 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.

Note: See reference 3 for BSC Commands.

52.3.1 Accordance Indication

BTS-supported value range:

AIP: 0 – 1, 3

IWD-defined value range: 0 – 3

52.3.2 Alarm Status Type

BTS-supported value range:

Alarm status type: 1

IWD

IWD-defined value range: 0 – 1

52.3.3 BS_AG_BLKS_RES

BTS-supported value range:

BS_AG_BLKS_RES: 0 – 1

IWD-defined value range: 0 – 7

52.3.4 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

52.3.5 Extended Range Indicator

BTS-supported parameter range:

ERI: 0 (extended range off)

IWD-defined value range: 0 – 1

52.3.6 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
LMT:	0

52.3.7 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

52.3.8 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.

52.3.9 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 ($052D_{(hex)}$)

52.3.10 Frequency List

BTS-supported value range:

ARFCN, 900 MHz:	1 – $124_{(dec)}$ (option 1) 0 – 124, 975 – $1023_{(dec)}$ (option 2) 0 – 54, 955 – $1023_{(dec)}$ (option 3)

ARFCN, 1800 MHz: $512 – 885_{(dec)}$

ARFCN, 1900 MHz: $512 – 810_{(dec)}$

Note: Valid 900 MHz "option" is dependent on hardware configuration.

IWD-defined value range:

ARFCN, 900 MHz: $0 – 124, 975 – 1023, 955 – 974_{(dec)}$

ARFCN, 1800 MHz: $512 – 885_{(dec)}$

ARFCN, 1900 MHz: $512 – 810_{(dec)}$

52.3.11 Frequency Specifier RX

BTS-supported value range:

ARFCN, 900 MHz: $1 – 124_{(dec)}$ (option 1)
$0 – 124, 975 – 1023_{(dec)}$ (option 2)
$0 – 54, 955 – 1023_{(dec)}$ (option 3)

ARFCN, 1800 MHz: $512 – 885_{(dec)}$

ARFCN, 1900 MHz: $512 – 810_{(dec)}$

Note: Valid 900 MHz "option" is dependent on hardware configuration.

IWD-defined value range:

ARFCN, 900 MHz: $0 – 124, 975 – 1023, 955 – 974_{(dec)}$

ARFCN, 1800 MHz: $512 – 885_{(dec)}$

ARFCN, 1900 MHz: $512 – 810_{(dec)}$

52.3.12 Frequency Specifier TX

BTS-supported value range:

ARFCN, 900 MHz: $1 – 124_{(dec)}$ (option 1)
$0 – 124, 975 – 1023_{(dec)}$ (option 2)
$0 – 54, 955 – 1023_{(dec)}$ (option 3)

ARFCN, 1800 MHz: $512 – 885_{(dec)}$

ARFCN, 1900 MHz: $512 – 810_{(dec)}$

Note: Valid 900 MHz "option" is dependent on hardware configuration.

IWD-defined value range:

ARFCN, 900 MHz: $0 – 124, 975 – 1023, 955 – 974_{(dec)}$

ARFCN, 1800 MHz: $512 – 885_{(dec)}$

ARFCN, 1900 MHz: $512 – 810_{(dec)}$

52.3.13 IS Connection List

BTS-supported value range:

ICP: $4 - 127_{(dec)}$
$132 - 351_{(dec)}$
$512 - 583_{(dec)}$
$640 - 711_{(dec)}$

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 the figure in Appendix.

52.3.14 Local Access State

BTS-supported value range:

Local Access State parameter: 0

IWD-defined value range: 0 – 1

52.3.15 MO Identifier

Table 152 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

52.3.16 MO State

Table 153 BTS-supported codes

Code	**MO State Parameter**	**Used by MO**
00	Reset	CF, IS, TRXC, RX, TF, TS, TX, DP, CON
01	Started	CF, TRXC
02	Enabled	IS, RX, TF, TS, TX, DP, CON
03	Disabled	IS, RX, TF, TS, TX, DP, CON

IWD-defined value range: 00 – 03

52.3.17 Power

Note: Only the following macro configurations are supported: RBS 2101, RBS 2102 and RBS 2202 with configurations 1x2, 2x2, 3x2, CDU-A for 900 MHz, CDU-A with TMA for 1800 MHz and 1900 MHz.

BTS-supported value range.

Nominal power parameters:

900 MHz:	35 – 47, 49[1] $_{(dec)}$
1800 MHz:	33 – 45, 47[1] $_{(dec)}$
1900 MHz:	33 – 45, 47[1] $_{(dec)}$
IWD-defined value range:	0 – 63 $_{(dec)}$

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

1) BSC uses this value to activate SW Power Boost (the value does not describe the actual output power). The RBS then uses TX diversity, and configures each transmitter that supports the master-slave configuration to max. power (for example 47 dec for Macro 900 MHz). An RBS with Filter Combiner does not support SW Power Boost.

52.3.18 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

52.3.19 TCH Capabilities

BTS-supported value:

Cross Combination Indicator:	127
IWD-defined value range:	0, 127

52.3.20 TF Mode

BTS-supported code:

TF mode parameter:	1 (= stand-alone)
IWD-defined value range:	00 – 02, FF

52.4 Appendix

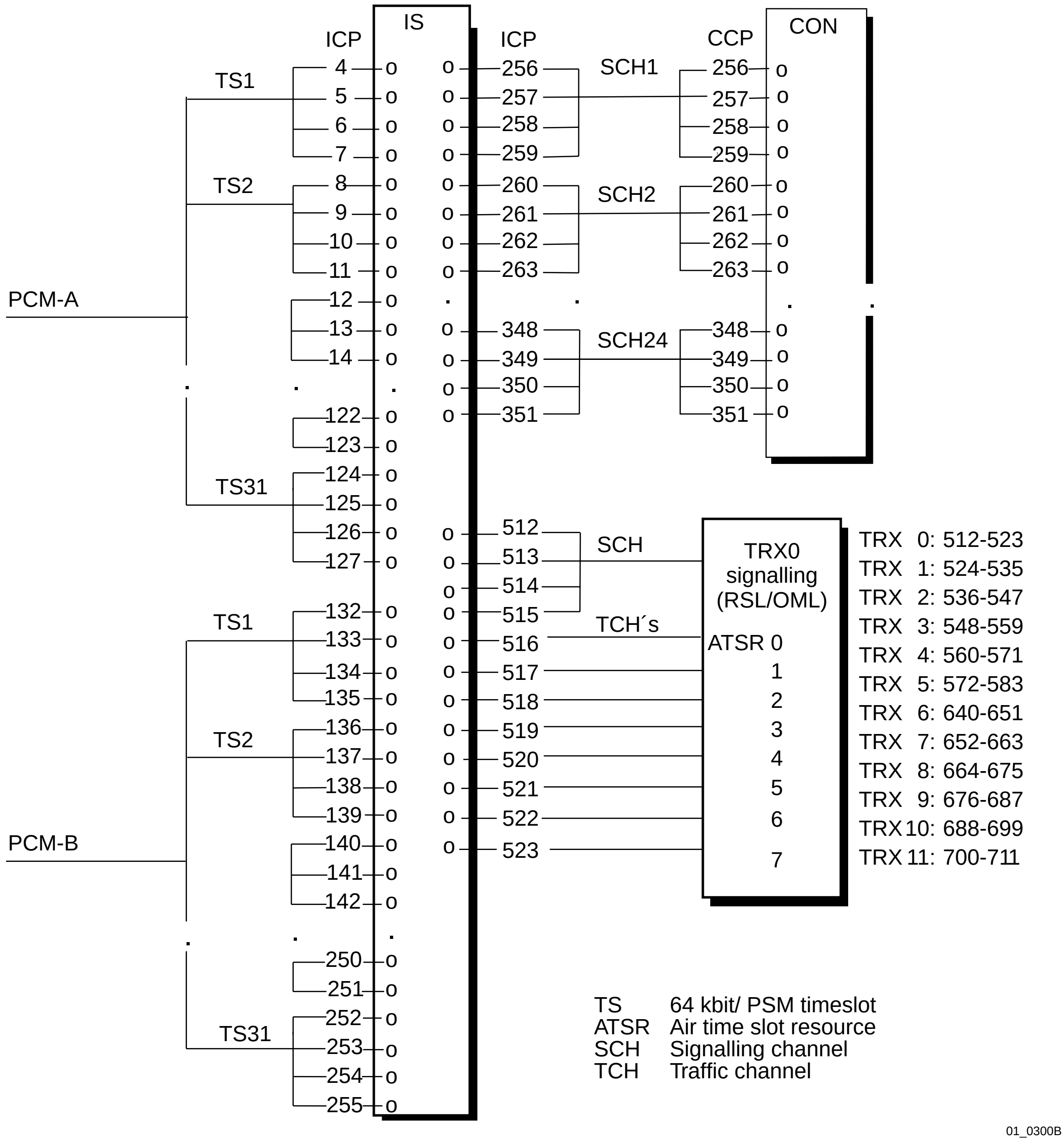

Figure 113 Physical mapping of entities and ICP/CCP

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.

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53 Glossary

This glossary lists abbreviations and acronyms used in texts dealing with RBS 2000. 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 GSM system products.

Terms and Abbreviations

An arrow -> is used to indicate a reference to another entry in this list.

Abis	GSM interface standard defining attributes of the communication between BSC and BTS
AC	Alternating Current
ACB	Alarm Collection Board
ACCU	Alternating Current Connection Unit
A/D converter	Analog to Digital converter
Air conditioner	One version of the climate unit (Active cooler)
AIS	Alarm Indication Signal
ALNA	Antenna Low Noise Amplifier
AO	Application Object
ARAE	Antenna Related Auxiliary Equipment
ARFCN	Absolute Radio Frequency Channel Number
ARU	Active Replaceable Unit
ASIC	Application Specific Integrated Circuit
Astra	ASIC in the TRU
AT	Alphanumeric Terminal
ATRU	Adaptive Transceiver Unit
ATSR	Air Time Slot Resource
BALUN	BALance and UNbalance transformer
Batt	Battery
BB	Battery Box
BBS	Battery Backup Stand

BCCH	Broadcast Control CHannel Downlink only broadcast channel for broadcast of general information at a base station, on a base station basis.
BDM	Battery Distribution Module The BDM is an IDM with a battery and a local processor.
BER	Bit Error Rate
BFU	Battery Fuse Unit
BIAS-IC	BIAS Injector
Bm	Denotes a full rate traffic channel
BPC	Basic Physical Channel Denotes the air interface transport vehicle formed by repetition of one time slot on one or more radio frequency channels.
BS	Base Station
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.
Burst	A portion of digital information, the physical content, that is transferred within the time interval of one time slot.
Cabinet	The physical housing of a base station
CBCH	Cell Broadcast CHannel This is a downlink only channel used by the GSM defined SMSCB function.
CCCH	Common Control CHannel Channel combining the following common control channels:

	PCH Paging CHannel
	RACH Random Access CHannel
	AGCH Access Grant CHannel
CCU	Climate Control Unit
CDU	Combining and Distribution Unit
CE	Conformité Européenne
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	Control Module (for TMA)
CMD	Digital Radio Communication Tester
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.
Compr	Compressor
CON	LAPD concentrator LAPD concentration is used to reduce the number of required physical links between the BSC and BTS.
Config	Configuration
Co-siting	Co-siting is to operate the radio base station in GSM together with the radio base station in Total Access Communication System (TACS) or Nordic Mobile Telephone system (NMT) on the same site by sharing common equipment.

CPU	Central Processing Unit
CSA	Canadian Standards Association
CSES	Consecutive Severely Errored Second
CSU	Channel Service Unit
CU	Combining Unit (RU in CDU_D)
CXU	Configuration Switch Unit
Dannie	ASIC in the TRU
DB	DataBase
DC	Direct Current
DCCH	Dedicated Control CHannel Dedicated control channels carry signalling data.
DCCU	DC Connection Unit
ddTMA	Dual Duplex Tower Mounted Amplifier This type needs only one combined TX/RX feeder from the BTS to the TMA. –>dTMA –>rTMA –>TMA –>BTS
DF	Distribution Frame
DFU	Distribution and Fuse Unit
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	Distribution Module
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	Digital Path
DPX	Duplexer
DS1	Digital Signal level 1 (1544 kbit/s)

DSP	Digital Signal Processor
DT	Data Transcript
dTMA	Duplex TMA dTMA is similar to the old ALNA except for different characteristics. –>ddTMA –>rTMA –>TMA
dTRU	double Transceiver Unit
DU	Distribution Unit (RU in CDU-D)
DX	Direct Exchange
DXC	Digital Cross Connector
DXU	Distribution Switch Unit
DXX	Ericsson Cellular Transmission System including NMS
E1	Short for G.703 2048 kbit/s PCM link
E-GSM	Extended GSM
EACU	External Alarm Connection Unit
ECU	Energy Control Unit
EC1	External Condition Map Class 1
EC2	External Condition Map Class 2
EDGE	Enhanced Data rate for Global Evolution
EDT	Electrical Down Tilt
EEPROM	Electrically Erasable Programmable Read-Only Memory
EMC	Electro Magnetic Compatibility
EMF	ElectroMotive Force
EMI	Electromagnetic Interference
ENV	Environmental
ES	Errored Second
ESB	External Synchronization Bus
ESD	ElectroStatic Discharge
ESO	Ericsson Support Office
EXT	External

FACCH	Fast Associated Control CHannel Main signalling channel in association with a TCH.
FCC	Federal Communications Commission
FCCH	Frequency Correction CHannel
FCOMB	Filter COMBiner
FCU	Fan Control Unit
FDL	Facility Data Link
FER	Frame Erasure Ratio
FIU	Fan Interface Unit
FS	Function Specification
FSC	Field Support Centre
FU	Filter Unit (RU in CDU-D)
FUd	Filter Unit with duplexer (RU in CDU-D)
FXU	Future Expansion Unit
G01	MO model for RBS 200
G12	MO model for RBS 2000
G.703	CCITT Standard for transmission
GPRS	General Packet Radio Services
GSM	Global System for Mobile communications International standard for a TDMA digital mobile communication system. Originally, GSM was an abbreviation for Group Special Mobile, which is a European mobile telecommunication interest group, established in 1982.
HCOMB	Hybrid COMBiner
HDLC	High level Data Link Control
HDSL	High bit rate Digital Subscriber Line
Heat Exchanger	One version of the climate unit
HEU	Heat Exchanger Unit
HLIN	High Level IN
HLOUT	High Level OUT

HMS	Heat Management System
Hum	Humidity
HW	HardWare
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).
IC	Integrated Circuit
ID	IDentification
IDB	Installation Data Base
IDM	Internal Distribution Module
IEC	International Electric Commission
IMSI	International Mobile Subscriber Identity
INIT	Initial
INT	Internal
IOG	Input/Output Group
IOM	Internal Operation and Maintenance bus
IR	InfraRed
IS	Interface Switch
IWD	InterWork Description
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 information carrying capacity of a physical channel. 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
MAC	Medium Access Controller
Magazine	A magazine is a reserved space in the cabinet, which may hold one or more RUs.
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
MR	Measurement Receiver
MS	Mobile Station
MSC	Mobile services Switching Centre GSM network unit for switching, routing and controlling calls to and from the Public Switched Telephone Network (PSTN) and other networks.
MSTP	Mobile Station Test Point
Multidrop	Two or more RBSs are connected in a chain to the same transmission system. All the relevant timeslots are dropped out by each RBS. (This function is sometime called cascading.)
NEBS	Network Equipment Building System
NMS	Ericsson Network Management System in DXX
Nominal Power	The nominal power is the power level defined when configuring the transceiver.
N terminal	Neutral terminal in a AC mains connection
O&M	Operation and Maintenance General term for activities such as configuration, utilization of channels (frequency bands), cell planning, system supervision, hardware and software maintenance, subscriber administration, and so forth.
OMC	Operation and Maintenance Centre
OML	Operation and Maintenance Link Layer 2 communication link for operation and maintenance services on Abis.
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

OVP	OverVoltage Protection
OXU	Space for Optional Expansion
P-GSM	Primary GSM
Passive RU	A passive replaceable unit has a very low level of intelligence and is independent of the processor system.
PCAT	Product CATalogue A web-based ordering system in Ericsson’s intranet.
PCH	Paging CHannel Downlink only subchannel of CCCH for system paging of MSs. -> CCCH
PCM	Pulse Code Modulation
PCU	Packet Control Unit
PE terminal	Protective Earth terminal in a AC mains connection
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
PLMN	Public Land Mobile Network A network, established and operated by an administration or its licensed operator(s), for the specific purpose of providing land mobile communication services to the public. It provides communication possibilities for mobile users. For communication between mobile and fixed users, interworking with a fixed network is necessary.
PPE	Personal Protective Equipment
PREFL	Power Reflected

PSU	Power Supply Unit
PWU	Power Unit
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
RBER	Radio Bit Error Ratio
RBS	Radio Base Station All equipment forming one or more Ericsson base stations. ->BTS
RCB	Radio Connection Box
RD	Receive Data
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
RFCH	Radio Frequency CHannel A radio frequency carrier with its associated bandwidth.
RFTL	Radio Frequency Test Loop
RLC	Repair Logistic Centre
R-state	Release state
RS232	American standard for term/MODEM interconnection
rTMA	Receiver TMA rTMA has no duplexers. It is used for amplification of the RX signal. –>ddTMA –>dTMA –>TMA
RU	Replacement 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
RXD	Receiver Divider
RXDA	Receiver Divider Amplifier
RXLEV	Measure of signal strength as defined in GSM 05.08:8.1.4
RXQUAL	Measure of signal quality as defined in GSM 05.08:8.2.4
SACCH	Slow Associated Control CHannel
SCH	Synchronization CHannel
SDCCH	Stand alone Dedicated Control CHannel Main dedicated signalling channel on the air interface, mainly used for call locating and establishment.
SCU	Switching and Combining Unit
SE	Supervised Entity
SES	Severely Errored Second
SIG	Signalling
SIM	Subscriber Identity Module
SMS	Short Message Service (point to point) A short message, up to 160 alphanumeric characters long, can be sent to or from an MS (point to point).
SO	Service Object
SS	Swedish Standard
Sub-RU	A sub-replaceable unit is always connected to a superior Main RU. This 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, which cannot be loaded, is classified as a sub-RU.
SVS	System Voltage Sensor

SW	SoftWare
SWR	Standing Wave Ratio
SYNC	Synchronous
T1	Transmission facility for DS1 (1544 kbit/s)
TA	Timing Advance A signal sent by the BTS to the MS which the MS uses to advance its timing of transmissions to the BTS to compensate for propagation delay.
TC	Transaction Capabilities
TCH	Traffic CHannel The traffic channels carry either encoded speech or user data.
TCH SIG	Traffic CHannel Signalling
TD	Transmit 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
TDR	Time Domain Reflectometer
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

	The Transport module is non-RBS equipment belonging to the transport network.
TMA	Tower Mounted Amplifier There are three types of TMAs: dTMA, rTMA and ddTMA. –>dTMA –>rTMA –>ddTMA
TN	Timeslot Number
TN O&M	Transport Network operation and Maintenance (in general)
Tora	ASIC in the TRU
TRA	Transcoder Rate Adapter The TRA Unit performs transcoding of speech information and rate adaption of data information.
Tracy	ASIC in the TRU
TRS	Transceiver System
TRU	Transceiver Unit
TRX	Transceiver
TRXC	Transceiver Controller
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
TU	Timing Unit
TX	Transmitter
TXA	Transmitter Antenna A
TXB	Transmitter Antenna B
TXBP	Transmitter BandPass filter
UAS	Unavailable Seconds
UL	Underwriter Laboratories

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 voltage.
X-bus	The X-bus carries transmit air data frames between transceivers.
Y-link	The interface between the DXU and each DSP System in Core based TRUs

RBS 2206 Product Description

Contents

- Please note that this description includes details on both basic and optional products. It does not necessarily correspond to any specific release or delivery time, nor is it a complete technical specification.

1 Introduction

The purpose of this document is to describe the powerful RBS 2206, which is a 12 TRX indoor GSM radio base station. The document aims to give a general overview of the RBS 2206.

1.1 A new powerful member of the RBS 2000 family

The RBS 2206 is a new member of the highly successful RBS 2000 family. This guarantees a world-class supply flow, fast installation and commissioning, reliable operation & maintenance and coexistence with other RBS 2000 and RBS 200 products.

The RBS 2206 is an indoor macro base station supporting up to twelve transceivers per cabinet. The cabinet has the same footprint and is only marginally higher than the RBS 2202 but has doubled capacity due to the new double capacity transceivers and combiners.

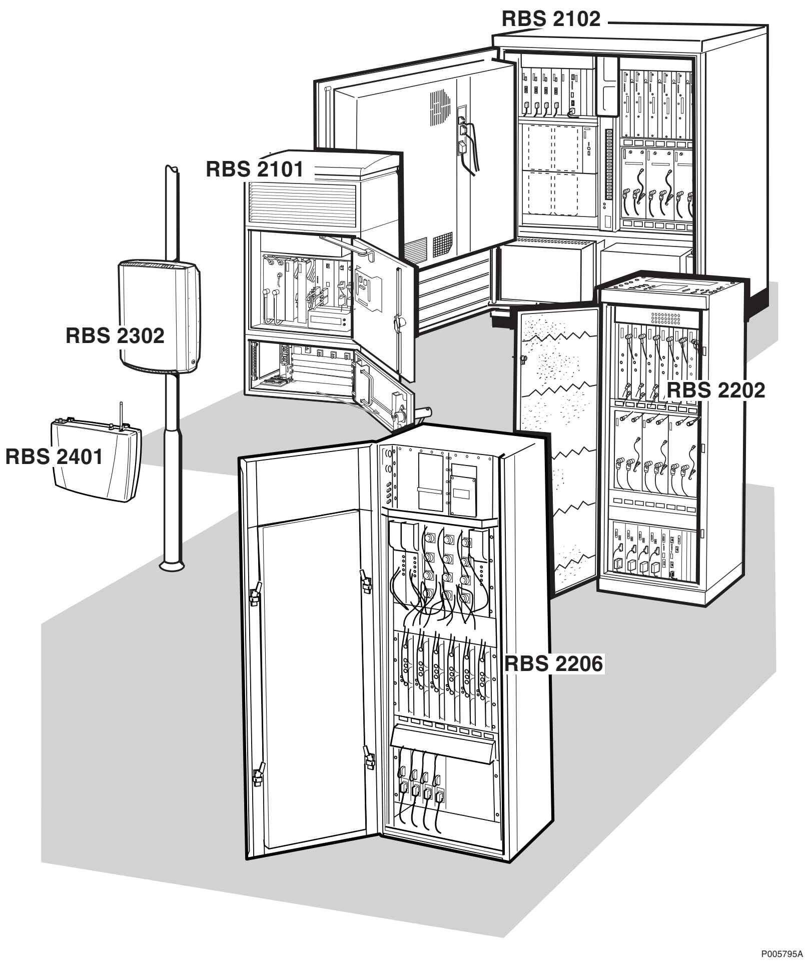

Figure 1. The RBS 2000 family.

1.2 RBS 2206 – Double Your Capacity with the same footprint

Ericsson's GSM radio base station RBS 2206 facilitates capacity expansion without the need for new sites. The RBS 2206 provides convenience without compromise for GSM operators.

Today, the mobile penetration has exceeded 70 percent in some mature markets and many operators are experiencing an almost explosive subscriber growth. In addition, the usage per subscriber is increasing. As a consequence, the operators must be able to handle more traffic in their networks.

At the same time, finding new base station sites is becoming increasingly difficult. Each new site requires building permission and extensive negotiations with landlords. The latter is nowadays an often time-consuming procedure and when the operator is lucky to close the deal, it often proves to be rather expensive.

As a result, the site space is a limiting factor for capacity growth and therefore it is of great interest to the operators to stick to the existing sites as long as possible. The powerful RBS 2206 is a means of addressing this need. The RBS 2206 has some new powerful RF features. With the RBS 2206, the requirement on channel separation is decreased for configurations with filter combiners. The RBS 2206 also has better output power than current RBS 2000 products. Another example of a cost saving feature is Extended Range 121 km. The double transceiver, dTRU, consists of two transceivers in one unit of the same size as the classic single TRU. To meet the operators' need for faster data communication solutions, the RBS 2206 can be equipped with an EDGE capable version of the dTRU. The RBS 2206 has the capacity to handle EDGE on all twelve transceivers.

The RBS 2206 comes with two new extremely flexible combiners, making it possible to build one-sector, two-sector, three-sector and dual band (GSM 900/GSM 1800, GSM 800/1900 and GSM 800/1800) configuration in one cabinet. Examples on configurations supported by the filter combiner (CDU-F) are 3x4, 2x6 and 1x12 in one cabinet (for GSM 900 and GSM 1800). The CDU-G combiner can be configured in two modes: capacity mode and the coverage mode, which makes it very flexible. By running the CDU-G in coverage mode, the output power from the combiner is increased by 3.5 dB, making it perfect for rural sites or when fast rollout is required to a minimum cost. To build a 3x4 configuration, the RBS 2206 is equipped with three CDU-G.

2 RBS 2206 Architecture

The RBS 2206 comprises the following major units:

- Power Supply Unit (PSU)
- Distribution Switch Unit (DXU)
- Internal Distribution Module (IDM)
- Double Transceiver Unit (dTRU)
- Configuration Switch Unit (CXU)
- Combining and Distribution Unit (CDU)
- AC or DC Connection Unit (ACCU/DCCU)
- Fan Control Unit (FCU)
- DC filter

Figure 2. RBS 2206.

Power Supply Unit (PSU)

The PSU rectifies or converts the power supply voltage to regulated system voltage, +24 VDC.

The PSU's are connected in parallel at the secondary side and may be configured with an N+1 redundancy.

When using a battery backup, an extra PSU is recommended for recharging of batteries. If the RBS is equipped with a redundant PSU no extra PSU is required for battery charging.

RBS 2206 is equipped with limited transient protection. An external "transient voltage surge suppressor" and "lightning protection" is recommended.

Distribution Switch Unit (DXU)

The DXU provides a system interface to the 2 Mbit/s or 1.5 Mbit/s link and cross connects individual time slots to certain transceivers. The DXU also extracts the synchronisation information from the PCM link and generates a timing reference for the RBS.

The DXU supports LAPD Multiplexing, LAPD Concentration and the Multi Drop functionality.

Figure 3. Front view of DXU-21.

The RBS 2206 is delivered with one DXU-21 per cabinet that has some powerful features:

- It is equipped with four transmission ports (E1/T1)
- It is hardware prepared for support of EDGE functionality on up to twelve transceivers.
- It will support a synchronised radio network with help of an interface to an external GPS receiver.
- It will support the mobile positioning function with help of an interface to an external LMU.
- It will consist of a single unit with a removable Flashcard, permitting a fast and simple load of Installation DataBase (IDB) and RBS software in the RBS 2206.
- It is hardware prepared to support a “Site LAN” implementation with help of an External O&M (EOM) bus. The EOM bus is designed as a standard Ethernet port.
- It supports TG synchronisation.
- It has built in ECU functionality.

Internal Distribution Module (IDM)

The IDM handles the distribution and fusing of the system voltage (+24 VDC) to the units in the cabinet. There is a connector for connection of ESD bracelet and instrument electrical earth on the IDM.

Double Transceiver Unit (dTRU)

The dTRU is a two-transceiver Replaceable Unit. Up to six dTRU units can be installed in one RBS 2206 cabinet, enabling up to 12 TRXs per cabinet.

Figure 4. Double Transceiver Unit.

There are different versions of the dTRU dependent on frequency band and EDGE support. All dTRUs are HW prepared to handle HSCSD and GPRS, the EDGE dTRU is HW prepared to also handle the ECSD and EGPRS functionality.

The dTRU supports different ciphering standards. Either A5/1 or A5/2 can be used. The ciphering is controlled via software.

A hybrid combiner is included inside the dTRU. The combiner can be used, optional, together with CDU-G to increase the number of TRXs per antenna. It is possible to by-pass the hybrid combiner by connecting a cable in the front of the dTRU.

Extended Range up to 121 km is supported.

The dTRU is hardware prepared to support performance improvements via software upgrades, e.g. four-branch RX diversity and Enhanced Interference Suppression (EIS).

Configuration Switch Unit (CXU)

The task of the CXU is to cross connect between the CDU and the dTRU in the receiving path. The CXU makes it possible to expand or reconfigure a cabinet with a minimum of moving or replacing RX cables.

Figure 5. Configuration Switch Unit.

The RX inputs/outputs on the dTRU and the CDU are placed in such positions that they minimise the amount of cable types for connecting the CXU with the dTRU/CDU.

Combining and Distribution Unit (CDU)

The CDU combines the transmitted signals from the transceivers and distributes the received signals. Duplex filters are included in the CDU. A measuring coupler, providing forward and reflected power measurements for Voltage Standing Wave Ratio (VSWR) calculations is located in the CDU.

Two different CDU types exist for GSM 900 and 1800 (CDU-F and CDU-G) and one CDU type for GSM 800 and GSM 1900 (CDU-G).

- With hybrid combining, CDU-G. Allows base band or synthesised frequency hopping.
- With filter combining to support large configurations, CDU-F. Allows base band frequency hopping. CDU-F is optimised for giving large configurations maximum output power on minimum number of antennas.

Figure 6. CDU-G and CDU-F.

The duplex filters allows both receiver and transmitter path connections to a common antenna. The duplex configurations also minimise the number of required feeders and antennas as well as the combining loss in the transmission path.

The different CDU types are further described in the Radio Specifications for the different frequencies.

The CDU-G and CDU-F are hardware prepared to support EDGE.

AC/DC connection unit and DC filter

The ACCU/DCCU handles the distribution and connection of the incoming power supply voltages 120-250 VAC (ACCU) or –48/-60 VDC (DCCU) to the PSU´s.

The DC filter handles the connection of the incoming +24 VDC power supply and battery backup.

Battery backup is available together with 120-250 VAC supply voltage.

Fan Control Unit (FCU)

The FCU controls the fans in the cabinet. The climate handling in the cabinet maintains the internal temperature range by controlling the fans. The climate handling is controlled by the DXU via the FCU with the aid of temperature sensors placed inside the RUs.

Tower Mounted Amplifier (TMA)

A Tower Mounted low noise Amplifier (TMA) is an option that can be used in order to compensate for losses in the antenna feeder and to improve the overall receiver performance. All the configurations, CDU-G or CDU-F are available with double duplex TMA as option. Bias injectors and a TMA control module (TMA-CM) are needed in the cabinet for TMA support. The BIAS injector is used to provide the TMA with DC power from the TMA-CM over the RF feeders.

Antenna Sharing Unit (ASU)

The Antenna Sharing Unit (ASU) is a new unit that is available as an option for GSM 800 and GSM 1900. The ASU is intended to support antenna sharing between TDMA 850 and GSM 800 or between TDMA 1900 and GSM 1900. The RX-path is fed from the Antennas trough the feeders to the ARP (antenna reference point) of the RBS 2206. The signal is then filtered and amplified in the CDU. From the RX output of the CDU the signal is fed to the ASU where a small portion of the signal is fed to the RX input of the Co-Sited RBS.

The RBS 2206 cabinet

- Indoor specified.
- Supports up to six double transceiver units (12 TRXs) per cabinet.
- One cabinet can be configured as a one, two or three sector cell configuration.
- The cabinet fulfils seismic requirements
- The cabinet door can be hinged on the left or right hand side.

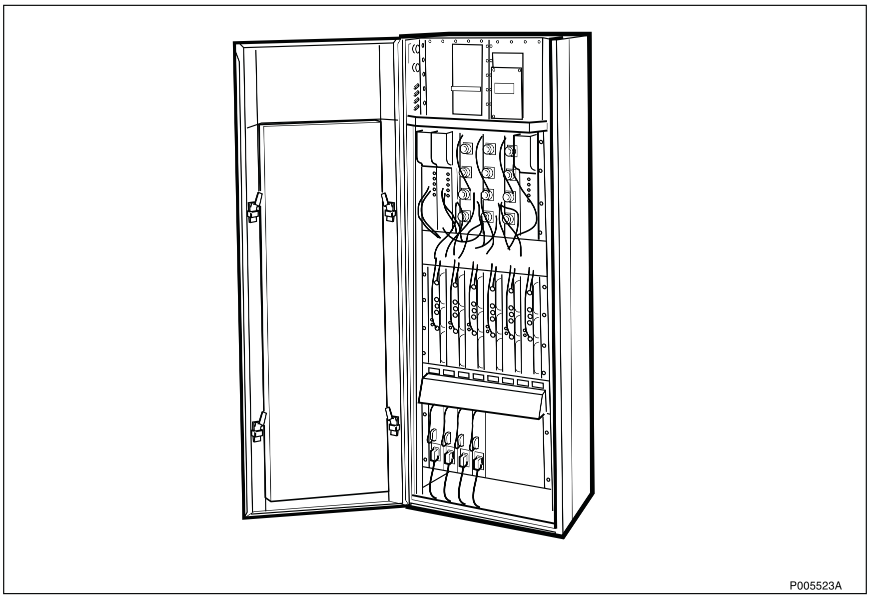

Figure 7. RBS 2206 cabinet.

All units in the cabinet are easily accessible from the front of the cabinet. There are no requirements on access to the cabinet from the sides or the back, which implies that the cabinets can be mounted side by side with the back to a wall.

Cable entries for antenna feeders, transmission cables, and mains power are concentrated at the top of the cabinet.

Backup batteries must be housed outside the RBS 2206 cabinet. Battery backup is available for different backup times in external cabinets.

3 Technical Specification

3.1 Mechanical Dimensions

Table 1. Mechanical Dimensions.

Unit	**Width (mm)**	**Depth (mm)**	**Height (mm)**
Cabinet incl. base frame	600	400	1850
Cabinet	600	400	1800
Base frame*)	600	400	50

*) The Base Frame is mandatory.

3.2 Weight

Table 2. Weight.

Unit	**Weight (kg)**
Fully equipped cabinet incl. base frame	230

3.3 Power Requirements

Table 3. Power Requirements.

Power Option
-(48/60) VDC
+24 VDC
120-250 VAC

3.4 Power Consumption

The maximum operating power consumption for RBS 2206 is 3855 Watt (valid for 120-250 VAC).

If battery back up is used the maximum incoming power consumption including maximum battery charging can be up to 5780 Watt temporary.

These figures correspond to operation during peak load in extreme conditions. The power consumption during operation is however also configuration dependent.

3.5 Colour

Table 4. Colour.

Colour	**Reference Number**	**Ericsson Number**
White	NCS 1002-R	MZY 38320/985

3.6 Electromagnetic Compatibility (EMC)

All RBS 2206 models fulfils the Electromagnetic Compatibility (EMC) requirements according to:

- ETS 300 342-2, the BTS product standard, in line with the European EMC Directive 89/336/EEC.
- 1999/5/EC Radio and TTE directive.
- EN 55022 Class B.
- GSM:11.21
- FCC, part 15.

The RBS 2206 is CE marked in order to show this compliance.

3.7 External Alarms

RBS 2206 provides connections for external alarms. The external alarms are defined by the customer and are reported to the BSC via LAPD signalling on the A-bis O&M interface.

There are 16 external alarms available (unoccupied). The external alarms are defined by using the Operation and Maintenance Terminal (OMT) or the Remote OMT. The external device sets the alarm by either an open or closed condition.

3.8 Battery Backup

Battery backup is available in an external cabinet, BBS 2000, with the same size as the RBS 2206 cabinet, providing up to 8 hours of backup.

In the external battery cabinet a Battery Fuse Unit, BFU, is installed. The BFU supervises and connects/disconnects the batteries at low voltage. It is possible to supply external transmission equipment outside the RBS 2206 with power from the system voltage (+24 VDC). This can be provided either from the cabinet or prioritised from the battery backup.

It is possible to share battery backup between RBS 2206 and RBS 2202/200.

3.9 Transmission

All RBS 2000 models support multi-drop bypass functionality. Each RBS can be configured for stand alone or linear cascade mode. The configuration is performed by means of the OMT.

LAPD concentration and LAPD multiplexing could be used to make the transmission resource more efficient.

The DXU-21 is equipped with four external ports supporting in total up to 8 Mbit/s.

Interfaces

T1, 1.5 Mbits/s, 100 Ohm
E1, 2 Mbit/s, 120 Ohm
E1, 2 Mbit/s, 75 Ohm

The interfaces are supported on the same physical ports.

Connections

E1/120 Ohm and T1/100 Ohm is connected to the RBS 2206 cabinet via a 15-pin DSUB connector. E1/75 Ohm is connected to the RBS 2206 via an adapter that includes an impedance converter with BNC connectors.

E1/120 Ohm and T1/100 Ohm transmission supports Long Haul. E1/G.703 and T1/DS1 offer multi vendor compatibility on the transmission level. Normally E1/G.703 and T1/DS1 only offers short haul interfaces, enabling distances up to 6 dB loss. The long haul feature allows for 30 dB loss and a more cost efficient transmission network configuration.

Coaxial connection (75 Ohm) is only available for E1 operation and does not support long haul. The distance allowed between units is determined by the cable loss, according to the 6 dB receiver sensitivity specified in G.703.

Additional transmission equipment

The RBS 2206 cabinet has got room for additional transmission equipment in the Optional Expansion Unit (OXU) positions beside the DXU.

The RBS 2206 supports the possibility of housing Mini-DXC or DXX equipment in the OXU positions.

The 2-card DXX plug-in unit for RBS 2206 is a Digital cross-connect with four G.704 ports and one slot for 2-4 additional interfaces that can be G.703, HDSL, LTE or Optical fibre.

The 1 card DXX plug-in unit for RBS 2206 is a Digital cross-connect with four G.703 ports.

The Mini-DXC plug-in unit for RBS 2206 is a Digital cross-connect with five G.703 ports.

The Mini-DXC or DXX plug-in has the functionality of a Mini-DXC / DXX node, a combination of Cross-connect, Control and G.703 interface units.

3.10 Other Requirements

Product Safety

In accordance with the Low Voltage Directive (LVD 73/23/EEC plus 93/68/EEC) within the European Union the RBS 2206 models comply with the following requirements regarding product safety:

- EN 60 950/IEC 950
- EN 60 215/IEC 215
- EN 60 529/IEC 529

The RBS 2206 models are designed to fulfil the following safety standards in North America:

- UL 1950, 2nd Edition, “Information Technology Equipment Including Electrical Business Equipment”
- UL 1419, 1st Edition, “Professional Video and Audio Equipment”
- CSA C22.2 No. 950-95, “Safety of Information Technology Equipment Including Electrical Business Equipment”
- CSA 22.2 No. 1-M94, “Audio, Video and Small Electronic Equipment”

The RBS 2206 models are CE marked and UL listed in order to show this compliance.

Environmental Requirements

The requirements for climatic/mechanical environment are based on ETSI standard ETS 300 019 Classification of Environmental Conditions and IEC 721.

Storage Requirements

The RBS 2206 complies with ETS class 1.2 Weather Protected, Not Temperature Controlled Storage Locations in ETS 300 019-1-1.

Transportation Requirements

The RBS 2206 complies with ETS class 2.3 Public Transportation in ETS 300 019-1-2.

Earthquake Protection

The RBS 2206 is designed to fulfil earthquake protection according to IEC 68-2-57.

In-Use Requirements

The RBS 2206 is designed for normal operation in the climate conditions of class 3.1 of IEC 721-3-4 (ETS 300 019-1-4).

Temperature range: +5 ºC to +40 ºC, Relative humidity: 5 to 85 %.

4 GSM 800 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

4.1 System Data

Receiver:	824 to 849 MHz
Transmitter:	869 to 894 MHz
Carrier bandwidth:	200 kHz
Channels per carrier:	8 full rate channels
Modulation method:	GMSK, EDGE-dTRU handles both GMSK and 8-PSK
Duplex Separation:	45 MHz

The RBS output power is dynamically controlled. The control range is 30 dB in 2 dB steps including the configuration steps from maximum output.

4.2 CDU-types for GSM 800

CDU-G 800

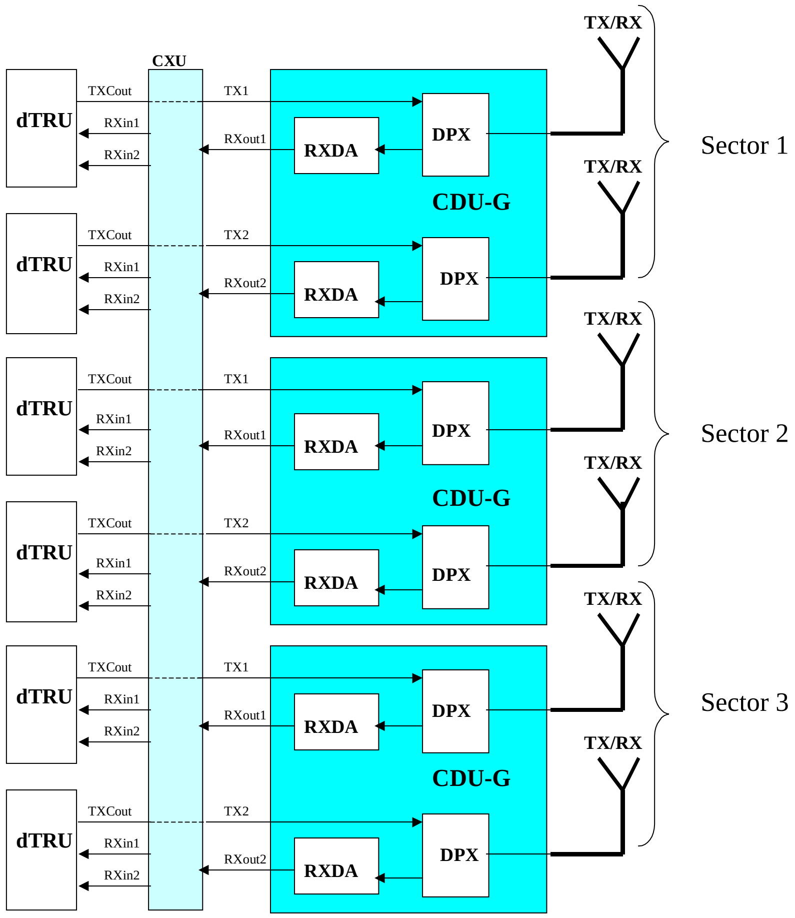

Figure 8. CDU-G for GSM 800 in a configuration with four TRXs (two dTRUs) in each sector. Hybrids in the dTRUs are used.

With CDU-G it is optional to use the hybrid combiner in the dTRU.

If the hybrid combiner is used 4 TRXs per cross-polarised antenna is supported. When the hybrid combiner is by-passed the output power is maximised.

Synthesised or base band frequency hopping is allowed for all CDU-G configurations.

The CDU-G 800 MHz main characteristics are:

- Up to 4 TRXs per two antennas (two physical antennas) or one dual polarised.
- No limitations on frequency planning.
- Required frequency separation is 400 kHz (due to GSM specification).
- Synthesiser and base band frequency hopping are supported.
- Configurations with and without hybrid combination are possible (with the same HW).
- Maximum 12 TRXs per cabinet when the hybrids in the dTRUs are used.
- Maximum 6 TRXs per cabinet when the hybrids in the dTRUs are not used. The 6 TRXs will in this configuration occupy the CDU-G capacity.
- Covers GSM 850 band (TX 869-894 MHz, RX 824-849 MHz).
- CDU-G is prepared to handle 8-TRXs per CDU by use of a future extra hybrid combiner on the TX path between the dTRUs and the CDU-G.

4.3 GSM 800 Configurations

The configurations are the maximum configurations within a given number of CDUs. The single cell configuration can be duplicated or triplicated to form multicell configurations by for instance utilising the Multi Drop functionality.

Table 5. Configurations for GSM 800 with CDU-G without hybrids used in the dTRUs (uncombined mode).

Max Config	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas**[1]	**CDU type**
1x2	1	Opt.	1	(2)	G
2x2	1	Opt.	2	(2)(2)	G
3x2	1	Opt.	3	(2)(2)(2)	G

Table 6. Configurations for GSM 800 with CDU-G with hybrids used in the dTRUs (combined mode).

Max Config	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas**[1]	**CDU type**
1x4	1	Opt.	1	(2)	G
1x8	1	Opt.	2	(4)	G
1x12	1	Opt.	3	(6)	G
2x4	1	Opt.	2	(2)(2)	G
2x6	1	Opt.	3	(3)(3)	G
3x4	1	Opt.	3	(2)(2)(2)	G

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

5 GSM 900 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

5.1 System Data

Receiver:	880 to 915 MHz (E-GSM)
Transmitter:	925 to 960 MHz (E-GSM)
Carrier bandwidth:	200 kHz
Channels per carrier:	8 full rate channels
Modulation method:	GMSK, EDGE-dTRU handles both GMSK and 8-PSK
Duplex Separation:	45 MHz

The RBS output power is dynamically controlled. The control range is 30 dB in 2 dB steps including the configuration steps from maximum output.

5.2 CDU-types for GSM 900

CDU-G 900

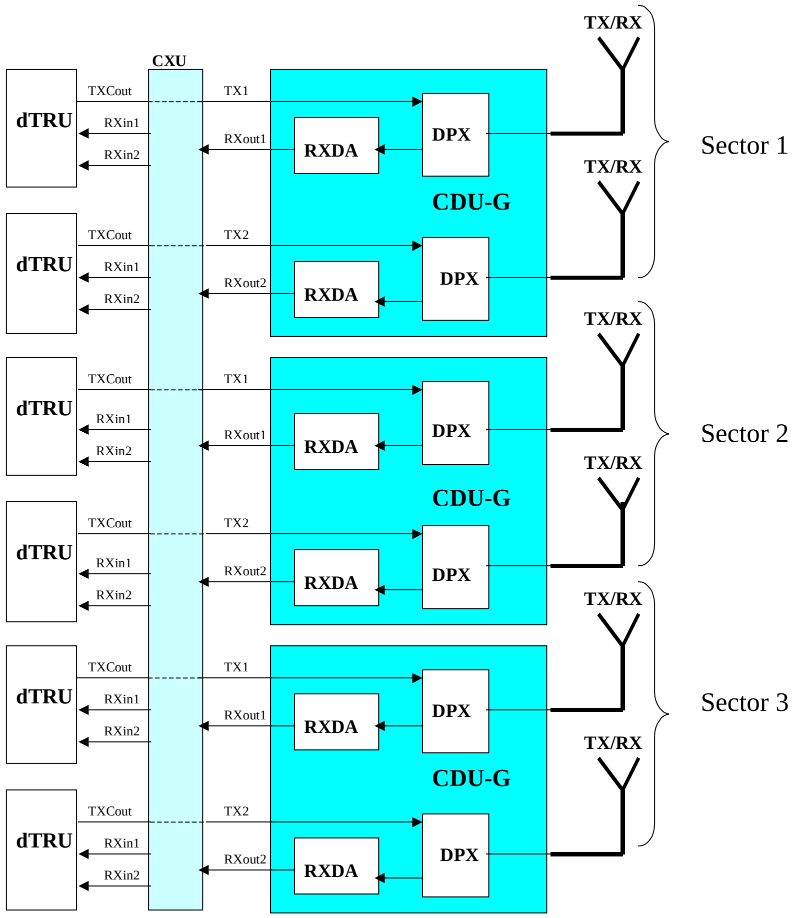

Figure 9. CDU-G for GSM 900 in a configuration with four TRXs (two dTRUs) in each sector. Hybrids in the dTRUs are used.

With CDU-G it is optional to use the hybrid combiner in the dTRU.

If the hybrid combiner is used 4 TRXs per cross-polarised antenna is supported. When the hybrid combiner is by-passed the output power is maximised.

Synthesised or base band frequency hopping is allowed for all CDU-G configurations.

The CDU-G 900 MHz main characteristics are:

- Up to 4 TRXs per two antennas (two physical antennas) or one dual polarised.
- No limitations on frequency planning.
- Required frequency separation is 400 kHz (due to GSM specification).
- Synthesiser and base band frequency hopping are supported.
- Configurations with and without hybrid combination are possible (with the same HW).
- Maximum 12 TRXs per cabinet when the hybrids in the dTRUs are used.
- Maximum 6 TRXs per cabinet when the hybrids in the dTRUs are not used. The 6 TRXs will in this configuration occupy the CDU-G capacity.
- Covers E-GSM (TX 925-960 MHz, RX 880-915 MHz) including P-GSM (TX 935-960 MHz, RX 890-915 MHz).
- CDU-G is prepared to handle 8-TRXs per CDU by use of a future extra hybrid combiner on the TX path between the dTRUs and the CDU-G.

CDU-F 900

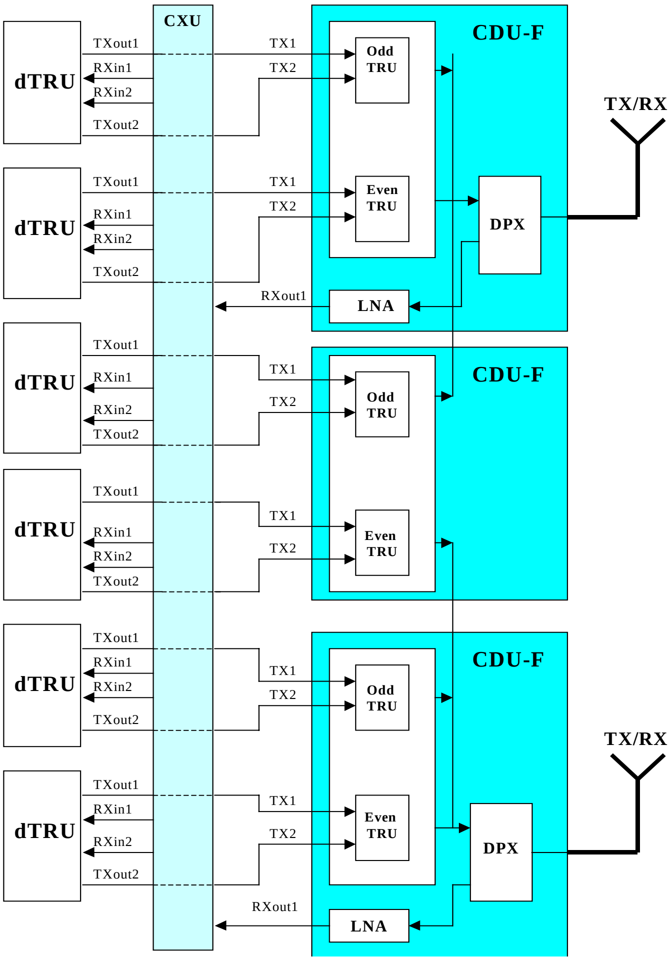

Figure 10. CDU-F for GSM 900 in a configuration with twelve TRXs (6 dTRUs) in one sector.

CDU-F can be used to optimise the cell for high capacity, since the possible number of TRXs per antenna is higher for this CDU compared to any other CDU-type.

The CDU-F 900 MHz main characteristics are:

- CDU-F is designed to enable many TRXs per antenna, see table 9.
- One CDU-F has the same physical size as of one CDU-G.
- Base band frequency hopping is supported.
- Required channel separation is 400 kHz. If a channel separation on 600 kHz is used ~0.5 dB higher maximum RF output is achieved.
- Covers E-GSM (TX 925-960 MHz, RX 880-915 MHz) including P-GSM (TX 935-960 MHz, RX 890-915 MHz).
- IM3 limitations on frequency planning (CDU-F might require IM3 frequency planning depending on the bandwidth used by the operator.)
- One, two and three sector configurations in one RBS 2206 cabinet are possible.
- Dual band (900 and 1800 MHz) configurations are supported using different CDU-F (different frequencies).

5.3 GSM 900 Configurations

The configurations are the maximum configurations within a given number of CDUs. The single cell configuration can be duplicated or triplicated to form multicell configurations by for instance utilising the Multi Drop functionality.

Table 7. Configurations for GSM 900 with CDU-G without hybrids used in the dTRUs (uncombined mode).

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x2	1	Opt.	1	(2)	G
2x2	1	Opt.	2	(2)(2)	G
3x2	1	Opt.	3	(2)(2)(2)	G

Table 8. Configurations for GSM 900 with CDU-G with hybrids used in the dTRUs (combined mode).

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x4	1	Opt.	1	(2)	G
1x8	1	Opt.	2	(4)	G
1x12	1	Opt.	3	(6)	G
2x4	1	Opt.	2	(2)(2)	G
2x6	1	Opt.	3	(3)(3)	G
3x4	1	Opt.	3	(2)(2)(2)	G

Table 9. Configurations for GSM 900 with CDU-F.

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x4	1	Opt.	1	(2)	F
1x8	1	Opt.	2	(2)	F
1x12	1	Opt.	3	(2)	F
2x4	1	Opt.	2	(2)(2)	F
2x6	1	Opt.	3	(2)(2)	F
3x4	1	Opt.	3	(2)(2)(2)	F
8+4[2]	1	Opt.	3	(2)(2)	F
4+8[2]	1	Opt.	3	(2)(2)	F

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

[2] Two sector configurations

6 GSM 1800 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

6.1 System Data

Receiver:	1710 to 1785 MHz
Transmitter:	1805 to 1880 MHz
Carrier bandwidth:	200 kHz
Channels per carrier:	8 full rate channels
Modulation method:	GMSK, EDGE-dTRU handles both GMSK and 8-PSK
Duplex Separation:	95 MHz

The RBS output power is dynamically controlled. The control range is 30 dB in 2 dB steps including the configuration steps from maximum output power.

6.2 CDU-types for GSM 1800

CDU-G 1800

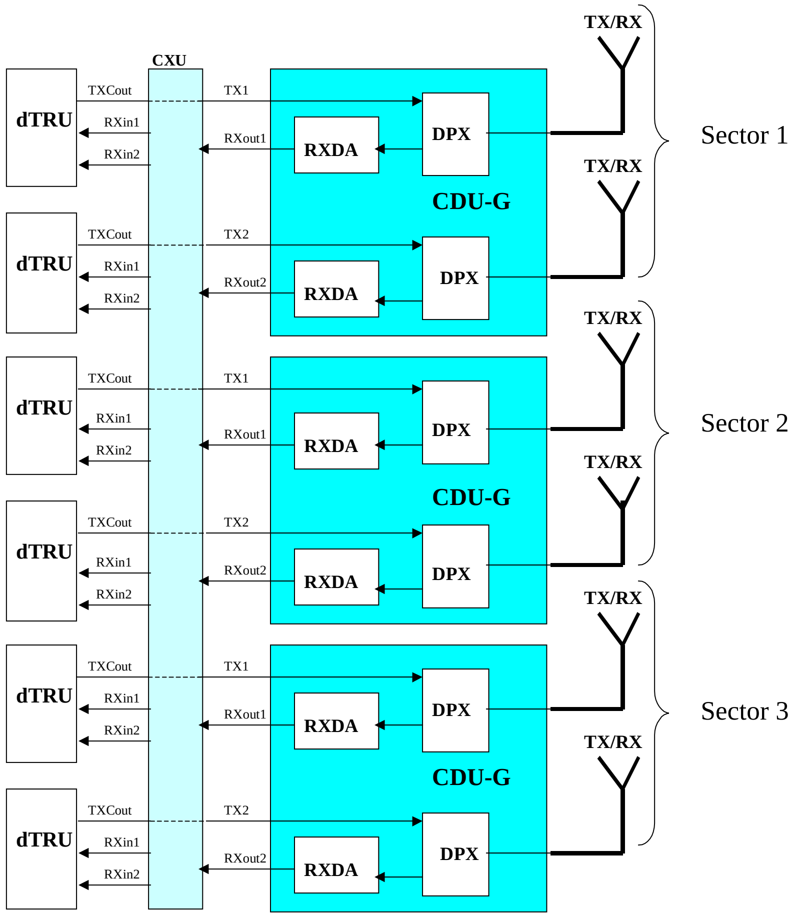

Figure 11. CDU-G for GSM 1800 in a configuration with four TRXs (two dTRUs) in each sector. Hybrids in the dTRUs are used.

With CDU-G it is optional to use the hybrid combiner in the dTRU.

If the hybrid combiner is used 4 TRXs per cross-polarised antenna is supported. When the hybrid combiner is by-passed the output power is maximised.

Synthesised or base band frequency hopping is allowed for all CDU-G configurations.

The CDU-G 1800 MHz main characteristics are:

- Up to 4 TRXs per two antennas (two physical antennas) or one dual polarised.
- No limitations on frequency planning.
- Required frequency separation is 400 kHz (due to GSM specification).
- Synthesiser and base band frequency hopping are supported.
- Configurations with and without hybrid combination are possible (with the same HW).
- Maximum 12 TRXs per cabinet when the hybrids in the dTRUs are used.
- Maximum 6 TRXs per cabinet when the hybrids in the dTRUs are not used. The 6 TRXs will in this configuration occupy the CDU-G capacity.
- CDU-G is prepared to handle 8-TRXs per CDU by use of a future extra hybrid combiner on the TX path between the dTRUs and the CDU-G.

CDU-F 1800

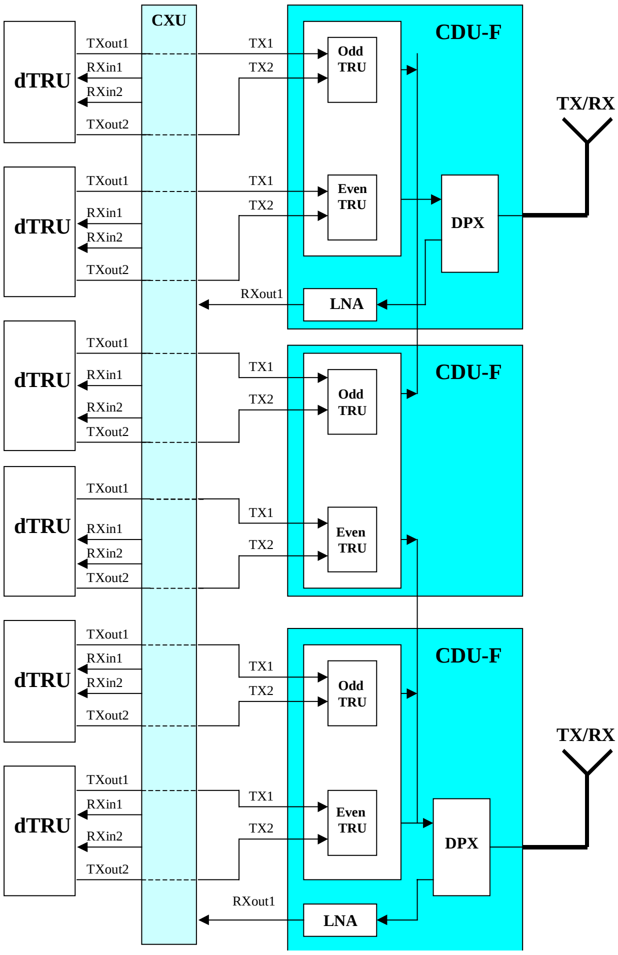

Figure 12. CDU-F for GSM 1800 in a configuration with twelve TRXs (6 dTRUs) in one sector.

CDU-F can be used to optimise the cell for high capacity, since the possible number of TRXs per antenna is higher for this CDU compared to any other CDU-type.

The CDU-F 1800 MHz main characteristics are:

- CDU-F is designed to enable many TRXs per antenna, see table 12.
- One CDU-F has the same physical size as of one CDU-G.
- Base band frequency hopping is supported.
- Required channel separation is 400 kHz. If a channel separation on 800 kHz is used ~1.0 dB higher maximum RF output is achieved.
- IM3 limitations on frequency planning (CDU-F might require IM3 frequency planning depending on the bandwidth used by the operator.)
- One, two and three sector configurations in one RBS 2206 cabinet are possible.
- Dual band (900 and 1800 MHz) configurations are supported using different CDU-F (different frequencies).

6.3 GSM 1800 MHz Configurations

The configurations are the maximum configurations within a given number of CDU's. The single cell configuration can be duplicated or triplicated to form multicell configurations by for instance utilising the Multi Drop functionality.

Table 10. Configurations for GSM 1800 with CDU-G without hybrids used in the dTRUs (uncombined mode).

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x2	1	Opt.	1	(2)	G
2x2	1	Opt.	2	(2)(2)	G
3x2	1	Opt.	3	(2)(2)(2)	G

Table 11. Configurations for GSM 1800 with CDU-G with hybrids used in the dTRUs (combined mode).

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x4	1	Opt.	1	(2)	G
1x8	1	Opt.	2	(4)	G
1x12	1	Opt.	3	(6)	G
2x4	1	Opt.	2	(2)(2)	G
2x6	1	Opt.	3	(3)(3)	G
3x4	1	Opt.	3	(2)(2)(2)	G

Table 12. Configurations for GSM 1800 with CDU-F

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x4	1	Opt.	1	(2)	F
1x8	1	Opt.	2	(2)	F
1x12	1	Opt.	3	(2)	F
2x4	1	Opt.	2	(2)(2)	F
2x6	1	Opt.	2	(2)(2)	F
3x4	1	Opt.	3	(2)(2)(2)	F
8+4 [2]	1	Opt.	3	(2)(2)	F
4+8 [2]	1	Opt.	3	(2)(2)	F

[1] The number of physical antennas is reduced if cross-polarised antennas are used.
[2] Two sector configurations.

7 GSM 1900 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

7.1 System Data

Receiver:	1850 to 1910 MHz
Transmitter:	1930 to 1990 MHz
Carrier bandwidth:	200 kHz
Channels per carrier:	8 full rate channels
Modulation method:	GMSK, EDGE-dTRU handles both GMSK and 8-PSK
Duplex Separation:	80 MHz

The RBS output power is dynamically controlled. The control range is 30 dB in 2 dB steps including the configuration steps from maximum output power.

7.2 CDU-types for GSM 1900

CDU-G 1900

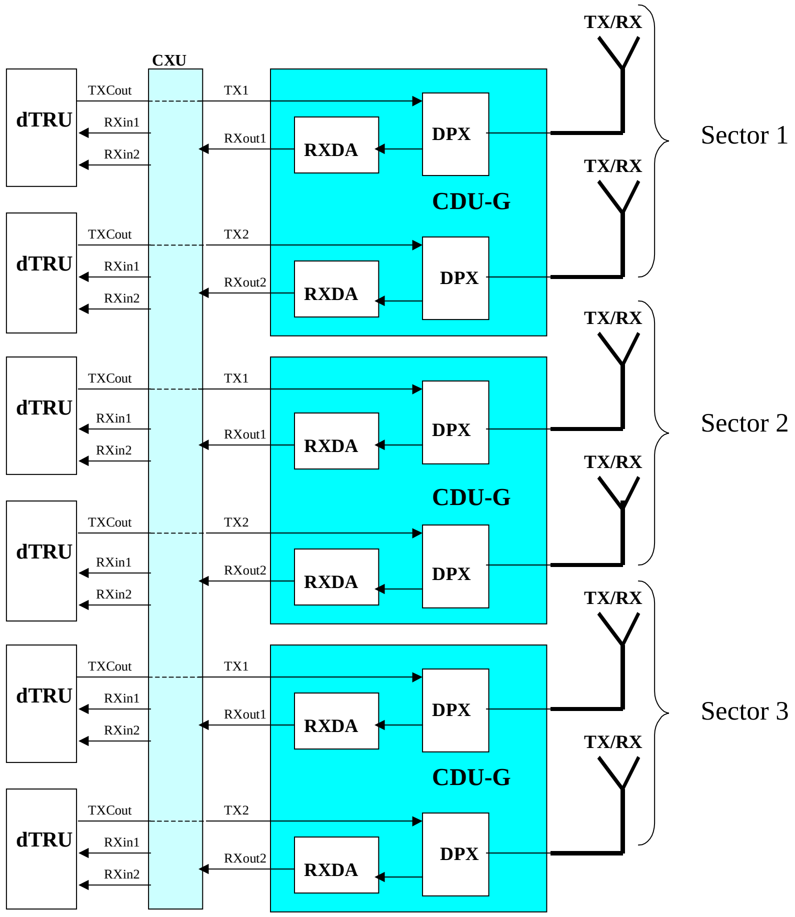

Figure 13. CDU-G for GSM 1900 in a configuration with four TRXs (two dTRUs) in each sector. Hybrids in the dTRUs are used.

With CDU-G it is optional to use the hybrid combiner in the dTRU.

If the hybrid combiner is used 4 TRXs per cross-polarised antenna is supported. When the hybrid combiner is by-passed the output power is maximised.

Synthesised or base band frequency hopping is allowed for all CDU-G configurations.

The CDU-G 1900 MHz main characteristics are:

- Up to 4 TRXs per two antennas (two physical antennas) or one dual polarised.
- No limitations on frequency planning.
- Required frequency separation is 400 kHz (due to GSM specification).
- Synthesiser and base band frequency hopping are supported.
- Configurations with and without hybrid combination are possible (with the same HW).
- Maximum 12 TRXs per cabinet when the hybrids in the dTRUs are used.
- Maximum 6 TRXs per cabinet when the hybrids in the dTRUs are not used. The 6 TRXs will in this configuration occupy the CDU-G capacity.
- CDU-G is prepared to handle 8-TRXs per CDU by use of a future extra hybrid combiner on the TX path between the dTRUs and the CDU-G.

7.3 GSM 1900 MHz Configurations

The configurations are the maximum configurations within a given number of CDU's. The single cell configuration can be duplicated or triplicated to form multicell configurations by for instance utilising the Multi Drop functionality.

Table 13. Configurations for GSM 1900 with CDU-G without hybrids used in the dTRUs (uncombined mode).

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x2	1	Opt.	1	(2)	G
2x2	1	Opt.	2	(2)(2)	G
3x2	1	Opt.	3	(2)(2)(2)	G

Table 14. Configurations for GSM 1900 with CDU-G with hybrids used in the dTRUs (combined mode).

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x4	1	Opt.	1	(2)	G
1x8	1	Opt.	2	(4)	G
1x12	1	Opt.	3	(6)	G
2x4	1	Opt.	2	(2)(2)	G
2x6	1	Opt.	3	(3)(3)	G
3x4	1	Opt.	3	(2)(2)(2)	G

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

8 Dual Band GSM 900/1800 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

The Dual Band BTS comprises equipment for both GSM 900 and GSM 1800.

8.1 System Data

The System Data for the Dual Band RBS are the same as for the GSM 900 and the GSM 1800.

8.2 Configurations Dual Band RBS

Table 15. Configurations for Dual band with CDU-G with hybrids used in the dTRUs (combined mode).

Max Config (900|1800)	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas[1]**	**CDU type**
1x4|1x4	1	Opt.	2	(2)|(2)	G
1x8|1x4	1	Opt.	3	(4)|(2)	G
1x4|1x8	1	Opt.	3	(2)|(4)	G

Table 16. Configurations for Dual Band with CDU-F.

Max Config (900|1800)	**No. of cabinets**	**TMA**	**Number of CDUs**	**Number of Antennas[1]**	**CDU type**
1x4|1x4	1	Opt.	2	(2)|(2)	F
1x8|1x4	1	Opt.	3	(2)|(2)	F
1x4|1x8	1	Opt.	3	(2)|(2)	F

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

9 Dual Band GSM 800/1900 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

The Dual Band BTS comprises equipment for both GSM 800 and GSM 1900.

9.1 System Data

The System Data for the Dual Band RBS are the same as for the GSM 800 and the GSM 1900.

9.2 Configurations Dual Band RBS

Table 17. Configurations for Dual band with CDU-G with hybrids used in the dTRUs (combined mode).

Max Config (800|1900)	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas[1]**	**CDU type**
1x4|1x4	1	Opt.	2	(2)|(2)	G
1x8|1x4	1	Opt.	3	(4)|(2)	G
1x4|1x8	1	Opt.	3	(2)|(4)	G

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

10 Dual Band GSM 800/1800 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

The Dual Band BTS comprises equipment for both GSM 800 and GSM 1800.

10.1 System Data

The System Data for the Dual Band RBS are the same as for the GSM 800 and the GSM 1800.

10.2 Configurations Dual Band RBS

Table 18. Configurations for Dual band with CDU-G with hybrids used in the dTRUs (combined mode).

Max Config (800|1800)	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas[1]**	**CDU type**
1x4|1x4	1	Opt.	2	(2)|(2)	G
1x8|1x4	1	Opt.	3	(4)|(2)	G
1x4|1x8	1	Opt.	3	(2)|(4)	G

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

11 Acronyms and Abbreviations

ACCU	AC Connection Unit
AO	Application Object
BCCH	Broadcast Control Channel
BDM	Battery Distribution Module
BFU	Battery Fuse Unit
BSC	Base Station Controller
BSS	Base Station System
BTS	Base Transceiver Station
CDU	Combining and Distribution Unit
CXU	Configuration Switch Unit
dB	Decibel
dBm	Decibel relative to 1 milliwatt
DCCU	DC Connection Unit
DTX	Discontinuous Transmission
DUPL	Duplex
DXU	Distribution Switch Unit
DXX	digital cross-connect
EACU	External Alarm Connection Unit
ECU	Energy Control Unit
ECSD	EDGE Circuit Switched Data
EDGE	Enhanced Data rates for Global Evolution
EGPRS	EDGE GPRS
EMC	Electromagnetic Compatibility
FCOMB	Filter Combiner
GMSK	Gaussian Minimum Shift Keying
GPRS	General Packet Radio Services
GSM	Global System for Mobile Communications
HCOMB	Hybrid Combiner
HCS	Hierarchical Cell Structure
HSCSD	High Speed Circuit Switched Data
HW	Hardware
IDB	Installation Data Base
IDM	Internal Distribution Module
kbit/s	kilobits per second
kg	kilogram
kW	kilowatt
L	Litres
lb	pound
LAPD	Link Access Protocol on D-channel
LED	Light Emitting Diode
LTE	Line Transmission Equipment
Mbit/s	Megabit per second
MCU	Measuring Coupler Unit
mm	millimetre
MMI	Man Machine Interface
MO	Managed Object
MS	Mobile Station
NMC	Network Management Centre
O&M	Operation and Maintenance
OML	Operation and Maintenance Link
OMT	Operation and Maintenance Terminal
OS	Operating System
OSS	Operation Support System
PC	Personal Computer
PCM	Pulse Code Modulation
PSK	Phase Shift Keying
PSTN	Public Switched Telephone Network
PSU	Power Supply Unit
RBS	Radio Base Station
RX	Receiver
RF	Radio Frequency
RSL	Radio Signalling Link
RU	Replaceable Unit
RXBP	Receiver Band Pass Filter
RXD	Receiver Divider
RXDA	Receiver Divider Amplifier
SDCCH	Stand Alone Dedicated Control Channel
SO	Service Object
STC	Signalling Terminal Central
TCH	Traffic Channel
TDMA	Time Division Multiple Access
TMA	Tower Mounted Amplifier
TRU	Transceiver Unit
TS	Time Slot
TX	Transmitter
TXBP	Transmitter Band Bass Filter
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
VSWR	Voltage Standing Wave Ratio
W	Watt

.

RBS 2106 Product Description

Contents

- Please note that this description includes details on both basic and optional products. It does not necessarily correspond to any specific release or delivery time, nor is it a complete technical specification.

1 Introduction

The purpose of this document is to describe the powerful RBS 2106, which is a 12 TRX outdoor GSM radio baste station. The document aims to give a general overview of the RBS 2106.

1.1 A new powerful member of the RBS 2000 family

The RBS 2106 is a new member of the highly successful RBS 2000 family. This guarantees a world-class supply flow, fast installation and commissioning, reliable operation & maintenance and coexistence with other RBS 2000 and RBS 200 products.

The RBS 2106 is an outdoor macro base station supporting up to twelve transceivers per cabinet. The cabinet has the same footprint and height as the RBS 2102 but has doubled capacity due to the new double capacity transceivers and combiner.

Due to increased generated heat (12 TRXs generates more heat than 6) the cabinet door will be deeper than in the RBS 2102.

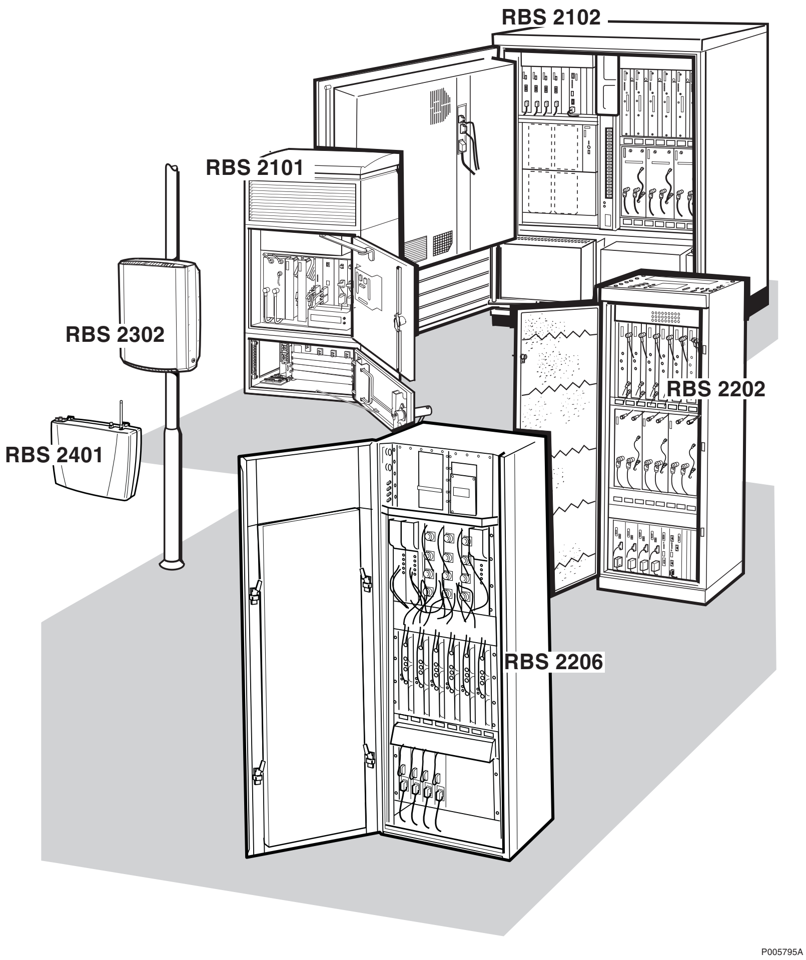

Figure 1. Members of the RBS 2000 family. The RBS 2106 looks similar as the RBS 2102.

1.2 RBS 2106 – Double Your Capacity with the same footprint

Ericsson's GSM radio base station RBS 2106 facilitates capacity expansion without the need for new sites. The RBS 2106 provides convenience without compromise for GSM operators.

Today, the mobile penetration has exceeded 40 percent in mature markets and many operators are experiencing an almost explosive subscriber growth. In addition, the usage per subscriber is increasing. As a consequence, the operators must be able to handle more traffic in their networks.

At the same time, finding new base station sites is becoming increasingly difficult. Each new site requires building permission and extensive negotiations with landlords. The latter is nowadays an often time-consuming procedure and if the operator is lucky to close the deal, it often proves to be rather expensive.

As a result, the site space is a limiting factor for capacity growth and therefore it is of great interest to the operators to stick to the existing sites as long as possible. The powerful RBS 2106 is a means of addressing this need.

With the RBS 2106, the requirement on channel separation is decreased for configurations with filter combiners (900 and 1800MHz). Another example of a cost saving feature is Extended Range 121 km. The double transceiver, dTRU, consists of two transceivers in one unit of the same size as the current single TRU. To meet the operators' need for faster data communication solutions, the RBS 2106 can be equipped with an EDGE capable version of the dTRU. The RBS 2106 has the capacity to handle EDGE on all twelve transceivers.

The RBS 2106 comes with two extremely flexible combiners CDU_G (800, 900,1800 and 1900MHz) and CDU_F (900 and 1800MHz). These combiners make it possible to build one-sector, two-sector, three-sector and dual band (GSM 900/GSM 1800, GSM 800/1900 and GSM 800/1800) configuration in one cabinet. Examples on configurations supported by the filter combiner (CDU-F) are 3x4, 2x6 and 1x12 in one cabinet.

The CDU-G combiner can be configured in two modes: capacity mode and the coverage mode, which makes it very flexible. By running the CDU-G in coverage mode, the output power from the combiner is increased by 3.5 dB, making it perfect for rural sites or when fast rollout is required to a minimum cost. To build a 3x4 configuration, the RBS 2106 is equipped with three CDU-G.

2 RBS 2106 Architecture

The RBS 2106 comprises the following major units:

- Power Supply Unit (PSU)
- Distribution Switch Unit (DXU)
- Internal Distribution Module (IDM)
- Double Transceiver Unit (dTRU)
- Configuration Switch Unit (CXU)
- Combining and Distribution Unit (CDU)
- AC Connection Unit (ACCU)
- Fan Control Unit (FCU)
- Climate Unit (CU, located in the door)
- Battery Box (BB)
- Transmission Module (TM)
- Antenna Sharing Unit (ASU) (option for GSM 800 and GSM 1900)

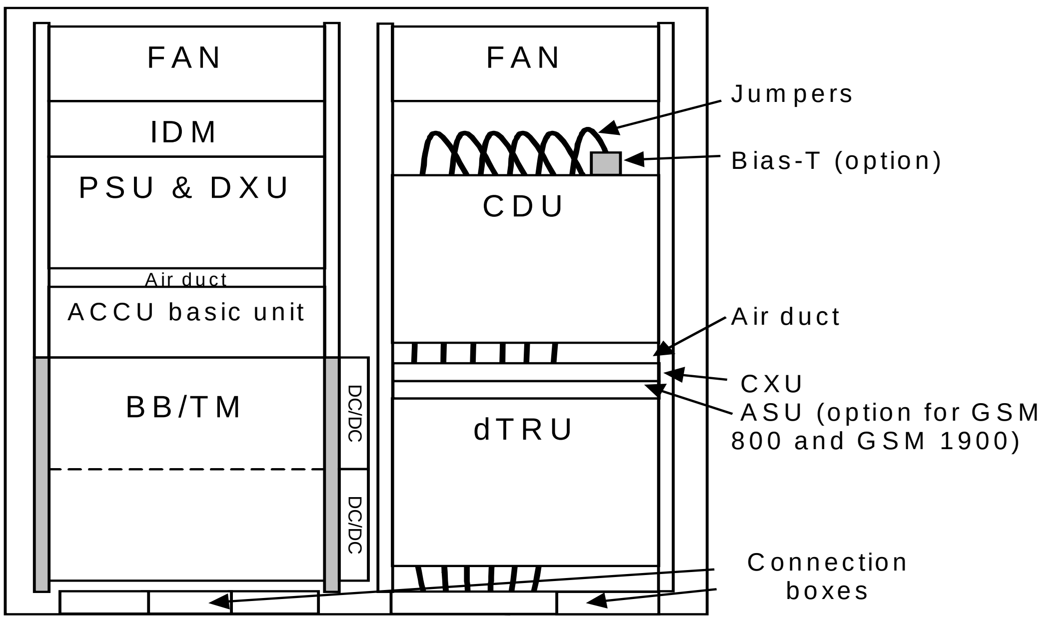

Figure 2. RBS 2106.

Power Supply Unit (PSU)

The PSU rectifies AC supply voltage to regulated system voltage, +24 VDC.

The PSU's are connected in parallel at the secondary side and may be configured with an N+1 redundancy.

When using a battery backup, an extra PSU is recommended for recharging of batteries. If the RBS is equipped with a redundant PSU no extra PSU is required for battery charging.

Distribution Switch Unit (DXU)

The DXU provides a system interface to the 2 Mbit/s or 1.5 Mbit/s link and cross connects individual time slots to certain transceivers. The DXU also extracts the synchronisation information from the PCM link and generates a timing reference for the RBS.

The DXU supports LAPD Multiplexing, LAPD Concentration and the Multi Drop functionality.

Figure 3. Front view of DXU-21.

The RBS 2106 is delivered with DXU-21 that has some powerful features:

- It is equipped with four transmission ports (E1/T1)
- It is hardware prepared for support of EDGE functionality on up to twelve transceivers.
- It will support a synchronised radio network with help of an interface to an external GPS receiver.
- It will support the mobile positioning function with help of an interface to an external LMU.
- It will consist of a single unit with a removable Flashcard, permitting a fast and simple load of Installation Data Base (IDB) and RBS software in the RBS 2106.
- It is hardware prepared to support a “Site LAN” implementation with help of an External O&M (EOM) bus. The EOM bus is designed as a standard Ethernet port.
- It supports TG synchronisation.
- It has built in ECU functionality.

Internal Distribution Module (IDM)

The IDM handles the distribution and fusing of the system voltage (+24 VDC) to the units in the cabinet. There is a connector for connection of ESD bracelet and instrument electrical earth on the IDM.

Double Transceiver Unit (dTRU)

The dTRU is a two-transceiver Replaceable Unit. Up to six dTRU units can be installed in one RBS 2106 cabinet, enabling up to 12 TRXs per cabinet.

Figure 4. Double Transceiver Unit.

There are different versions of the dTRU dependent on frequency band and EDGE support. All dTRUs are HW prepared to handle HSCSD and GPRS, the EDGE dTRU is HW prepared to also handle the ECSD and EGPRS functionality.

The dTRU supports different ciphering standards. Either A5/1 or A5/2 can be used. The ciphering is controlled via software.

A hybrid combiner is included inside the dTRU. The combiner can be used, optional, together with CDU-G to increase the number of TRXs per antenna. It is possible to by-pass the hybrid combiner by connecting a cable in the front of the dTRU.

Extended Range up to 121 km is supported.

The dTRU is hardware prepared to support performance improvements via software upgrades, e.g. four-branch RX diversity and Enhanced Interference Suppression (EIS).

Configuration Switch Unit (CXU)

The task of the CXU is to cross connect between the CDU and the dTRU in the receiving path. The CXU makes it possible to expand or reconfigure a cabinet without moving or replacing any RX cables.

Figure 5. Configuration Switch Unit.

The RX inputs/outputs on the dTRU and the CDU are placed in such positions that they minimise the amount of cable types for connecting the CXU with the dTRU/CDU.

Combining and Distribution Unit (CDU)

The CDU combines the transmitted signals from the transceivers and distributes the received signals. Duplex filters are included in the CDU. A measuring coupler, providing forward and reflected power measurements for Voltage Standing Wave Ratio (VSWR) calculations is located in the CDU. Two different CDU types exist to support all the configurations.

- With hybrid combining, CDU-G, for 800, 900,1800 and 1900MHz. Allows base band or synthesised frequency hopping.
- With filter combining to support large configurations, CDU-F, for 900 and 1800 MHz. Allows base band frequency hopping. CDU-F is optimised for giving large configurations maximum output power on minimum number of antennas.

Figure 6. CDU-G and CDU-F.

Duplex filters allow both receiver and transmitter path connections to a common antenna. The duplex configurations minimise the number of required feeders and antennas as well as the combining loss in the transmission path.

The different CDU types are further described in the Radio Specifications for the different frequencies.

The CDU-G and CDU-F are hardware prepared to support EDGE.

AC connection unit and BFU

The ACCU handles the distribution and connection of the incoming power supply voltages 200-250 VAC to the PSU´s and climate unit.

The BFU supervises and connects/disconnects the batteries at low voltage.

Transient and lightning protection

RBS 2106 is equipped with transient and lightning protection, located in the connection boxes.

Climate Unit (CU) and FCU

The climate unit maintains the internal temperature in the cabinet. The CU communicates with the DXU.

The fans are controlled by the DXU via the fan control unit with the aid of temperature sensors placed inside the RU´s.

Tower Mounted Amplifier (TMA)

A Tower Mounted low noise Amplifier (TMA) is an option that can be used in order to compensate for losses in the antenna feeder and to improve the overall receiver performance. All the configurations, CDU-G or CDU-F are available with double duplex TMA as option. Bias injectors and a TMA control module (TMA-CM) are needed in the cabinet for TMA support. The BIAS injector is used to provide the TMA with DC power from the TMA-CM over the RF feeders.

External Alarms

The customer may define up to 16 external alarms. The external device sets the alarm by either an open or closed condition.

Antenna Sharing Unit (ASU)

The Antenna Sharing Unit (ASU) is a new unit that is available as an option for GSM 800 and GSM 1900. The ASU is intended to support antenna sharing between TDMA 850 and GSM 800 or between TDMA 1900 and GSM 1900. The RX-path is fed from the Antennas trough the feeders to the ARP (antenna reference point) of the RBS 2106. The signal is then filtered and amplified in the CDU. From the RX output of the CDU the signal is fed to the ASU where a small portion of the signal is fed to the RX input of the Co-Sited RBS.

The RBS 2106 cabinet

- Outdoor specified.
- Supports up to six double transceiver units (12 TRX's) per cabinet.
- One cabinet can be configured as a one, two or three sector cell configuration.
- The cabinet fulfils seismic requirements

Figure 7. RBS 2106 cabinet.

All units in the cabinet are easily accessible from the front of the cabinet. There are no requirements on access to the cabinet from the sides or the back, which implies that the cabinets can be mounted side by side with the back to a wall.

Cable entries for antenna feeders, transmission cables, and mains power are concentrated at the bottom of the cabinet.

3 Technical Specification

3.1 Mechanical Dimensions

Table 1. Mechanical Dimensions.

Quantity	**Value (mm)**
Height	1614
Width	1300
Depth (inclusive door of 230 mm)	940
Footprint (Depth)	710

3.2 Weight

Table 2. Weight.

Unit	**Weight (kg)**
Fully equipped cabinet incl. batteries.	590
Fully equipped cabinet excl. batteries.	550

3.3 Power Requirements

Table 3. Power Requirements.

Quantity	**Value**
AC input voltage:	200–250 VAC
Backup capacity at maximum load (depending on number of batteries)	15–30 min
External fuse:	
– AC input	1x50A or 3×32 A

3.4 Power Consumption

The maximum operating power consumption for RBS 2106 is 6.6 kW with air condition valid for 200-250 VAC.

These figures correspond to operation during peak load in extreme conditions. The power consumption during normal operation is however also configuration dependent.

3.5 Colour

The RBS 2106 will have same colours, which are used on the RBS 2102.

Table 4. Colours

Colour	**Reference Number**	**Ericsson Number**
Grey	RAL 7035	MZY 543 03/8119
Green	NCS 8010-G 10Y	MZY 543 03/685

3.6 Electromagnetic Compatibility (EMC)

All RBS 2106 models fulfils the Electromagnetic Compatibility (EMC) requirements according to:

- ETS 300 342-2, the BTS product standard, in line with the European EMC Directive 89/336/EEC.
- 1999/5/EC Radio and TTE directive
- EN 55022 Class B
- GSM:11.21
- FCC, part 15

The RBS 2106 is CE marked in order to show this compliance.

3.7 External Alarms

RBS 2106 provides connections for external alarms. The external alarms are defined by the customer and are reported to the BSC via LAPD signalling on the A-bis O&M interface.

There are 16 external alarms available (unoccupied). The external alarms are defined by using the Operation and Maintenance Terminal (OMT) or the Remote OMT.

3.8 Battery Backup and BFU

In the cabinet a Battery Fuse Unit, BFU, is installed. The BFU supervises and connects/disconnects the batteries at low voltage.

It is possible to chose between internal and external battery backup. Both cannot be used at the same time.

Internal battery backup

Flexible 6-12 HE can be used for battery backup inside the cabinet.

The BB is 6 HE and the transmission box is also 6HE. If no extra transmission is needed, the transmission box could be used for extended internal battery backup.

External battery backup

External battery backup will be available. It will be possible to share battery backup between RBS 2106 and RBS 2102/200.

3.9 Transmission

All RBS 2000 models support multi-drop bypass functionality. Each RBS can be configured for stand alone or linear cascade mode. The configuration is performed by means of the OMT.

LAPD concentration and LAPD multiplexing could be used to make the transmission resource more efficient.

The DXU-21 is equipped with four external ports supporting in total up to 8 Mbit/s.

Interfaces

- T1/1.5 Mbit/s, 100 Ohm
- E1 2 Mbit/s, 75 Ohm
- E1 2 Mbit/s, 120 Ohm

The interfaces are supported on the same physical ports.

Connections

E1/75, E1/120 and T1/100 Ohm is connected to the RBS 2106 via a screw terminal that includes an impedance converter.

E1/120 Ohm and T1/100 Ohm transmission supports Long Haul. E1/G.703 and T1/DS1 offer multi vendor compatibility on the transmission level. Normally E1/G.703 and T1/DS1 only offers short haul interfaces, enabling distances up to 6 dB loss. The long haul feature allows for 30 dB loss and a more cost efficient transmission network configuration.

75 Ohm is only available for E1 operation and does not support long haul. The distance allowed between units is determined by the cable loss, according to the 6 dB receiver sensitivity specified in G.703.

Additional transmission equipment and TM box

The RBS 2106 cabinet has got room for additional transmission equipment in the Optional Expansion Unit (OXU) positions above the dTRU.

The RBS 2106 supports the possibility of housing Mini-DXC or DXX equipment in the OXU positions in the PSU sub rack.

The 2-card DXX plug-in unit for RBS 2106 is a Digital cross-connect with four G.704 ports and one slot for 2-4 additional interfaces that can be G.703, HDSL, LTE or Optical fibre.

The 1 card DXX plug-in unit for RBS 2106 is a Digital cross-connect with four G.703 ports.

The Mini-DXC plug-in unit for RBS 2106 is a Digital cross-connect with five G.703 ports.

The Mini-DXC or DXX plug-in has the functionality of a Mini-DXC / DXX node, a combination of Cross-connect, Control and G.703 interface units.

The TM-box (6HE) in the bottom of the cabinet can house customer specific transmission equipment. If no internal batteries are used, additional customer specific transmission equipment can be placed in the internal battery box. This gives a total space of 12HE.

In case customer specific equipment is set in this compartment the equipment must fulfil the Electromagnetic Compatibility (EMC) requirements according to:

- ETS 300 342-2, the BTS product standard, in line with the European EMC Directive 89/336/EEC.
- FCC, part 15

The transmission box supports the equipment with 250 or 500 W. When 500 W is used the PSU redundancy is reduced, the allowed heat generated in TM-box is max 300W and transmission battery backup time will be slightly shorter.

3.10 Other Requirements

Product Safety

In accordance with the Low Voltage Directive (LVD 73/23/EEC plus 93/68/EEC) within the European Union the RBS 2106 models comply with the following requirements regarding product safety:

- EN 60 950/IEC 950
- EN 60 215/IEC 215
- EN 60 529/IEC 529

The RBS 2106 models are designed to fulfil the following safety standards in North America:

- UL 1950, 2nd Edition, “Information Technology Equipment Including Electrical Business Equipment”
- CSA C22.2 No. 950-95, “Safety of Information Technology Equipment Including Electrical Business Equipment”

The RBS 2106 models are CE marked and UL listed in order to show this compliance.

Environmental Requirements

The requirements for climatic/mechanical environment are based on ETSI standard ETS 300 019 Classification of Environmental Conditions and IEC 721.

Storage Requirements

The RBS 2106 complies with ETS class 1.2 Weather Protected, Not Temperature Controlled Storage Locations in ETS 300 019-1-1.

Transportation Requirements

The RBS 2106 complies with ETS class 2.3 Public Transportation in ETS 300 019-1-2.

Earthquake Protection

The RBS 2106 is designed to fulfil earthquake protection according to IEC 68-2-57.

In-Use Requirements

The RBS 2106 is designed for normal operation in the climate conditions of class 4.1 of IEC 721-3-4 (ETS 300 019-1-4). Temperature range: -33 ºC up to +45 ºC, Relative humidity: 15 to 100 %.

4 GSM 800 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

4.1 System Data

Receiver:	824 to 849 MHz
Transmitter:	869 to 894 MHz
Carrier bandwidth:	200 kHz
Channels per carrier:	8 full rate channels
Modulation method:	GMSK, EDGE-dTRU handles both GMSK and 8-PSK
Duplex Separation:	45 MHz

The RBS output power is dynamically controlled. The control range is 30 dB in 2 dB steps including the configuration steps from maximum output.

4.2 CDU-types for GSM 800

CDU-G 800

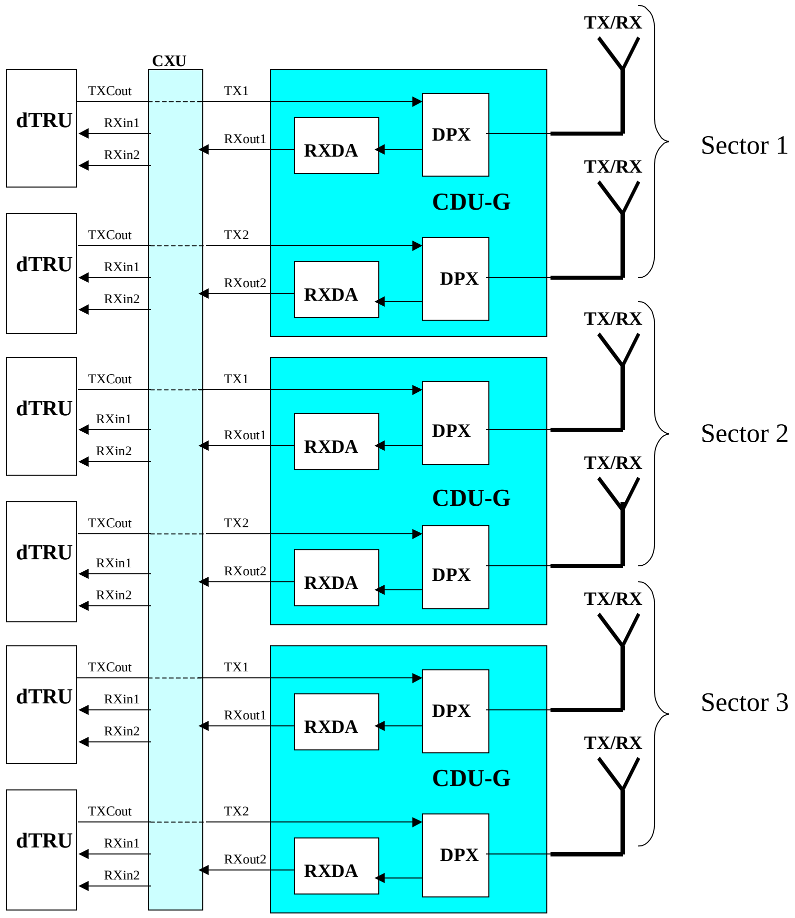

Figure 8. CDU-G for GSM 800 in a configuration with four TRXs (two dTRUs) in each sector. Hybrids in the dTRUs are used.

With CDU-G it is optional to use the hybrid combiner in the dTRU.

If the hybrid combiner is used 4 TRXs per cross-polarised antenna is supported. When the hybrid combiner is by-passed the output power is maximised.

Synthesised or base band frequency hopping is allowed for all CDU-G configurations.

The CDU-G 800 MHz main characteristics are:

- Up to 4 TRXs per two antennas (two physical antennas) or one dual polarised.
- No limitations on frequency planning.
- Required frequency separation is 400 kHz (due to GSM specification).
- Synthesiser and base band frequency hopping are supported.
- Configurations with and without hybrid combination are possible (with the same HW).
- Maximum 12 TRXs per cabinet when the hybrids in the dTRUs are used.
- Maximum 6 TRXs per cabinet when the hybrids in the dTRUs are not used. The 6 TRXs will in this configuration occupy the CDU-G capacity.
- Covers GSM 850 band (TX 869-894 MHz, RX 824-849 MHz).
- CDU-G is prepared to handle 8-TRXs per CDU by use of a future extra hybrid combiner on the TX path between the dTRUs and the CDU-G.

4.3 GSM 800 Configurations

The configurations are the maximum configurations within a given number of CDUs. The single cell configuration can be duplicated or triplicated to form multicell configurations by for instance utilising the Multi Drop functionality.

Table 5. Configurations for GSM 800 with CDU-G without hybrids used in the dTRUs.

Max Config	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas**[1]	**CDU type**
1x2	1	Opt.	1	(2)	G
2x2	1	Opt.	2	(2)(2)	G
3x2	1	Opt.	3	(2)(2)(2)	G

Table 6. Configurations for GSM 800 with CDU-G with hybrids used in the dTRUs.

Max Config	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas**[1]	**CDU type**
1x4	1	Opt.	1	(2)	G
1x8	1	Opt.	2	(4)	G
1x12	1	Opt.	3	(6)	G
2x4	1	Opt.	2	(2)(2)	G
2x6	1	Opt.	3	(3)(3)	G
3x4	1	Opt.	3	(2)(2)(2)	G

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

5 GSM 900 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

5.1 System Data

Receiver:	880 to 915 MHz (E-GSM)
Transmitter:	925 to 960 MHz (E-GSM)
Carrier bandwidth:	200 kHz
Channels per carrier:	8 full rate channels
Modulation method:	GMSK, EDGE-dTRU handles both GMSK and 8-PSK
Duplex Separation:	45 MHz

The RBS output power is dynamically controlled. The control range is 30 dB in 2 dB steps including the configuration steps from maximum output.

5.2 CDU-types for GSM 900

CDU-G 900

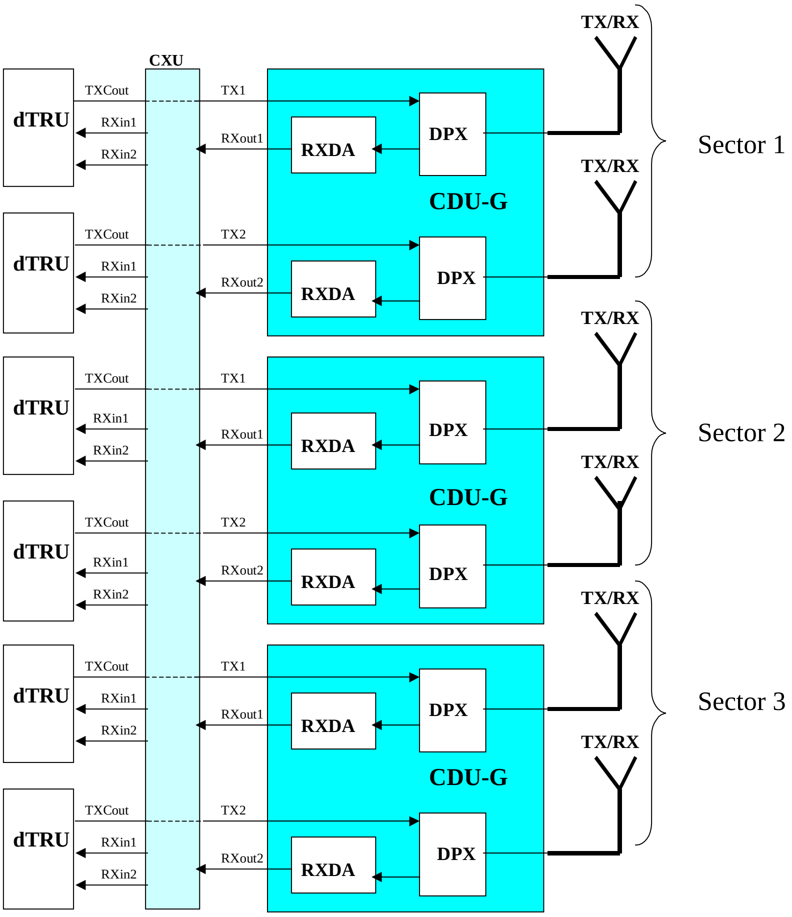

Figure 8. CDU-G for GSM 900 in a configuration with four TRX's (two dTRU's) in each sector. Hybrids in the dTRU's are used.

With CDU-G it is optional to use the hybrid combiner in the dTRU.

If the hybrid combiner is used 4 TRXs per cross-polarised antenna is supported. When the hybrid combiner is by-passed the output power is maximised.

Synthesised or base band frequency hopping is allowed for all CDU-G configurations.

The CDU-G 900 MHz main characteristics are:

- Up to 4 TRX's per two antennas (two physical antennas) or one dual polarised.
- No limitations on frequency planning.
- Required frequency separation is 400 kHz (due to GSM specification).
- Synthesiser and base band frequency hopping are supported.
- Configurations with and without hybrid combination are possible (with the same HW).
- Maximum 12 TRX's per cabinet when the hybrids in the dTRU's are used.
- Maximum 6 TRX's per cabinet when the hybrids in the dTRU's are not used. The 6 TRX's will in this configuration occupy the CDU-G capacity.
- Covers E-GSM (TX 925-960 MHz, RX 880-915 MHz) including P-GSM (TX 935-960 MHz, RX 890-915 MHz).
- CDU-G is prepared to handle 8-TRX's per CDU by use of a future extra hybrid combiner on the TX path between the dTRU and the CDU-G.

CDU-F 900

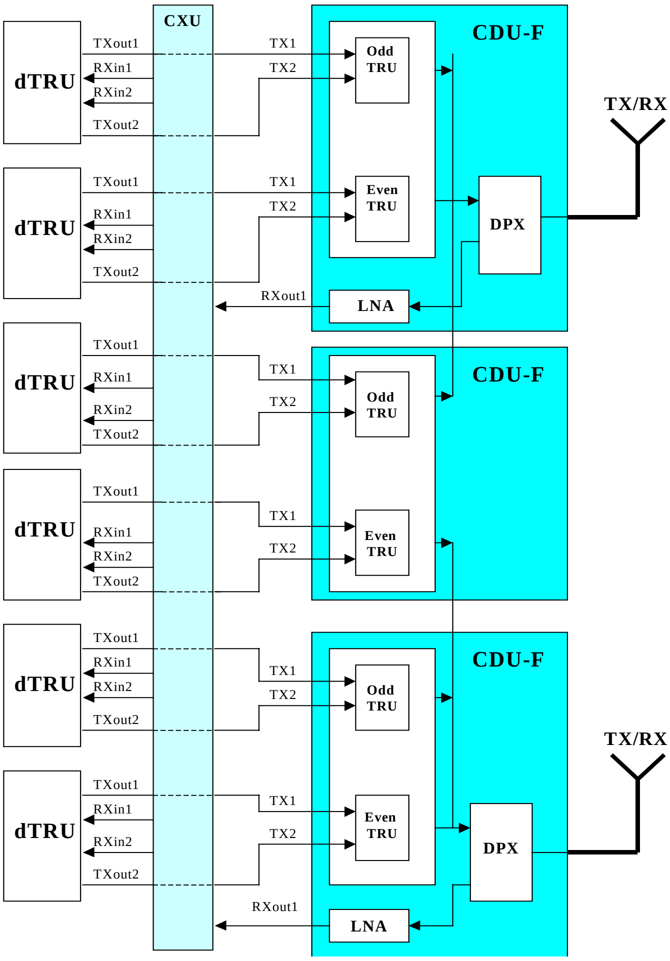

Figure 9. CDU-Fs for GSM 900 in a configuration with twelve TRX's (6 dTRU's) in one sector.

CDU-F can be used to optimise the cell for high capacity, since the possible number of TRXs per antenna is higher for this CDU compared to any other CDU-type.

The CDU-F 900 MHz main characteristics are:

- CDU-F is designed to enable many TRXs per antenna, see table 9.
- One CDU-F has the same physical size as of one CDU-G.
- Base band frequency hopping is supported.
- Required channel separation is 400 kHz. If a channel separation on 600 kHz is used ~0.5 dB higher maximum RF output is achieved.
- Covers E-GSM (TX 925-960 MHz, RX 880-915 MHz) including P-GSM (TX 935-960 MHz, RX 890-915 MHz).
- IM3 limitations on frequency planning (CDU-F might require IM3 frequency planning depending on the bandwidth used by the operator.)
- One, two and three sector configurations in one RBS 2106 cabinet are possible.
- Dual band (900 and 1800 MHz) configurations are supported using different CDU-F (different frequencies).

5.3 GSM 900 Configurations

The configurations are the maximum configurations within a given number of CDU's. The single cell configuration can be duplicated or triplicated to form multicell configurations by for instance utilising the Multi Drop functionality.

Table 7. Configurations for GSM 900 with CDU-G without hybrids used in the dTRU's.

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x2	1	Opt.	1	(2)	G
2x2	1	Opt.	2	(2)(2)	G
3x2	1	Opt.	3	(2)(2)(2)	G

Table 8. Configurations for GSM 900 with CDU-G with hybrids used in the dTRU's.

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x4	1	Opt.	1	(2)	G
1x8	1	Opt.	2	(4)	G
1x12	1	Opt.	3	(6)	G
2x4	1	Opt.	2	(2)(2)	G
2x6	1	Opt.	3	(3)(3)	G
3x4	1	Opt.	3	(2)(2)(2)	G

Table 9. Configurations for GSM 900 with CDU-F.

Max Config	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x4	1	Opt.	1	(2)	F
1x8	1	Opt.	2	(2)	F
1x12	1	Opt.	3	(2)	F
2x4	1	Opt.	2	(2)(2)	F
2x6	1	Opt.	3	(2)(2)	F
3x4	1	Opt.	3	(2)(2)(2)	F
8+4[2]	1	Opt.	3	(2)(2)	F
4+8[2]	1	Opt.	3	(2)(2)	F

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

[2] Two sector configurations

6 GSM 1800 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

6.1 System Data

Receiver:	1710 to 1785 MHz
Transmitter:	1805 to 1880 MHz
Carrier bandwidth:	200 kHz
Channels per carrier:	8 full rate channels
Modulation method:	GMSK, EDGE-dTRU handles both GMSK and 8-PSK
Duplex Separation:	95 MHz

The RBS output power is dynamically controlled. The control range is 30 dB in 2 dB steps including the configuration steps from maximum output power.

6.2 CDU-types for GSM 1800

CDU-G 1800

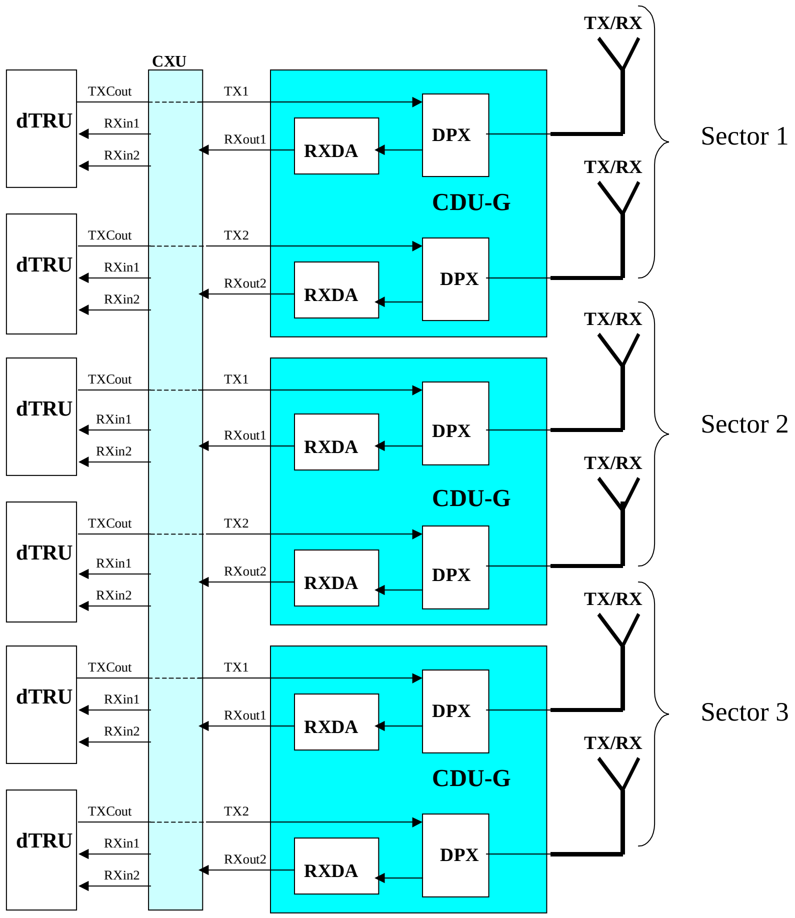

Figure 10. CDU-G for GSM 1800 in a configuration with four TRX's (two dTRU's) in each sector. Hybrids in the dTRU's are used.

With CDU-G it is optional to use the hybrid combiner in the dTRU.

If the hybrid combiner is used 4 TRXs per cross-polarised antenna is supported. When the hybrid combiner is by-passed the output power is maximised.

Synthesised or base band frequency hopping is allowed for all CDU-G configurations.

The CDU-G 1800 MHz main characteristics are:

- Up to 4 TRX’s per two antennas (two physical antennas) or one dual polarised.
- No limitations on frequency planning.
- Required frequency separation is 400 kHz (due to GSM specification).
- Synthesiser and base band frequency hopping are supported.
- Configurations with and without hybrid combination are possible (with the same HW).
- Maximum 12 TRX’s per cabinet when the hybrids in the dTRU’s are used.
- Maximum 6 TRX’s per cabinet when the hybrids in the dTRU’s are not used. The 6 TRX’s will in this configuration occupy the CDU-G capacity.
- CDU-G is prepared to handle 8-TRX’s per CDU by use of a future extra hybrid combiner on the TX path between the dTRU and the CDU-G.

CDU-F 1800

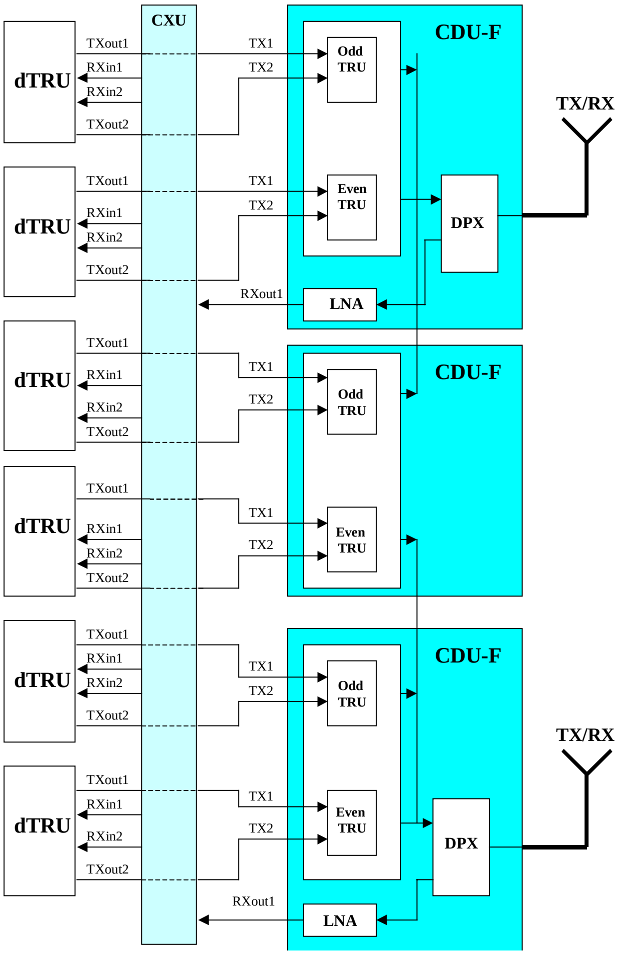

Figure 11. Three 3 CDU-Fs for GSM 1800 in a configuration with twelve TRX's (6 dTRU's) in one sector.

CDU-F can be used to optimise the cell for high capacity, since the possible number of TRXs per antenna is higher for this CDU compared to any other CDU-type.

The CDU-F 1800 MHz main characteristics are:

- CDU-F is designed to enable many TRXs per antenna, see table 12.
- One CDU-F has the same physical size as of one CDU-G.
- Base band frequency hopping is supported.
- Required channel separation is 400 kHz. . If a channel separation on 800 kHz is used ~1.0 dB higher maximum RF output is achieved.
- IM3 limitations on frequency planning (CDU-F might require IM3 frequency planning depending on the bandwidth used by the operator.)
- One, two and three sector configurations in one RBS 2106 cabinet are possible.
- Dual band (900 and 1800 MHz) configurations are supported using different CDU-F (different frequencies).

6.3 GSM 1800 MHz Configurations

The configurations are the maximum configurations within a given number of CDU's. The single cell configuration can be duplicated or triplicated to form multicell configurations by for instance utilising the Multi Drop functionality.

Table 10. Configurations for GSM 1800 with CDU-G without hybrids used in the dTRU's (uncombined mode).

Max Config	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas[1]**	**CDU type**
1x2	1	Opt.	1	(2)	G
2x2	1	Opt.	2	(2)(2)	G
3x2	1	Opt.	3	(2)(2)(2)	G

Table 11. Configurations for GSM 1800 with CDU-G with hybrids used in the dTRU's (combined mode).

Max Config	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas[1]**	**CDU type**
1x4	1	Opt.	1	(2)	G
1x8	1	Opt.	2	(4)	G
1x12	1	Opt.	3	(6)	G
2x4	1	Opt.	2	(2)(2)	G
2x6	1	Opt.	3	(3)(3)	G
3x4	1	Opt.	3	(2)(2)(2)	G

Table 12. Configurations for GSM 1800 with CDU-F

Max Config	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas[1]**	**CDU type**
1x4	1	Opt.	1	(2)	F
1x8	1	Opt.	2	(2)	F
1x12	1	Opt.	3	(2)	F
2x4	1	Opt.	2	(2)(2)	F
2x6	1	Opt.	2	(2)(2)	F
3x4	1	Opt.	3	(2)(2)(2)	F
8+4 [2]	1	Opt.	3	(2)(2)	F
4+8 [2]	1	Opt.	3	(2)(2)	F

[1] The number of physical antennas is reduced if cross-polarised antennas are used.
[2] Two sector configurations.

7 GSM 1900 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

7.1 System Data

Receiver:	1850 to 1910 MHz
Transmitter:	1930 to 1990 MHz
Carrier bandwidth:	200 kHz
Channels per carrier:	8 full rate channels
Modulation method:	GMSK, EDGE-dTRU handles both GMSK and 8-PSK
Duplex Separation:	80 MHz

The RBS output power is dynamically controlled. The control range is 30 dB in 2 dB steps including the configuration steps from maximum output power.

7.2 CDU-types for GSM 1900

CDU-G 1900

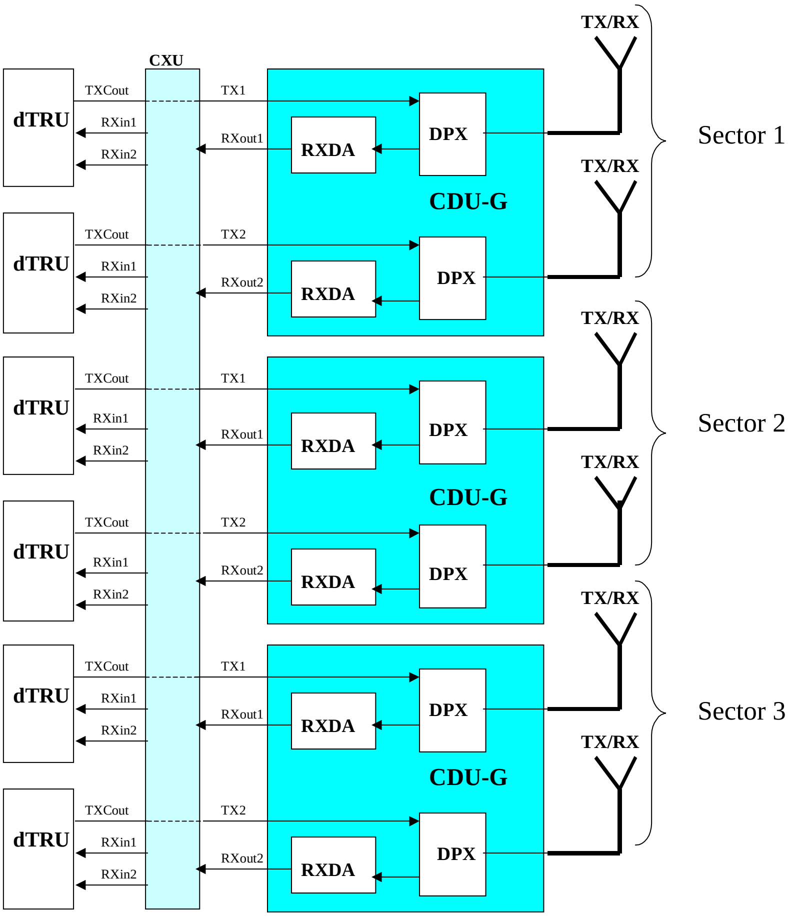

Figure 12. CDU-G for GSM 1900 in a configuration with four TRX's (two dTRU's) in each sector. Hybrids in the dTRU's are used.

With CDU-G it is optional to use the hybrid combiner in the dTRU.

If the hybrid combiner is used 4 TRXs per cross-polarised antenna is supported. When the hybrid combiner is by-passed the output power is maximised.

Synthesised or base band frequency hopping is allowed for all CDU-G configurations.

The CDU-G 1900 MHz main characteristics are:

- Up to 4 TRX’s per two antennas (two physical antennas) or one dual polarised.
- No limitations on frequency planning.
- Required frequency separation is 400 kHz (due to GSM specification).
- Synthesiser and base band frequency hopping are supported.
- Configurations with and without hybrid combination are possible (with the same HW).
- Maximum 12 TRX’s per cabinet when the hybrids in the dTRU’s are used.
- Maximum 6 TRX’s per cabinet when the hybrids in the dTRU’s are not used. The 6 TRX’s will in this configuration occupy the CDU-G capacity.
- CDU-G is prepared to handle 8-TRX’s per CDU by use of a future extra hybrid combiner on the TX path between the dTRU and the CDU-G.

7.3 GSM 1900 MHz Configurations

The configurations are the maximum configurations within a given number of CDU's. The single cell configuration can be duplicated or triplicated to form multicell configurations by for instance utilising the Multi Drop functionality.

Table 13. Configurations for GSM 1900 with CDU-G without hybrids used in the dTRU's (uncombined mode).

Max Config	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas[1]**	**CDU type**
1x2	1	Opt.	1	(2)	G
2x2	1	Opt.	2	(2)(2)	G
3x2	1	Opt.	3	(2)(2)(2)	G

Table 14. Configurations for GSM 1900 with CDU-G with hybrids used in the dTRU's (combined mode).

Max Config	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas[1]**	**CDU type**
1x4	1	Opt.	1	(2)	G
1x8	1	Opt.	2	(4)	G
1x12	1	Opt.	3	(6)	G
2x4	1	Opt.	2	(2)(2)	G
2x6	1	Opt.	3	(3)(3)	G
3x4	1	Opt.	3	(2)(2)(2)	G

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

8 Dual Band GSM 900/1800 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

The Dual Band BTS comprises equipment for both GSM 900 and GSM 1800.

8.1 System Data

The System Data, for the Dual Band RBS are the same as for the GSM 900 and the GSM 1800.

8.2 Configurations Dual Band RBS

Table 15. Configurations for Dual band with CDU-G.

Max Config (900|1800)	No. of cabinets	TMA	Number of CDU's	Number of Antennas[1]	CDU type
1x4|1x4	1	Opt.	2	(2)|(2)	G
1x8|1x4	1	Opt.	3	(4)|(2)	G
1x4|1x8	1	Opt.	3	(2)|(4)	G

Table 16. Configurations for Dual Band with CDU-F and the hybrids used in the dTRU's (combined mode).

Max Config (900|1800)	No. of cabinets	TMA	Number of CDUs	Number of Antennas[1]	CDU type
1x4|1x4	1	Opt.	2	(2)|(2)	F
1x8|1x4	1	Opt.	3	(2)|(2)	F
1x4|1x8	1	Opt.	3	(2)|(2)	F

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

9 Dual Band GSM 800/1900 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

The Dual Band BTS comprises equipment for both GSM 800 and GSM 1900.

9.1 System Data

The System Data for the Dual Band RBS are the same as for the GSM 800 and the GSM 1900.

9.2 Configurations Dual Band RBS

Table 17. Configurations for Dual band with CDU-G.

Max Config (800|1900)	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas[1]**	**CDU type**
1x4|1x4	1	Opt.	2	(2)|(2)	G
1x8|1x4	1	Opt.	3	(4)|(2)	G
1x4|1x8	1	Opt.	3	(2)|(4)	G

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

10 Dual Band GSM 800/1800 Radio Specification

The operating specifications of the radio equipment will in most cases exceed the performance requirements specified in the GSM Technical Specifications.

The Dual Band BTS comprises equipment for both GSM 800 and GSM 1800.

10.1 System Data

The System Data for the Dual Band RBS are the same as for the GSM 800 and the GSM 1800.

10.2 Configurations Dual Band RBS

Table 18. Configurations for Dual band with CDU-G.

Max Config (800|1800)	**No. of cabinets**	**TMA**	**Number of CDU's**	**Number of Antennas[1]**	**CDU type**
1x4|1x4	1	Opt.	2	(2)|(2)	G
1x8|1x4	1	Opt.	3	(4)|(2)	G
1x4|1x8	1	Opt.	3	(2)|(4)	G

[1] The number of physical antennas is reduced if cross-polarised antennas are used.

11 Acronyms and Abbreviations

ACCU	AC Connection Unit
AO	Application Object
BCCH	Broadcast Control Channel
BDM	Battery Distribution Module
BFU	Battery Fuse Unit
BSC	Base Station Controller
BSS	Base Station System
BTS	Base Transceiver Station
CDU	Combining and Distribution Unit
CXU	Configuration Switch Unit
dB	Decibel
dBm	Decibel relative to 1 milliwatt
DTX	Discontinuous Transmission
DUPL	Duplex
DXU	Distribution Switch Unit
DXX	digital cross-connect
EACU	External Alarm Connection Unit
ECU	Energy Control Unit
ECSD	EDGE Circuit Switched Data
EDGE	Enhanced Data rates for Global Evolution
EGPRS	EDGE GPRS
EMC	Electromagnetic Compatibility
FCOMB	Filter Combiner
GMSK	Gaussian Minimum Shift Keying
GPRS	General Packet Radio Services
GSM	Global System for Mobile Communications
HCOMB	Hybrid Combiner
HCS	Hierarchical Cell Structure
HSCSD	High Speed Circuit Switched Data
HW	Hardware
IDB	Installation Data Base
IDM	Internal Distribution Module
kbit/s	kilobits per second
kg	kilogram
kW	kilowatt
l	litre
lb	pound
LAPD	Link Access Protocol on D-channel
LED	Light Emitting Diode
LTE	Line Transmission Equipment
Mbit/s	Megabit per second
MCU	Measuring Coupler Unit
mm	millimetre
MMI	Man Machine Interface
MO	Managed Object
MS	Mobile Station
NMC	Network Management Centre
O&M	Operation and Maintenance
OML	Operation and Maintenance Link
OMT	Operation and Maintenance Terminal
OS	Operating System
OSS	Operation Support System
PC	Personal Computer
PCM	Pulse Code Modulation
PSK	Phase Shift Keying
PSTN	Public Switched Telephone Network
PSU	Power Supply Unit
RBS	Radio Base Station
RX	Receiver
RF	Radio Frequency
RSL	Radio Signalling Link
RU	Replaceable Unit
RXBP	Receiver Band Pass Filter
RXD	Receiver Divider
RXDA	Receiver Divider Amplifier
SDCCH	Stand Alone Dedicated Control Channel
SO	Service Object
STC	Signalling Terminal Central
TCH	Traffic Channel
TDMA	Time Division Multiple Access
TMA	Tower Mounted Amplifier
TRU	Transceiver Unit
TS	Time Slot
TX	Transmitter
TXBP	Transmitter Band Bass Filter
VAC	Volts, Alternating Current
VDC	Volts, Direct Current
VSWR	Voltage Standing Wave Ratio
W	Watt