Global System for Mobile Communications (GSM)

Nortel GSM BTS 18000 Fundamentals

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Contents

New in this release

The following sections detail what is new in the *Nortel GSM BTS 18000 Fundamentals* (411-9001-160) guide for release V18.0 Pick & Choose 2.

Features

See the following section for information about feature changes:

- BTS18000 RICAM, ICAM, and ABM redesign (35035)
- GSM900-UMTS900 combination on the same antenna (35147)
- BTS 18000 Outdoor Worldwide (35152)
- Abis over IP on BTS6000 / BTS9000 / BTS18000 (34966)

BTS18000 RICAM, ICAM, and ABM redesign (35035)

This feature introduces a redesign of digital boards ABM, RICAM, and ICAM.

See impacts of this feature in the following locations:

- Updated 1.4.2 “BTS 18000 modules” (page 25).
- Updated 3.1 “BTS 18010 cabinet layout” (page 35).
- Updated 3.1.1 “Indoor cabinet with BCF on IBP/CIBP” (page 37).
- Updated 3.1.2 “Indoor cabinet with RICAM or RICAM2” (page 41).
- Updated 3.2 “BTS 18010 NG2 cabinet layout” (page 44).
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- Updated Chapter 4 “BTS 18000 modules description” (page 77).
- Updated 4.1 “Interface and digital back-planes” (page 79).
- Updated 4.2 “Interface Module (IFM/IFM1)” (page 92).
- Added 4.5 “Interface Control and Alarm Module (RICAM(2)/ICAM)” (page 130).
- Updated 4.3 “Interface Control Module (ICM)” (page 97).
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- Updated 4.11 “Radio InterCOnnect module (RICO)” (page 180).
- Updated 4.16 “BTS 18020 Power System general overview” (page 206).
- Updated 4.17 “BTS 18020 NG/BTS 18020 WW Power System general overview” (page 225).
- Updated Chapter 5 “BTS 18000 functional architecture” (page 263).
- Updated 6.2.1 “Downloadable files” (page 275).
- Updated 6.2.2 “BTS 18000 ICM software” (page 275).
- Updated 6.3 “BTS 18000 software functions” (page 278).
- Updated 6.3.2 “BCF software functions” (page 282).
- Updated 7.3.2 “Slave BTS 18000 LEDs behavior” (page 290).
- Updated 8.2 “GPS equipment” (page 293).
- Updated 9.1 “BTS 18000 - GSM - UMTS overview” (page 295).
- Updated 9.2.3 “Multi-cabinet GSM/UMTS configurations” (page 298).

GSM900-UMTS900 combination on the same antenna (35147)

This feature addresses the impacts for the GSM BCCH TDMA mapping to a GSM band TRX, when the GSM 900 band TRX and a UMTS 900 band TRX are sharing a single antenna.

See impacts of this feature in the following location:

- added 11.3 “Feature locking” (page 312)
- updated Chapter 11 “GSM900-UMTS900 combination on the same antenna” (page 309)

BTS 18000 Outdoor Worldwide (35152)

This feature introduces the BTS 18000 Outdoor worldwide.

See impacts of this feature in the following locations:

- Updated “Introduction” (page 13).
- Updated 1.1 “BTS 18000 versions” (page 23).
- Updated 1.4.2 “BTS 18000 modules” (page 25).
- Updated Chapter 3 “BTS 18000 cabinets description” (page 35).
- Added 3.5 “BTS 18020 WW cabinet layout” (page 64).
- Updated 3.7 “Cooling system” (page 70).
- Added 3.8.4 “BTS 18020 WW cabinet” (page 74).
- Updated Chapter 4 “BTS 18000 modules description” (page 77).
- Updated 4.1 “Interface and digital back-planes” (page 79).
- Updated 4.2 “Interface Module (IFM/IFM1)” (page 92).
- Updated 4.6 “Alarms and Bridge Module (ABM)” (page 140).
- Updated 4.11 “Radio InterCOnnect module (RICO)” (page 180).
- Updated 4.14 “Environmental Control System (ECS) of the BTS 18020 NG and BTS 18020 WW” (page 199).
- Updated 4.17 “BTS 18020 NG/BTS 18020 WW Power System general overview” (page 225).
- Updated 4.18 “Internal batteries” (page 240).
- Updated 4.19 “User rack” (page 246).
- Updated 4.20 “User InterCOnnect module (User ICO)” (page 248).
- Updated Chapter 5 “BTS 18000 functional architecture” (page 263).

Abis over IP on BTS6000 / BTS9000 / BTS18000 (34966)

This feature allows a BTS 6000, BTS 9000, BTS 12000, BTS 18000, to connect to the BSC using an Abis interface that runs over a packetized IP network.

See impacts of this feature in the following locations:

- Updated 1.4.2 “BTS 18000 modules” (page 25)
- Updated 2.2 “GSM features” (page 27)
- Updated 3.1 “BTS 18010 cabinet layout” (page 35)
- Updated 3.2 “BTS 18010 NG2 cabinet layout” (page 44)
- Updated 3.3 “BTS 18020 cabinet layout” (page 46)
- Updated 3.4 “BTS 18020 NG cabinet layout” (page 53)

- Updated Chapter 4 “BTS 18000 modules description” (page 77)
- Added 4.23 “Internet Protocol Module (RIPM/IPM)” (page 256)
- Updated Chapter 5 “BTS 18000 functional architecture” (page 263)

Other changes

See the following sections for information about changes that are not feature-related.

- Minor editorial updates.
- Updated 1.3 “BTS 18000 frequency bands supported for GSM” (page 24).
- Updated 3.2 “BTS 18010 NG2 cabinet layout” (page 44).
- Updated 4.7.1 “Mixing RMs” (page 148).
- Updated 4.12 “Cooling System (SICS) of the BTS 18010, Cooling System (SICS-S) of the BTS 18010 and BTS 18010 NG2” (page 186).
- Updated 4.23 “Internet Protocol Module (RIPM/IPM)” (page 256).
- Updated 3.2 “BTS 18010 NG2 cabinet layout” (page 44).
- Updated Figure 5 "BTS 18010 with BCF on CIBP (supporting Abis over IP)" (page 40).

Introduction

This document describes the BTS 18000 Base Transceiver Station (BTS), which is a component of the Base Station Subsystem (BSS).

It applies to:

- BTS 18010 (also known as the BTS 18000 Indoor)
- BTS 18010 NG2 (also known as the BTS 18000 Indoor New Generation 2)
- BTS 18020 (also known as the BTS 18000 Outdoor)
- BTS 18020 NG (also known as the BTS 18000 Outdoor New Generation)
- BTS 18020 WW (also known as BTS 18000 Outdoor Worldwide)
- BTS 18000 - GSM-UMTS (for GSM-UMTS combo configurations)

Prerequisites

It is recommended that the readers are also familiar with the following documents:

- *Nortel GSM BSS Documentation Roadmap* (411-9001-000)
- *Nortel GSM BSS Overview* (411-9001-001)
- *Nortel GSM BSS Fundamentals—Operating Principles* (411-9001-007)
- *Nortel GSM BSS Fault Management—Maintenance Principles* (411-9001-039)
- *Nortel GSM BSS Parameter Reference* (411-9001-124)
- *Nortel GSM BSS Performance Management—Observation Counters Dictionary* (411-9001-125)
- *Nortel GSM OMC-R Commands Reference—Object and Fault menus* (411-9001-128)
- *Nortel GSM OMC-R Commands Reference—Configuration, Performance, and Maintenance menus* (411-9001-129)

- *Nortel GSM OMC-R Commands Reference—Security, Administration, SMS-CB, and Help menus* (411-9001-130)
- *Nortel GSM BSS Performance Management—Observation Counters Fundamentals* (411-9001-133)
- *Nortel GSM BTS 18000 Fault Clearing* (411-9001-161)
- *Nortel GSM BTS 18000 Troubleshooting* (411-9001-162)
- *Nortel GSM BSS Terminology* (411-9001-803)

The following engineering document: *GSM/GPRS/EDGE BSS Engineering Rules* (PE/DCL/DD/0138) also contains relevant information.

Navigation

Chapter 1 “BTS 18000 offer” (page 23) presents the BTS 18000 offer.

Chapter 2 “BTS 18000 functionality” (page 27) describes the BTS 18000 functionality.

Chapter 3 “BTS 18000 cabinets description” (page 35) describes the layout and content of the BTS 18000 cabinets.

Chapter 4 “BTS 18000 modules description” (page 77) describes the BTS 18000 modules.

Chapter 5 “BTS 18000 functional architecture” (page 263) examines the BTS 18000 functional architecture.

Chapter 6 “BTS 18000 software” (page 273) describes the BTS 18000 software.

Chapter 7 “BTS 18000 used in synchronized co-location mode” (page 287) presents the BTS 18000 operated in a synchronized co-location mode.

Chapter 8 “Using GPS synchronization” (page 293) describes how GPS can be used as a source of synchronization for the BTS 18000.

Chapter 9 “GSM-UMTS dual mode configurations” (page 295) describes the GSM-UMTS dual mode configurations.

Chapter 10 “Dimensioning and configuration rules” (page 307) indicates where the dimensioning and configuration rules are described.

Chapter 11 “GSM900-UMTS900 combination on the same antenna” (page 309) gives information about 11.3 “Feature locking” (page 312)

Regulatory information

This part which provides the regulatory information concerning the BTS is split into the following items:

- European regulatory requirement compliance
- North American regulatory requirement compliance
- compliances for other regions/countries
- operation conditions
- cable specifications
- product labeling

European regulatory requirement compliance

As a radio product, the Nortel Networks BTS 18000 falls under the requirement of the RTTE (Radio and Telecom Terminal Equipment) European directive 1999/5/EEC. The RTTE directive covers essential requirements in the field of:

- protection of the Health and Safety of the user and any other person, including the objectives with respect to safety requirements contained in the Low Voltage directive (73/23/EEC).
- the protection requirements with respect to EMC contained in Directive 89/336/EEC.

  The equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with the instruction manual, the equipment may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference.

  The EMC requirements have been selected to ensure an adequate level of compatibility for apparatus at residential, commercial, and light industrial environments. The levels however, do not cover extreme cases which may occur in any location but with a low probability of occurrence. In particular, it may not cover those cases where a potential source of interference which is producing individually repeated transient phenomena, or continuous phenomena, is permanently present, for example a radar or broadcast site in the near vicinity. In such a case it may be necessary to either limit the source of interference, or use special protection applied to the interfered part, or both.

For operation or maintenance inside Nortel Networks systems, the antistatic wrist shall always be used to maintain the integrity of the product.

- effective use of the Radio spectrum allocated to terrestrial/space radio communication and orbital resources so as to avoid harmful interference. The routes and standards used to demonstrate compliance with these essential requirements are outlined in the following paragraphs.

- BTS EMC
Compliance with the essential requirements of EMC has been demonstrated using EN301489-1 and -23 standard.

- BTS radio compliance
Compliance with the essential requirements of effective use of the radio spectrum has been demonstrated using EN301908-1 and -3 standard.

- BTS safety
Compliance with the essential requirements of Safety has been demonstrated using EN 60950 Standard.

- BTS health protection
Compliance with the essential requirement of health requirement has been demonstrated using EN50385.

European Union Environmental Directive (EUED)

The RoHS Directive, 2002/95/EC, imposes restrictions on the type and quantity of materials used in the manufacturing and construction of Electronic and Electrical Equipment (EEE). RoHS (Restriction of Hazardous Substances) requires vendors to eliminate the following substances from their products: Lead, mercury, cadmium, hexavalent chromium, poly-brominated biphenyls (PBB) and poly-brominated diphenyl ethers (PBDE).

The Annex to the directive lists a number of exemptions (for example, there is an exemption for lead in solders).

The directive is applicable to new electrical and electronic equipment put on the market from 1 July 2006.

The directive is not applicable to spare parts for the repair, or the reuse of electrical and electronic equipment put on the market before 1 July 2006.

For details concerning Nortel's environmental strategy, see

http://www.nortel.com/corporate/community/environment/life_cycle/index.html

North American regulatory requirements compliance

The Nortel Networks BTS 18000 has been qualified according to North American market requirements for the Indoor and Outdoor versions.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

- BTS safety
Nortel Networks BTS 18000 complies with UL60950 and CAN/CSA C22.2 No. 60950-00 Safety Standards. The CSA mark is applied on the BTS and demonstrates compliance with both US and Canadian Standards.

- BTS EMC and radio compliance
Nortel Networks BTS 18000 complies with 47CFR Part 15 class B and 47 CFR Part 24 for EMC and radio emission limits according to US regulatory requirements as indicated on the regulatory label.

- BTS interconnection compliance
The Nortel Networks BTS 18000 complies with Part 68 of the FCC rules and the requirements adopted by the ACTA.
On the top right of this equipment is a label that contains, among other information, a product identifier in the following format:

US: AB6XDNANBTS18000
If requested, the following information must be provided to the telephone company:

- ACTA Registered Number: AB6XDNANBTS18000.
- Facility Interface Code (FIC): 04DU9.BN, 04DU9.DN, 04DU9.1KN, and 04DU9.1SN.
- Service Order Code (SOC): 6.0F.

A FCC part 68 and ACTA compliant cable is provided with the BTS equipment, with no connector at network interface side. The BTS equipment operates with a 1.544 Mbps digital channel. See Installation Instructions for details.

If the BTS 18000 equipment causes harm to the phone network, the telephone company will notify the user in advance that temporary discontinuance of service may be required. But if advance notice is not practical, the telephone company will notify the customer as soon as possible. Also, the user will be advised of his right to file a complaint with the FCC if the user believe that it is necessary.

The telephone company may make changes to its facilities, equipment, operations or procedures that could affect the operation of the equipment. If this happens the telephone company will provide advance notice so the user can make the necessary modifications to maintain uninterrupted services.

If trouble is experienced with BTS 18000 equipment, for repair or warranty information, see "Technical assistance service telephone numbers" (page 21).

If the equipment is causing harm to the telephone network, the telephone company may request that the user disconnect the equipment until the problem is resolved.

All repairs should be handled by authorized Nortel Networks Service Personnel.

- BTS 18000 data equipment
The following table shows which jacks are associated with which modes of operation.

Table 1
BTS 18000 data equipment

Operation mode	USOC Jack
Programmable Test	RJ45S

- BTS 18000 systems
Facility Interface Codes (FIC), Services Order Codes (SOC), USOC Jack Codes, and Ringer Equivalence Number (REN) are shown in the table below for each port where applicable.

Table 2
BTS 18000 systems

Port	FIC	SOC	USOC Jack	REN
ICM T1 board	04DU9.BN	6.0F	N/A	N/A
ICM T1 board	04DU9.DN	6.0F	N/A	N/A
ICM T1 board	04DU9.1KN	6.0F	N/A	N/A
ICM T1 board	04DU9.1SN	6.0F	N/A	N/A

In a configuration with RICAM/ICAM, see 4.4 “Interface Control and Alarm Module (RICAM/ICAM)” (page 114).

- BTS 18000 RF health protection
Compliance with the North American requirements is demonstrated through calculation according to FCC OET bulletin 65.

Compliances for other regions/countries

For countries outside Europe and the Americas, the requirements of European countries usually apply.

It is not possible to list all the applicable approvals/compliances as they will be dependent on the markets and products considered.

Please contact the local Nortel Networks representative for more information.

Operational conditions

The aforementioned standards compliance of the products are based on the following operating conditions (called normal operation):

- Doors shall be closed and (or) covers shall be in place.
- External cables shall be of the same type as specified by Nortel Networks.
- No modification of any mechanical or electrical characteristics of the product shall be made.

Any change or modification made to the product without written approval from Nortel Networks releases Nortel Networks from subsequent responsibility regarding the standards compliance.

Cable specifications

The compliance to the aforementioned standards has been verified using cables as specified by Nortel Networks. The continuing compliance of the product relies upon use of the correct cabling scheme as well as use of identical type cables as specified by Nortel Networks. Refer to the installation guides for details on cable specifications.

Product labeling

The label may be located inside or outside the product, provided that the operation and/or maintenance personnel have the information when working on the product.

- BTS labeling for American Countries
To indicate compliance with the CSA and UL Safety requirements, the Nortel Networks BTS 18000 bears the following mark in a conspicuous location.

On the regulatory label, compliance 47 CFR Part 15, 24 and 68 is stated along with:

- FCC ID, FCC Registration Number
- manufacturer name
- equipment designation
- nominal voltage operating range and maximum rated current

- BTS labeling for European Countries
To indicate compliance with the European RTTE Directive, the Nortel Networks BTS 18000 bears the following information in a conspicuous location:

- manufacturer name
- equipment designation
- nominal voltage operating range and maximum rated current

- Labeling for other regions / countries
Labeling for other regions and countries is performed as appropriate and required by the local regulatory framework.

Technical assistance service telephone numbers

For technical support and information from Nortel, see the following.

For service-affecting problems

For 24-hour emergency recovery or software upgrade support, that is, for

- restoration of service for equipment that has been carrying traffic and is out-of-service
- issues that prevent traffic protection switching
- issues that prevent completion of software upgrades

North America:

1-800-4NORTEL (1-800-466-7835)

International:

001-919-992-8300

For non-service-affecting problems

For 24-hour support on issues requiring immediate support or for 14-hour support (8 a.m. to 10 p.m. EST) on upgrade notification and non-urgent issues.

North America:

1-800-4NORTEL (1-800-466-7835)

The user require an express routing code (ERC). To determine the ERC, see our corporate Web site at www.nortel.com. Click on the Express Routing Codes link.

International:

Varies according to country. For a list of telephone numbers, see our corporate Web site at www.nortel.com. Click on the Contact Us link.

Global software upgrade support

North America:

1-800-4NORTEL (1-800-466-7835)

International:

Varies according to country. For a list of telephone numbers, see our corporate Web site at www.nortel.com. Click on the Contact Us link.

Nortel web site

Users can also contact us through the Nortel web site at:

www.nortel.com

Select the link **Support**.

Chapter 1 BTS 18000 offer

1.1 BTS 18000 versions

The BTS (Base Transceiver Station) 18000 is proposed in standard in five main versions:

- BTS 18000 indoor, named BTS 18010
- BTS 18000 indoor new generation 2, named BTS 18010 NG2
- BTS 18000 outdoor, named BTS 18020
- BTS 18000 outdoor new generation, named BTS 18020 NG
- BTS 18000 outdoor worldwide, named BTS 18020 WW

Each can provide up to 18 TRXs per cabinet.

In addition to these main versions, the BTS 18000 is also proposed in the following variant: Combo GSM/UMTS dual mode variant, proposed in the BTS 18010 and BTS 18020 versions.

1.2 BTS 18000 possible uses

The BTS 18000, which is meant for various operating environments:

- replaces the BTS S8000 or BTS S12000 in Nortel Networks portfolio for greenfield site deployments
- provides continuity to the BTS S8000 and BTS S12000 by its ability to be operated in a synchronized co-location mode, to increase the capacity of existing S8000 or S12000 sites

1.3 BTS 18000 frequency bands supported for GSM

The following table shows the GSM frequency bands supported.

Table 3
Frequency bands supported for GSM

Name	Uplink (mobile transmit, base receive)	Downlink (base transmit, mobile receive)
GSM 850	824 - 849 MHz	869 - 894 MHz
GSM 900 E-GSM 900 P-GSM 900	 880 - 905 MHz 890 - 915 MHz	 925 - 950 MHz 935 - 960 MHz
GSM 1800	1710 - 1785 MHz	1805 - 1880 MHz
GSM 1900	1850 - 1910 MHz	1930 - 1990 MHz

where:

P-GSM 900 = Primary or Standard GSM 900 band

E-GSM 900 = Extended GSM 900 band (includes part of the Standard GSM 900 band)

The GSM 900 band (35 MHz) is covered by two 25 MHz RF-combiner part band variants.

For GSM 850, there are two types of combiner family (DDM and TxF):

- **Full band (25 MHz)** versions that cover the frequencies listed in the preceding table.
- **Part band (first 22.5 MHz)** versions that cover 824 - 846.5 MHz uplink and 869 - 891.5 MHz downlink.

1.4 RoHS compliancy

1.4.1 RoHS directive

The RoHS (Restriction of Hazardous Substances) directive imposes restrictions on the type and quantity of materials used in the manufacturing and construction of Electronic and Electrical Equipment (EEE).

The directive is not applicable to spare parts for the repair, or the reuse of electrical and electronic equipment put on the market before 1 July 2006.

See also "European Union Environmental Directive (EUED)" (page 16).

1.4.2 BTS 18000 modules

There are RoHS compliant versions for the following BTS 18000 modules:

- cables
- internal batteries, internal battery circuit breaker
- door gaskets
- lightning protectors (ALPRO, ALPRO2, and PRIPRO2)
- IFM1
- ICM
- ABM
- RM
- DDM
- TxF
- H3
- H4
- RICO
- DBP, IBP, CIBP
- USER ICO
- UCPS (rack, rectifier, ADU, and DDU)
- CCU (UMTS/GSM)
- ECU (assembly, blower, control board, dust filter, heater, heater thermostat, and internal temperature probe)
- SICS (blowers, control board, module, pressure sensor, filter, and thermal sensor)
- SICS-S (fans, control board, module, pressure sensor, filter, and thermal sensor)
- ECS (ECS control board, fan tray with or without damper and heater)

- ngUCPS (rack, rectifier, ADUng, and ngDDU)
- CCU (GSM only)
- RIPM/IPM

PEC/CPC for the RoHS compliant modules are given in the replacement procedures in *Nortel GSM BTS 18000 Troubleshooting* (411-9001-162).

Chapter 2 BTS 18000 functionality

2.1 GSM-UMTS dual technology proposal

The BTS 18000 is designed to integrate, within the same cabinet, both GSM/GPRS/EDGE and UMTS technologies.

This configuration is available on all GSM frequency variants (850, 900, 1800, and 1900 MHz) and on both 1900 and 2100 MHz frequency variants for UMTS (Universal Mobile Telecommunication System). The maximum one-cabinet configuration is GSM S333 + UMTS STSR-2.

2.2 GSM features

The BTS 18000 offers a set of features enhancing the Quality of Service and the spectrum efficiency of the network such as:

- IP networking through new modules RIPM/IPM (RIPM is the redundant variant of IPM)
- some new specific controls are necessary for the RM downloading because it supports three TRX
- full support of GPRS data services
- full support of EDGE 8-PSK modulation
- guaranteed -110 dBm dynamic single-branch receive sensitivity (GMSK modulation) at the BTS antenna, without any tower-mounted Low Noise Amplifier (LNA)
- improved receiver diversity gain using a Nortel Networks specific algorithm, providing 5 dB or more diversity gain in most situations, when spatial diversity and de-correlated antennas are used
- a range of different output powers:
  - RM1 850 60/45
  - RM1/2 900 40/40
  - RM2 900 60/45
  - RM1/2 1800 30/30
  - RM1/2 1800 50/30

- RM1/2 1900 30/30
- RM2 1900 50/30

- dual-band GSM configurations with single-BCCH, built in a single or in multiple BTS 18000 cabinets
- enhanced voice quality due to an innovative algorithm of interference cancellation significantly reducing the end-user’s perception of errors generated in the radio transmission
- full RF power control range (static and dynamic)
- spectrum efficiency optimization with the support of the undisputed Nortel Networks capacity features that provide high quality voice and data services to a dense subscriber population, in a limited spectrum and at competitive cost

  These solutions include

  - Fractional Frequency Reuse
  - Automated Cell Tiering
  - Adaptive Multi Rate (AMR) support
- best-in-class radio performance because of its high sensitivity receivers, unique interference cancellation and improved spatial diversity algorithms along with high output power, providing optimum coverage, and link quality for both data and voice services
- high integration of advanced technology:
  - This in turn contributes to a significant reduction in required floor space, size, and equipment operating costs.
  - This concept is adapted to stringent environmental constraints and is leading to the best economic trade-off between initial and final capacity.

  In addition, the BTS 18000 supports asymmetrical radio configurations such as S963 in one cabinet.
- compatibility with the BTS S8000 and BTS S12000:
  - through existing site synchronized co-location
  - through the possibility to reuse existing site equipment (such as an S8000/S12000 outdoor plinth)
- industry leading transmission solution including high signaling concentration on the Abis interface and drop-and-insert capability

  For example:

- Only a single timeslot is required for carrying the signaling of a S333 BTS.
- Only two PCM timeslots over the Abis interface are required for each 8-radio timeslot TRX.

For signaling:

- Only one PCM timeslot is required, with configurations up to S333.
- Only three PCM timeslots are required, with configurations up to S999.
- Only six PCM timeslots are required, with configurations up to S18.18.18.

The BTS 18000 can support eight E1/T1 PCM links, with a granularity of four E1/T1 per IFM/IFM1 board.

The drop-and-insert capability is used to reduce the number of PCM links needed to connect the BTSs to their BSC. This can be implemented through chain connection or loop connection, depending on the level of reliability required. The BTS 18000 supports the drop-and-insert function exactly the same way as the S8000 and S12000 BTSs do. Therefore, it is possible to have the S8000, S12000, and BTS 18000 BTSs on the same chain or loop.

- GSM/GPRS/EDGE and UMTS dual technology capabilities for operator evolution to 3G data services

2.3 GSM functions

The BTS 18000 provides

- the radio interface with the mobile handsets
- the associated signal processing and the transmission interface with the Base Station Controller (BSC)

The BTS 18000 ensures the following main functions:

- RF functions:
  - antenna coupling and duplexing
  - power amplification
  - reception, including RF 2-way receive diversity
  - Gaussian Minimum Shift Keying (GMSK) modulation/demodulation
  - 8-Phase Shift Keying (8-PSK) EDGE modulation/demodulation
  - synthesized frequency hopping in all hybrid coupling types
- radio channel management:

  - BTS and mobile handset power control
  - Discontinuous Transmission and Voice Activity Detection (DTX/VAD), on both uplink and downlink paths
  - radio channel filling
  - call setup and release
  - mobile timing advance processing
  - support of Enhanced Full-Rate (EFR), Full-Rate (FR), AMR Full-Rate and AMR Half-Rate speech coding
  - support of SAIC (Single Antenna Interference Cancellation) and non-SAIC mobiles
- signal processing:
  - channel encoding and decoding
  - encryption (A5/3 and A5/1)
  - equalization
  - cancellation of interference
  - processing of radio measurements, including handover algorithms
- interface with the BSC:
  - communication with the BSC
  - concentration of signaling on the Abis interface (a single PCM timeslot can concentrate signaling for up to nine transceivers)
  - multiplexing of four traffic channels on one PCM slot (each TRX needs two PCM slots for traffic)
- switching:
  - connection between the PCM links and the traffic/signaling channels
  - management of drop-and-insert connections
  - management of the TRX and PCM link redundancy
- operation and maintenance:
  - high level of availability through optional duplication of switching, synchronization and control unit (working in active/standby mode) and optional N+1 redundancy for rectifiers and radio module
  - monitoring of internal and external alarms, through internal bus and alarm loops
  - remote configuration management from the BSC (site, sector, Abis, and TRX)
  - remote software downloading

2.4 Novel adaptive receiver

This section describes a novel digital processing approach developed by Nortel Networks to improve reception performances of GSM and EDGE radio communications.

2.4.1 Purpose

This adaptive receiver enhances performance in real radio conditions (multi-path profiles). It is designed to focus on interference from other radio channels, as this is a major cause of disturbance for reception performance. This new approach introduces an adaptive receiver structure that matches the estimated noise, through a digital filtering step (enabling an early and accurate detection of the interference situation), and a novel filter design yielding filters optimized for the detected interference situation.

2.4.2 Benefits

Reception performances are improved significantly in most situations and especially in adjacent interference conditions. These benefits apply both to GMSK and 8-PSK modulations, and traffic and data applications.

It provides the end-user with an increased throughput for data transmission along with an improved quality of service for speech communication. The increased throughput might make it necessary to tune link adaptation tables.

2.4.3 Adjacent and co-channel interference handled differently

Many reception schemes are optimal only under one specific noise assumption (basically, thermal noise). In practice, digital communication faces other noise sources, namely adjacent channel, and/or co-channel interferences. The statistics of these differ significantly from thermal noise. The consequence is lower reception performance in the presence of interferers, leading to a poorer speech quality or lower throughput for the end-user.

The approach developed by Nortel Networks uses a scheme that adapts itself to the interference condition affecting each received burst. In addition, a new filter design strategy has been developed for each basic noise situation, to provide a filtering process yielding the minimal BER. Prior to processing the burst, this method estimates the noise situation.

For adjacent interferers, this is achieved using a filter bank detector. Co-channels interferers are taken into account later on (after channel sounding).

According to the adjacent interference noise estimated by the detector, a filter is designed to match the noise situation and applied to the current burst. The impact of any adjacent interferer is significantly lowered from the outset. Channel sounding is then performed and yields an estimator of the impulse response of the radio channel for the current burst.

Co-channel interferer detection is then performed. Depending on the detector result, an additional filtering process is applied to the burst to minimize the effect of the co-channel interference (prior to the equalization).

2.4.4 Processing

From a hardware point of view, the processing is shared between two entities:

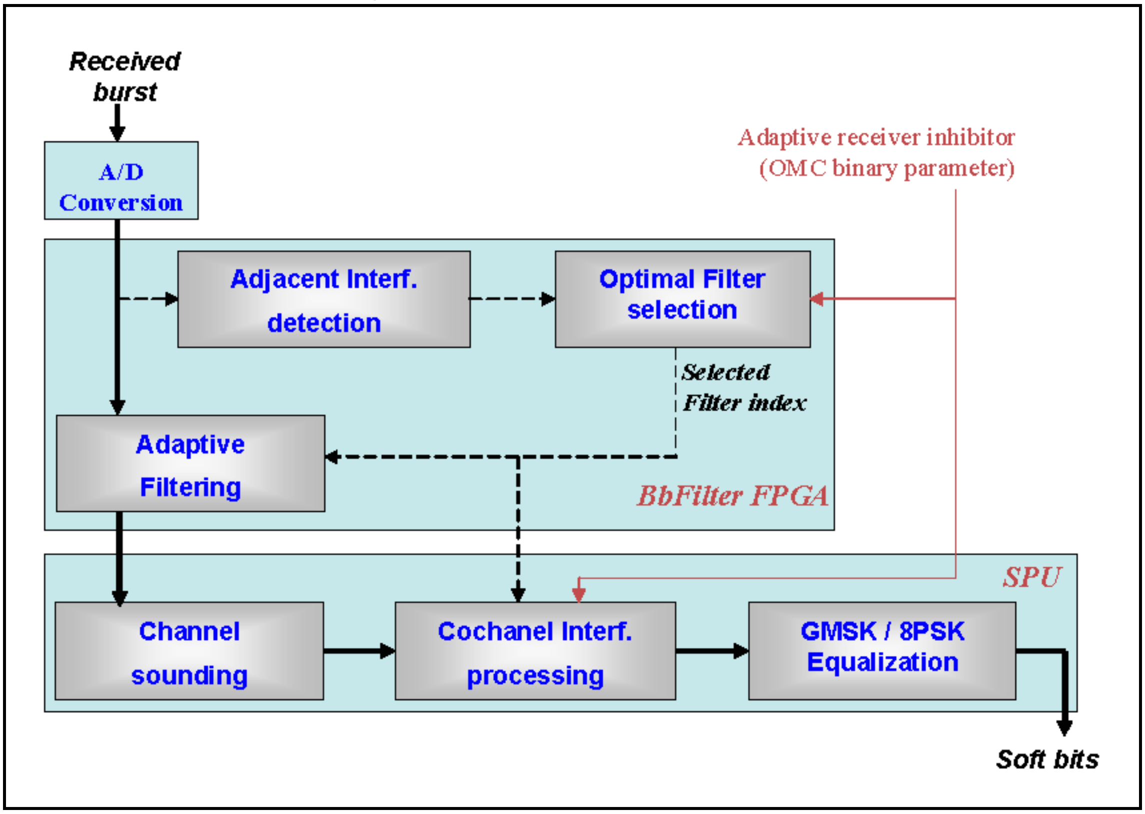
- BbFilter FPGA
- SPU

The BbFilterFPGA (Field Programmable Gate Array) component deals with adjacent interferer detection and processing.

The SPU (Gateway between the radio network and the BSC software unit) carries out co-channel interference processing (if and only if, any adjacent channel processing has been applied previously).

This processing is summarized in the following figure.

Figure 1
Adaptive receiver - block diagram



2.4.5 Activation

The feature is enabled/disabled using the adaptiveReceiver parameter. The default is disabled which is compatible with earlier releases.

The recommended value is enabled except for extended cells and cells with hilly terrain radio profiles.

Only the BTS 18000 and BTS 6000 support this feature.

Other BTSs (that are not concerned by this feature or are not yet in V17/V18), accept the presence of the adaptiveReceiver parameter (in the TDMA CONFIG Abis message) even though no action is required of them.

This feature is valid only for the GSM 1900 band.

If receiver diversity is used, the best in class receiver performance is achieved by activating both the Joint diversity and Novel adaptive receiver features.

For an extended cell configuration, the adaptive receiver must be deactivated.

Chapter 3 BTS 18000 cabinets description

- one combiner rack
- one digital rack

- one combiner rack
- one digital rack
- one cooling system

3.1 BTS 18010 cabinet layout

The BTS 18010 cabinet includes the following elements:

- indoor enclosure
- DC breaker panel
- Integrated Cooling System (SICS or SICS-S)
- back-planes: Interface Back-Plane (IBP), or Compact Interface Back-Plane (CIBP) and Digital Back-Plane (DBP)
- one Radio InterCOnnect board (RICO)
- up to six Radio Modules RM1 or RM2
- up to six Dual Duplexer Modules (DDM) or DDM with optional H2 coupling (DDM H2), with optional VSWR meter

  At the same location, optional Transmit Filters (TxF) or TxF with optional H2 coupling (TxF H2), with optional VSWR meter, can be provided.
- up to six 3-way Hybrid couplers (H3), used in association with DDM or TxF

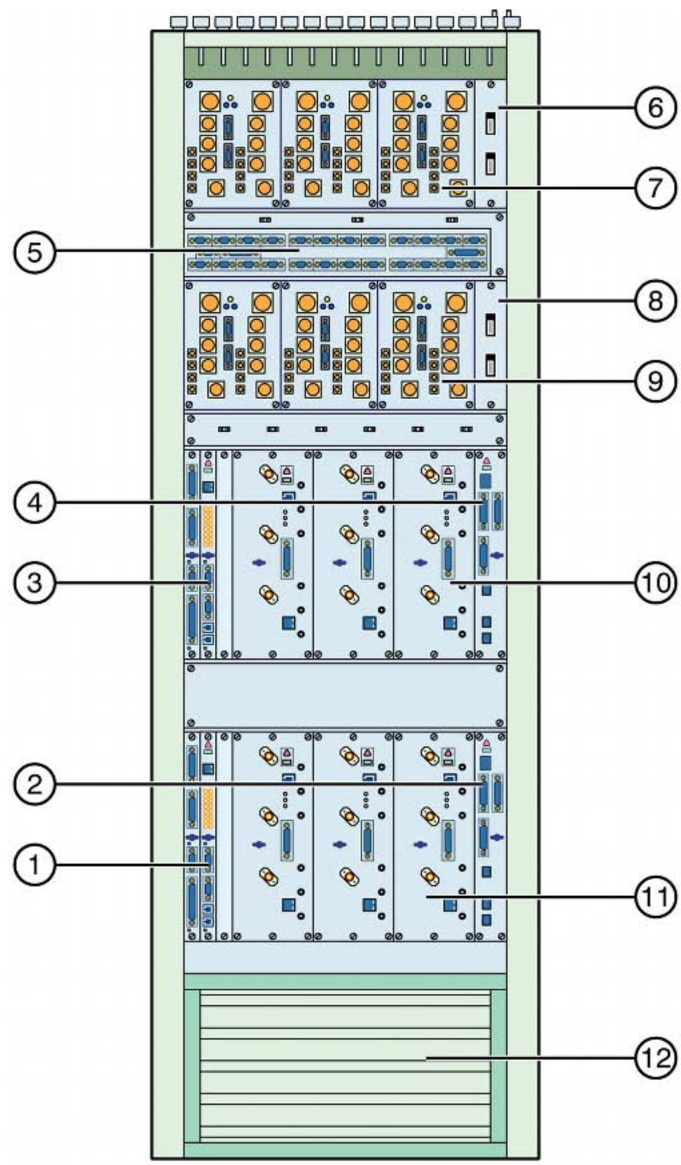
- up to six 4-way Hybrid couplers (H4), used in association with DDM or TxF
- for the BCF (on IBP/CIBP) configuration:
  - up to two Alarm and Bridge Modules (ABM)
  - up to two Interface Modules (IFM/IFM1)
  - one Interface Control Module (ICM) or two ICMs (in a redundant configuration)
  - one optional Internet Protocol Module (IPM) or Redundant Internet Protocol Module (RIPM) if the connectivity to an IP network is selected.

    A BTS supporting the Abis over IP feature is populated with one IPM or RIPM. The RIPM is the redundant variant of the IPM. Only cold redundancy (through redundancy of sub-components) is supported inside the RIPM. No redundancy of the RIPM is supported to insure hot duplex mechanism.

The DDM, TxF, H3, and H4 modules are physically grouped into the two combiner racks. Each digital rack consists of the association of IFM/IFM1, ICM (or ICAM, or RICAM), ABM, IPM (or RIPM), and radio modules RM1 or RM2.

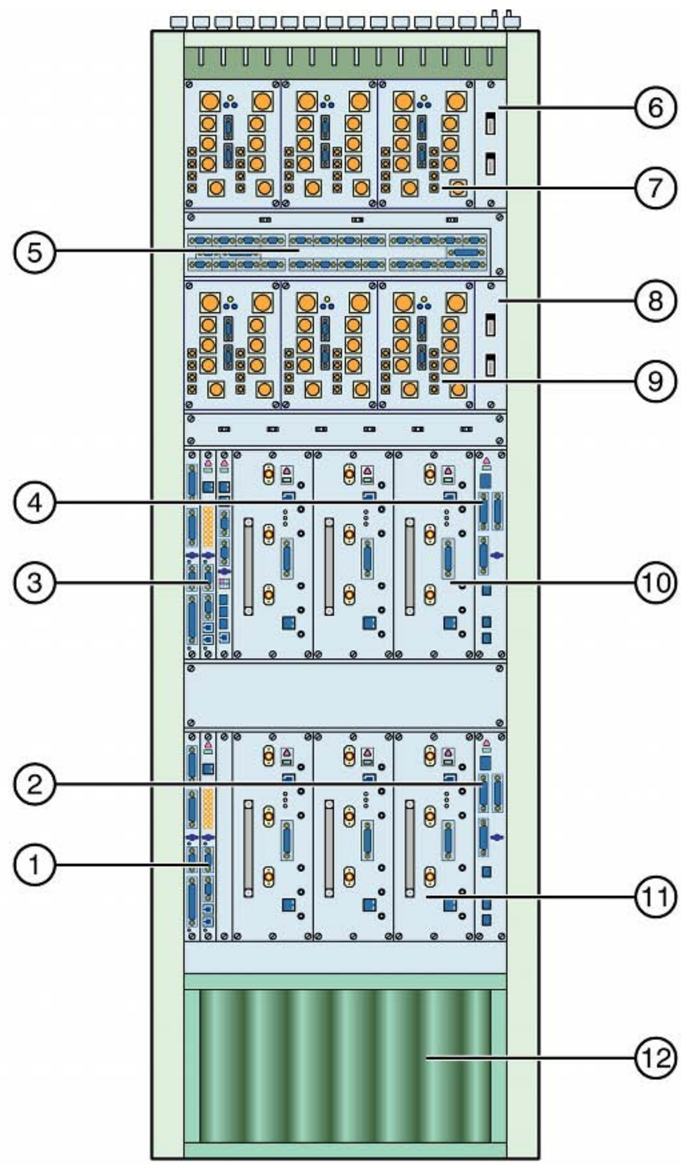
3.1.1 Indoor cabinet with BCF on IBP/CIBP

Figure 2
BTS 18010 with BCF on IBP (not supporting Abis over IP)



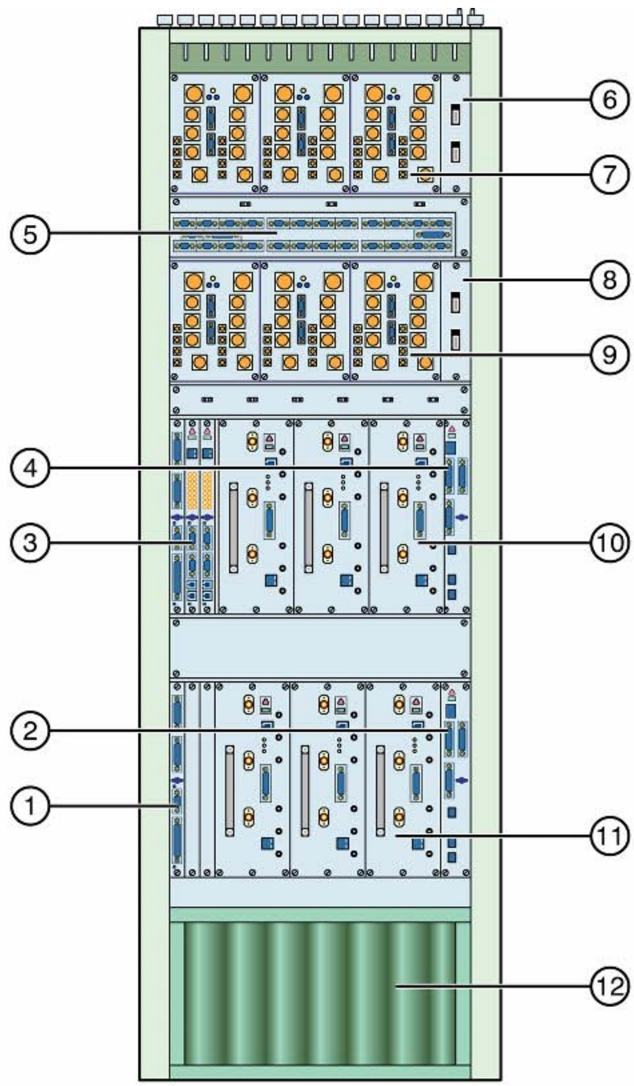
1	IFM + ICM	5	RICO	9	DDM (3,4,5)
2	ABM	6	DC Breakers panel	10	RM (0,1,2)
3	IFM + ICM	7	DDM (0,1,2)	11	RM (3,4,5)
4	ABM	8	DC Breakers panel	12	SICS or SICS-S

Figure 3
BTS 18010 with BCF on IBP (supporting Abis over IP)



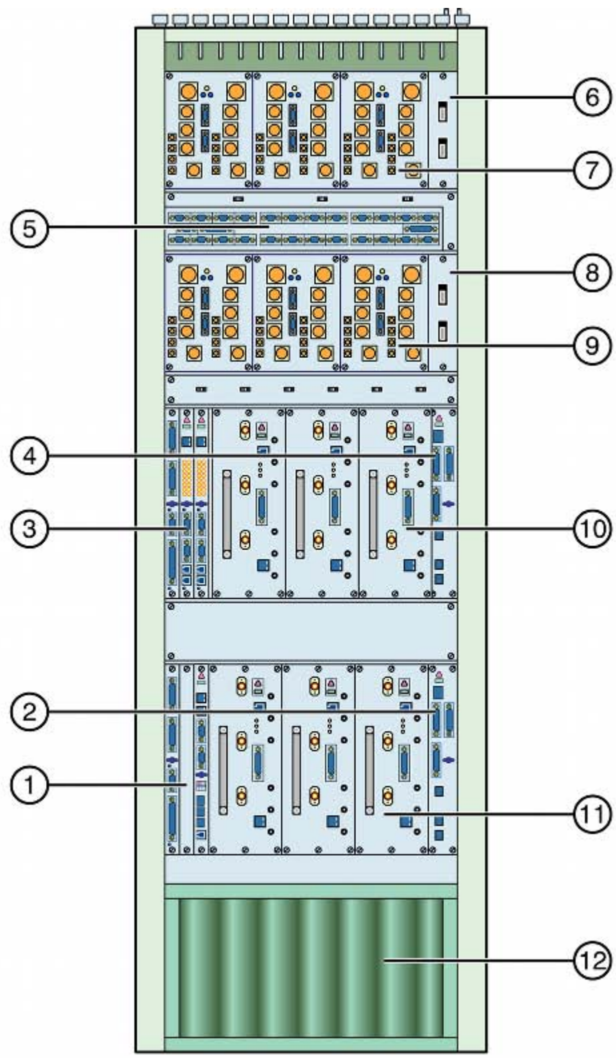
1	IFM + ICM	5	RICO	9	DDM (3,4,5)
2	ABM	6	DC Breaker panel	10	RM (0,1,2)
3	IFM + ICM + (R)IPM	7	DDM (0,1,2)	11	RM (3,4,5)
4	ABM	8	DC Breaker panel	12	SICS or SICS-S

Figure 4
BTS 18010 with BCF on CIBP (not supporting Abis over IP)



1. IFM
2. ABM
3. IFM + ICM + ICM
4. ABM
5. RICO
6. DC Breakers panel
7. DDM (0,1,2)
8. DC Breakers panel
9. DDM (3,4,5)
10. RM (0,1,2)
11. RM (3,4,5)
12. SICS or SICS-S

Figure 5
BTS 18010 with BCF on CIBP (supporting Abis over IP)



1 IFM + filler + RIPM
2 ABM
3 IFM + ICM + ICM
4 ABM
5 RICO
6 DC Breakers panel
7 DDM (0,1,2)
8 DC Breakers panel
9 DDM (3,4,5)
10 RM (0,1,2)
11 RM (3,4,5)
12 SICS or SICS-S

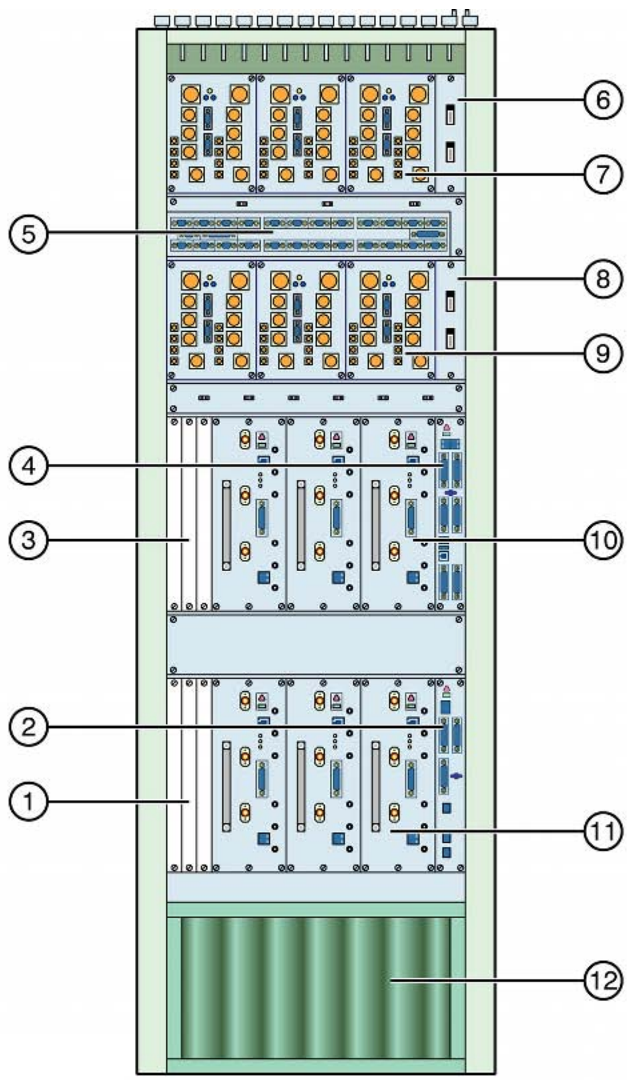
Note: In case of non-redundant ICM, an IPM replaces the RIPM.

3.1.2 Indoor cabinet with RICAM or RICAM2

If a RICAM or RICAM2 is present, it replaces ABM-0 (item two in the preceding figure) and the IFM/IFM1 and ICM (items one and three in the preceding figure) are removed (and replaced by fillers).

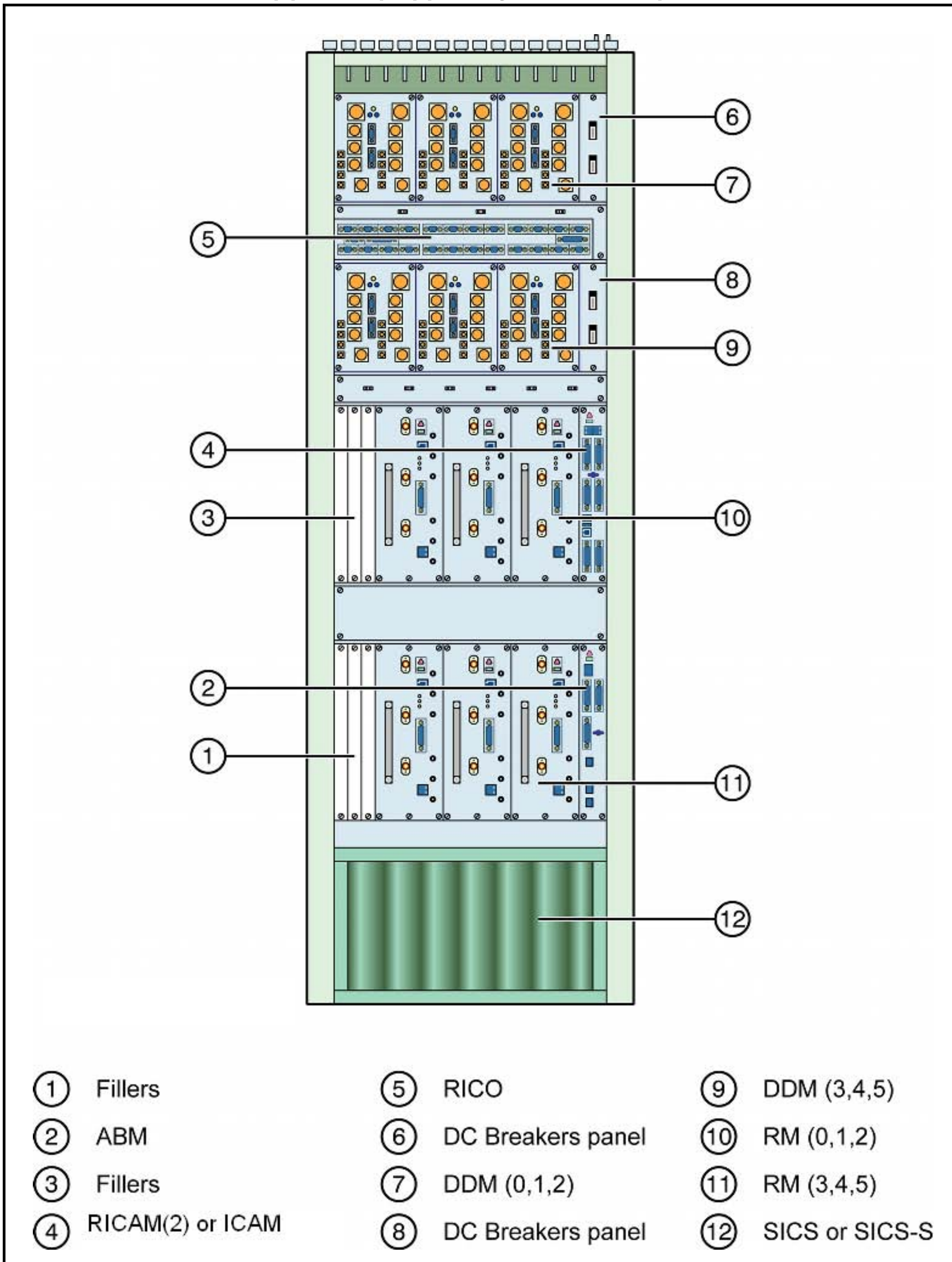
The following figure shows the cabinet if a RICAM or RICAM2 is present. The IFM/IFM1 and ICM(s) are removed and replaced by fillers. ABM-0 is removed and replaced by the RICAM or RICAM2. The other ABM(s) remain.

Figure 6
BTS 18010 with RICAM(2)/ICAM (not supporting Abis over IP)



1	Fillers	5	RICO	9	DDM (3,4,5)
2	ABM	6	DC Breakers panel	10	RM (0,1,2)
3	Fillers	7	DDM (0,1,2)	11	RM (3,4,5)
4	RICAM(2) or ICAM	8	DC Breakers panel	12	SICS or SICS-S

Figure 7
BTS 18010 with RICAM(2)/ICAM (supporting Abis over IP)



3.2 BTS 18010 NG2 cabinet layout

The BTS 18010 NG2 cabinet includes the following elements:

- indoor enclosure
- DC breaker panel
- Integrated Cooling System (SICS-S)
- one Radio InterCOnnect board (RICO)
- up to six Radio Modules (RM1/RM2)
- up to six Dual Duplexer Modules (DDM) or DDM with optional H2 coupling (DDM H2), with optional VSWR meter.

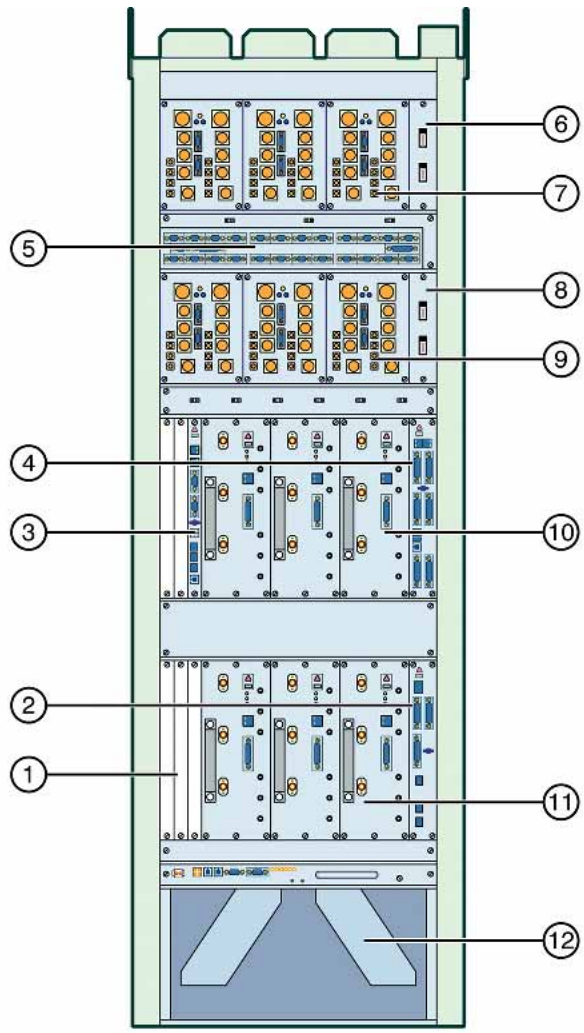
  At the same location, optional Transmit Filters (TxF) or TxF with optional H2 coupling (TxF H2), with optional VSWR meter, can be provided.
- up to six 4-way Hybrid couplers (H4), used in association with DDM or TxF
- for the BCFin IBP/CIBP configuration:
  - up to two alarm and bridge modules
  - up to two interface modules
  - one interface control module
  - one optional Internet Protocol Module (IPM) or Redundant Internet Protocol Module (RIPM) if the connectivity to an IP network is selected

    A BTS supporting the Abis over IP feature is populated with one IPM or RIPM. The RIPM is the redundant variant of the IPM. Only cold redundancy (through redundancy of sub-components) is supported inside the RIPM. No redundancy of the RIPM is supported to insure hot duplex mechanism.
- up to two ALPROs

The DDM, TxF, and H4 modules are physically grouped into the two combiner racks. Each digital rack consists of the association of IFM/IFM1, ICM (ICAM or RICAM), ABM, IPM (or RIPM), and radio modules (RM1 and RM2).

The following figure presents the BTS 18010 NG2 cabinet layout and situates the modules in a fully equipped cabinet in its default configuration.

Figure 8
BTS 18010 NG2 (default configuration: RICAM(2)/ICAM) (supporting Abis over IP)



(1) Fillers
(2) ABM
(3) Filler + filler + (R)IPM
(4) RICAM or RICAM2
(5) RICO
(6) DC Breakers panel
(7) DDM (0,1,2)
(8) DC Breakers panel
(9) DDM (3,4,5)
(10) RM (0,1,2)
(11) RM (3,4,5)
(12) SICS-S

Note: In case of RICAM(2) in the BTS, the RIPM is installed.

3.3 BTS 18020 cabinet layout

The BTS 18020 can be housed in one or several cabinets depending on the required capacity:

- One base cabinet can provide up to 18 TRX (in GSM-only mode) or nine TRX (in GSM-UMTS dual mode).
- Up to two additional extension cabinets can be added. Each extension cabinet can support up to 18 TRX.

The BTS 18020 cabinet includes the following elements:

- outdoor enclosure including AC Distribution Unit (ADU)
- AC/DC power supply: Univity Compact Power System (UCPS)
- optional internal batteries
- Environmental Control Unit (ECU)
- User Rack space and its associated User ICO
- back-planes: Interface Back-Plane (IBP), or Compact Interface Back-Plane (CIBP), and Digital Back-Plane (DBP)
- one Radio InterCOnnect board (RICO)
- up to two Interface Modules (IFM/IFM1)
- one Interface Control Module (ICM) or two ICMs (in a redundant configuration)
- up to two Alarm and Bridge Modules (ABM)
- up to two optional ALarm secondary PROtection (ALPRO2) boxes
- up to six Radio Modules (RM1 or RM2)
- up to six Dual Duplexer Modules (DDM) or DDM with optional H2 coupling (DDM H2), with optional Voltage Standing Wave Ratio (VSWR) meter.

  At the same location, optional Transmit Filters (TxF) or TxF with optional H2 coupling (TxF H2), with optional VSWR meter, can be provided.
- up to six 3-way Hybrid couplers (H3), used in association with DDM or TxF
- up to six 4-way Hybrid couplers (H4), used in association with DDM or TxF
- one optional Internet Protocol Module (IPM) or Redundant Internet Protocol Module (RIPM) if the connectivity to an IP network is selected.

  A BTS supporting the Abis over IP feature is populated with one IPM or RIPM. The RIPM is the redundant variant of the IPM. Only cold redundancy (through redundancy of sub-components) is supported inside the RIPM. No redundancy of the RIPM is supported to insure hot duplex mechanism.

The DDM, TxF, and H4 modules are physically grouped into the two combiner racks. Each digital rack consists of the association of IFM/IFM1, ICM (or ICAM, or RICAM), ABM, IPM (or RIPM), and radio modules (RM1 or RM2).

IFM/IFM1, ICM, RIPM/IPM, and RICAM(2) are not required in a BTS 18000 extension cabinet.

3.3.1 Outdoor cabinet with BCF on IBP/CIBP

The following figure presents the BTS 18020 cabinet layout and situates the modules in a fully equipped cabinet. This is a configuration with the BCF on IBP/CIBP (that is, without a RICAM(2)/ICAM.

Figure 9
BTS 18020 with BCF on IBP (not supporting Abis over IP)

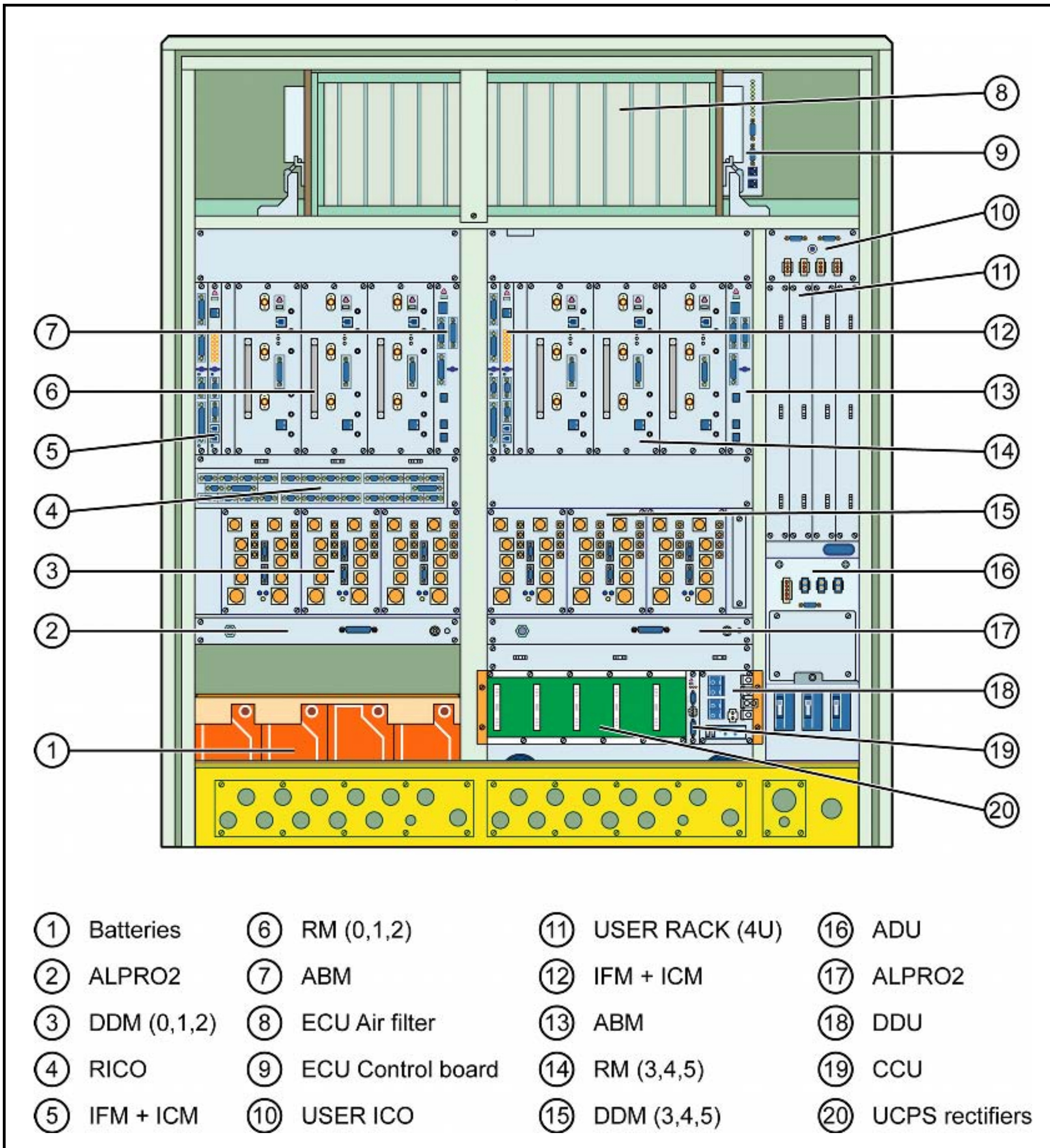
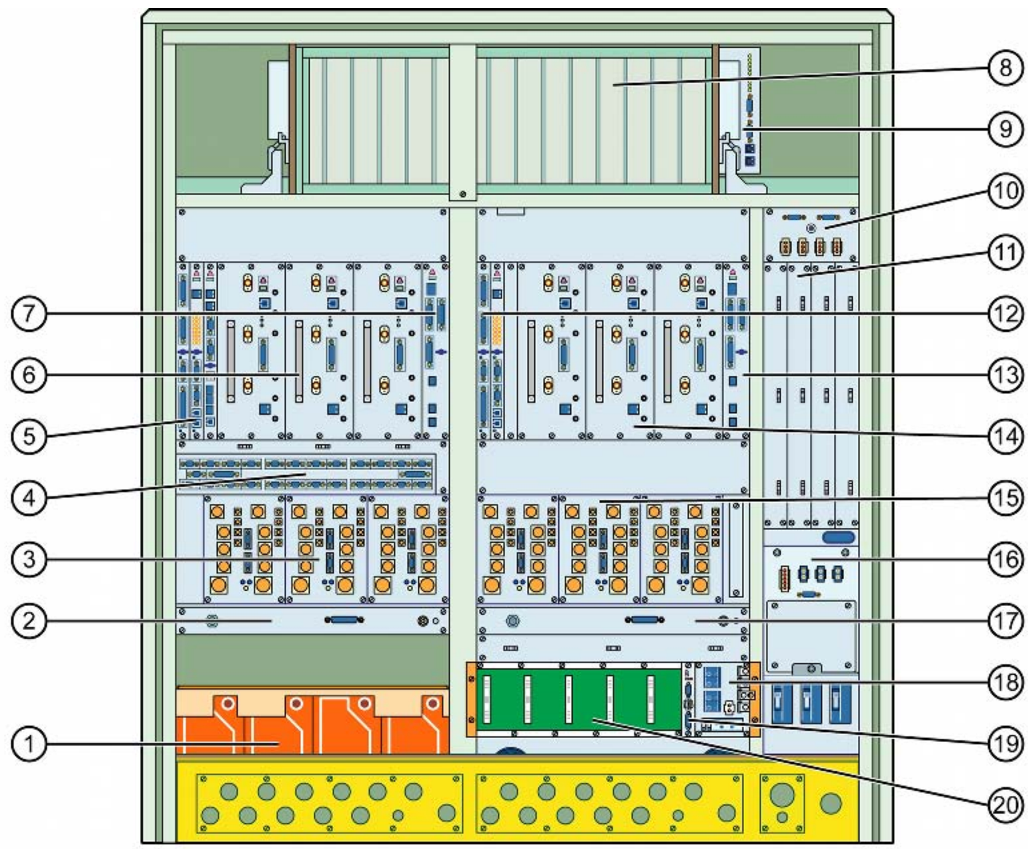


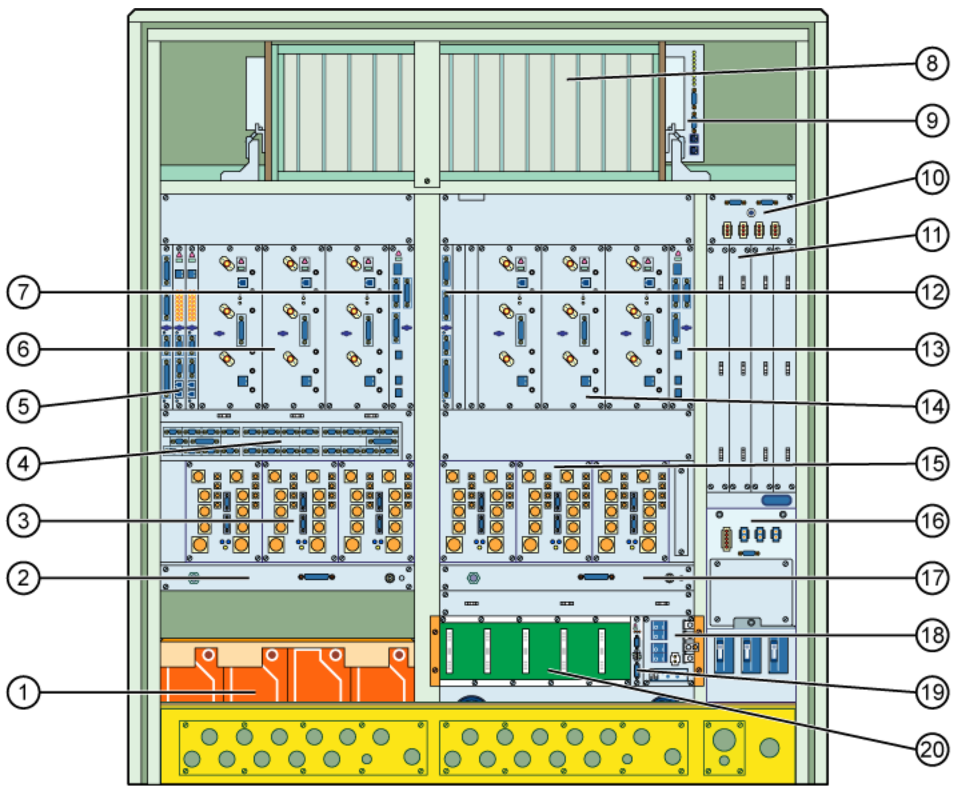
Figure 10
BTS 18020 with BCF on IBP (supporting Abis over IP)



1. Batteries
2. ALPRO2
3. DDM (0,1,2)
4. RICO
5. IFM + ICM + RIPM
6. RM (0,1,2)
7. ABM
8. ECU Air filter
9. ECU Control board
10. USER ICO
11. USER RACK (4U)
12. IFM + ICM
13. ABM
14. RM (3,4,5)
15. DDM (3,4,5)
16. ADU
17. ALPRO2
18. DDU
19. CCU
20. UCPS rectifiers

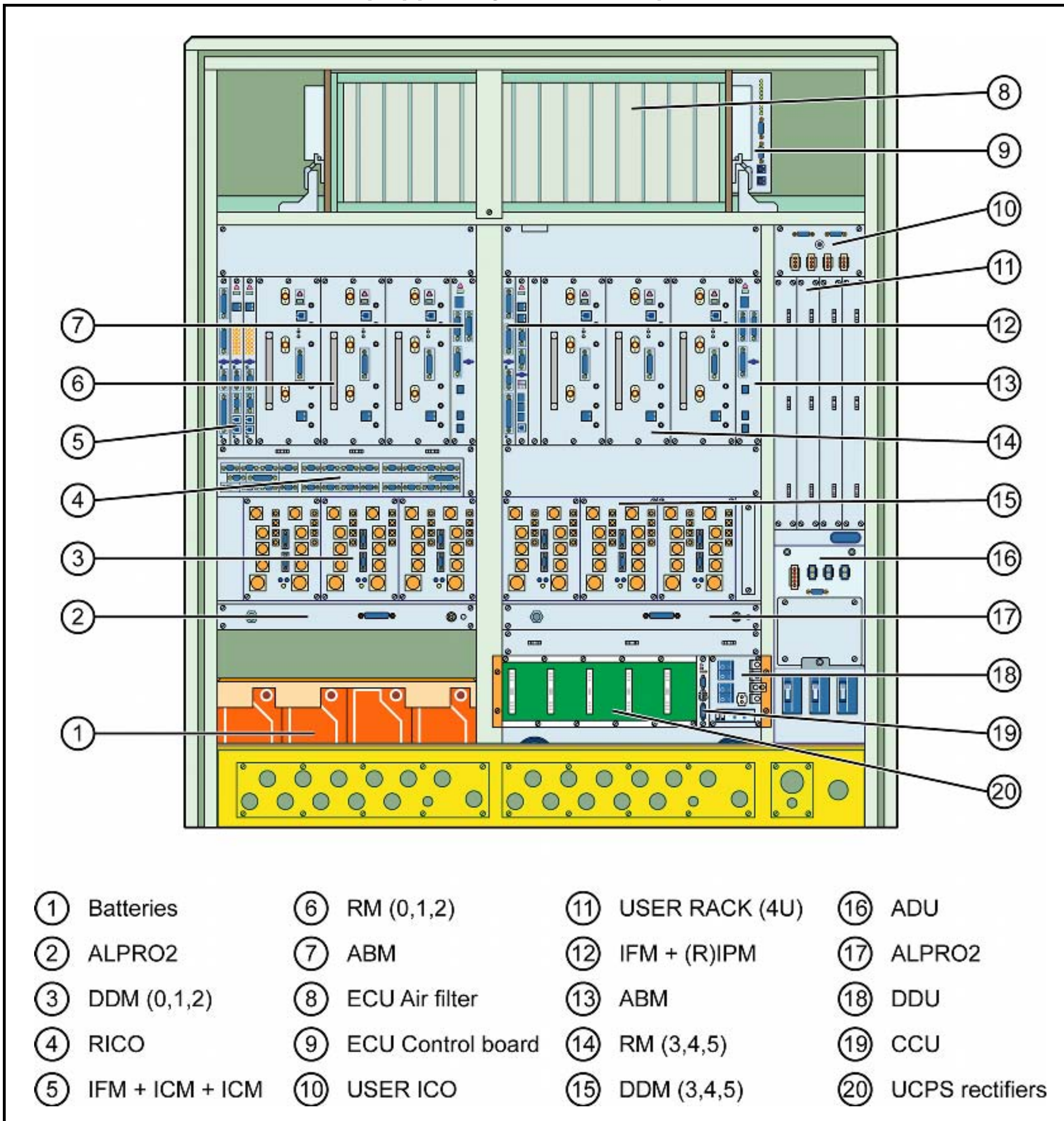
Note: In case of non-redundant ICM, an IPM replaces the RIPM.

Figure 11
BTS 18020 with BCF on CIBP (not supporting Abis over IP)



1 Batteries	6 RM (0,1,2)	11 USER RACK (4U)	16 ADU
2 ALPRO2	7 ABM	12 IFM	17 ALPRO2
3 DDM (0,1,2)	8 ECU Air filter	13 ABM	18 DDU
4 RICO	9 ECU Control board	14 RM (3,4,5)	19 CCU
5 IFM + ICM + ICM	10 USER ICO	15 DDM (3,4,5)	20 UCPS rectifiers

Figure 12
BTS 18020 with BCF on CIBP (supporting Abis over IP)



3.3.2 Outdoor cabinet with RICAM(2)/ICAM

If a RICAM(2)/ICAM is present, it replaces ABM-0 (item seven in the preceding figure) and the IFM/IFM1 and ICM (items seven and 12 in the preceding figure) are removed (and replaced by fillers).

The following figure shows the cabinet if a RICAM(2)/ICAM is present. The IFM/IFM1 and ICM(s) are removed and replaced by fillers. The ABM-0 is removed and replaced by the RICAM(2). The other ABM(s) remain.

Figure 13
BTS 18020 with RICAM(2)/ICAM (not supporting Abis over IP)

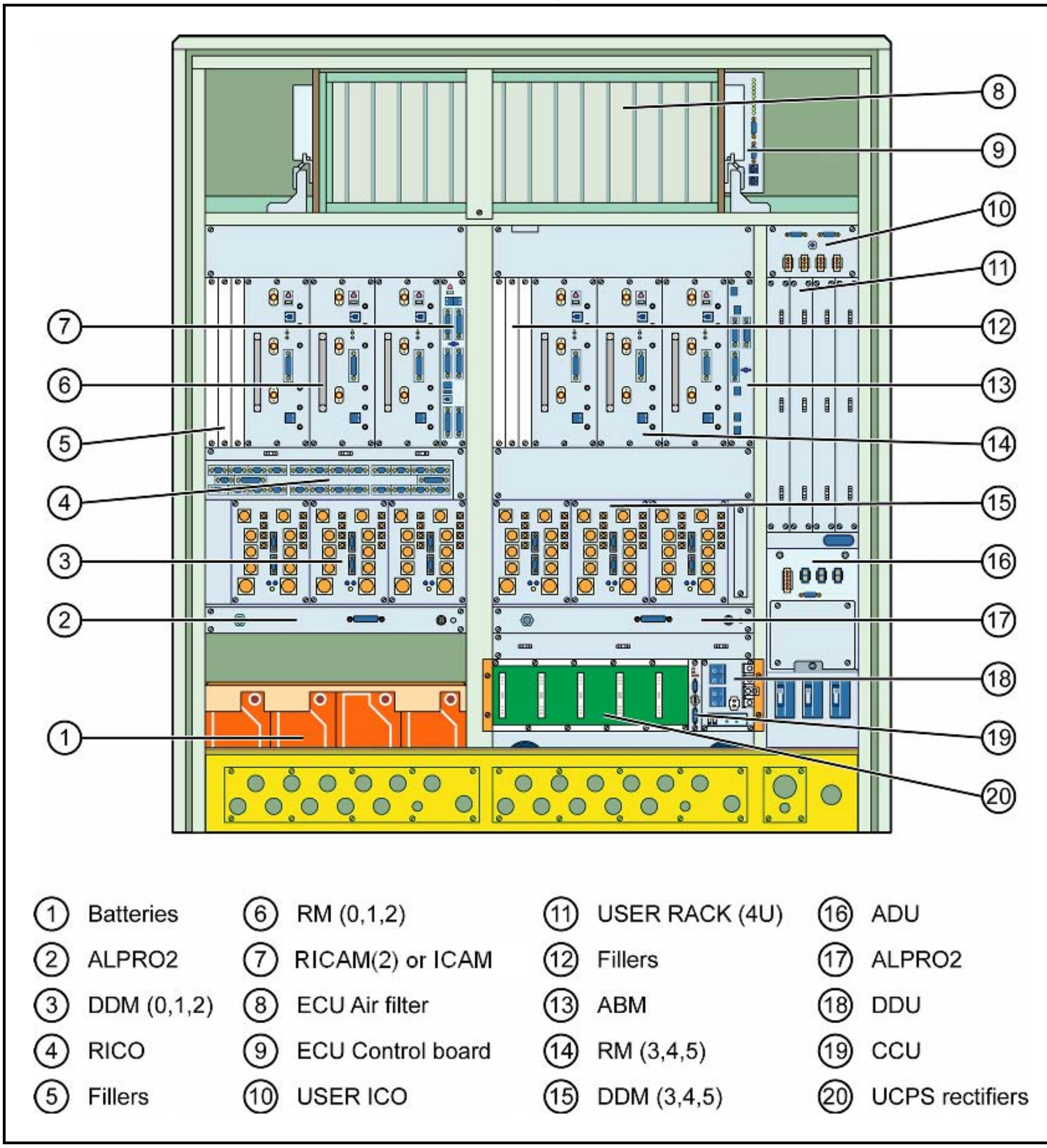
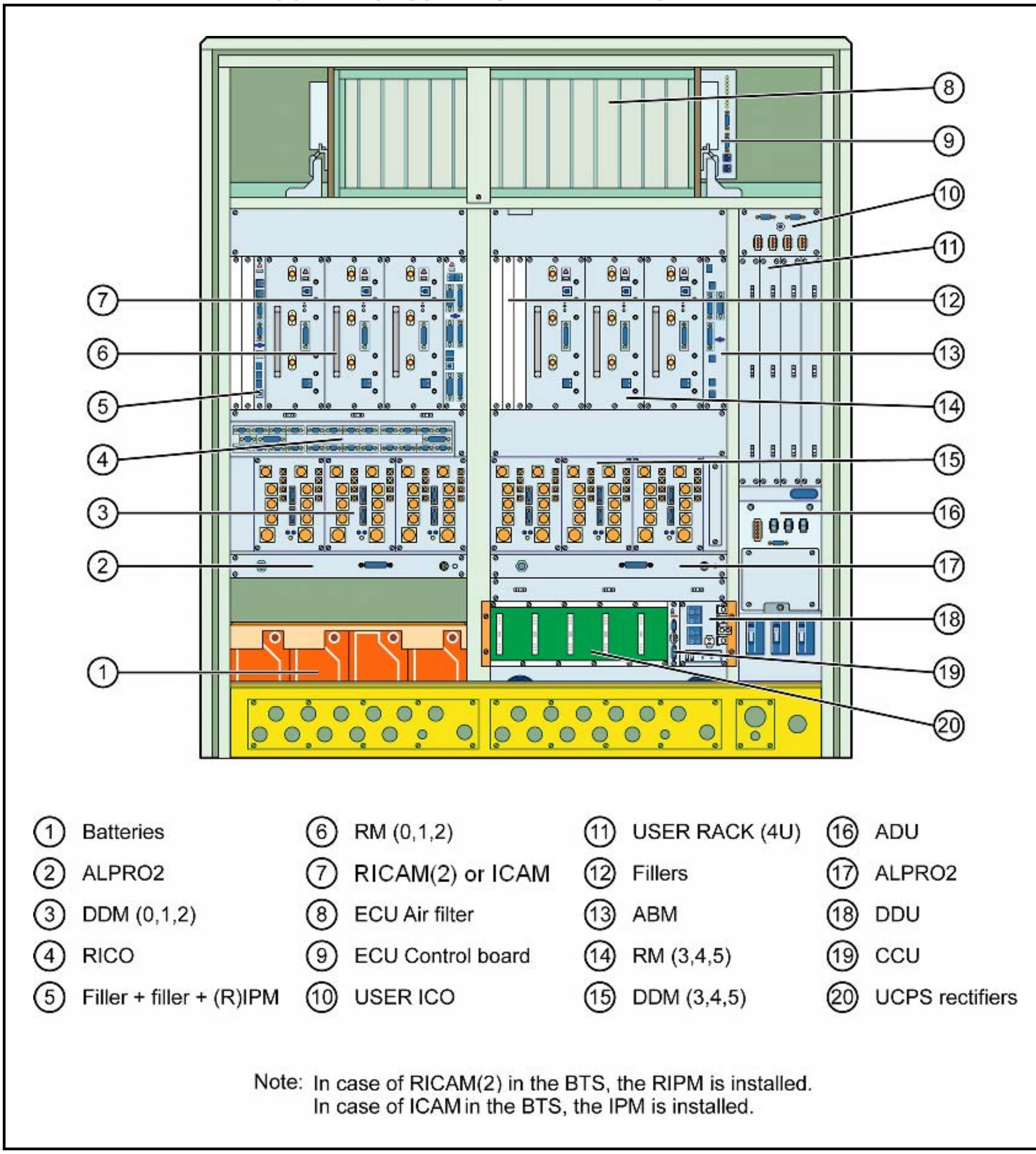


Figure 14
BTS 18020 with RICAM(2)/ICAM(supporting Abis over IP)



3.4 BTS 18020 NG cabinet layout

The BTS 18020 NG can be housed in one or several cabinets depending on the required capacity:

- One S333 or S666 base cabinet (standard)
- One S333 or S666 extension cabinet (standard)

The BTS 18020 NG cabinet includes the following elements:

- One AC Distribution Unit (ADUng)
- AC/DC power supply: ngUCPS (including shelf/DDU) able to support up to four x 1.6kW rectifiers and a GSM CCU (Cabinet Control Unit)
- Four optional internal batteries: Enersys SBS 60 or Narada TTG12V52
- Environmental Control System (ECS)
- User rack + optional user InterCOnnect (ngUser ICO) module
- Optional user plug (EUR, UK, GER, US) adaptable on the front face of the ADU
- Up to two Radio InterCOnnect (RICO) modules
- Optional Compact Interface Back-Plane (CIBP)
  - Up to two optional Interface Modules (IFM/IFM1)
  - Up to two optional Interface Control Modules (ICM, redundancy)
  - Up to two Alarm and Bridge Modules (ABM)
  - One optional RICAM(2)/ICAM module:
    - RICAM
    - RICAM2
    - ICAM
- Up to two optional ALarm secondary PROtection (ALPRO2)
- Up to six Radio Modules (RM1 or RM2)
- Up to six Dual Duplexer Modules (DDM)
- Up to 18 Transmit Filters (TxF)
- Up to six 3-way Hybrid couplers (H3)
- Up to four 4-way Hybrid couplers (H4)
- One optional Internet Protocol Module (IPM) or Redundant Internet Protocol Module (RIPM) if the connectivity to an IP network is selected.

  A BTS supporting the Abis over IP feature is populated with one IPM or RIPM. The RIPM is the redundant variant of the IPM. Only cold redundancy (through redundancy of sub-components) is supported inside the RIPM. No redundancy of the RIPM is supported to insure hot duplex mechanism.

The DDM, TxF, H3, and H4 modules are physically grouped into the two combiner racks. Each digital rack consists of the association of IFM/IFM, ICM (or ICAM, or RICAM), ABM, IPM (or RIPM), and radio modules RM1 or RM2.

IFM/IFM1, ICM, RIPM/IPM, and RICAM/ICAM are not required in a BTS 18000 extension cabinet.

3.4.1 BTS 18020 NG cabinet with BCF on CIBP

The following figures present the BTS 18020 NG cabinet layout and situates the modules in a fully equipped cabinet. This is a configuration with the BCF on CIBP (that is, without a RICAM(2) or ICAM).

Figure 15
S333 configuration of the BTS 18020 NG standard cabinet with BCF on CIBP (not supporting Abis over IP)

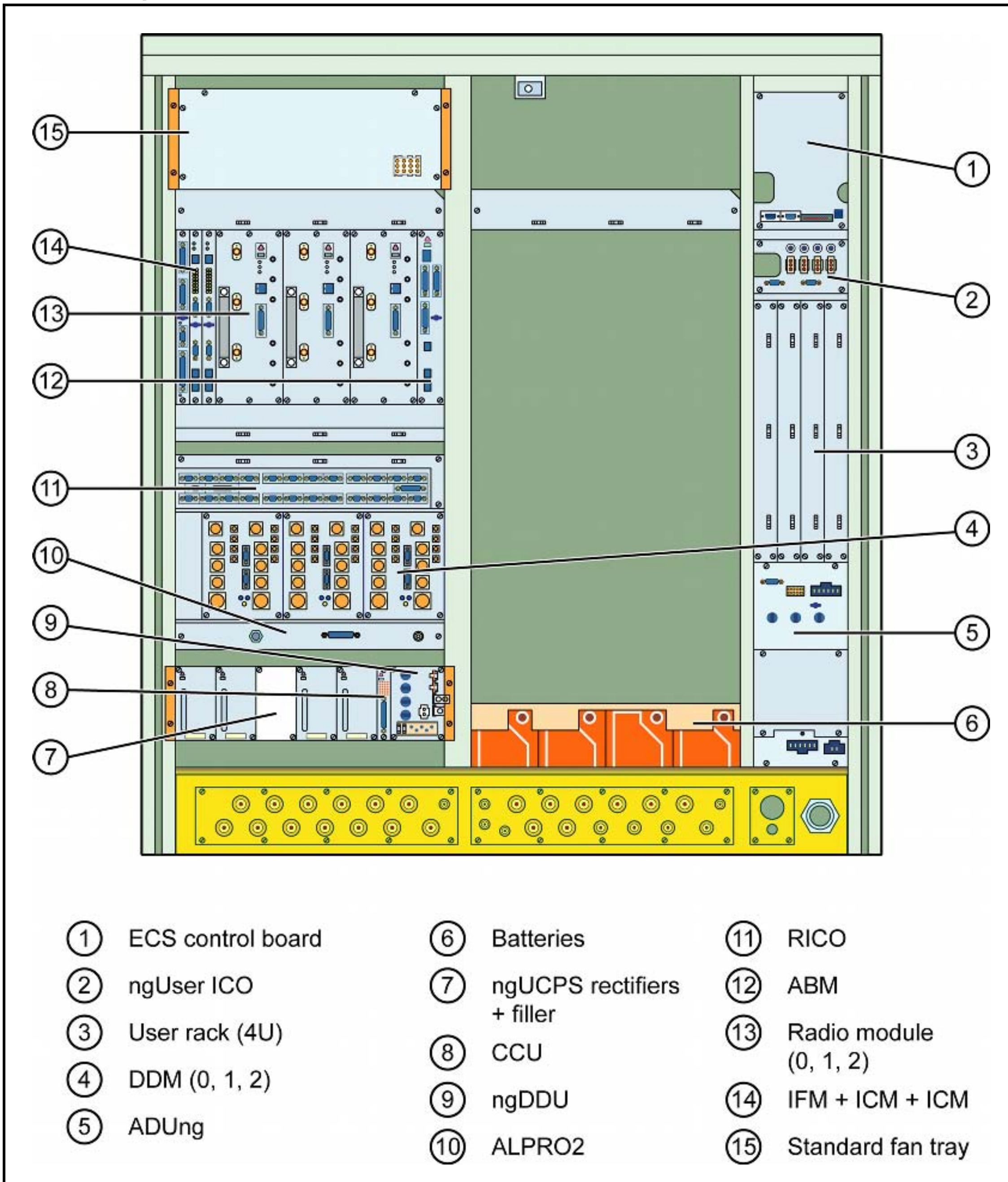
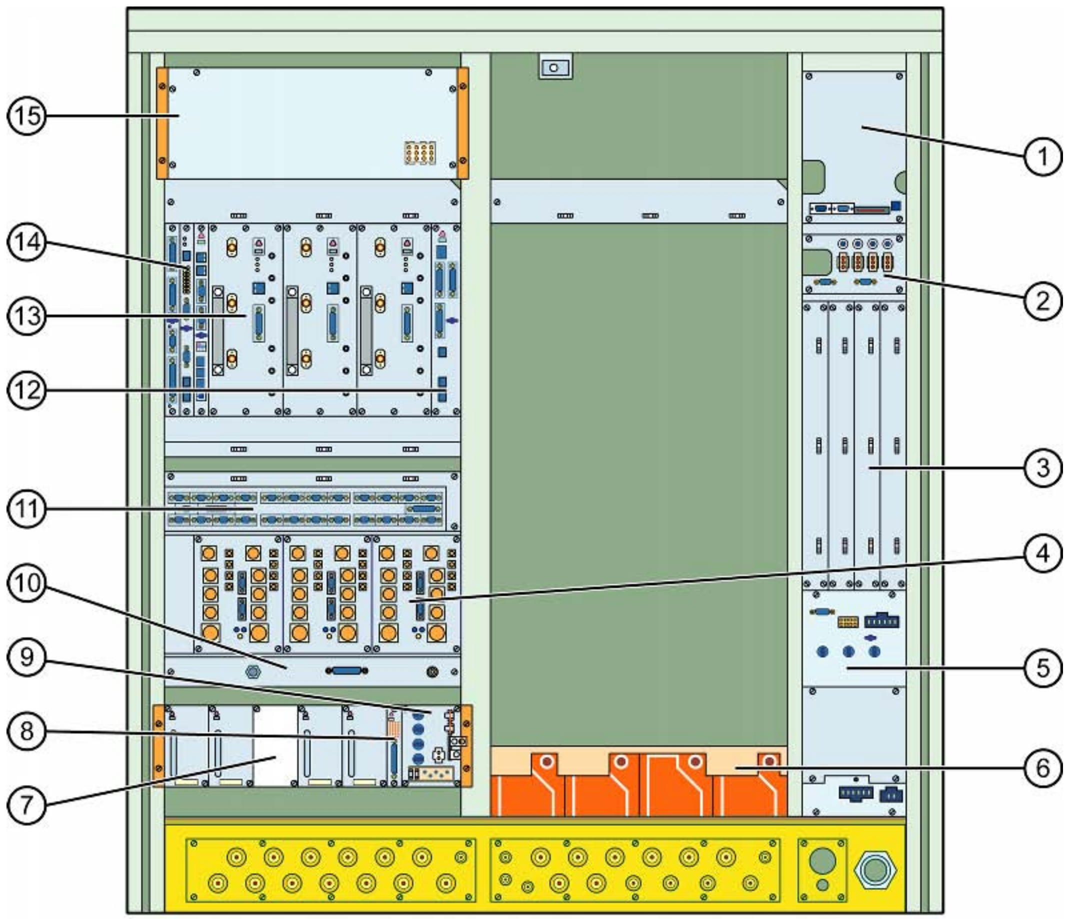


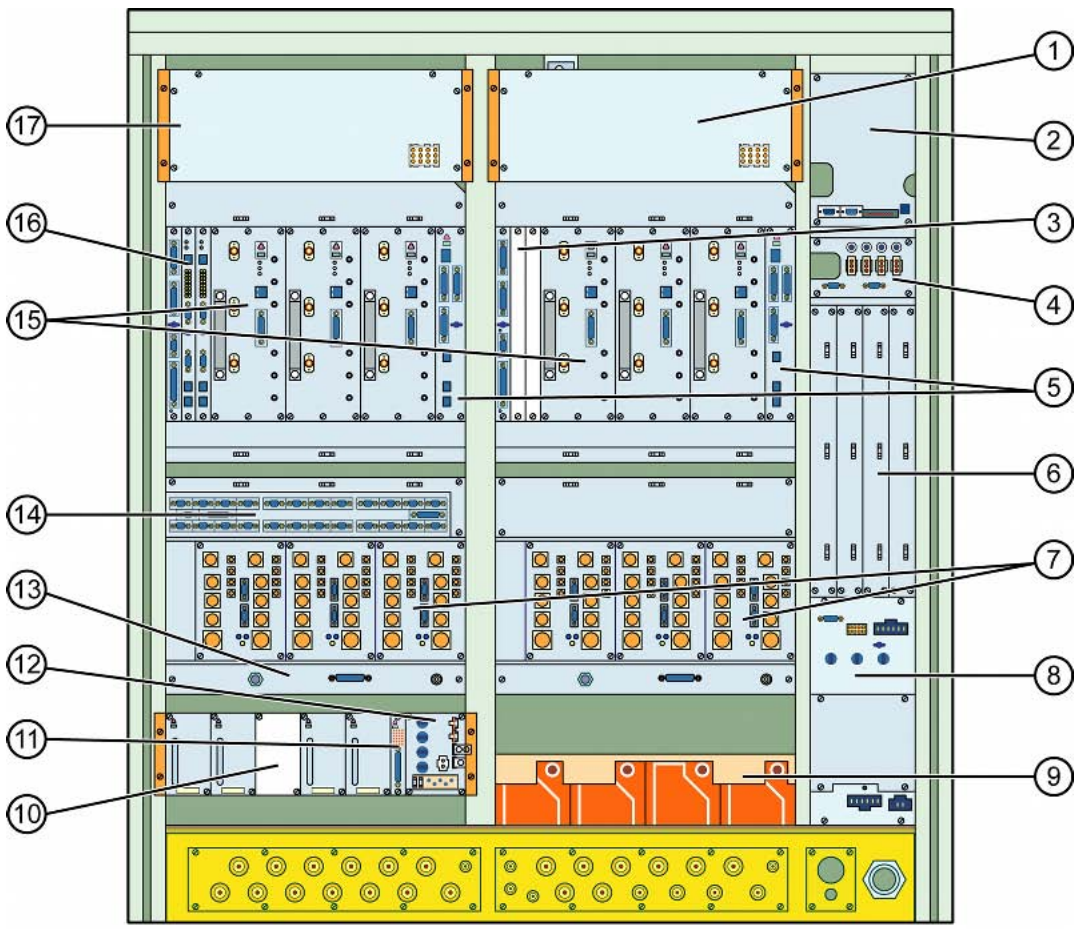
Figure 16
S333 configuration of the BTS 18020 NG standard cabinet with BCF on CIBP (supporting Abis over IP)



(1) ECS control board	(6) Batteries	(11) RICO
(2) ngUser ICO	(7) ngUCPS rectifiers + filler	(12) ABM
(3) User rack (4U)	(8) CCU	(13) Radio module (0, 1, 2)
(4) DDM (0, 1, 2)	(9) ngDDU	(14) IFM + ICM + IPM
(5) ADUng	(10) ALPRO2	(15) Standard fan tray

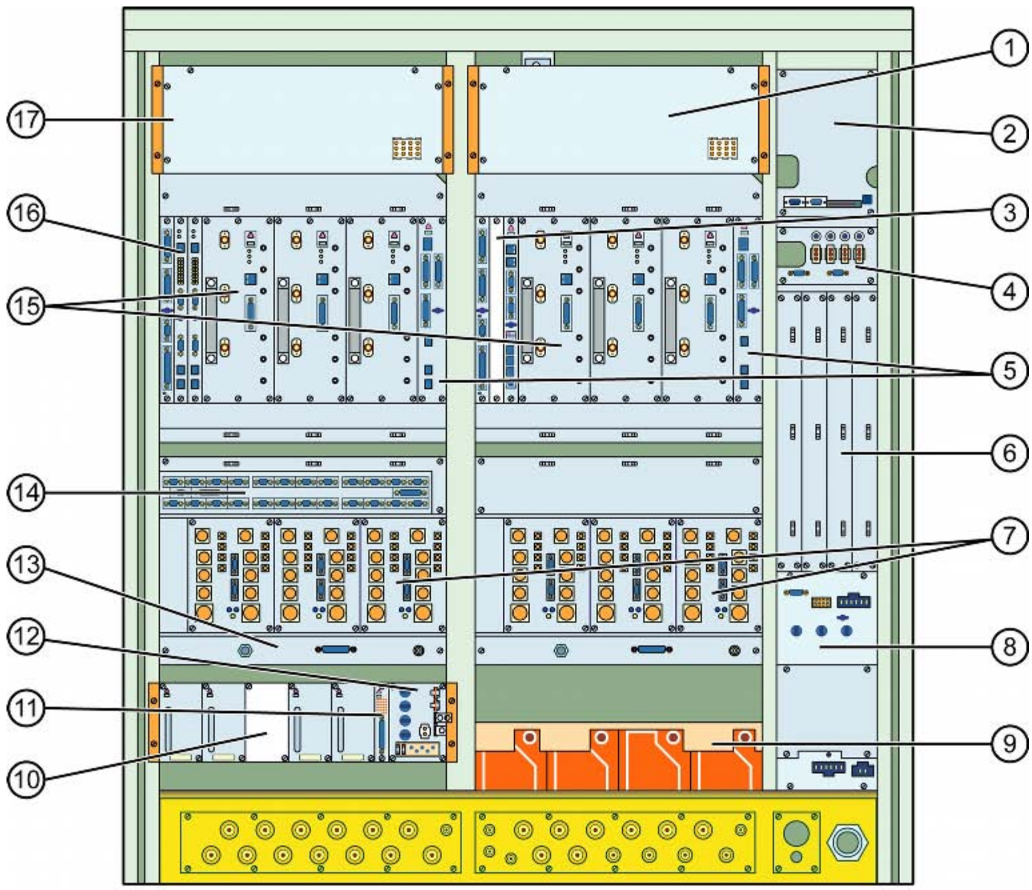
Note: In case of redundant ICM, an RIPM replaces the IPM.

Figure 17
S666 configuration of the BTS 18020 NG standard cabinet with BCF on CIBP (not supporting Abis over IP)



1 Standard fan tray 2
2 ECS control board
3 IFM + 2 fillers
4 ngUser ICO
5 ABM
6 User rack (4U)
7 DDM (0, 1, 2, 3, 4, 5)
8 ADUng
9 Batteries
10 ngUCPS rectifiers + filler
11 CCU
12 ngDDU
13 ALPRO2
14 RICO
15 Radio module (0, 1, 2, 3, 4, 5)
16 IFM + ICM + ICM
17 Standard fan tray 1

Figure 18
S666 configuration of the BTS 18020 NG standard cabinet with BCF on CIBP (supporting Abis over IP)



1. Standard fan tray 2
2. ECS control board
3. IFM + filler + RIPM
4. ngUser ICO
5. ABM
6. User rack (4U)
7. DDM (0, 1, 2, 3, 4, 5)
8. ADUng
9. Batteries
10. ngUCPS rectifiers + filler
11. CCU
12. ngDDU
13. ALPRO2
14. RICO
15. Radio module (0, 1, 2, 3, 4, 5)
16. IFM + ICM + ICM
17. Standard fan tray 1

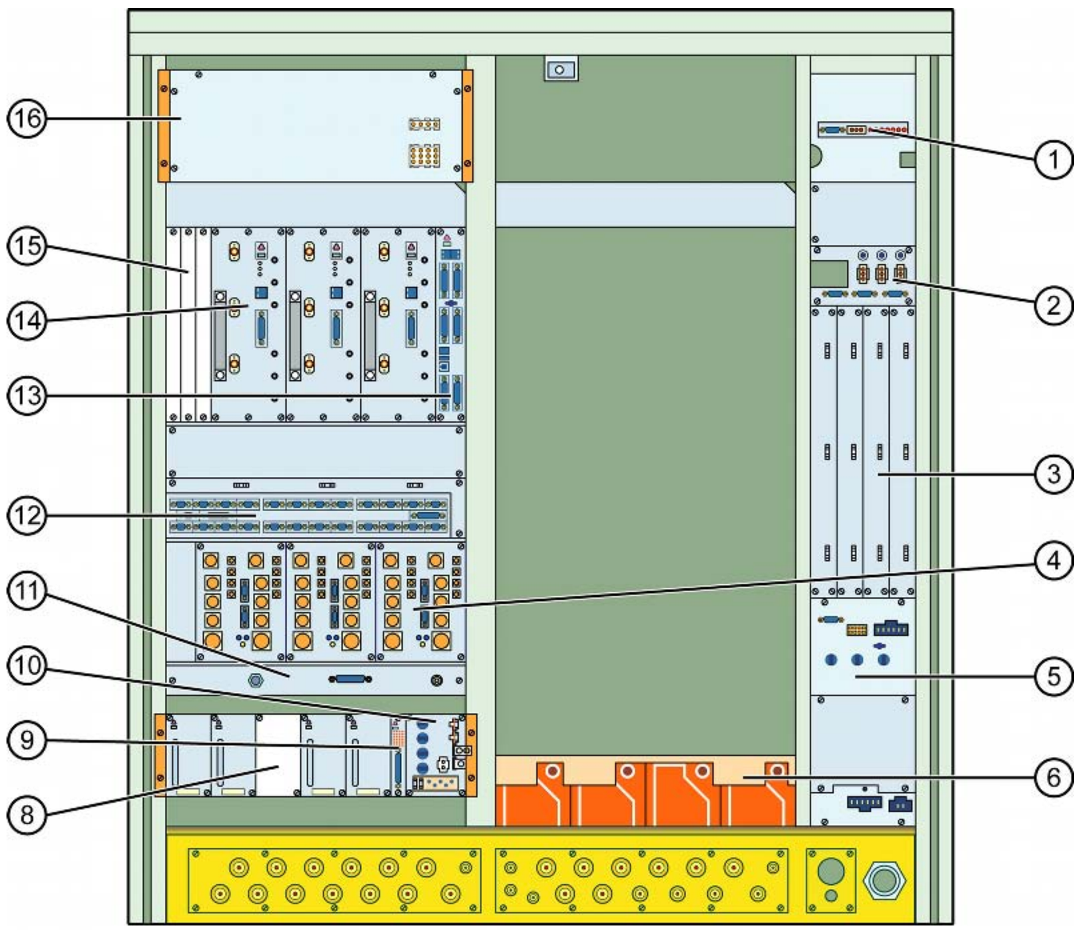
Note: In case of non-redundant ICM, an IPM replaces the RIPM.

3.4.2 BTS 18020 NG cabinet with RICAM(2)/ICAM

If a RICAM(2) or ICAM is present, it replaces ABM-0 and the IFM/IFM1 and ICM are removed (and replaced by fillers).

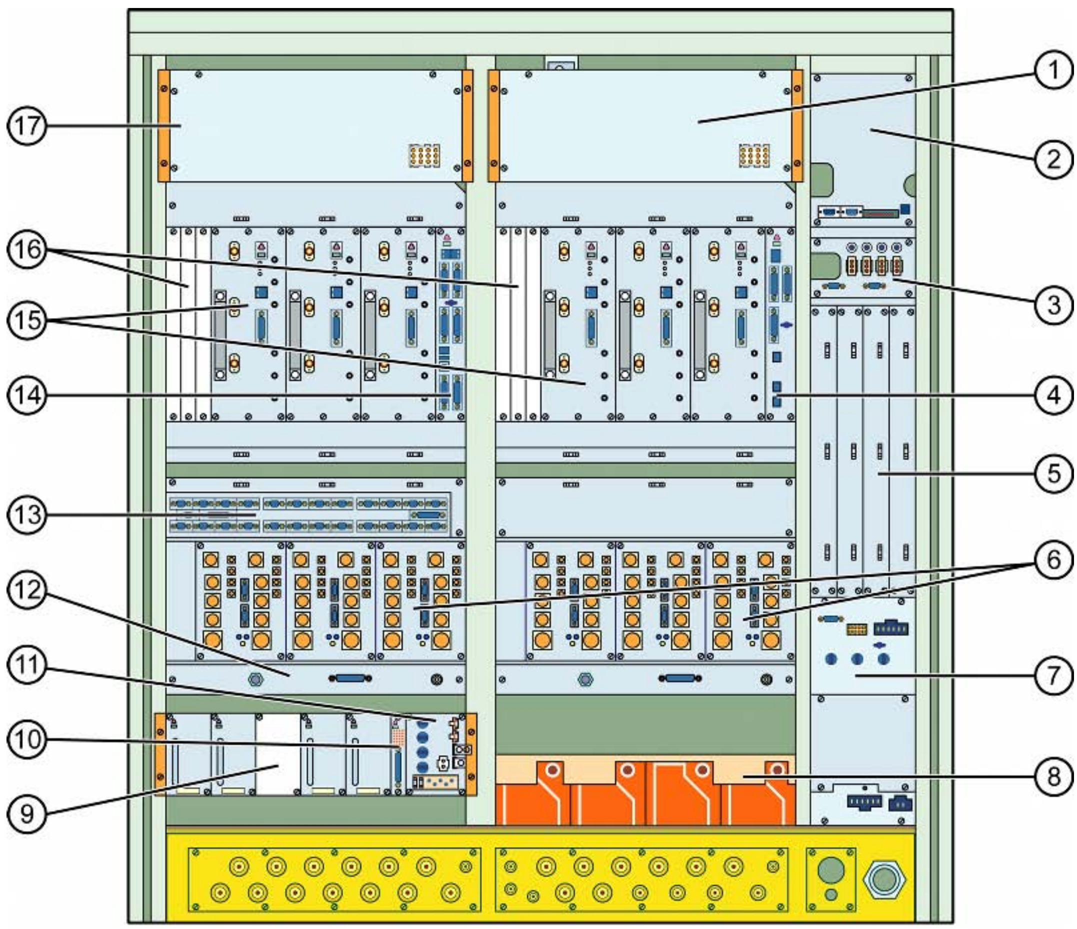
The following figures show the cabinet if a RICAM(2) or ICAM is present. The IFM/IFM1 and ICM(s) are removed and replaced by fillers. The ABM-0 is removed and replaced by the RICAM(2) or ICAM. The other ABM(s) remain.

Figure 19
S333 configuration of the BTS 18020 NG standard cabinet with ICAM or RICAM(2) (not supporting Abis over IP)



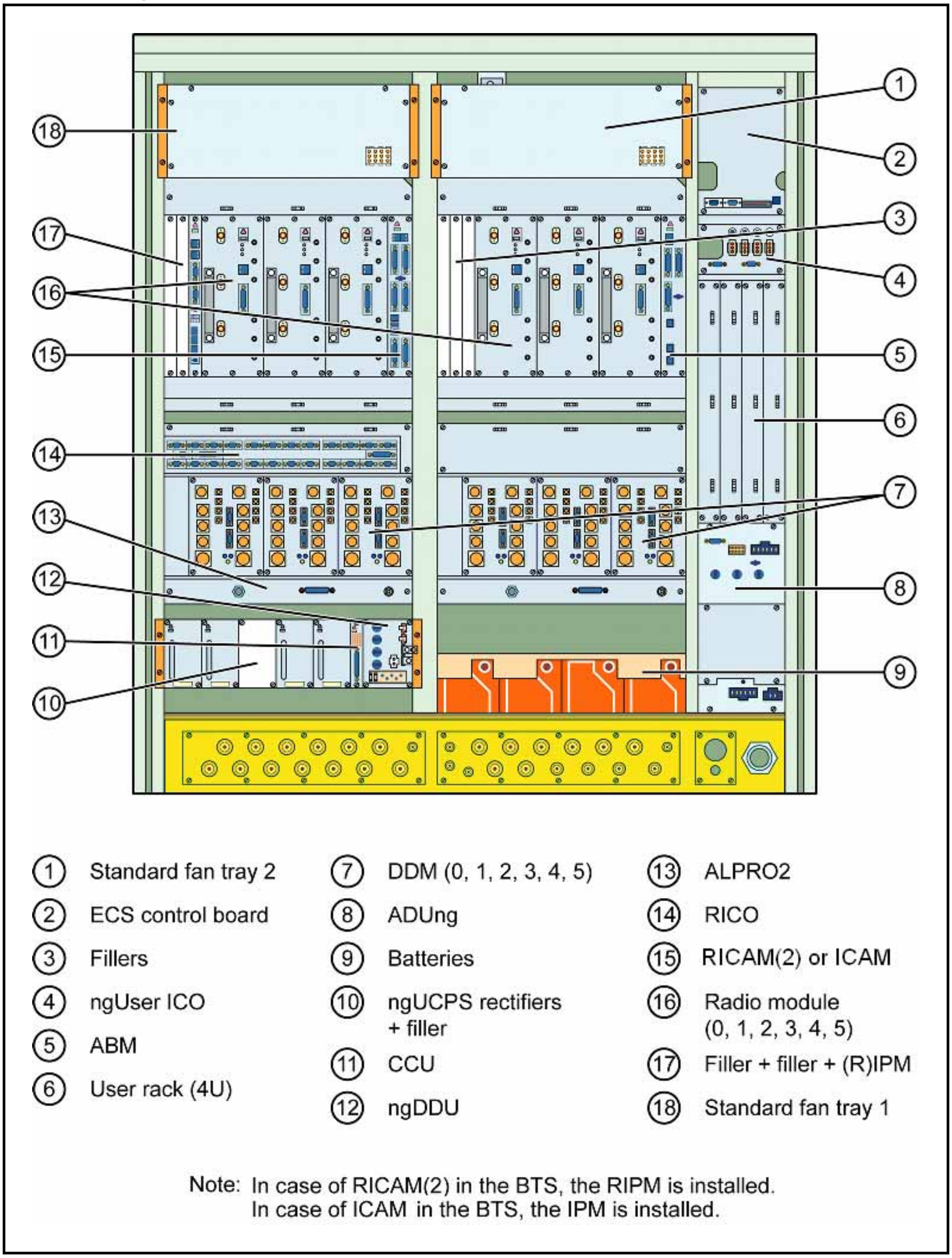
1. ECS control board
2. ngUser ICO
3. User rack (4U)
4. DDM (0, 1, 2)
5. ADUng
6. Batteries
7. ngUCPS rectifiers + filler
8. CCU
9. ngDDU
10. ALPRO2
11. RICO
12. RICAM(2) or ICAM
13. Radio module (0, 1, 2)
14. Fillers
15. Standard fan tray

Figure 20
S666 configuration of the BTS 18020 NG standard cabinet with RICAM(2) or ICAM (not supporting Abis over IP)



1 Standard fan tray 2
2 ECS control board
3 ngUser ICO
4 ABM
5 User rack (4U)
6 DDM (0, 1, 2, 3, 4, 5)
7 ADUng
8 Batteries
9 ngUCPS rectifiers + filler
10 CCU
11 ngDDU
12 ALPRO2
13 RICO
14 RICAM(2) or ICAM
15 Radio module (0, 1, 2, 3, 4, 5)
16 Fillers
17 Standard fan tray 1

Figure 21
S666 configuration of the BTS 18020 NG standard cabinet with RICAM(2) or ICAM (supporting Abis over IP)



3.5 BTS 18020 WW cabinet layout

The BTS 18020 WW has the same cabinet layout as the BTS 18020 NG except for the following:

- In BTS 18020 WW, the location of the filters on the doors is slightly changed. In BTS 18020 NG, filters are located only on the left door for the S333 configuration, both on the left and the right doors for in the S666 configuration; whereas in BTS 18020 WW, the filters are located on the left and right doors by default.
- In BTS 18020 NG, heaters are located at the bottom of the cabinet. In BTS 18020 WW, heaters are located in the fan tray. In an S333 configuration, only the left fan tray is installed. In an S666 configuration, both the left and the right fan trays are installed.

The BTS 18020 WW can be housed in one or several cabinets depending on the required capacity:

- One S333 or S666 base cabinet
- Up to two S333 or S666 extension cabinets

The BTS 18020 WW cabinet includes the following elements:

- One AC Distribution Unit (ADUng)
- AC/DC power supply: ngUCPS (including shelf/DDU) able to support up to four x 1.6 kW rectifiers and a GSM CCU (Cabinet Control Unit)
- Four optional internal batteries: Enersys SBS 60
- User rack + optional user InterCOnnect (ngUser ICO) module
- Optional user plug (EUR, UK, GER, US) adaptable on the front face of the ADUng
- One Redundant Interface Control Alarm Module RICAM(2)/ICAM by default
- Up to two Radio InterCOnnect (RICO) modules
- Internet Protocol Module (RIPM/IPM)
- Optional Compact Interface Back-Plane (CIBP)
  - Up to two optional Interface Modules (IFM/IFM1)
  - Up to two optional Interface Control Modules (ICM, redundancy)
  - Up to two Alarm and Bridge Modules (ABM)
- Up to two optional ALarm secondary PROtection (ALPRO2)
- Up to six Radio Modules (RM1 or RM2)
- Up to six Dual Duplexer Modules (DDM)

- Up to 18 Transmit Filters (TxF)
- Up to six 3-way Hybrid couplers (H3)
- Up to four 4-way Hybrid couplers (H4)

The DDM, TxF, H3, and H4 modules are physically grouped into the two combiner racks. Each digital rack consists of the association of IFM/IFM, ICM (or RICAM(2) or ICAM, ABM, and radio modules.

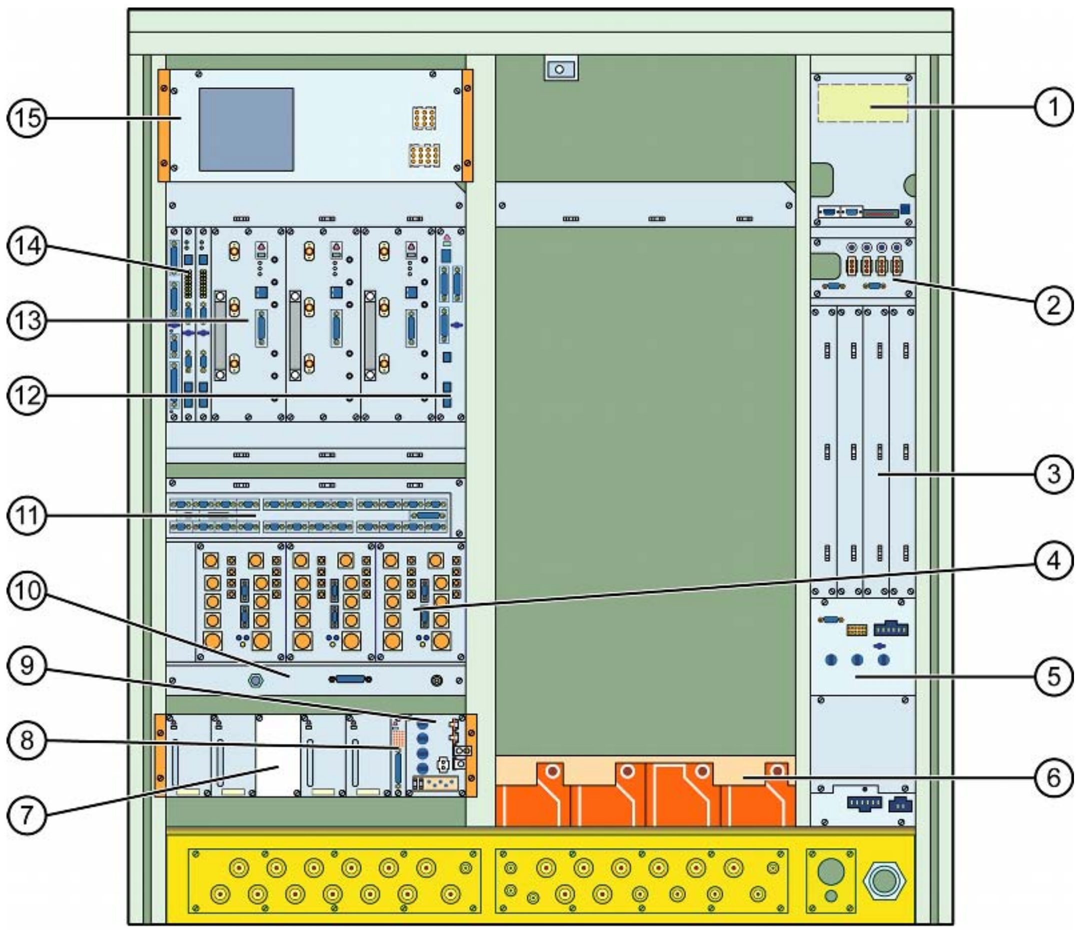
IFM/IFM1 and ICM(s) are not required in a BTS 18000 extension cabinet.

3.5.1 BTS 18020 WW cabinet with BCF on CIBP

The following figures present the BTS 18020 WW cabinet layout and locate the modules in a fully equipped cabinet.

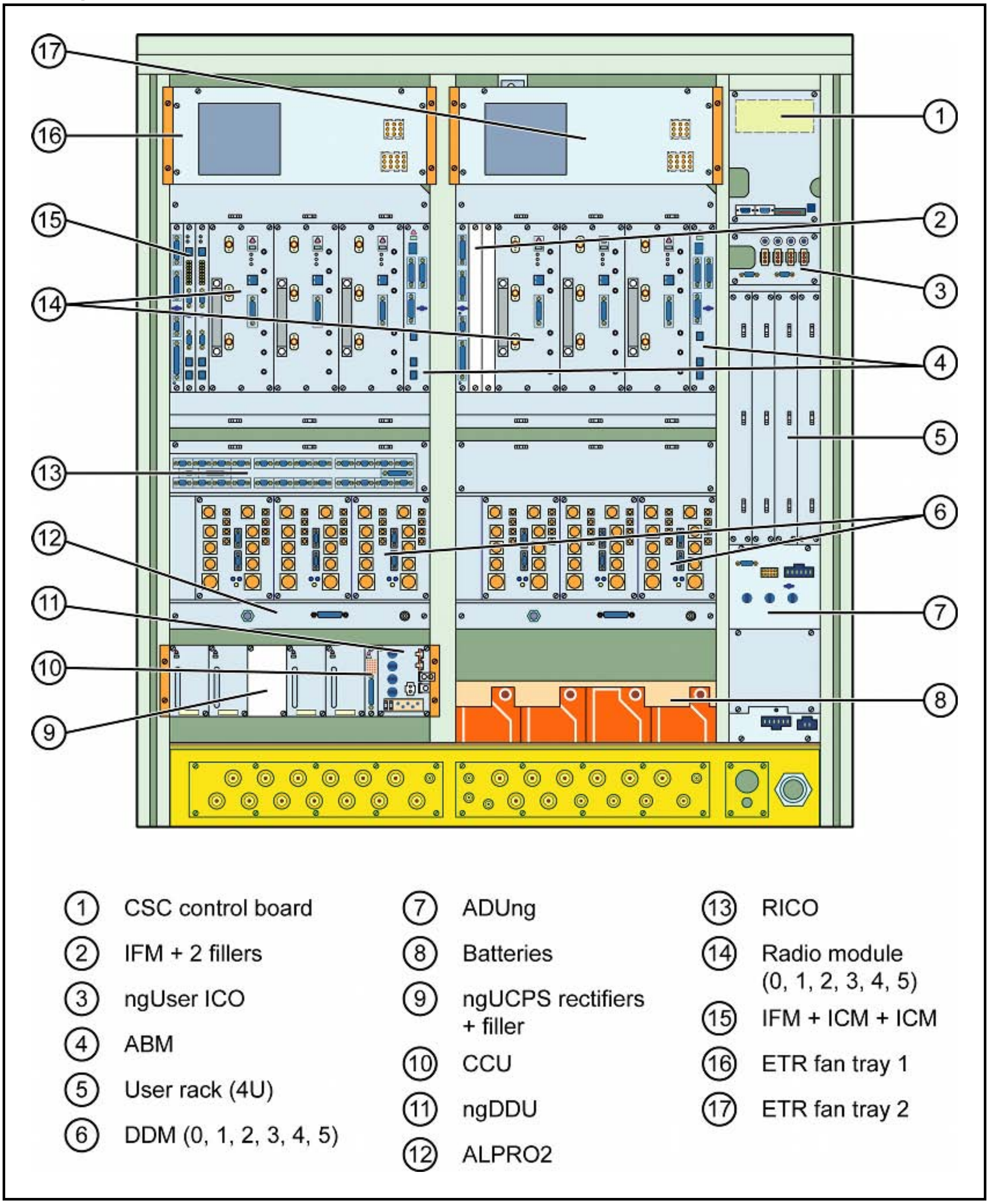
This is a configuration with the BCF on CIBP (that is, without a RICAM(2) or ICAM.

Figure 22
S333 configuration of the BTS 18020 WW cabinet with BCF on CIBP (not supporting Abis over IP)



- (1) CSC control board
- (2) ngUser ICO
- (3) User rack (4U)
- (4) DDM (0, 1, 2)
- (5) ADUng
- (6) Batteries
- (7) ngUCPS rectifiers + filler
- (8) CCU
- (9) ngDDU
- (10) ALPRO2
- (11) RICO
- (12) ABM
- (13) Radio module (0, 1, 2)
- (14) IFM + ICM + ICM
- (15) ETR fan tray

Figure 23
S666 configuration of the BTS 18020 WW cabinet with BCF on CIBP (not supporting Abis over IP)

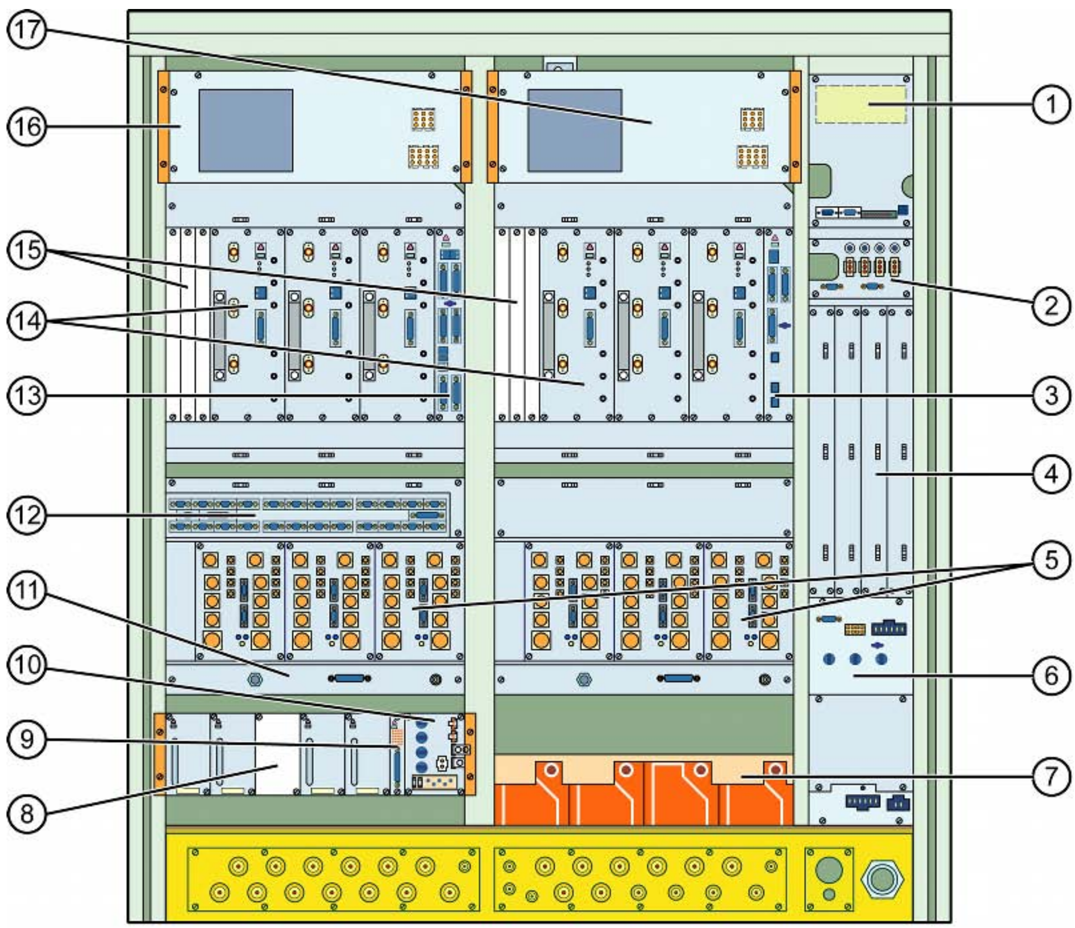


3.5.2 BTS 18020 WW cabinet with RICAM(2) or ICAM

If a RICAM(2) or ICAM is present, it replaces ABM-0 and the IFM/IFM1 and ICM are removed (and replaced by fillers).

The following figures show the cabinet if a RICAM(2) or ICAM is present. The IFM/IFM1 and ICM(s) are removed and replaced by fillers. The ABM-0 is removed and replaced by the RICAM(2) or ICAM. The other ABM(s) remain.

Figure 24
S666 configuration of the BTS 18020 WW cabinet with RICAM/ICAM (not supporting Abis over IP)



1. CSC control board
2. ngUser ICO
3. ABM
4. User rack (4U)
5. DDM (0, 1, 2, 3, 4, 5)
6. ADUng
7. Batteries
8. ngUCPS rectifiers + filler
9. CCU
10. ngDDU
11. ALPRO2
12. RICO
13. RICAM or RICAM2
14. Radio module (0, 1, 2, 3, 4, 5)
15. Fillers
16. ETR fan tray 1
17. ETR fan tray 2

3.6 Power supply

3.6.1 BTS 18020 cabinet

The outdoor cabinet provides an AC input. The AC Distribution Unit (ADU) performs AC protection, filtering and distribution.

The UCPS power supply system delivers -48 V DC voltage from the AC input. The UCPS also manages optional internal or external batteries.

For detailed information, see Chapter 4 “BTS 18000 modules description” (page 77).

3.6.2 BTS 18020 NG cabinet

The outdoor cabinet provides an AC input. The AC Distribution Unit (ADUng) performs AC protection, filtering, and distribution.

The ngUCPS power supply system delivers -48 V DC voltage from the AC input. The ngUCPS also manages optional internal batteries.

For detailed information, see Chapter 4 “BTS 18000 modules description” (page 77).

3.6.3 BTS 18010 and BTS 18010 NG2 cabinets

The indoor cabinet provides a DC input, -48 V.

3.6.4 BTS 18020 WW cabinet

The outdoor cabinet provides an AC input. The AC Distribution Unit (ADUng) performs AC protection, filtering, and distribution.

The ngUCPS power supply system delivers -48 V DC voltage from the AC input. The ngUCPS also manages optional internal batteries.

For detailed information, see Chapter 4 “BTS 18000 modules description” (page 77).

3.7 Cooling system

There are two cooling systems, depending on the BTS 18000 cabinet version:

- The Indoor Cooling System (SICS) is available for the BTS 18010 cabinet.

  See 4.12 “Cooling System (SICS) of the BTS 18010, Cooling System (SICS-S) of the BTS 18010 and BTS 18010 NG2” (page 186) for detailed information.

- The Indoor Cooling System (SICS-S) is available for the BTS 18010 and BTS 18010 NG2 cabinets. See 4.12 “Cooling System (SICS) of the BTS 18010, Cooling System (SICS-S) of the BTS 18010 and BTS 18010 NG2" (page 186) for detailed information.

- The Environmental Control Unit (ECU) is available for the BTS 18020 cabinet.

  See 4.13 "Environmental Control Unit (ECU) of the BTS 18020" (page 193) for detailed information.

3.8 Physical characteristics and environmental requirements

3.8.1 BTS 18010 and BTS 18010 NG2 cabinets

As shown in the Table 4 "BTS 18010 and BTS 18010 NG2 dimensions and weight" (page 72), the weight and dimensions of the two BTS 18010 cabled cabinets allows for installations using generally available installation tools and methods. Key construction features are:

- cabled cabinet design integrating all mechanical sub-racks and mechanical support systems required for the installation, transport and operation of the GSM wireless equipment
- centralized single low acoustic noise Indoor Cooling System (SICS or SICS-S), supplying standardized cooling performance regardless of BTS configuration
- standardized DC distribution system, allowing BTS minimum to maximum configuration expansion
- standardized Radio InterCOnnection module (RICO), allowing minimum to maximum BTS configuration expansion
- standardized digital back-plane assembly (DBP), allowing minimum to maximum BTS configuration expansion

Table 4
BTS 18010 and BTS 18010 NG2 dimensions and weight

BTS 18010 and BTS 18010 NG2 cabinets	Height mm	Width mm	Depth mm	Weight kg
BTS 18010 and BTS 18010 NG2 pre-cabled cabinets	1750	600	600	120
BTS 18010 and BTS 18010 NG2 fully equipped cabinets	1750	600	600	300

The BTS 18010 and BTS 18010 NG2 cabinets are designed to support an external temperature range of -5°C to +45°C with an absolute humidity between 1 g/m3 and 29 g/m3.

The BTS 18010 and BTS 18010 NG2 enclosures are designed for a standard indoor environment.

The Combo GSM-UMTS variant of BTS 18010 cabinet supports the same environmental conditions.

3.8.2 BTS 18020 cabinet

As shown in Table 5 "BTS 18020 dimensions and weights" (page 73), the weights and dimensions of the BTS 18020 cabled cabinet allows for installations using generally available installation tools and methods. Key construction features are:

- cabled cabinet design integrating all mechanical sub-racks and mechanical support systems required for the installation, transport and operation of the GSM wireless equipment
- centralized single Environmental Control Unit (ECU), supplying standardized cooling performance regardless of BTS configuration
- AC Distribution Unit (ADU)
- standardized AC/DC distribution system, allowing BTS minimum to maximum configuration expansion: Univity Compact Power System (UCPS)
- standardized Radio InterCOnnection module (RICO), allowing minimum to maximum BTS configuration expansion
- standardized digital back-plane assembly (DBP), allowing minimum to maximum BTS configuration expansion

Table 5
BTS 18020 dimensions and weights

BTS 18020 cabinet	Height mm	Width mm	Depth mm	Weight kg
BTS 18020 pre-cabled cabinet	1500	1350	735	180
BTS 18020 fully equipped cabinet	1500	1350	735	450

The BTS 18020 cabinet is designed to support an external temperature range of -40°C to +50°C with an absolute humidity between 1 g/m3 and 36 g/m3.

The minimum external temperature value is modified if one or more heaters are deactivated. For more information, see 4.13.8 “Reducing the power consumption of the BTS 18020” (page 198).

The BTS 18020 enclosure is designed for an outdoor environment.

The Combo GSM-UMTS variant of BTS 18020 cabinet supports the same environmental conditions.

3.8.3 BTS 18020 NG cabinet

As shown in Table 6 "BTS 18020 NG dimensions and weights" (page 74), the weights and dimensions of the BTS 18020 NG cabled cabinet allows for installations using generally available installation tools and methods. Key construction features are:

- cabled cabinet design integrating all mechanical sub-racks and mechanical support systems required for the installation, transport and operation of the GSM wireless equipment
- centralized single Environmental Control System (ECS), supplying standardized cooling performance regardless of BTS configuration
- AC Distribution Unit (ADUng)
- standardized AC/DC distribution system, allowing BTS minimum to maximum configuration expansion: new generation Univity Compact Power System (ngUCPS)
- standardized Radio InterCOnnection module (RICO), allowing minimum to maximum BTS configuration expansion
- standardized Digital Back-Plane assembly (DBP), allowing minimum to maximum BTS configuration expansion

Table 6
BTS 18020 NG dimensions and weights

BTS 18020 NG cabinet	Height mm	Width mm	Depth mm	Weight kg
BTS 18020 NG pre-cabled cabinet	1500	1350	735	325
BTS 18020 NG fully equipped cabinet	1500	1350	735	660

The standard cabinets of the BTS 18020 NG are designed to support an external temperature range of -5°C to +50°C. The BTS 18020 NG cabinet has an absolute humidity of 36 g/m3.

The minimum external temperature value is modified if one or more heaters are deactivated. For more information, see 4.13.8 “Reducing the power consumption of the BTS 18020” (page 198).

The BTS 18020 NG enclosure is designed for an outdoor environment.

3.8.4 BTS 18020 WW cabinet

The weights and dimensions of the BTS 18020 WW cabled cabinet allows for installations using generally available installation tools and methods. For more information, see Table 7 "BTS 18020 WW dimensions and weights" (page 75).

Key construction features are:

- cabled cabinet design integrating all mechanical sub-racks and mechanical support systems required for the installation, transport, and operation of the GSM wireless equipment
- centralized single Environmental Control System (ECS), supplying standardized cooling performance regardless of BTS configuration
- AC Distribution Unit (ADUng)
- standardized AC/DC distribution system, allowing BTS minimum to maximum configuration expansion: new generation Univity Compact Power System (ngUCPS)
- standardized Radio InterCOnnection module (RICO), allowing minimum to maximum BTS configuration expansion
- standardized Digital Back-Plane assembly (DBP), allowing minimum to maximum BTS configuration expansion

Table 7
BTS 18020 WW dimensions and weights

Equipment	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
BTS 18020 WW pre-cabled cabinet	1480	1350	808	270
BTS 18020 WW fully equipped cabinet	1480	1350	808	437

Chapter 4 BTS 18000 modules description

This chapter describes the BTS 18000 modules, shared between the following subsystems:

- BTS 18000 Common Function Modules:
  - IBP or CIBP, and DBP
  - IFM/IFM1
  - ICM
  - ABM
  - RICAM(2) or ICAM
  - RIPM/IPM
- BTS 18000 Radio Modules:
  - radio module
  - TX and RX RF Coupling Modules:
    - DDM, DDM H2, DDM with VSWR meter, or DDM H2 with VSWR meter
    - TxF, TxF H2, TxF with VSWR meter, or TxF H2 with VSWR meter
    - H3 or H4 modules
  - RICO
- BTS 18000 Cabinet Modules:
  - for BTS 18010 cabinet: SICS or SICS-S
  - for BTS 18010 NG2 cabinet: SICS-S
  - for BTS 18020 cabinet:
    - ECU
    - UCPS
    - ADU

    - Internal batteries
    - User rack and User ICO
  - for BTS 18020 NG cabinet:
    - ECS (standard fan tray and ETR fan tray)
    - ngUCPS
    - ADUng
    - Internal batteries
    - User rack and ngUser ICO
  - for BTS 18020 WW cabinet
    - ngUCPS
    - ADUng
    - four optional internal batteries (Enersys SBS 60)
    - User rack and ngUser ICO
- BTS 18000 Ancillary Modules:
  - ALPRO
  - ALPRO2
  - PRIPRO2

4.1 Interface and digital back-planes

There are two types of interface back-planes:

- Interface Back-Plane (IBP)
- Compact Interface Back-Plane (CIBP)

There is one type of digital back-plane, the Digital Back-Plane (DBP).

> ***Note:*** The CIBP is an option.

All modules and some cables carrying external signals are plugged into connectors mounted on the back-planes printed-circuit board.

4.1.1 Main functions

The IBP or CIBP and the DBP provide the electrical interfaces that support DC power distribution and communication between all digital and radio modules.

4.1.1.1 IBP/DBP configuration

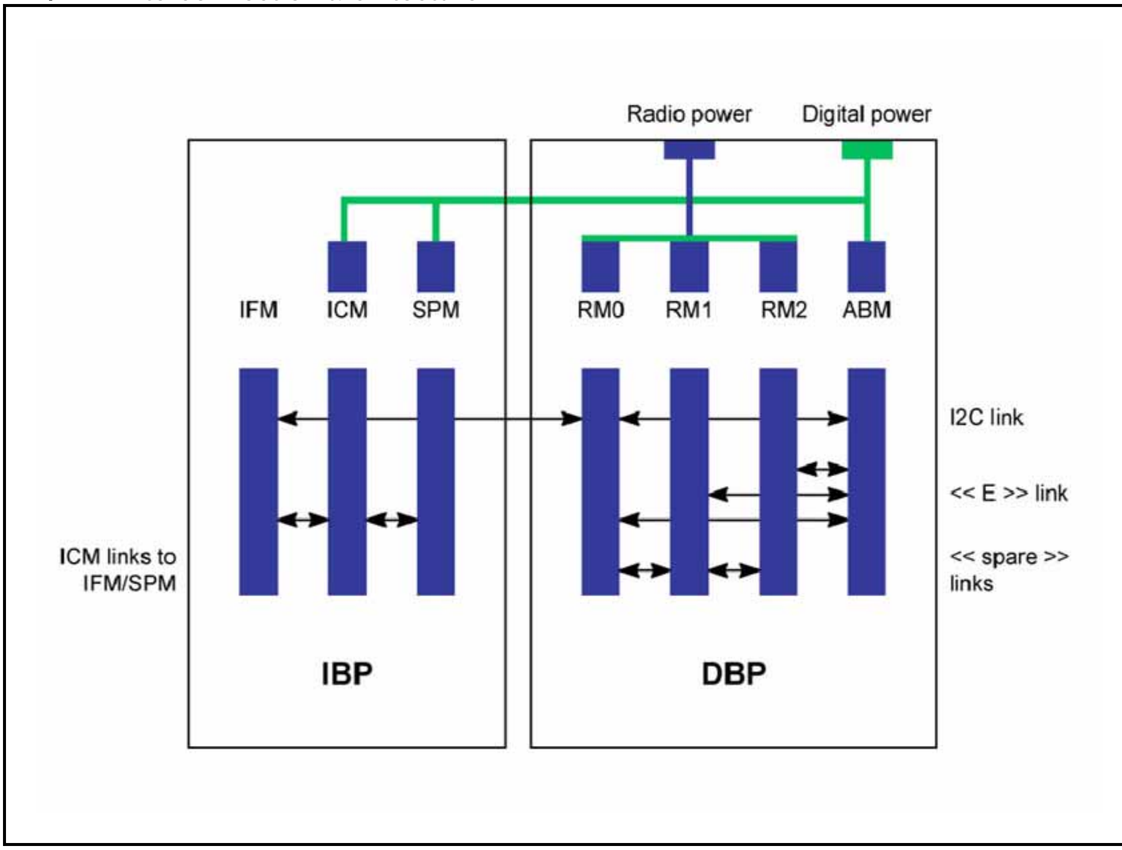
In an IBP (Interface Backplane)/DBP (Digital Backplane) configuration, the functions are split as follows:

- IBP for IFM/IFM1 + ICM + SPM, routing low power and dense digital signals
- DBP for ABM + three radio modules (RM1 or RM2) routing radio module high or medium power, digital boards low power, and a few digital signals

In an IBP/DBP configuration, two IBPs are required (and therefore, two shelves) to support ICM redundancy. In the case of a dual mode GSM-UMTS configuration (combo), only one shelf is available (for GSM), so ICM redundancy cannot be achieved using an IBP/DBP configuration.

The following figure illustrates the IBP/DBP interconnection architecture.

Figure 25
IBP/DBP interconnection architecture



4.1.1.2 CIBP/DBP configuration

The CIBP/DBP configuration is a more compact solution than IBP/DBP in that ICM redundancy can be obtained in one single CIBP. An IBP/DBP configuration is upgradeable to a CIBP/DBP one.

In a CIBP/DBP configuration, the functions are split as follows:

- CIBP for IFM/IFM1 + ICM + (redundant ICM or SPM), routing low power and dense digital signals
- DBP for ABM + three radio modules, routing radio modules high or medium power, digital boards low power, and a few digital signals

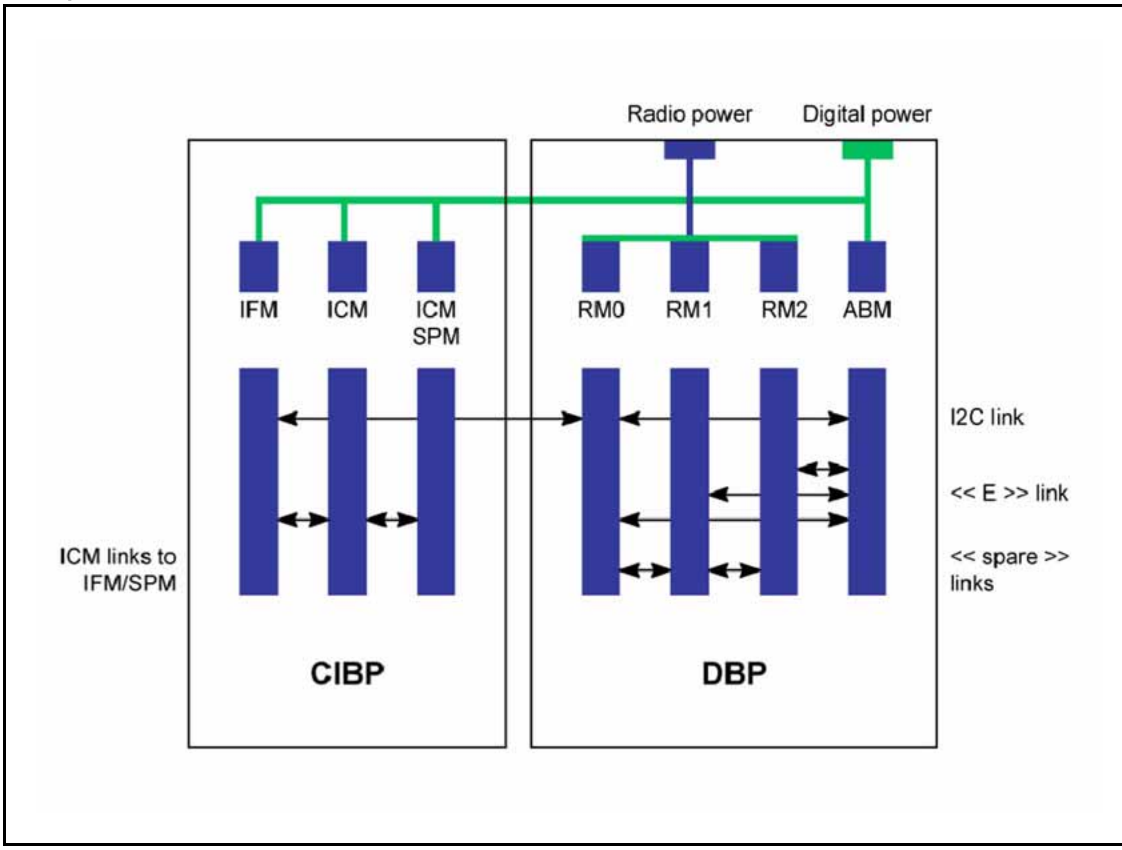
In an CIBP/DBP configuration, only one CIBP is required (and therefore, one shelf) to support ICM redundancy. In the case of a dual mode GSM-UMTS configuration (combo), only one shelf is available (for GSM), so ICM redundancy can be achieved using an CIBP/DBP configuration.

Both ICMs must be on the first CIBP.

The second CIBP can be used if more than four ABIS links are required.

The following figure illustrates the CIBP/DBP interconnection architecture.

Figure 26
CIBP/DBP interconnection architecture



4.1.2 Physical and electrical characteristics

Table 8
IBP dimensions and weight

Module name	Height (mm)	Width (mm)	Depth of the associated shelf (mm)	Weight (kg)
IBP	290	75	415	< 1
CIBP	290	90	415	< 1

Maximum number per cabinet: two

No power dissipation.

Maximum voltage: 60 V

DANGER
Electric shock
The IBP/CIBP distributes 48 V power, so take care while handling the equipment.

Table 9
DBP dimensions and weight

Module name	Height (mm)	Width (mm)	Depth of the associated shelf (mm)	Weight (kg)
DBP	120	311	415	< 1

Maximum number per cabinet: two

No power dissipation.

Maximum voltage: 60 V

DANGER
Electric shock
The DBP distributes 48 V power, so take care while handling the equipment.

4.1.3 Interfaces between modules

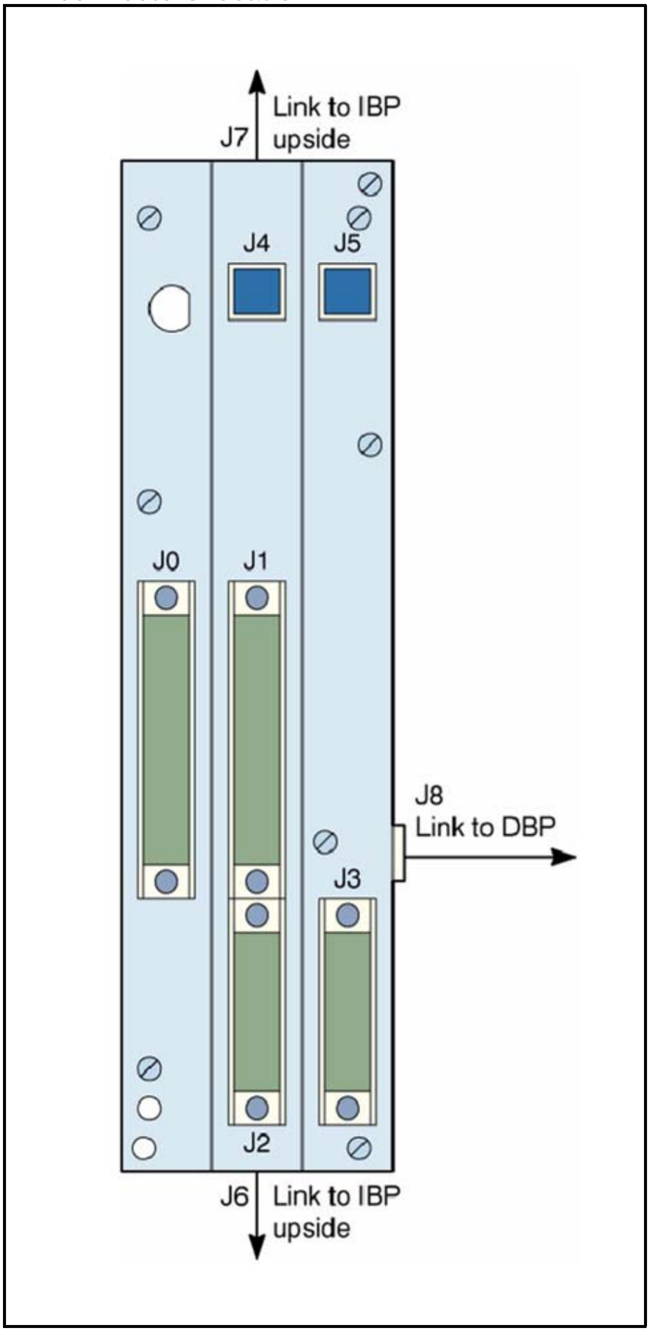
The IBP/CIBP and DBP interface with IFM/IFM1, ICM, ABM, and radio modules using multiple high-density connectors, for digital signal path, and power connectors. The radio module connectors are placed in order to optimize the DC power distribution distance on the back-plane. The radio module power traces, on the back-plane and ground plane, can handle a current of up to 45 A.

The interface between IBP/CIBP and DBP is performed through a digital and power cable.

4.1.4 IBP connectors

The following figure shows the location of the connectors on the IBP module. They are front panel connectors, except for J8, which is located on the right side of IBP.

Figure 27
IBP connectors location



The following table indicates the type and the use of the IBP connectors.

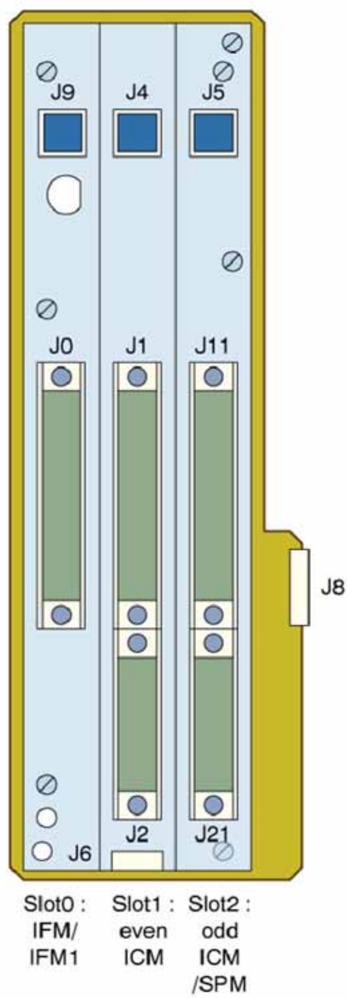
Table 10
IBP connectors type and use

IBP connectors	Use	Type
J0	Connection between IBP and IFM	HM1 210 pins male
J1	Connection between IBP and ICM	
J2	Connection between IBP and ICM	HM1 120 pins male
J3	-	
J4	Connection between IBP and ICM (ICM power)	HM1 30 pins male
J5	-	
J6	Connection between two IBPs	DUBOX 6 pins female
J7		
J8 (on IBP right side)	Connection between IBP and DBP (I2C link, detect, 48 V power)	DUBOX 26 pins female

4.1.5 CIBP connectors

The following figure shows the location of the connectors on the CIBP module. They are front panel connectors, except for J8, which is located on the right side of the CIBP.

Figure 28
CIBP connectors location



The following table indicates the type and the use of the CIBP connectors.

Table 11
CIBP connectors type and use

CIBP connectors	Use	Type
J0	Connection between CIBP and IFM/IFM1	HM1 210 pins male
J1	Connection between CIBP and even ICM	
J2	Connection between CIBP and even ICM	HM1 120 pins male
J3	-	

Table 11
CIBP connectors type and use (cont'd.)

CIBP connectors	Use	Type
J4	Connection between CIBP and even ICM (ICM power)	HM1 6 pins male
J5	Connection between CIBP and odd ICM (ICM power)	
J6	-	DUBOX 6 pins female
J7		
J8 (on IBP right side)	Connection between CIBP and DBP (I2C link, detect, 48 V power)	DUBOX 26 pins female
J9	Reserved for future use	HM1 6 pins male
J11	Connection between CIBP and odd ICM (or SPM)	HM1 210 pins male
J21	Connection between CIBP and odd ICM (or SPM)	HM1 210 pins male

In a configuration with RICAM/ICAM, the IFM/IFM1 and ICMs are replaced by a filler.

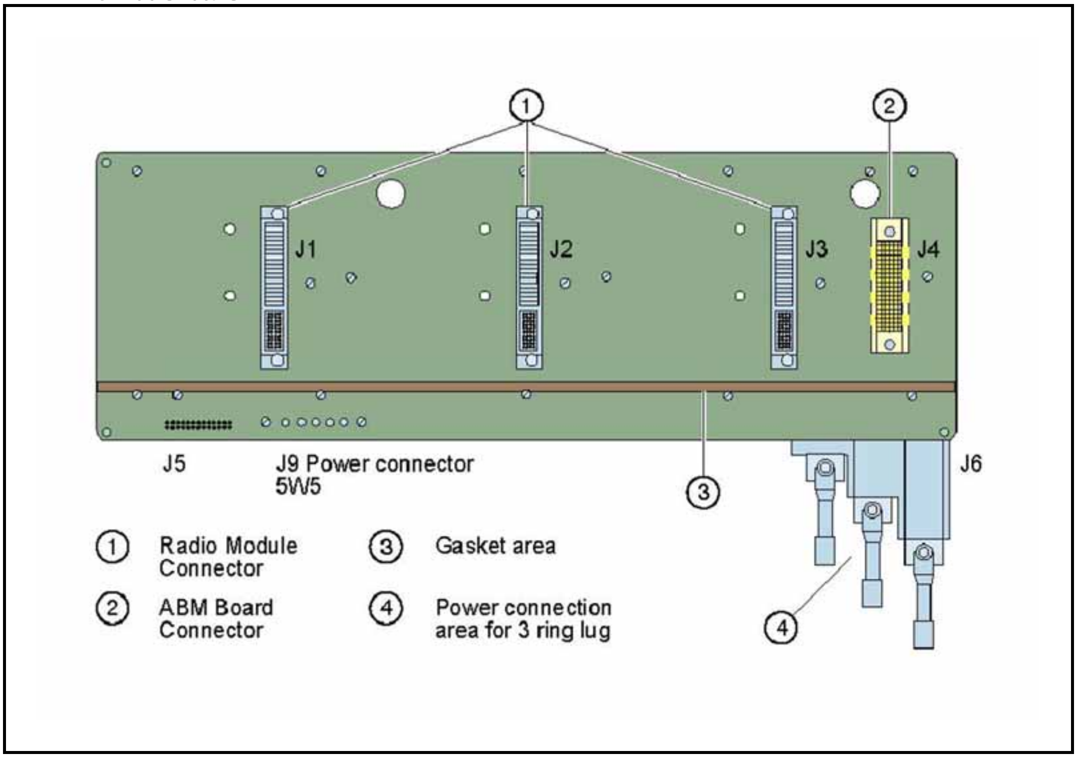
4.1.6 DBP connectors

The following figures show the locations of the connectors on the DBP module. They are front panel connectors, except for J5 and J6, which are located on the rear panel of the DBP.

There are two versions of the DBP:

- a version with bus bars
- a version without bus bars

Figure 29
DBP with bus bars



In the preceding figure, the bus bars are shown at the bottom right hand corner (they are indicated as item four).

The two following images provide views of the DBP without bus bars.

Figure 30
DBP without bus bars

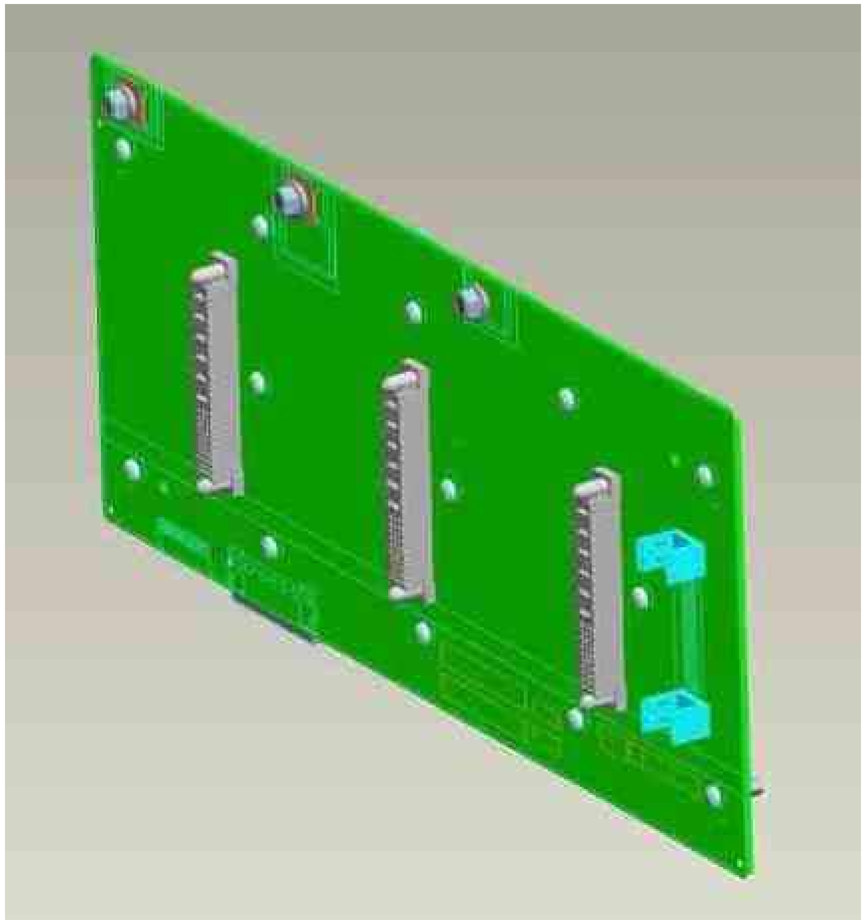
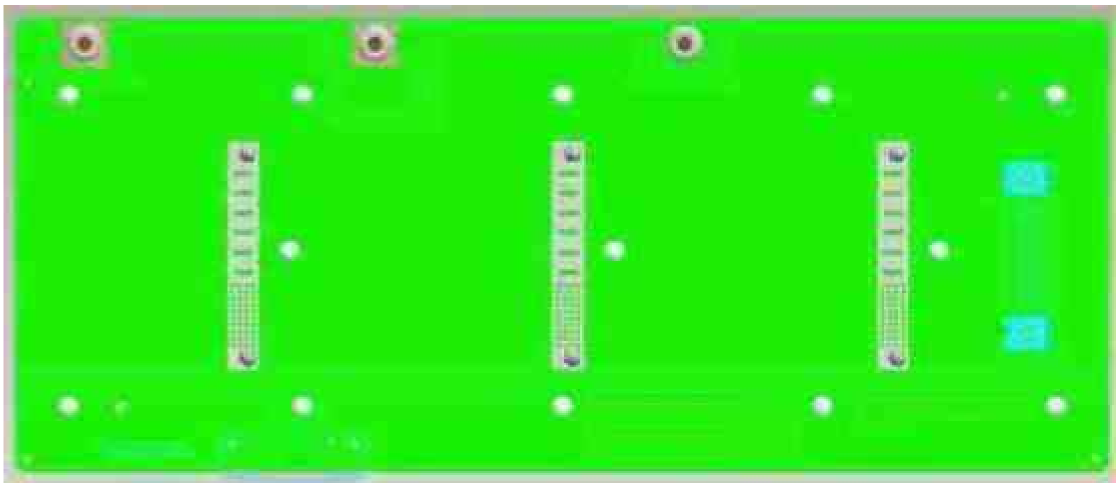


Figure 31
DBP without bus bars full frontal view



The following table indicates the type and the use of the DBP connectors.

Table 12
DBP connectors type and use

DBP connectors	Use	Type
J1	Connection to RM/MPRM/HPRM0	FCI Power Blade connector:4x10 pins array (1A to 10D) +6 power contacts (P1 to P6)
J2	Connection to RM/MPRM/HPRM1	
J3	Connection to RM/MPRM/HPRM2	
J4	Connection to ABM/	HM1 120 pins male
J5 (rear panel)	Connection to IBP or CIBP	2x13 pins array male
J6 (rear panel)	Power	SUBD 5W5 male

4.1.7 Digital signals

The modules are inter-connected through the IBP/CIBP and the DBP through controlled impedance Printed Circuit Board (PCB) traces. Signals routed through the back-plane between the modules include:

- E1/T1 links between IFM and ICM operating at up to 4.096 MHz
- I2C clock and data using Low-Voltage Transistor-Transistor Logic (LVTTL) operating at 100 Kbps
- static LVTTL signals (rack and slot Id, presence detection, status and reset signals, remote power supplies...)
- ICM redundancy
- external synchro
- inter IBP/CIBP signals

4.1.8 Power signals

A 3-wire DC power bus carries the -48 V DC power and ground from the radio DC breaker module to the radio modules. Another three-wire DC power bus, on the DBP, carries the -48 V DC power from the digital breaker module to the ABM, and to the IFM/IFM1 and ICM through the IBP/CIBP.

The ABM remotely powers the inventory memories of the other digital modules with a low drive 3.3 V signal routed through the IBP/CIBP and the DBP.

4.2 Interface Module (IFM/IFM1)

The IFM/IFM1 is only used in the BTS 18000 base cabinet. It is not present in the extension cabinets. The IFM/IFM1 is composed of a single passive board with connections on the IBP/CIBP and on the front panel.

4.2.1 Main functions

The IFM/IFM1 provides connectivity and secondary protection (the level of protection depends on the type of board, see 4.2.2 “Types of IFM board” (page 93)) on the PCM links. It provides the following:

- E1 (120 ohms) or T1 (100 ohms) links from the Abis (front panel) with secondary protection to the local ICM (back panel) and the redundant ICM (cross-connect connector on front panel)
- additional E1/T1 links from the other IFM (cross-connect connector on the front panel) to the local ICM (back panel)

  The IFM/IFM1 also provides detection for this additional Abis link to the ICM.
- external synchronization link from external source (CMCF phase 2 or GPS antenna, on the front panel) to the local ICM (back panel) and the remote ICM (cross-connect connector on front panel).

  The active ICM provides an RS422 receive link to the GPS antenna, and retrieves PPS synchro input from the antenna.

  The IFM/IFM1 provides antenna detection to both ICMs.
- cross-connect link between the remote ICM (cross-connect connector on front panel) and the local one (back panel)

  This link conveys detection, active/passive, synchro and signaling signals between both ICMs.
- the ICM with several status signals (GPS antenna presence, redundancy status)
- the ABM with a board presence detection signal and an I2C Electrically-Erasable Programmable Read-Only Memory (EEPROM) for inventory

  This memory contains factory data and is remotely powered by the ABM.

The IFM/IFM1 does not provide the ICM with the link type (E1 or T1) detection. The selection of E1 or T1 mode must be performed through commissioning switches inside the ICM.

4.2.2 Types of IFM board

There are two types of IFM board:

- IFM
- IFM1

Each board has a different PEC/CPC. For more information about this codes, see the replacement procedure in *Nortel GSM BTS 18000 Troubleshooting* (411-9001-162).

4.2.2.1 IFM board

The IFM board provides a level of secondary protection greater than or equal to that provided by a CSU (Channel Service Unit). Consequently, IFM is the appropriate board to use if a CSU is not being used to provide protection. The name on this board is IFM.

4.2.2.2 IFM1 board

The IFM1 board provides a lower level of secondary protection than that provided by the IFM board. If a CSU (Channel Service Unit) is being used to provide protection, then the IFM1 board can be used instead of the IFM board. The name on this board is IFM1.

4.2.2.3 Location in cabinet

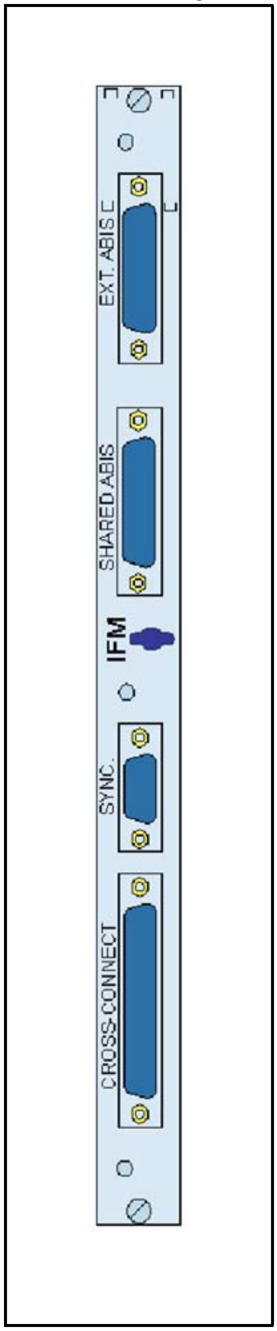
The BTS 18000 cabinet includes:

- one mandatory even IFM/IFM1 (IFM-even/IFM1-even), located:
  — in the upper shelf, for BTS 18010 and BTS 18010 NG2 cabinets
- one optional odd IFM/IFM1 (IFM-odd/IFM1-odd), located:
  — in the bottom shelf, for BTS 18010 and BTS 18010 NG2 cabinets

4.2.3 Front panel

The following figure presents the IFM/IFM1 front panel. Except for the name IFM1, the IFM1 board is identical to the IFM board.

Figure 32
IFM/IFM1 front panel



4.2.4 Physical and electrical characteristics

Table 13
IFM dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
IFM	335	25	410	< 1

Maximum number per cabinet: two, in the base cabinet only

Maximum power consumption: 0 W

Associated breaker:

- Digital breaker (BTS 18010)
- CB3 digital breaker (BTS 18020)

4.2.5 Interface description

4.2.5.1 Connectors

The following table shows the type and the use of the IFM/IFM1 connectors. They are front panel connectors, except for J4, which is a back panel connector.

Table 14
IFM connectors type and use

Abis connectors	**Use**	**Type**
J0	E1/T1 links to Abis network - EXT ABIS	SUBD 25 pins male
J1	E1/T1 links to ICM - SHARED ABIS	SUBD HD 44 pins female
External synchro connector	**Use**	**Type**
J3	External synchro: GPS clock, detect, Gnd, synchro RS422 - SYNC	SUBD 9 pins female
Cross-connect connector	**Use**	**Type**
J2	Cross link: synchro, activity detection, signaling between ICMs - CROSS-CONNECT	SUBD HD 62 pins female
Signal connector (back panel)	**Use**	**Type**
J4	Signals from Abis and Cross-connect connectors, I2C to ABM	HM1 210 pins female

The Abis front panel connector provide the following signals: four E1/T1 main bidirectional links.

The External Synchro front panel connector provides the following signals:

- cable detection
- signaling bidirectional link to GPS antenna or CBCF link
- PPS clock from GPS antenna or 8 kHz synchro from CBCF

The Shared Abis front panel connector provide the following signals:

- four E1/T1 bidirectional links from secondary protection cell to other IFM
- four E1/T1 bidirectional links from other cell to local ICM

The Cross-connect front panel connector provides the following signals:

- cable detection
- active/passive signals
- signaling bidirectional link between ICMs
- synchro signals from active to passive
- external synchro signals share between IFM/IFM1s

The back panel connector provides the following signals:

- all signals from Abis front panel connectors (secondary protected)
- all signals from Cross-connect front panel connectors (except the protected four E1/T1 to remote IFM/IFM1)
- board presence, I2C bus and address, EEPROM power supply

4.2.6 LEDs behavior

There is no LED on the IFM/IFM1.

4.3 Interface Control Module (ICM)

The ICM is only used in the BTS 18000 base cabinet. It is not present in the extension cabinets. It is designed to manage the whole BTS 18000 site in simplex or duplex mode.

The ICM is composed of a single board with connections on the IBP/CIBP and on the front panel.

4.3.1 Main functions

The ICM in simplex mode covers the functions related to a complete site including:

- support of drop-and-insert facilities for the PCM links with the BSC
- reference clock for the air interface, synchronized on the Abis PCM interface, a synchronizing BTS, or a GPS antenna
- GSM_TIME calculations with possible network synchronization
- switching of PCM slots
- conversion of electrical signals, from external to internal PCM data formats
- concentration of the data flow of the BTS
- configuration and supervision of all the modules

Redundancy can optionally be introduced using two ICMs in the cabinet: one even ICM (ICM0) and one odd ICM (ICM1). In such a mode, called duplex, there is one active ICM and one passive ICM.

The even ICM (ICM0) shall be equipped in simplex mode and is the default active ICM at start up.

In duplex mode

- the active ICM is the currently operational one, as opposed to the passive one
- the passive ICM is the currently non-operational one, as opposed to the active one

The redundancy is static. If the passive ICM traps, the swap from passive to active occurs, but the traffic is lost and the newly active ICM can accept new traffic.

> **ATTENTION**
> ICM chain switching may disturb punctually the Abis lines, as line transceivers of both boards share the same signals. This disturbance may last several microseconds to several milliseconds, depending on the hardware implementation. These characteristics are also met on the BSC interface boards.

4.3.2 Location in cabinet

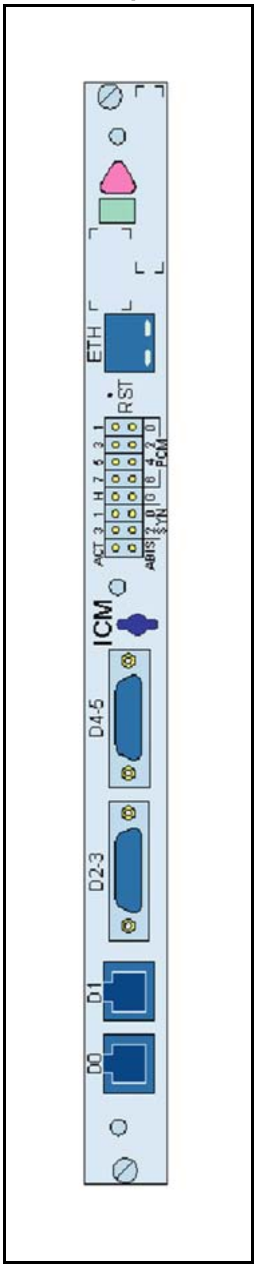
The BTS 18000 cabinet includes one to two ICMs on the IBP/CIBP:

- one mandatory even ICM (ICM-even), located:
  - — in the upper shelf, for BTS 18010 and BTS 18010 NG2 cabinets
  - — in the left shelf, for BTS 18020 cabinets
- one optional odd ICM (ICM-odd), located:
  - — in the bottom shelf, for BTS 18010 and BTS 18010 NG2 cabinets
  - — in the right shelf, for BTS 18020 cabinets

4.3.3 Front panel

The following figure shows the ICM front panel.

Figure 33
ICM front panel



4.3.4 Physical and electrical characteristics

Table 15
ICM dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
ICM	335	25	410	< 1

Maximum number per cabinet: two, in the base cabinet only

Maximum power consumption: 30 W

Input voltage range: 20 V to 60 V

Associated breaker:

- digital breaker (BTS 18010)
- CB3 digital/RICO/user breaker (BTS 18020)

4.3.5 Interface description

4.3.5.1 Connectors

The following table shows the type and the use of the ICM connectors. They are front panel connectors, except for J10, J11, and J12, which are back panel connectors.

Table 16
ICM connectors type and use

Debug connector	Use	Type
J2	Ethernet / RS232 debug - ETH	8 pins RJ45 female
Signal connectors (front panel)	**Use**	**Type**
J0	D link in the base cabinet (ABM) - D0	10 pins RJ45 female
J1	D link in the base cabinet (ABM) - D1	
J23	D link for one extension cabinet - D2-3	SUBD HD 26 pins female
J45	D link for one extension cabinet - D4-5	
Signal connectors (back panel)	**Use**	**Type**
J10	Power	HM1 30 pins female
J12	Spare links	HM1 120 pins female
J11	E1/T1 links, GPS or external synchro	HM1 210 pins female

The front panel Debug connector provides the following signals:

- reset the push button
- debug access (RS232 monitor + 10/100 bT)

The six D link front panel connectors provide the following LVDS signals: clock, synchro, and full duplex bi-directional data at 16.384 Mbps (signals which are hot pluggable).

The back panel power connector provides 48 V wide input range floating supply.

The Signal back panel connectors provide:

- eight E1/T1 main bi-directional links with the IFM
- all ICM GPS signals (cable detection, power to the antenna, signaling bi-directional link to antenna, PPS clock from antenna), or external synchronization signals (SY and MICR from CBCF)
- all cross connect signals with IFM (cable detection, active/passive signals, signaling bi-directional link between ICMs, synchro signals from active to passive)
- board presence, I2C bus, address, and power

4.3.6 ICM Corporate LEDs behavior

As shown in the following table, an upper triangle-shaped red LED and a lower rectangle-shaped green LED are used to indicate the status for some BTS 18000 modules.

Figure 34
ICM corporate LEDs

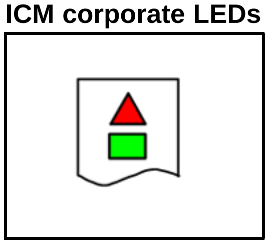


Table 17
ICM Corporate LEDs behavior

Green LED	Red LED	ICM status
switched off	switched off	Sleep, unpowered or not inserted (default hardware value)
■	▲	starting, BISTs in progress
■	switched off	normal operation - no faults
■	blinking	module is possibly partially faulty - ICM installation problem
switched off	▲	alarm status: abnormal operation - must be removed or replaced
blinking	▲ or switched off	wait for ICM connection - used on passive ICM
blinking	blinking	internal downloading - used on passive ICM

4.3.7 ICM specific LEDs behavior

The following table gives detailed information on ICM specific LEDs behavior. All these LEDs are OFF when the ICM is unpowered. All these LEDs are amber during BISTs.

Table 18
ICM specific LEDs behavior

LED name	Color	Meaning
PCMx (x = 0 to 7)	● ● ●	Eight PCM status LEDs (one per PCM): - Green: the PCM is OK - Red: the PCM is in fault - Amber: the PCM is in test

Table 18
ICM specific LEDs behavior (cont'd.)

LED name	Color	Meaning
G (GPS)	● ● ●	One GPS or external synchro status LED: - OFF: no external synchronization - Green: GPS synchronization or holdover mode - Red: bad external synchronization signal - Amber: slave BTS is synchronized on its master BTS
SYN (synchro)	●	Four LEDs for synchronizing source: one out of the eight PCMs or external synchronization (in that case the four LEDs are ON)
H (holdover)	●	One LED for synchro locked status: - ON for active ICM: unlocked or holdover indication - ON for passive ICM: unlocked indication - OFF: synchro is locked on external source (GPS or master BTS), or Abis
ACT (activity)	● ●	One LED for ICM Passive or Active Status: - Green: the ICM is active - OFF: the ICM is passive - Red on both ICMs: the simplex or duplex configuration cannot be determined, both ICMs are in faulty passive state
ABIS	●	Level-2 status with BSC: - ON: Level-2 is OK - Blinking: downloading in progress - OFF: no Level-2 with the BSC

In the case of synchronization on Abis, the H LED remains ON (on the active ICM) until the BTS is fully "locked onto" the synchronization signal (from the Abis link). This may take from 6 to 15 minutes.

4.3.7.1 ICM SYN LEDs behavior

The behavior of the four LEDs for synchronization source is described in the following table.

Table 19
ICM SYN LEDs behavior

SYNCHRO SOURCE	0	1	2	3
PCM 0	●	switched off	switched off	switched off
PCM 1	switched off	●	switched off	switched off
PCM 2	●	●	switched off	switched off
PCM 3	switched off	switched off	●	switched off
PCM 4	●	switched off	●	switched off
PCM 5	switched off	●	●	switched off
PCM 6	●	●	●	switched off
PCM 7	switched off	switched off	switched off	●

(*) If GPS or external synchronization signals are newly detected, the four SYN LEDs blink three times (1 second on, 1 second off).

(**) In Holdover, the SYN LED indicates the clock source (PCM number) that the syn tries to use for synchronization. In that case, the holdover LED (H) is ON for the active ICM.

Table 19
ICM SYN LEDs behavior (cont'd.)

SYNCHRO SOURCE	0	1	2	3
external source (GPS, master BTS)	● (*)	● (*)	● (*)	● (*)
holdover (*)	● / switched off (**)	● / switched off (**)	● / switched off (**)	● / switched off (**)
(*) If GPS or external synchronization signals are newly detected, the four SYN LEDs blink three times (1 second on, 1 second off). **(**) In Holdover, the SYN LED indicates the clock source (PCM number) that the syn tries to use for synchronization. In that case, the holdover LED (H) is ON for the active ICM.**				

In the case of synchronization on Abis, the H LED remains ON (on the active ICM) until the BTS is fully "locked onto" the synchronization signal (from the Abis link). This may take from 6 to 15 minutes.

4.3.8 LEDs behavior at active ICM starting up

The following table summarizes the behavior of corporate and specific LEDs when active ICM starts up.

Table 20
LEDs behavior at active ICM starting up

	ICM boot sequence	ICM BISTs	Abis connection	ICM downloading	Nominal operation
triangle corporate	▲	▲			
rectangle corporate	■	■	■	■	■
ACT		●	●	●	●
*** In the case of synchronization on Abis, the H LED remains ON (on the active ICM) until the BTS is fully "locked onto" the synchronization signal (from the Abis link). This may take from 6 to 15 minutes.**					

Table 20
LEDs behavior at active ICM starting up (cont'd.)

	ICM boot sequence	ICM BISTs	Abis connection	ICM downloading	Nominal operation
SYN		●	●	●	●
G		●			
Abis		●	●	● blinking	●
PCMx		●	●	●	●
H	●	●	*		
*** In the case of synchronization on Abis, the H LED remains ON (on the active ICM) until the BTS is fully "locked onto" the synchronization signal (from the Abis link). This may take from 6 to 15 minutes.**					

4.3.9 LEDs behavior at passive ICM starting up

The passive ICM can be differentiated from the active one when the ACT LED is switched off. The behavior of the SYN and PCM LEDs is the same as for the active ICM.

The following table summarizes the behavior of corporate and specific LEDs when passive ICM starts up.

Table 21
LEDs behavior at passive ICM starting up

	ICM boot sequence	ICM BISTs	Active ICM connection	Passive ICM downloading	Nominal operation
triangle corporate	▲	▲	▲ or switched off	▲ blinking	
rectangle corporate	■	■	■ blinking	■ blinking	■

Table 21
LEDs behavior at passive ICM starting up (cont'd.)

	ICM boot sequence	ICM BISTs	Active ICM connection	Passive ICM downloading	Nominal operation
ACT		🟠			
SYN		🟠	🟢	🟢	🟢
G		🟠			
Abis		🟠			
PCMx		🟠	🟢	🟢	🟢
H		🟠			

4.3.10 Summary of ICM LED behavior during BTS 18000 synchronization

4.3.10.1 BTS 18000 Start-up

Step	Action
1	At startup, the BTS 18000 is in Holdover mode and the four SYN LEDs indicate the PCM on which the BTS 18000 is attempting to synchronize. This is Case 1.
2	Once the BTS connects successfully to the BSC, the BTS synchronizes on the Abis link. This is Case 2.
3	If external BTS synchronization was configured, the OMC-R informs the BTS 18000 of the type of synchronization to use (set external contact message).
4	Once the BTS 18000 has successfully synchronized on the external source, it goes from Case 2 to Case 3 or Case 4 (depending on the type of external BTS synchronization). When the ICM detects a valid synchronization signal (from the GPS

receiver or from the master BTS), four SYN LEDs blink three times.

--End--

4.3.10.2 Case 1 - Holdover mode

The following table describes the status of the ICM LEDs in case of Holdover.

Table 22
ICM LEDs in case of Holdover mode

LED	ICM active	ICM passive
SYN0, SYN1, SYN2, SYN3	Number of the PCM on which the BTS 18000 is attempting to synchronize	All OFF
H	ON	OFF
G	OFF	OFF

4.3.10.3 Case 2 - Abis synchronization

The following table describes the status of the ICM LEDs in case of synchronization on the BSC using the Abis link.

Table 23
ICM LEDs in case of Abis synchronization

LED	ICM active	ICM passive
SYN0, SYN1, SYN2, SYN3	Number of the PCM on which the BTS 18000 is synchronized	All OFF
H	OFF The H LED remains ON (on the active ICM) until the BTS is fully "locked onto" the synchronization signal (from the Abis link). This may take from 6 to 15 minutes	OFF
G	OFF	OFF

4.3.10.4 Case 3 - 8 kHz synchronization (on a master BTS)

The following table describes the status of the ICM LEDs the case of 8 kHz synchronization. In this case, the BTS 18000 is a slave BTS synchronized on an S8000 or S12000 master BTS.

Table 24
ICM LEDs in case of 8 kHz synchronization

LED	ICM active	ICM passive
SYN0, SYN1, SYN2, SYN3	All ON	All OFF
H	OFF	OFF
G	ON (amber)	OFF

4.3.10.5 Case 4 - GPS synchronization
The following table describes the status of the ICM LEDs in case of GPS synchronization.

Table 25
ICM LEDs in case of GPS synchronization

LED	ICM active	ICM passive
SYN0, SYN1, SYN2, SYN3	All ON	All OFF
H	OFF	OFF
G	ON (green)	OFF

4.3.10.6 Case 5 - Defense return to Abis synchronization on loss of 8 kHz synchronization
This is as described for Case 2.

4.3.10.7 Case 6 - Defense return to Holdover on loss of GPS synchronization
The following table describes the status of the ICM LEDs in case of a return to Holdover if GPS synchronization is lost.

Table 26
ICM LEDs in case of loss of GPS synchronization

LED	ICM active	ICM passive
SYN0, SYN1, SYN2, SYN3	All ON	All OFF
H	ON	OFF
G	ON (green)	OFF

4.3.11 Configuration of the ICM switches for commissioning

4.3.11.1 SW10 switch

Figure 35
ICM SW10 switch

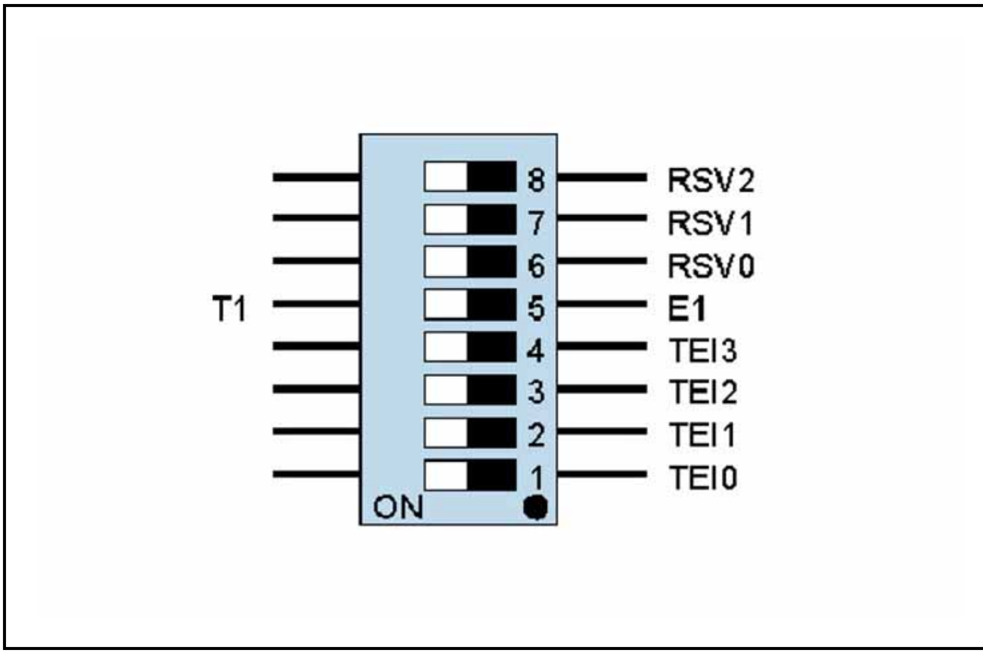


Table 27
Frame format

E1/T1	RSV0	Frame Format
OFF	OFF	E1 mode (120 ohms)
OFF	ON	E1 mode with 75 ohms adapter
ON	-	T1 mode (100 ohms)

Table 28
ICM SW10 switch configuration

TEI(3)	TEI(2)	TEI(1)	TEI(0)	Site TEI coding
OFF	OFF	OFF	OFF	0
OFF	OFF	OFF	ON	1
OFF	OFF	ON	OFF	2
OFF	OFF	ON	ON	3
OFF	ON	OFF	OFF	4
OFF	ON	OFF	ON	5
OFF	ON	ON	OFF	6
OFF	ON	ON	ON	7

Table 28
ICM SW10 switch configuration (cont'd.)

TEI(3)	TEI(2)	TEI(1)	TEI(0)	Site TEI coding
ON	OFF	OFF	OFF	8
ON	OFF	OFF	ON	9

An ICM board cannot start if its TEI value is out of the range given in the preceding table. Factory setting is TEI equal to zero. RSV(0-2) are unused (default value is OFF).

4.3.11.2 SW11 switch

Figure 36
ICM SW11 switch

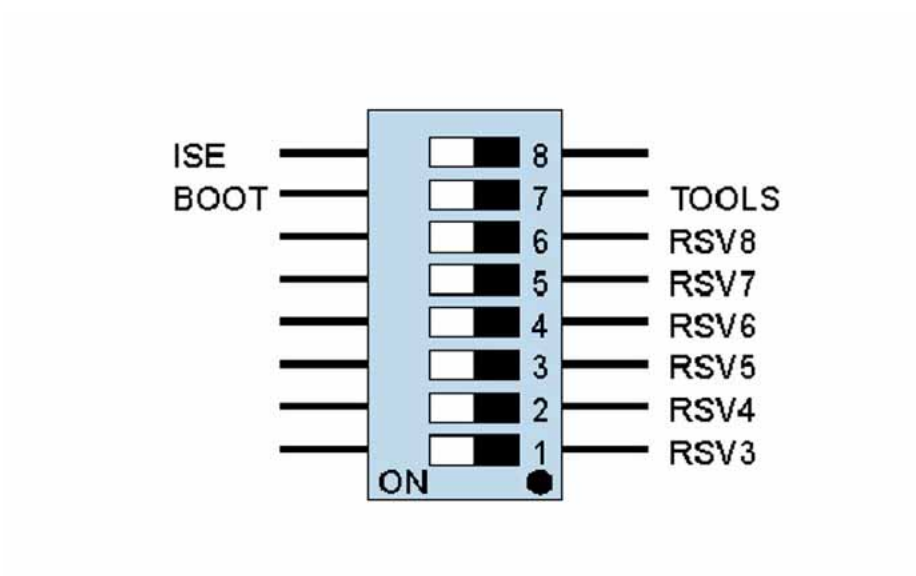


Table 29
ICM for New-SEB mode

ISE	ICM for New-SEB mode
OFF	ICM in nominal mode
ON	ICM in New-SEB mode if confirmation bit is set in FPGA

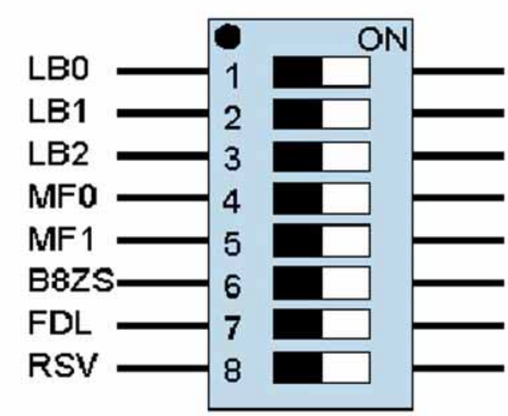
Table 30
ICM SW11 switch configuration

BOOT/TOOLS	Processor booting mode
OFF	Require emulator probe connected
ON	Booting in Flash memory (nominal mode)

RSV (3-8) are unused (default value is OFF). Passive and active ICM must have the same switches configuration. Otherwise, both ICM are in the "passive partially faulty" state: the corporate green LED is ON and the red one is blinking.

4.3.11.3 SW0-SW7 switches: one per Abis line

Figure 37
ICM Abis switch



The E1 or T1 mode selection is performed through to switch SW10. Refer to the following tables for detailed information on E1/T1 configurations of the ICM Abis switches.

Table 31
Frame format

MF1	MF0	Frame Format
OFF	OFF	12-frame multi-frame (Super-Frame)
OFF	ON	Extended Super-frame (ESF) with CRC6 check/generation
ON	OFF	Extended Super-frame (ESF) without CRC6 check/generation
ON	ON	Not used

Table 32
Line Build-Out

LB2	LB1	LB0	Line Build-Out
OFF	OFF	OFF	length = 000..133ft (0.6 dB - DSX-1) / 0.0 dB (DS1)
OFF	OFF	ON	length = 133..266ft (1.2 dB - DSX-1)
OFF	ON	OFF	length = 266..399ft (1.8 dB - DSX-1)
OFF	ON	ON	length = 399..533ft (2.4 dB - DSX-1)
ON	OFF	OFF	length = 533..655ft (3.0 dB - DSX-1)
ON	OFF	ON	-7.5 dB (DS1)
ON	ON	OFF	-15.0 dB (DS1)
ON	ON	ON	-22.5 dB (DS1)

Table 33
ICM Abis switch - T1 configuration

B8ZS	Line code
OFF	AMI coding
ON	B8ZS coding

FDL (Facility Data-Link) and RSV are not used. Their default value is OFF.

Table 34
Frame format

MF1	MF0	Frame Format
OFF	OFF	Single frame
OFF	ON	Multi-frame with CRC4 decoding
ON	OFF	Multi-frame without any CRC4 decoding
ON	ON	Automatic multi-frame with CRC4 decoding

Table 35
Line Build-Out

LB2	LB1	LB0	Line Build-Out is NOT used
OFF	OFF	OFF	Default value

Table 36
ICM Abis switch - E1 configuration

B8ZS	Line code
OFF	HDB3 coding
ON	AMI coding (provision)

FDL (Facility Data-Link) and RSV are not used. Their default value is OFF.

4.4 Interface Control and Alarm Module (RICAM/ICAM)

RICAM/ICAM is a single module that replaces the IFM/IFM1, ICM, and ABM.

RICAM provides self redundancy but it is not mandatory to use.

With RICAM/ICAM, the IBP/CIBP is no longer used and can be removed. The air flow remains unchanged in the IBP/CIBP area by either keeping the air deflector or replacing it by a dedicated filler.

The RICAM/ICAM is used only in the BTS 18000 base cabinet. It is not present in the extension cabinets. It is designed to manage the whole BTS 18000 site in simplex or duplex mode.

With RICAM, the simplex mode is activated if one of the ICM functions is down.

The RICAM/ICAM is a single board with connections on the DBP.

The RICAM/ICAM is located in the BTS 18000 DBP at the position of the ABM-0.

A BTS 18000 equipped with RICAM can have up to 27 TRXs.

The associated TEIs are:

- TRXs associated with ABM-0: TEI 32 to 39, 14
- TRXs associated with ABM-1: TEI 15 to 17, 62 to 67
- TRXs associated with ABM-2: TEI 40-47, 18

4.4.1 Main functions for ICAM

The ICAM is made up of the following blocks:

- IFM1 block (providing IFM functions)
- ICM-0 block (providing ICM functions)
- ABM-0 block (providing ABM functions)

IFM1 block

The ICAM has one IFM1 function similar to the one described in 4.2 “Interface Module (IFM/IFM1)” (page 92) with simplified interfaces.

Of the IFM1 interfaces, only the following remain:

- four of the eight Abis links connections to the BSC on the front panel with limited secondary protection (only the common mode is protected, like on IFM1)
- external synchro (other BTS or GSP receiver) on the front panel

The following IFM1 interfaces are removed:

- The interface to the IBP/CIBP backplane is removed. Most connections to the ICM blocks are local on the ICAM board itself. This includes Abis, external synchro, inventory, and all detection signals.
- The shared Abis is local on the board between the IFM1 and the ICM-0 block. Consequently, no front panel interface is necessary on ICAM.
- Since there is just one ICM block, ICM Cross Connect is not necessary and most detection signals are permanently configured. Consequently, no front panel interface is necessary on ICAM.

ICM-0

The ICM-0 block located on the ICAM is similar to the one described in 4.3 “Interface Control Module (ICM)” (page 97).

The ICM-1 block is not present on ICAM (that is, no ICM redundancy). The interface signals between ICM-0 and the absent ICM-1 block are polarized as for a simplex ICM. This gives ICAM the same behavior as a simplex ICM configuration without software modification.

The ICM-0 block interfaces to:

- power distribution (limited to 36-75 V range) from the DBP backplane and not from the IBP/CIBP
- the ABM-0 block through direct CMOS signals on the board instead of the front panel (D link in LVDS)
- the ABM-1 and ABM-2 on the front panel as in the IBP/CIBP configurations (but a single cable is enough for each ABM as the ICM block is located on the same PCB)
- front panel debug interfaces (unchanged)

The following ICM interfaces are removed or changed:

- Interface to the IFM1 through the IBP/CIBP backplane is removed. Most connections to the ICM-0 block are local on the ICAM board. This includes Abis, external synchro, and most detection signals.
- Interface to the ABM-0 through the IBP/CIBP backplane (inventory) is removed. There is no ICM EEPROM on ICAM, only the previous ABM one remains with a new ICAM content.
- Interface to the ABM-0 through a front panel connector (D link) is moved to local CMOS board signals for nominal operation.
- Interface to the ABM-3, ABM-4, and ABM-5 on the front panel is removed as capacity is restricted.
- The SPM interface is removed. For SPM, an ICM + IBP/CIBP configuration must be used instead of ICAM.
- Front panel interfaces, such as LEDs, are merged with other ICM and ABM LEDs.
- The TOOL LVDS feature is not used on ICAM.

ABM-0 block

The ABM-0 block located on the ICAM is similar to the one described in 4.6 “Alarms and Bridge Module (ABM)” (page 140).

The ABM-0 block interfaces without any changes to:

- three “E” links to each radio module on the backplane
- control signals to the radio modules on the backplane
- inventory links on the backplane
- alarm collection links (DALI, DALE/RC, RICO) on the front panel
- front panel reset button
- front panel debug RS232 + Ethernet link
- spare front panel UART link

The following ABM-0 interfaces are removed or changed:

- Power distribution remains routed on the backplane with changed current rating limited to the 36-75 V range but internal dissipated power is 40 W max. Maximum input current is 2 A instead of 0.75 A for ABM (actually supported by the ABM to DBP connection).
- Interface to the ICM-0 block uses direct CMOS signals on the board instead of front panel ones for the D link with a simplified redundancy mechanism.

- Front panel interfaces, such as LEDs, are merged with the ICM-0 LEDs.
- Backplane LVDS trace signals are not implemented on ICAM (they have never been used on ABM)
- Test-ABM features are not implemented on ICAM.

4.4.2 Main functions for RICAM

The RICAM is made up of the following blocks:

- IFM-0/IFM1-0 block (providing IFM functions)
- ICM-0 block (providing ICM functions)
- ICM-1 block (providing ICM functions)
- ABM-0 block (providing ABM functions)

IFM-0/IFM1-0 block

The RICAM has one IFM/IFM1 function similar to the one described in 4.2 “Interface Module (IFM/IFM1)” (page 92) with simplified interfaces.

Of the IFM/IFM1 interfaces, only the following remain:

- four of the eight Abis link connectivity to the BSC on the front panel with limited secondary protection (only the common mode is protected, like on IFM1)
- external synchro (other BTS or GSP receiver) on the front panel

The following IFM/IFM1 interfaces are removed:

- The interface to the IBP/CIBP backplane is removed. Most connections to the ICM blocks are local on the RICAM board. This includes Abis, external synchro, inventory, and all detection signals.
- The shared Abis is local on the board between the IFM1 and the two ICM blocks. Consequently, no front panel interface is necessary on RICAM.
- The Cross Connect is local between the two ICM blocks and most detection signals are permanently configured. Consequently, no front panel interface is necessary on RICAM.

ICM-0 and ICM-1 blocks

Each of the two ICM blocks located on the RICAM is similar to the one described in 4.3 “Interface Control Module (ICM)” (page 97).

Each one of the two ICM blocks interfaces to

- power distribution (limited to 36-75 V range) from the DBP backplane and not from the IBP/CIBP
- the other ICM block through direct CMOS signals on the board instead of backplane LVDS
- the ABM-0 block through direct CMOS signals on the board instead of the front panel (D link in LVDS)
- the ABM-1 and ABM-2 on the front panel as in the IBP/CIBP configurations (but a single cable is enough for each ABM as both ICM blocks are located on the same PCB)
- front panel debug interfaces (unchanged)

The following ICM interfaces are removed or changed:

- Both ICM blocks share a common reset button that forces activity swap if one ICM block is active and the other one ready. Otherwise, both ICM blocks are reset.
- Interface to the IFM1 and the other ICM block through the IBP/CIBP backplane is removed. Most connections to ICM blocks are local on the RICAM board. This includes Abis, external synchro, cross connect, and most detection signals.
- Interface to the ABM-0 through the IBP/CIBP backplane (inventory) is removed. There is no ICM EEPROM on RICAM, only the previous ABM one remains with a new RICAM content.
- Interface to the ABM-0 through a front panel connector (D link) is moved to local CMOS board signals for nominal operation.
- Interface to the ABM-3, ABM-4, and ABM-5 on the front panel is removed as capacity is restricted.
- The SPM interface is removed. For SPM, an ICM + IBP/CIBP configuration must be used instead of RICAM.
- Front panel interfaces, such as LEDs, are merged with other ICM and ABM LEDs.
- The TOOL LVDS feature is not used on RICAM.

ABM-0 block

The ABM-0 block located on the RICAM is similar to the one described in 4.6 “Alarms and Bridge Module (ABM)” (page 140).

The ABM-0 block interfaces without any changes to:

- three “E” links to one RM each on the backplane
- control signals to the RMs on the backplane
- inventory links on the backplane
- alarm collection links (DALI, DALE/RC, RICO) on the front panel
- front panel reset button
- front panel debug RS232 + Ethernet link
- spare front panel UART link

The following ABM-0 interfaces are removed or changed:

- Power distribution remains routed on the backplane with changed current rating limited to the 36-75 V range but internal dissipated power is 50 W max. Maximum input current is 1.50 A instead of 0.75 A for ABM (actually supported by the ABM to DBP connection).
- Interface to both ICM blocks use direct CMOS signals on the board instead of front panel ones for the D link with a simplified redundancy mechanism.
- Front panel interfaces, such as LEDs, are merged with the ICM-0 and ICM-1 LEDs.
- Backplane LVDS trace signals are not implemented on RICAM (they have never been used on ABM)
- Test-ABM features are not implemented on RICAM.

4.4.3 Location in cabinet

The BTS 18000 can include only one RICAM. The user can add an ABM-1 in the second shelf.

When RICAM is used, there are no IFM/IFM1 and no ICM.

4.4.4 Restrictions and limitations

The following restrictions apply on ICAM:

- removal of the ICAM results in a loss of the BTS
- connectivity for only four Abis links (E1 or T1) without any possibility to increase this number using additional modules
- maximum configuration S999 with nine radio modules (27 TRXs) in two cabinets

- EDGE traffic is restricted on the Abis link due to the limitation to four links
- ICAM accepts only input DC supply in the 36-75 V range

The following restrictions apply on RICAM:

- removal of the RICAM results in a loss of the BTS
- connectivity for only four Abis links (E1 or T1) without any possibility to increase this number using additional modules
- maximum configuration S666_333 or S99_9 with nine radio modules (27 TRXs) in two cabinets
- EDGE traffic is restricted on the Abis link due to the limitation to four links
- RICAM accepts only input DC supply in the 36-75 V range

For configurations that exceed these limits, the IBP/CIBP variant of the BCF must be used instead of RICAM/ICAM.

The RICAM/ICAM software defense against overload of the BCF capacity is adapted to fit the ICAM-specific and RICAM-specific limitations.

4.4.5 Compatibility with previous versions of the BCF

RICAM/ICAM is compatible with previous BCF versions:

- RICAM/ICAM is slotted inside the ABM-0 slot of the cabinet and therefore complies with the ABM for all the ABM requirements (hardware, mechanical, environment, and regulatory)
- As existing BCF software running on IBP/CIBP based configurations does not run properly on RICAM/ICAM, a dedicated mechanism prevents RICAM/ICAM from being upgraded with such a software load.
- The RICAM/ICAM compatible software loads are compatible with all IBP and CIBP based BTS 18000s. At start up, a dedicated mechanism differentiates between these configurations and runs the appropriate one.

All the usual BCF software features work transparently on RICAM/ICAM.

These include the following:

- all site management processes including duplex
- all radio traffic and performance features
- all synchronization features, including external and GPS sources

4.4.6 Front panel

The following figure shows the ICAM and RICAM front panel.

Figure 38
ICAM front panel

Figure 39
RICAM front panel

4.4.7 Physical and electrical characteristics

Table 37
RICAM/ICAM dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
RICAM/ICAM	335	50	410	< 2

Maximum number per cabinet: one, in the base cabinet only

Maximum power consumption (ICAM): 30 W

Maximum power consumption (RICAM): 40 W

Input voltage range: 36 V to 75 V

Associated breaker:

- digital breaker (BTS 18010)
- CB3 digital/RICO/user breaker (BTS 18020)

4.4.8 RICAM/ICAM corporate LEDs behavior

As shown in the following figure, an upper triangle-shaped red LED and a lower rectangle-shaped green LED are used to indicate the status of the RICAM/ICAM.

The fault (NOK) state overrides all other states. If one of the blocks is NOK and requests to display the LEDs in this state, the corporate LEDs also show this NOK state.

Figure 40
RICAM/ICAM corporate LEDs

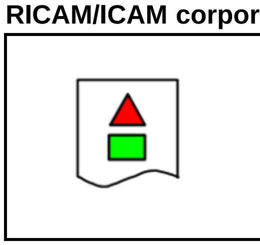


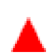
Table 38
ICAM corporate LEDs behavior

Green LED	Red LED	ICAM state
OFF	OFF	Sleep, unpowered, or not inserted (default hardware value).
		Starting, BISTs in progress. One or two blocks are in the Starting/BISTs state, the other blocks are OK.
	OFF	ICAM is OK (two blocks are OK). This is the normal operational state (no faults). The ICAM must not be removed while it is in this state.
OFF		Alarm status. The ICAM is NOK (abnormal operation). The module may be removed and replaced. One or two blocks are in a NOK state, whatever the state of the others.

Table 38
ICAM corporate LEDs behavior (cont'd.)

Green LED	Red LED	ICAM state
blinking	 or OFF	The ABM block is waiting for ICM connection.
blinking	blinking	The ABM block is being internally downloaded by the ICM.

Table 39
RICAM corporate LEDs behavior

Green LED	Red LED	RICAM state
OFF	OFF	Sleep, unpowered, or not inserted (default hardware value).
		Starting, BISTs in progress. One, two, or three blocks are in the Starting/BISTs state, the other blocks are OK.
	OFF	RICAM is OK (three blocks are OK). This is the normal operational state (no faults). The RICAM must not be removed while it is in this state.
OFF		Alarm status. The RICAM is NOK (abnormal operation). The module may be removed and replaced. One, two, or three blocks are in a NOK state, whatever the state of the others.
blinking	 or OFF	The ABM block is waiting for ICM connection.
blinking	blinking	The ABM block is being internally downloaded by the ICM.

Red LED (ICAM)

The red corporate LED is ON if any of the two blocks (ICM-0, ABM-0) sets it ON as defined for the original ICM/ABM. The red LED state corresponds to a logical OR of the states of the blocks.

A faulty or unpowered ICM block on the ICAM forces the red LED to be ON permanently as this is an unexpected behavior of the module.

Green LED (ICAM)

The green corporate LED is ON if all of the two blocks (ICM-0, ABM-0) drives it ON as defined on the original ICM/ABM. The green LED state corresponds to a logical AND of the states of the blocks.

A faulty or unpowered ICM block on the ICAM forces the green LED to be OFF permanently as this is an unexpected behavior of the module.

Red LED (RICAM)

The red corporate LED is ON if any of the three blocks (ICM-0, ICM-1, or ABM-0) sets it ON as defined for the original ICM/ABM. The red LED state corresponds to a logical OR of the states of the blocks.

A faulty or unpowered ICM block on the RICAM forces the red LED to be ON permanently as this is an unexpected behavior of the module.

Green LED (RICAM)

The green corporate LED is ON if all of the three blocks (ICM-0, ICM-1, and ABM-0) drives it ON as defined on the original ICM/ABM. The green LED state corresponds to a logical AND of the states of the three blocks.

A faulty or unpowered ICM block on the RICAM forces the green LED to be OFF permanently as this is an unexpected behavior of the module.

4.4.9 RICAM/ICAM specific LEDs behavior

On the front panel, the RICAM/ICAM displays a single group of status LEDs similar to those present on ICMs. For more information, see 4.3.7 “ICM specific LEDs behavior” (page 102).

These LEDs are bicolor like on the ICM and display the following:

- activity (one LED for the ICM block, with the same meaning as the ICM LEDs)
- Abis Level 2 communication status with BSC (one LED, shared between both ICM blocks)
- GPS status (one LED, shared between both ICM blocks)
- Holdover status (one LED, shared between both ICM blocks)
- synchro source selection (three LEDs shared between both ICM blocks, the ICM “SYN3” LED is removed)
- PCM status (four LEDs shared between both, the four ICM LEDs PCM7 to PCM4 are removed)

With RICAM, except for the ACT LEDs that are permanently driven by one ICM block, by default, the ICM-0 block is the driver for these LEDs. However, if the ICM-1 block has become active, then a hardware based mechanism selects the ICM-1 block as the driver for the LEDs.

The following table gives detailed information on the RICAM/ICAM specific LEDs behavior.

Table 40
RICAM specific LEDs behavior

LED name	Color	Meaning
PCMx (x = 0 to 3)		Four PCM status LEDs: (same states as the active ICM) - Green: the PCM is OK - Red: the PCM is in fault (NOK) - Amber: the PCM is in test
G (GPS)		One GPS or external synchro status LED: (same states as the active ICM) - OFF: no external synchronization - Green: GPS synchronization - Red: bad external synchronization signal - Amber: master BTS synchronization
SYN (synchro)		Three LEDs for synchronizing source: one out of the four PCMs or external synchronization. Same states as the active ICM.
H (holdover)		One LED for synchro locked status: (same states as ICM)
From RICAM ACT (activity)		Two LEDs, one for each ICM block: - Green: the ICM block is active - OFF: as the ICM block is passive
ABIS		Level-2 status with BSC: (same states as the active ICM) - ON: level-2 is OK - Blinking: downloading in progress - OFF: no Level-2 with the BSC

All the LEDs are OFF when the RICAM/ICAM is unpowered.

All the RICAM/ICAM LEDs are amber during BISTs.

4.4.9.1 RICAM/ICAM SYN LEDs behavior

The three SYN LEDs, the G and H LEDs are managed the following way:

Table 41
RICAM/ICAM SYN LEDs behavior

SYNC SOURCE	SYN 0	SYN 1	SYN 2	G	H
PCM 0	🟢	OFF	OFF	OFF	OFF
PCM 1	OFF	🟢	OFF	OFF	OFF
PCM 2	🟢	🟢	OFF	OFF	OFF
PCM 3	OFF	OFF	🟢	OFF	OFF
8 kHz master BTS external source	🟢	🟢	🟢	🟠	OFF
GPS External synchronization	🟢	🟢	🟢	🟢	OFF
Holdover (*)	🟢 / OFF(*)	🟢 / OFF (*)	🟢 / OFF (*)	🟢 / OFF (**)	🔴

(*) In Holdover, the SYN and G LEDs indicate the clock source (PCM number or external synchronization) on which synchronization is being attempted. In that case, the holdover LED (H) is ON for the ICM-0 block for ICAM (or ICM block for RICAM).

(**) If the Holdover is due to a loss of the GPS synchronization source, the G LED remains ON.

In the case of synchronization on Abis, the H LED remains ON (on the active ICM block) until the BTS is fully "locked onto" the synchronization signal (from the Abis link). This may take from 6 to 15 minutes.

4.4.10 RICAM/ICAM Startups

With ICAM, If the ICM-0 block is active and both blocks (ICM-0 and ABM-0) are OK, the LED management at start up on a “nominal BTS” (synchronized on a PCM link and with all PCMs OK) is illustrated in Table 42 "RICAM/ICAM LED behavior at start up" (page 128).

With RICAM, If the ICM-0 block 0 is active and all three blocks (ICM-0, ICM-1, and ABM-0) are OK, the LED management at start up on a “nominal BTS” (synchronized on a PCM link and with all PCMs OK) is illustrated in Table 42 "RICAM/ICAM LED behavior at start up" (page 128).

Table 42
RICAM/ICAM LED behavior at start up

	ICM boot sequence	ICM BISTs	Abis connection	ICM downloading	Nominal operation
triangle corporate	🔺	🔺	(*)		
rectangle corporate	🟩	🟩	🟩	🟩	🟩
ACT 0		🟠	🟢	🟢	🟢
ACT 1	As the ICM-1 block is not present on ICAM, the corresponding activity LED is always OFF.				
SYN		🟠	🟢	🟢	🟢
G		🟠			
Abis		🟠	🟢	🟢 blinking	🟢
PCMx		🟠	🟢	🟢	🟢
H		🟠			

(*) With ICAM, this LED remains ON as long as the ICM-0 block or the ABM-0 block BISTs are not finished.

(*) With RICAM, this LED remains ON as long as the ICM block or the ABM block BISTs are not finished.

External synchronization

When the master 8 kHz or the GPS signal is detected, the SYN 0, SYN 1, and SYN 2 synchronization LEDs blink simultaneously three times with a period of two seconds, regardless of the current synchronization source of the BTS.

This blinking occurs under the following conditions:

- at BCF start up (power up, hardware or software reset), if the cable is present and the master BTS/GPS antenna is powered on
- at cable plug in, if the master BTS/GPS antenna is powered on
- at master BTS power up/GPS antenna, if the cable is already plugged into the slave BTS
- if the cable is unplugged, the LED will blink again at cable replug

4.4.11 Configuration of the RICAM/ICAM switches for commissioning

The RICAM/ICAM contains dip-switches that must be commissioned.

These dip-switches are similar to the ICM dip-switches and must be commissioned as for ICM 'as described in 4.3.11 "Configuration of the ICM switches for commissioning" (page 110)' except for the difference listed in this section.

The differences in these switch settings between ICM and RICAM/ICAM are:

- **PCM commissioning dip-switches**
  There is one series of eight dip-switches for each Abis PCM.
  The differences between ICM and RICAM/ICAM are:
  - On an ICM, eight PCM switches (SW0 to SW 7) are available.
  - On an RICAM/ICAM, only four PCM switches (S3 to S6) are available.
- **BCF general dip-switches**
  The differences between ICM and RICAM/ICAM are:
  - On an ICM, RSV1 is always set to OFF (that is, unused).
  - On an RICAM/ICAM, RSV1 is used to differentiate between the BTS 18000 and the BTS 6000. RSV1 must be set to ON for the BTS 18000 or to OFF for the BTS 6000.
  - On both ICM and RICAM/ICAM, RSV2 is unused (the default value is OFF).

4.5 Interface Control and Alarm Module (RICAM(2)/ICAM)

Globally, there is nothing new compared to (R)ICAM in terms of software management. The common EFT is compatible with all sites of the BTS 18000 family. Of course the specificities of the RICAM(2)/ICAM (that is, D3, D4, and D5 link handled in the new software) can only be triggered when the hardware indicates to the software that it really runs on a RICAM(2) and not on a (R)ICAM.

The RICAM(2)/CAM is hardware-ready for eight PCM links, but the software is limited to six PCM links.

RICAM(2)/ICAM can be used as spare of RICAM(2)/ICAM when the compatible software version is available.

It is important to know that the RICAM(2)/ICAM requires a software evolution, even if it is used for the small configurations already addressed by RICAM(2)/ICAM. The reason for that is because the new board contains new components that are not compatible with the current RICAM(2)/ICAM software.

The new software handling the RICAM(2)/ICAM will include also the RICAM(2)/ICAM code.

A BTS 18000 equipped with RICAM(2)/ICAM can have up to 48 TRXs.

- TRX associated to ABM-0: TEI 32 to 39, 14
- TRX associated to ABM 1: TEI 15 to 17, 62 to 67
- TRX associated to ABM 2: TEI 40 to 47, 18
- TRX associated to ABM 3: TEI 19 to 21, 68 to 73
- TRX associated to ABM 4: TEI 48 to 55, 22
- TRX associated to ABM 5: TEI 23 to 25, 74 to 79

All configurations that require other TRXs are nacked with cause “equipment not able to perform such configuration” (value 0x03).

4.5.1 Main functions

RICAM(2) has the same functions as with (R)ICAM. For more information, see 4.4 “Interface Control and Alarm Module (RICAM/ICAM)” (page 114).

RICAM2 is a single board module aiming at:

- Addressing with a single board the same configurations addressable with ICM/IFM1/CIBP (i.e. up to S16-16-16, and 6 PCM)
- Addressing the same configurations as RICAM modules (up to S9-9-9, four PCM)

- Thus, RICAM2 can be used for all new installation or as spare part for existing ICM/IFM1/CIBP or RICAM sites (provided that the software loaded is compatible with RICAM2)
- Addressing some component obsolescence of RICAM and ICM/IFM1

  To achieve 48 TRX / S16-16-16 connectivity, the RICAM2 is featured with three new D-link called:

  — D3, for connecting ABM 3

  — D4, for connecting ABM 4

  — D5, for connecting ABM 5

  The RICAM2 is hardware-ready for 54 TRX / S18-18-18 but the software corresponding to the RFF is limited to 48 TRX / S16-16-16.

4.5.2 Location in cabinet

RICAM2 is placed in the same location as the RICAM in the BTS18000 family that is to say the ABM-0 in place of the DBP.

4.5.3 Restrictions and limitations

When replacing RICAM(2) with ICAM which has the same configuration, the internetworking and restrictions are the same except for the following:

- the 5th and 6th PCM configurations will not be nacked
- all TRX TEI possible in ICM are also allowed with RICAM/ICAM
- the answer to a Hardware Display command will show RM installed in extended positions which were not possible in RICAM/ICAM

RICAM(2)/ICAM is used for its new feature or attribute. Its D links permits more TRX than (R)ICAM (as many as ICM) It can reach its maximum TRX configuration only in BTS 18000 with extension cabinets (the same as the ICM).

4.5.4 Compatibility with previous versions of the BCF

RICAM(2)/ICAM is compatible with previous BCF versions:

- RICAM(2)/ICAM is slotted inside the ABM-0 slot of the cabinet, and therefore, complies with the ABM for all the ABM requirements (hardware, mechanical, environmental, and regulatory).
- As existing BCF software running on IBP/CIBP based configurations does not run properly on RICAM2, a dedicated mechanism prevents RICAM(2)/ICAM from being upgraded with such a software load.
- The RICAM(2)/ICAM compatible software loads are compatible with all IBP and CIBP based BTS 18000s. At start up, a dedicated mechanism differentiates between these configurations and runs the appropriate one.

All the usual BCF software features work transparently on RICAM(2)/ICAM.

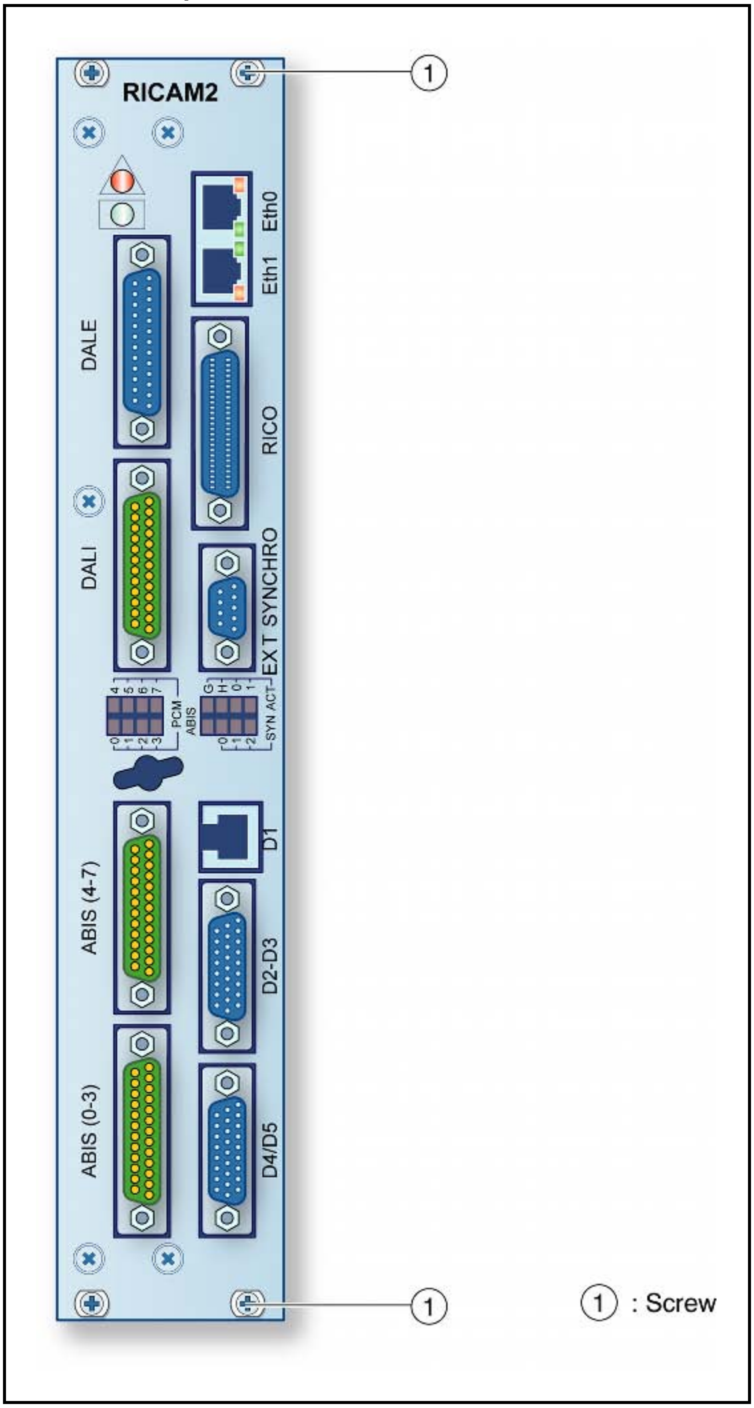
These include the following:

- all site management processes, including duplex
- all radio traffic and performance features
- all synchronization features, including external and GPS sources

4.5.5 Front panel

The following figure shows the RICAM(2) front panel.

Figure 41
RICAM2 front panel



4.5.6 Physical and electrical characteristics

Table 43
RICAM2 dimensions and weight

Module Name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
RICAM2	335	50	410	< 2

Maximum number per cabinet: one, in the base cabinet only

Maximum power consumption (RICAM2): 40 W

Input voltage range: 36 V to 75 V

Associated breaker:

- digital breaker (BTS 18010)
- CB3 digital/RICO/user breaker (BTS 18020)

4.5.7 RICAM2 corporate LEDs behavior

Table 44
RICAM2 corporate LEDs behavior

Green LED	Red LED	Meaning
OFF	OFF	Sleep, unpowered or not inserted (default hardware value)
		Starting, BISTs in progress. (one to three blocks are in the Starting/BISTs state, the other blocks are OK.)
	OFF	Module OK (three blocks are OK) : module should not be removed
OFF		Alarm state: module is NOK and may be removed and replaced (one to three blocks are in a NOK state, whatever the state of the others.)
blinking	ON or OFF	ABM block is waiting for ICM connection
blinking	blinking	ABM block is being internally downloaded by the ICM

4.5.8 RICAM2 specific LEDs behavior

Due to the additional number of Abis PCM links, there are four more PCMx LEDs for indicating the PCM status.

For SYN synchro LEDs, the three LEDs already defined for RICAM are enough given the fact that the binary coding for the PCM4 and PCM5 (numbering starting at 0) were free and unused.

Table 45
RICAM2 specific LEDs behavior

LED name	Color	Signification
PCMx (x=0,1,2,3, 4,5,6,7)		Eight PCM status LEDs (one per PCM): same states as active ICM: Green: the PCM is OK Red: the PCM is KO Amber: the PCM is tristate
G (GPS)		One GPS or external synchro status LED: same states as active ICM: OFF: no external synchronization Green: GPS synchronization Amber: master BTS synchronization Red: bad external synchronization signal
SYN (synchro)		Three LEDs for synchronizing source: one out of the six first PCMs or external synchronization (same states as active ICM)
H (holdover)		One LED for synchro locked status: (same states as ICM)

ACT (activity)	●	Two LEDs, one for each ICM core: Green: the ICM core is active OFF: the ICM core is passive (RICAM2) or not existing (ICAM2)
ABIS	●	Level 2 status with BSC: same states as active ICM: ON: Level 2 is OK, BLINKING: downloading in progress OFF: no Level 2 with the BSC.

4.5.9 RICAM2 SYN LEDs behavior

The three SYN LEDs, the G, and H LEDs are managed the following way:

Table 46
RICAM2 SYN LEDs behavior

SYNC SOURCE	SYN 0	SYN 1	SYN 2	G	H
PCM 0	●	OFF	OFF	OFF	OFF
PCM 1	OFF	●	OFF	OFF	OFF
PCM 2	●	●	OFF	OFF	OFF
PCM 3	OFF	OFF	●	OFF	OFF
8 kHz master BTS external source	●	●	●	●	OFF
GPS External synchronization	●	●	●	●	OFF
Holdover (*)	● / OFF(*)	● / OFF (*)	● / OFF (*)	● / OFF (**)	●

(*) In Holdover, the SYN and G LEDs indicate the clock source (PCM number or external synchronization) on which synchronization is being attempted. In that case, the holdover LED (H) is ON for the ICM-0 block for ICAM (or ICM block for RICAM2).

(**) If the Holdover is due to a loss of the GPS synchronization source, the G LED remains ON.

In the case of synchronization on Abis, the H LED remains ON (on the active ICM block) until the BTS is fully "locked onto" the synchronization signal (from the Abis link). This may take from 6 to 15 minutes.

4.5.10 RICAM2 Startups

With RICAM2, If the ICM-0 block 0 is active and all three blocks (ICM-0, ICM-1, and ABM-0) are OK, the LED management at start up on a “nominal BTS” (synchronized on a PCM link and with all PCMs OK) is illustrated in Table 47 "RICAM2 LED behavior at start up" (page 137).

Table 47
RICAM2 LED behavior at start up

	ICM boot sequence	ICM BISTs	Abis connection	ICM downloading	Nominal operation
triangle corporate	🔺	🔺	(*)		
rectangle corporate	🟩	🟩	🟩	🟩	🟩
ACT 0		🟠	🟢	🟢	🟢
ACT 1	As the ICM-1 block is not present on ICAM, the corresponding activity LED is always OFF.				
SYN		🟠	🟢	🟢	🟢
G		🟠			
Abis		🟠	🟢	🟢 blinking	🟢

	ICM boot sequence	ICM BISTs	Abis connection	ICM downloading	Nominal operation
PCMx		🟠	🟢	🟢	🟢
H		🟠			

(*) With RICAM2, this LED remains ON as long as the ICM block or the ABM block BISTs are not finished.

External synchronization

When the master 8 kHz or the GPS signal is detected, the SYN 0, SYN 1, and SYN 2 synchronization LEDs blink simultaneously three times with a period of two seconds, regardless of the current synchronization source of the BTS.

This blinking occurs under the following conditions:

- at BCF start up (power up, hardware or software reset), if the cable is present and the master BTS/GPS antenna is powered on
- at cable plug in, if the master BTS/GPS antenna is powered on
- at master BTS power up/GPS antenna, if the cable is already plugged into the slave BTS
- if the cable is unplugged, the LED will blink again at cable replug

4.5.11 Configuration of the RICAM2 switches for commissioning

The RICAM2 contains dip-switches that must be commissioned.

These dip-switches are similar to the ICM dip-switches and must be commissioned as for ICM, as described in 4.3.11 “Configuration of the ICM switches for commissioning” (page 110) except for the difference listed in this section.

The differences in these switch settings between ICM and RICAM2 are:

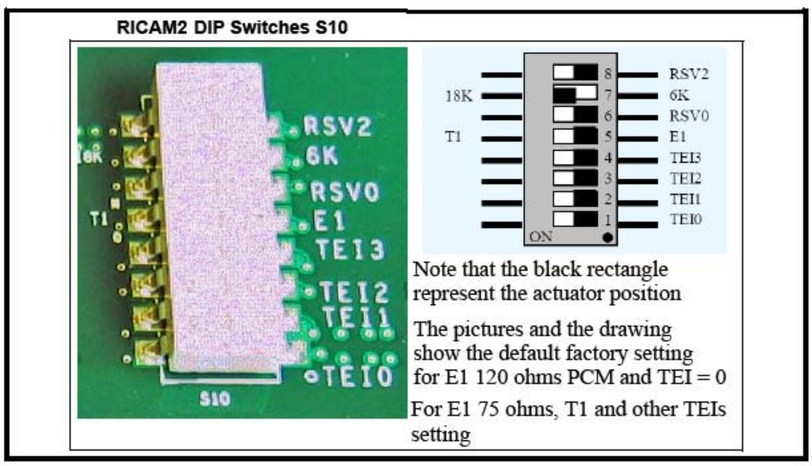
- **PCM commissioning dip-switches**
  There is one series of eight dip-switches for each Abis PCM.
  The differences between ICM and RICAM2 are:
  - — On an ICM, eight PCM switches (SW0 to SW 7) are available.
  - — On a RICAM2, only four PCM switches (S3 to S6) are available.
- **BCF general dip-switches**
  The differences between ICM and RICAM2 are:

— On an ICM, RSV1 is always set to OFF (that is, unused).

— On an RICAM2, RSV1 is replaced by 6K/18K switch: 6K small switch is used to differentiate between the BTS 18000 and the BTS 6000. 6K small switch must be set to ON for the BTS 18000 or to OFF for the BTS 6000.

— On both ICM and RICAM2, RSV2 is unused (the default value is OFF).

Figure 42
Configuration of the RICAM2 switches for commissioning



4.6 Alarms and Bridge Module (ABM)

The ABM is composed of a single board with connections on the DBP and on the front panel.

In a configuration with ICAM or RICAM(2), the ABM-0 is removed and the (R)ICAM or RICAM2 is slotted in its place. The other ABMs remain. For more information about (R)ICAM and RICAM2, see 4.4 “Interface Control and Alarm Module (RICAM/ICAM)” (page 114) and 4.5 “Interface Control and Alarm Module (RICAM(2)/ICAM)” (page 130).

4.6.1 Main functions

4.6.1.1 Alarm collector function

The ABM alarm collector function performs the following operations under the ICM control:

- detection of cabinet alarms:
  - door status
  - BTS 18020 cabinet User Rack and ADU
  - BTS 18020 NG cabinet ngUser Rack and ADUng
- presence detection of the digital rack, combiner rack and other cabinet modules:
  - digital rack modules: IFM/IFM1, ICM, and the three radio modules
  - RF combiners: DDM, TxF, DDM (H2), TxF (H2), H3, and H4
- inventory of the digital rack, combiner rack and other cabinet modules:
  - IFM/IFM1, ICM, and the three radio modules, through the I2C bus
  - DDM, TxF, DDM (H2), TxF (H2), H3, and H4, through the pseudo I2C over RS422
  - UCPS and ngUCPS modules, through a dedicated protocol over RS422
- alarm polling of the radio coupling modules, through the pseudo I2C bus over RS422:
  - Low Noise Amplifier (LNA) over-current detection in the DDMs
  - VSWR alarms and associated setting of thresholds in the DDMs and TX filters with the VSWR option
- alarm polling of the cooling system modules, through the pseudo I2C bus over RS422:
  - BTS 18010 SICS blowers, filter, power, and control board status
  - BTS 18010 SICS-S fans, filter, power, and control board status

   - BTS 18010 NG2 SICS-S fans, filter, power, and control board status
   - BTS 18020 ECU blowers, filter, damper, heater, power, and control board status
-
   - AC monitoring
   - DC monitoring
   - breakers status
   - battery status
- optional external alarm detection (up to eight customer alarms per ABM)
- remote control drive (up to two remote controls per ABM)

4.6.1.2 Bridge function

The ABM assures bridge functions between several interfaces:

- On one side, it manages interface with ICM (one front panel D link or two in case of ICM redundancy).
- On the other side, the bridge manages one internal E link for ABM alarm function and three E links to the radio modules.

The traffic management between all interfaces is automatic and does not need specific configuration. It is kept available whatever the module software status, as long as power is on.

4.6.2 Location in cabinet

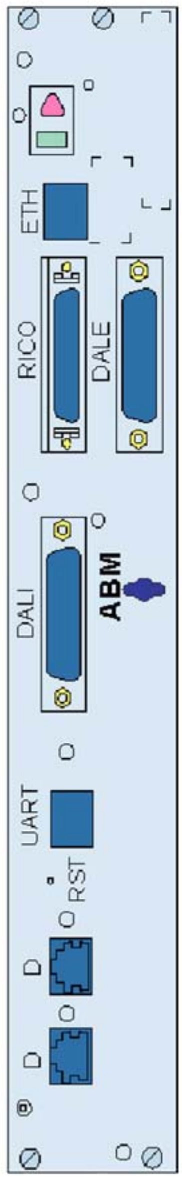
One ABM is used in each BTS 18000 digital rack. Therefore, a BTS 18000 cabinet contains two ABMs (even and odd).

There is a maximum of two ABMs in an IBP/CIBP configuration, but only one in a RICAM(2) or ICAM configuration. The ABM-0 function is incorporated in RICAM(2)/ICAM.

4.6.3 Front panel

The following figure presents the ABM front panel.

Figure 43
ABM front panel



4.6.4 Physical and electrical characteristics

Table 48
ABM dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
ABM	335	50	410	< 1

Maximum number per cabinet: two

Maximum power consumption: 15 W

Associated breaker: digital breaker

4.6.5 Interface description

4.6.5.1 Connectors

The following table indicates the type and the use of the ABM connectors. They are front panel connectors, except for J10, which is a back panel connector.

Table 49
ABM connectors type and use

Debug connector	Use	Type
J6	Ethernet / RS232 debug - ETH	8 pins RJ45 female
Cabinet interface connector	**Use**	**Type**
J21	I2C data / clock, combiner detection, cabinet detection - RICO	SCSI 50 pins female
External alarm connector	**Use**	**Type**
J21	External alarm, remote control - DALE	SUBD 25 pins female
Internal alarm connector	**Use**	**Type**
J20	Internal alarm - DALI	SUBD 25 pins male
UART connector	**Use**	**Type**
J22	UART link - UART	6 pins RJ11 female
Signal connectors (front panel)	**Use**	**Type**
J14	D link (0 or 1) - D	10 pins RJ45 female
J15	D link (0 or 1) - D	
Signal connector (back panel)	**Use**	**Type**
J10	Three E links, detection, inventory	HM1 120 pins female

The front panel Debug connector provides the following signals:

- reset push button
- debug access (RS232 monitor + 10/100 bT)

The Signal front panel connectors provide the following:

- one D link connectivity from ICM, in case of simplex mode, or two D links connectivity from ICM, in case of redundant mode
- one spare link over RS422 for future use

The Internal alarm front panel connector provides:

- even or odd position detection from Radio InterCO panel
- detection, inventory, and alarm of the radio combiners and cabinet modules through Booleans, I2C and UART busses
- collection of cabinet Boolean alarms

The External, user alarms front panel connector provides collection of external protected Boolean alarms and remote control.

The back panel power connector provides 48 V wide input range floating supply.

The Signal back panel connector provides the following:

- three point-to-point E links to the radio modules
- board presence detection, remote power I2C inventory to all digital modules (including ABM itself)

4.6.6 ABM corporate LEDs behavior

The following table gives ABM detailed status information.

Table 50
ABM corporate LEDs behavior

Green LED	Red LED	ABM status
switched off	switched off	unpowered or not inserted (default hardware value)
		starting, BISTs in progress
	switched off	normal operation - no faults

Table 50
ABM corporate LEDs behavior (cont'd.)

Green LED	Red LED	ABM status
switched off	▲	alarm status: abnormal operation - must be removed and replaced
blinking	▲ or switched off	wait for ICM connection
blinking	blinking	internal downloading

4.6.7 ABM specific LEDs behavior

The following table gives detailed information on ABM specific LEDs behavior.

Table 51
ABM specific LEDs behavior

LED Name	Color	Meaning
D	●	two LEDs for D activity ON: when the connection to active ICM through the D link related to the LED is correctly established Only one of the two D LEDs can be ON
UART	●	ON: UART activity (reserved for future use)

4.6.8 LEDs behavior at ABM starting up

The following table gives the behavior of corporate and specific LEDs when ABM starts up.

Table 52
LEDs behavior at ABM starting up

	ABM boot sequence	ABM BIST	Active ICM connection	ABM downloading	Nominal operation
triangle corporate	▲	▲	▲ or OFF	▲ blinking	

Table 52
LEDs behavior at ABM starting up (cont'd.)

	ABM boot sequence	ABM BIST	Active ICM connection	ABM downloading	Nominal operation
rectangle corporate	■	■	■ blinking	■ blinking	■
D			●	●	●

External alarms do not impact the ABM corporate LEDs management (these LEDs only indicate ABM board alarms).

4.7 Radio Module (RM1/RM2)

The BTS 18000 is a complete BSM/GPRS/EDGE transmitter/receiver. The radio module is in charge of all processing related to the GSM TDMAs.

There are a variety of different radio modules available. These are grouped into two types:

- RM1: First design version of Radio Module which is declined in two sub families:
  - — 3-TDMA capacity (three TRX)
  - — 2-TDMA capacity (two TRX)
- RM2: Second design version of Radio Module, 3-TDMA capacity (three TRX) only

In V16, differentiation is made at the OMC in order to distinguish power versions only. The 3-TDMA capacity radio modules are commonly known as RM. The 2-TDMA capacity radio module is commonly known as HPRM.

From V17, additional differentiation is made between RM1 and RM2.

The following table shows the currently available RM models and their representation at a V18 OMC-R. The value of the hardware Configuration parameter of the OMC object transceiver Equipment depends on the RM type, the frequency band, and the power output for the GMSK and 8-PSK modulation schemes, respectively.

Table 53
RM hardware specifications

standard Indicator	Eqt types	BSC V16 HW configuration	OMC V17/V18 HW configuration
GSM	0xB3	MPRM	RM1/2 900 40/40
GSM	0xB0	HPRM	RM1 900 60/45
GSM	0xB0	HPRM3T	RM2 900 60/45
PCS	0xCA	RM	RM1/2 1900 30/30
PCS	0xB3	MPRM	RM2 1900 50/30
DCS	0xCA	RM	RM1/2 1800 30/30
DCS	0xB3	MPRM	RM1/2 1800 50/30
GSM850	0xB0	HPTM3T	RM1 850 60/45

4.7.1 Mixing RMs

The following types of Radio Modules are available for the BTS 18000:

- RM1 850 60/45
- RM1/2 900 40/40
- RM2 900 60/45
- RM1/2 1800 30/30
- RM1/2 1800 50/30
- RM1/2 1900 30/30
- RM2 1900 50/30

All are plug-to-plug compatible and can be plugged in a BTS 18000 cabinet in the same place.

The BTS 18000 supports the mixing of 2-TDMA and 3-TDMA radio modules in the same BTS 18000 cabinet or even in the same BTS 18000 self. In this case, the BTS supports up to six RMs for each cabinet, whatever the RM type.

4.7.2 3-TDMA RM1 and RM2

4.7.2.1 Main functions

The 3-TDMA Radio Modules (both RM1 and RM2) offer the same functionality except for different downlink power levels. The 3-TDMA capacity radio modules are commonly known as RM.

The RM is a complete GSM/GPRS/EDGE transmitter/receiver. The RM is in charge of all processing related to the GSM TDMAs. It is designed to support 3-TDMA (GSM or EDGE). It is logically equivalent to three TRXs (0, 1, and 2).

The following is a list of 3-TDMA RM version as seen by the OMC-R:

- 850 MHz
  - — RM1 850 60/45
- 900 MHz
  - — RM1/2 900 40/40
  - — RM2 900 60/45
- 1800 MHz
  - — RM1/2 1800 30/30
  - — RM1/2 1800 50/30
- 1900 MHz

— RM1/2 1900 30/30

— RM2 1900 50/30

During OMC-R upgrade it is not possible to define the radio module for instances listed as RM1/2. Thus the values “RM1/2 900 40/40”, “RM1/2 1900 30/30”, “RM1/2 1800 30/30” and “RM1/2 1800 50/30” are set during upgrade and later a customer should choose more accurate value (for instance, HW replacement or new BTS installation).

The RM may operate

- on a one-sector basis (three carriers per sector, O3 mode)
- on a three-sector basis (one carrier per sector, S111 mode)

Maximum configurations for BTS 18000 mono-cabinet with RM are S666, O18 and S99.

4.7.2.2 RX splitter function

The RM integrates a RX splitter function. It is inserted between the DDM and RM RX paths (main and diversity). It allows splitting DDM RX outputs in order to reach maximum configurations (one input to three outputs split for main and diversity paths).

In order to fit both RM configurations (S111 and O3), this function is configurable by RF switches. The commands of switches are provided by the DDM (DC command multiplexed on RF signals on DDM RX outputs and automatic RX splitter configuration by RF connection).

4.7.2.3 Front panel

The following figure presents the RM1 and RM2 front panel.

Figure 44
RM1 front panel

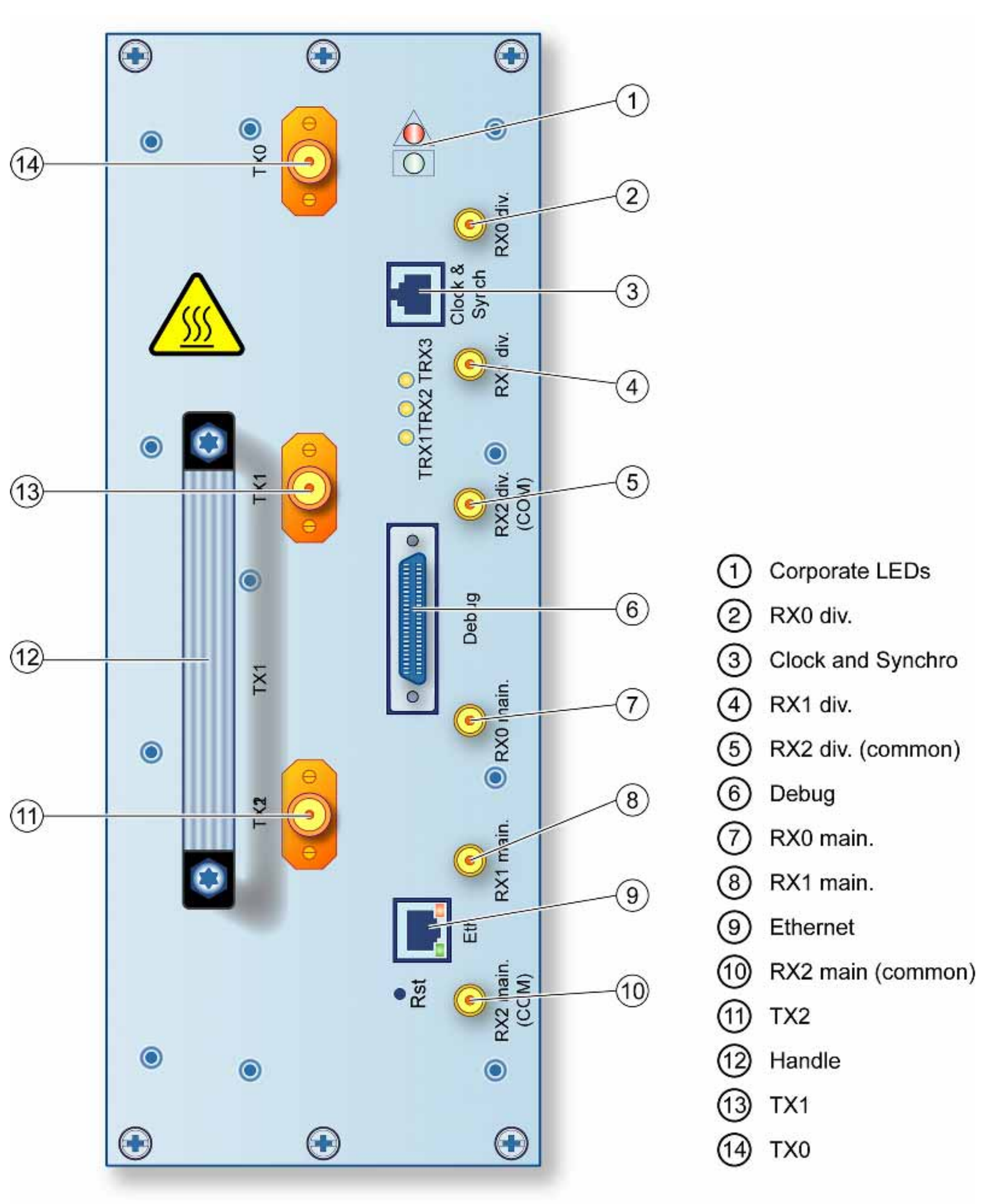
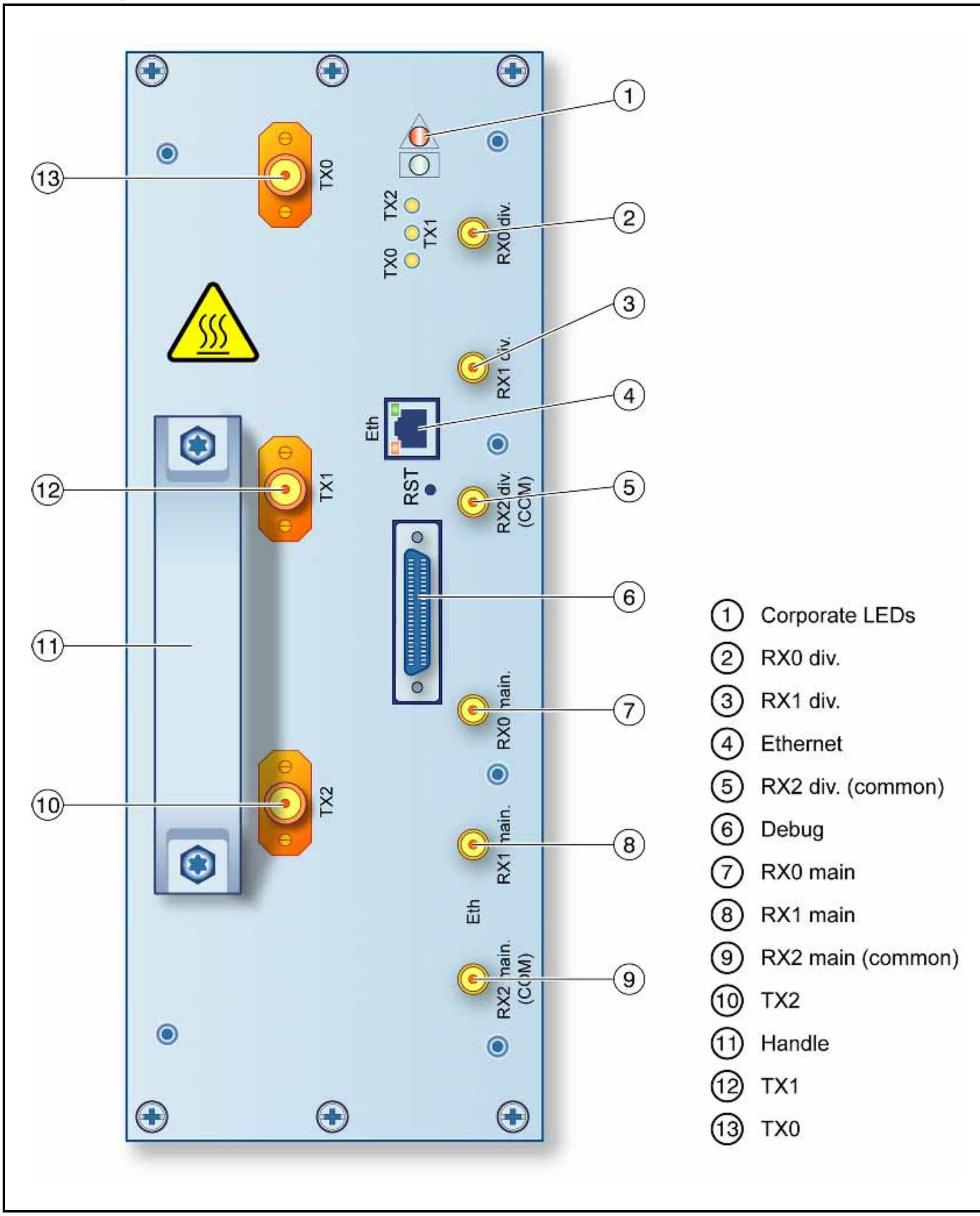


Figure 45
RM2 front panel



4.7.2.4 Physical and electrical characteristics

Table 54
Dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
RM1/2	335	125	410	19

Maximum number per cabinet: six

Maximum power consumption: 765 W

Output power:

The RM output power may vary according to the frequency band. The frequency variant of the RM is managed by software using the RF board frequency variants detection. The following table gives the RM output power for all frequency bands.

Table 55
RM output power per frequency band

Output power	GSM850 60W/45W	GSM900 40W/40W	GSM900 60W/45W	GSM1800 50W/30W	GSM1900 30W/30W	GSM1900 50W/30W
Typical output power (dBm)	47.8/46.5	46	47.8/46.5	47/44.8	44.8	
Typical output power (W)	60/45	40	60/45	50/30	30	50/30
Variation (dB)	+/-0.5	+/-0.5	+/-0.5	+/-0.5	+/-0.5	+/-0.5

Associated breaker (one for each group of three RMs):

- RF0 and RF1 breakers, for BTS 18010 and BTS 18010 NG2 cabinets:
- CB1 RF0 and CB2 RF1 breakers, for BTS 18020 and BTS 18020 NG cabinets:

4.7.2.5 Interface description

The RM provides the following interfaces:

- radio interface:
  - three PA outputs (QN type 50 ohms connectors)
  - six RX inputs (three main, three diversity) (QMA type 50 ohms connectors)
- digital/power interface on the DBP:
  - 48 V wide range input power feeder
  - a point-to-point E link to the ABM
  - board presence detection and inventory I2C link to the ABM
  - a point-to-point spare link to each of the two other RMs
- debug interface:
  - reset push button
  - CPU debug access (RS232 monitor + BDM + 10/100bT)
  - DSP debug access
  - trace access

4.7.2.6 RM corporate LEDs behavior

The following table gives RM detailed status information.

Table 56
RM corporate LEDs behavior

Green LED	Red LED	RM status
switched off	switched off	unpowered or not inserted (default hardware value)
		starting, BISTs in progress
	switched off	normal operation - no faults
	blinking	module is possibly partially faulty - TRX(s) in fault
switched off		alarm status: abnormal operation - RM is in fault - must be removed and replaced
blinking	 or switched off	wait for ICM connection

4.7.2.7 RM specific LEDs behavior

Ethernet LEDs behavior The TX (green) and LI (amber) Ethernet LEDs are on the Ethernet connector.

These LEDs are switched off in nominal mode of operation. They are only used for debug purposes.

TRX LEDs behavior The following table gives detailed information on RM/MPRM TRX LEDs behavior.

Table 57
RM TRX 0-1-2 LEDs behavior

LED Name	Color	Meaning
TRX 0-1-2		- flashes during SPU cluster download - blinks until BSC connection, including Abis downloading - switched off when TRX is operational - switched on when TRX is in fault

4.7.2.8 LEDs behavior at RM start-up

The following table gives the behavior of corporate and specific LEDs when the RM starts up.

In this table

- C2 => RM power up
- C3 => RM start up
- C4 => RM BISTs
- C5 => RM soft start
- C6 => RM soft init (1/2)
- C7 => SPU load and start
- C8 => RM soft init (2/2)
- C9 => Connection to BCF/Abis downloading
- C10 => Nominal operation
- R2 => triangle corporate
- R3 => rectangle corporate

Table 58
LEDs behavior at RM start-up

	C2	C3	C4	C5	C6	C7	C8	C9	C10
R2	▲	▲	▲	▲					
R3	■	■	■	■	■ blinking	■ blinking	■ blinking	■	■
TRX 0-1-2	●		●			● blinking		● blinking	

4.7.2.9 Dual band 1900/900

Both 1900 MHz and 900 MHz frequencies can be supported in a single BTS 18000 cabinet. This applies both to BTS 18010 (Indoor) and BTS 18020 (Outdoor) with E1 or T1 PCM.

A BTS 18000 in such a configuration works like two co-localized cabinets (one 900 MHz and one 1900 MHz).

Both frequencies can be supported in the same shelf. One BCCH must be configured per band.

Handover between 900 MHz and 1900 MHz is not available.

Reselection between 900 and 1900 MHz cells is not available.

H2 coupling The following dual band configurations can be reached (with three sectors in 900 MHz, and three sectors in 1900 MHz):

- 3S333_333/333_333/333_333 RM in O3 mode
- 3S333_333/333_333/333_333 RM in S111 mode
- 3S444_222/444_222/444_222 RM in S111 mode
- 3S444_222/444_222/444_222 RM in mixed mode
- 3S333_222/333_222/333_222 RM in S111 mode

In the above configurations, “/” is used as the cabinet separator; and “_” is used as the band separator.

D plus TxF coupling The following dual band configurations can be reached (with three sectors in 900 MHz, and three sectors in 1900 MHz):

- 3S222_222/222_222/222_222 RM in O3 mode
- 3S222_222/222_222/222_222 RM in S111 mode
- 3S222_222/222_222/222_222 RM in O3 mode

Mixed coupling D plus H2 The following dual band configurations can be reached (with three sectors in 900 MHz, and three sectors in 1900 MHz):

- 3S444_222/444_222/444_222 RM in mixed mode
- 3S444_222/444_222/444_222 RM in S111 mode

4.7.2.10 Dual band 1900/850

Dual band cells allow having RMs of two different bands in one cell. The BCCH is transmitted in one band only.

Depending on the value specified at the OMC-R level (standardIndicator parameter), two types of configurations are possible:

- **GSM850/GSM1900:** the BCCH is on the GSM850 band
- **GSM1900/GSM850:** the BCCH is on the GSM1900 band

Biband cells are also possible. In this case, there is one BCCH per frequency band.

On both dual band and bi-band configurations, handovers from one band to another band are possible.

4.7.3 2-TDMA RM1

4.7.3.1 Main functions

The 2-TDMA is a variant of the RM1 with only a RM1 capacity, but with a high output power. It is logically equivalent to two TRXs (0 and 1).

Only one frequency and power variant version exists: RM1 900 60/45

The RM1 900 60/45 can operate on

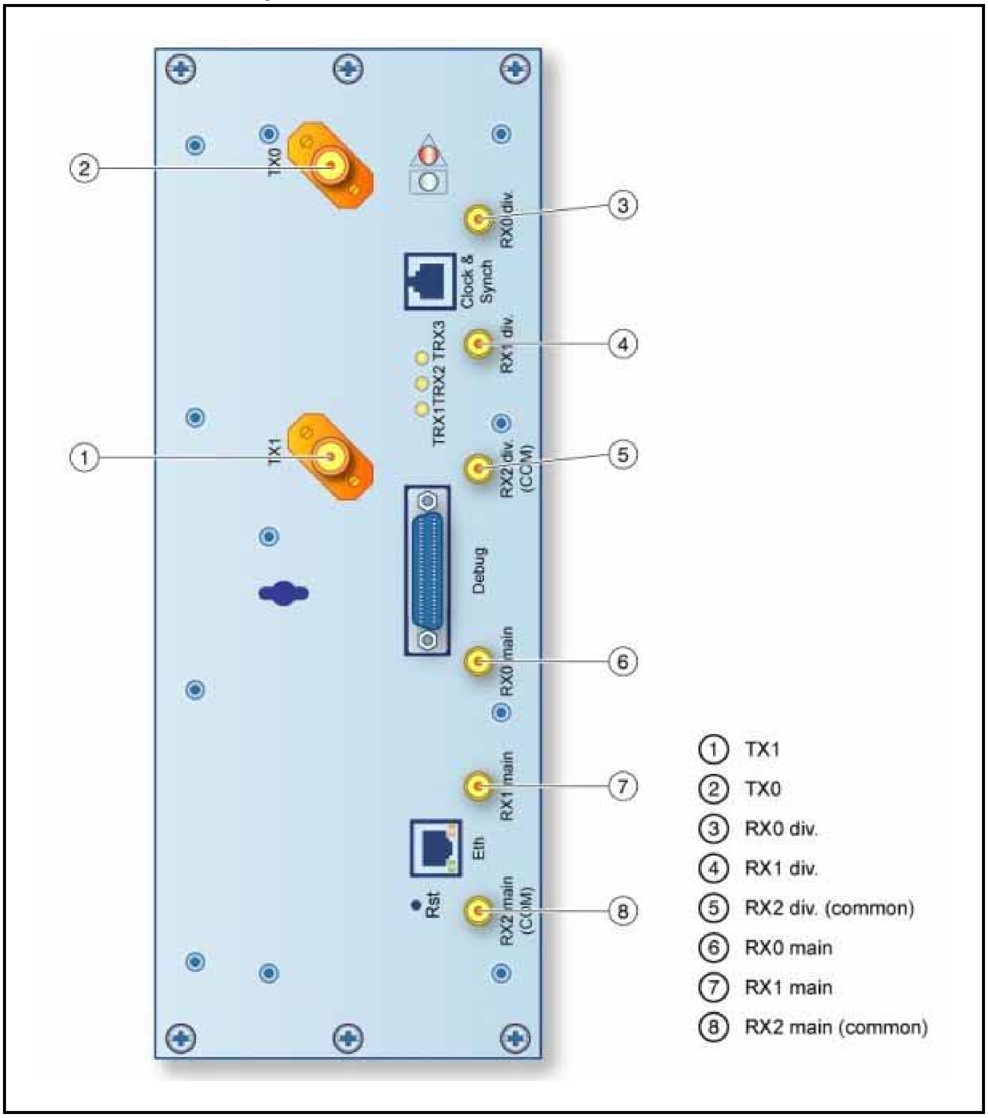
- one-sector basis (two carriers per sector, O2 mode)
- two-sector basis (one carrier per sector, S11 mode)

Maximum configurations for BTS 18000 mono-cabinet with RM1 900 60/45 are S444, O12, and S66.

4.7.3.2 Front panel

The following figure presents the RM1 900 60/45 front panel.

Figure 46
RM1 900 60/45 front panel



4.7.3.3 Physical and electrical characteristics

Table 59
Dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
RM1 900 60/45	335	125	410	19

Maximum number per cabinet: six

Maximum power consumption: 540 W

Associated breaker (one for each group of three RMs):

- RF0 and RF1 breakers, for BTS 18010 cabinet
- CB1 RF0 and CB2 RF1 breakers, for BTS 18020 cabinet

The following table gives the output power at the RM1 900 60/45.

Table 60
Output power by type of modulation

Output power	GSM900 (GMSK)	GSM900 (8-PSK)
Typical output power (dBm)	47.8	46.5
Typical output power (W)	60	45
Variation (dB)	+/-0.5	+/-0.5

4.7.3.4 Interface description

The RM1 900 60/45 provides the following interfaces:

- radio interface:
  - two PA outputs (QN type 50 ohms connectors)
  - six RX inputs (three main, three diversity) (QMA type 50 ohms connectors)
- digital/power interface on the DBP (the same as for 3-TDMA capacity RM)
- debug interface (the same as for 3-TDMA capacity RM)

4.7.3.5 LEDs behavior

The 2-TDMA capacity RM LEDs behavior is identical to the 3-TDMA capacity RM LEDs behavior. The TRX2 LED remains always OFF. It is only tested during BISTs.

4.8 Dual Duplexer Module (DDM)

The operator can use different types of couplers to couple the PAs to the antennas and to combine the RX and TX paths:

- duplexers
- transmit filters
- hybrid combiners

These couplers can be found in the following BTS 18000 modules:

- DDM or DDM with optional H2 coupling, both including an optional VSWR meter
- TxF or TxF with optional H2 coupling, both including an optional VSWR meter

4.8.1 Main functions

The DDM allows to share TX and RX signals on the same antenna. The DDM is aimed at providing:

- TX filtering (noise suppression)
- RX filtering (noise suppression)
- TX to RX isolation
- front end low noise amplification for the receive chain

The DDM provides two separate RX paths with four outputs per chain. It also provides two transmit inputs (two transmit carrier's capacity). The DDM is used in a sector basis with one duplexer for main receive path and the other one for diversity receive path.

4.8.1.1 H2 coupling option

In addition, in order to increase the transmit capacity of the DDM, integrated two-way hybrid combiners (H2 coupling) are proposed as an option for the DDM. These combiners can be by-passed.

A front panel switch informs the system of the current DDM H2 configurations (two-way hybrid by-passed or not).

4.8.1.2 VSWR meter option

As an option, the DDM integrates a VSWR meter on both antenna accesses. This VSWR meter provides three levels of alarms. The corresponding thresholds of alarms are settable on site, through DDM front panel switches.

The DDM provides a presence detection signal to the ABM. The DDM is also connected to the ABM through a I2C bus. This bus allows ABM to collect alarms, inventory information, and to read VSWR thresholds settings.

The DDM operates on -48 V main power supply through the RICO board. In addition, the DDM provides the RICO board with:

- A DC signal of 3.3 V, to power supply the inventory circuitry of the associated SICS (BTS 18010) or ECU (BTS 18020).
- A DC signal of 5 V, to power supply the associated TxF (VSWR meter and inventory circuitry).

4.8.2 Front panel

Figure 47
DDM front panel

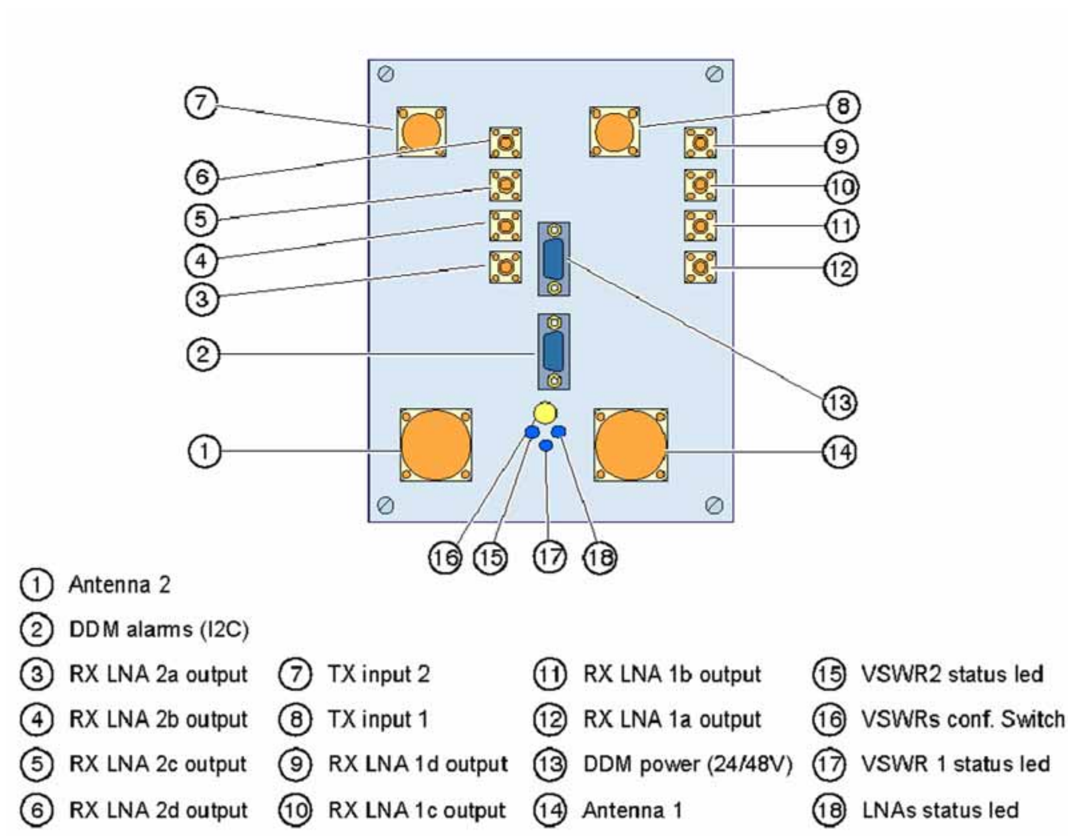
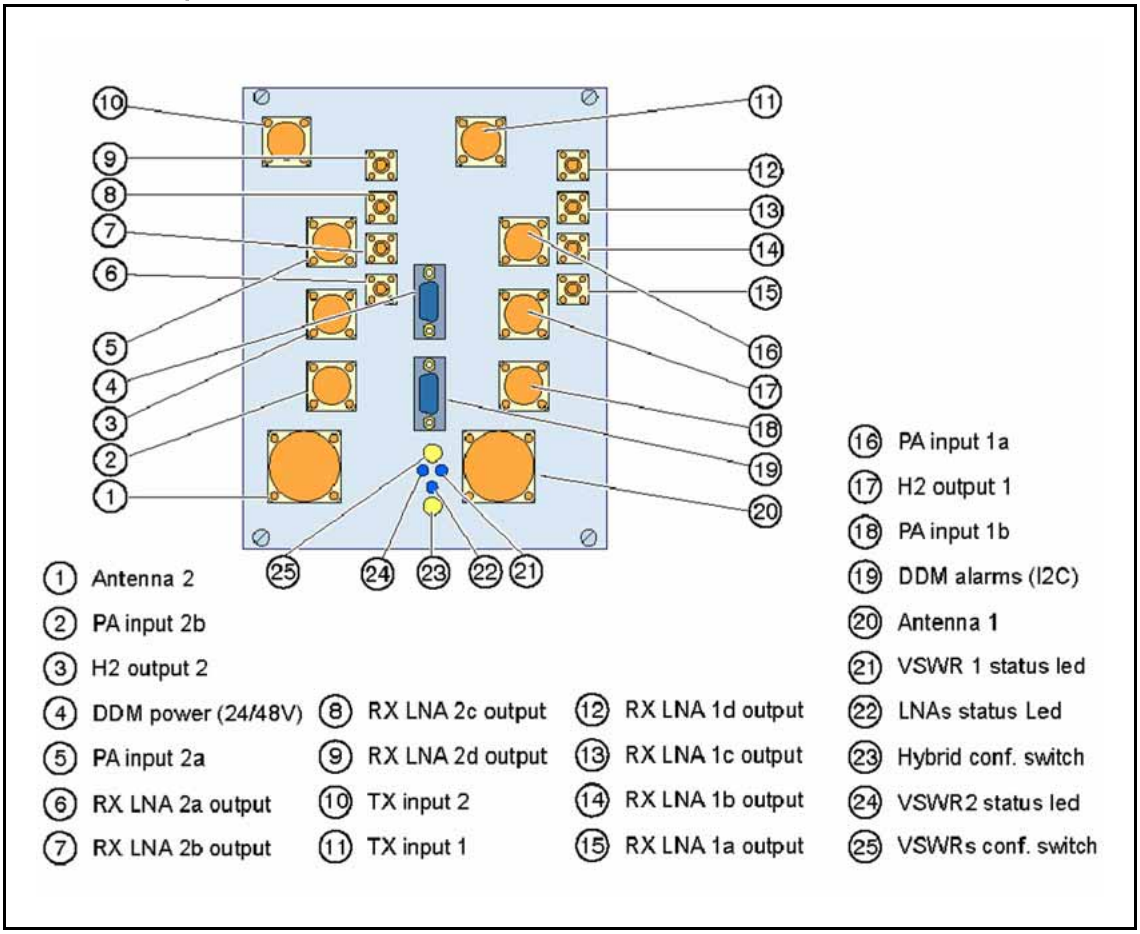


Figure 48
DDM H2 front panel



4.8.3 Physical and electrical characteristics

Table 61
DDM / DDM H2 dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
DDM / DDM H2	190.7	149.7	400	11

Maximum number per cabinet: six

Maximum total power consumption:

- 21 W, for GSM1800 and GSM1900
- 35 W, for others

Input voltage range: 20 V to 60 V

Associated breaker:

- Digital breaker (BTS 18010)
- CB3 digital/RICO/user breaker (BTS 18020)

4.8.4 Interface description

The DDM provides the following interfaces:

- radio interface:
  - antenna ports: two 7/16 coaxial 50 ohms connectors
  - TX input ports: two QN type 50 ohms connectors
  - RX outputs: eight QMA type 50 ohms connectors
- digital/power interface:
  - 48 V wide range input power feeder
  - board presence detection and inventory I2C link to the ABM

4.8.5 DDM specific LEDs behavior

Three LEDs are located on the DDM font panel in order to monitor DDM internal alarm:

- one LED is dedicated to LNAs
- two LEDs are dedicated to VSWR meter:
    - — one for antenna 1 port
    - — one for antenna 2 port

The following table describes the DDM specific LEDs behavior.

Table 62
DDM specific LEDs behavior

LED Name	Color	Meaning
LNA		ON when DDM is powered on
VSWR1		Red: Port 1 VSWR alarm level 3 Amber: Port 1 VSWR alarm level 2 OFF: no alarm or level 1
VSWR2		Red: Port 2 VSWR alarm level 3 Amber: Port 2 VSWR alarm level 2 OFF: no alarm or level 1

4.8.6 Configuration of the DDM switches for commissioning

Two four-position rotate switches are located on the DDM front panel.

These switches must be positioned on site:

- The VSWR switch (only on DDMs with the VSWR option)
- The hybrid configuration switch (only present on DDM H2)

4.8.6.1 VSWR configuration switch

The VSWR switch (only on DDMs with the VSWR option) allows the user to modify (on site) the VSWR meter thresholds on both antenna ports.

To set the value, use a screwdriver to rotate switch until the arrow points to the desired value. Three positions are used to offset VSWR thresholds of respectively 0, 2, or 4 dB. The fourth position checks that the three LEDs operate correctly.

The following table gives the meaning of the switch settings.

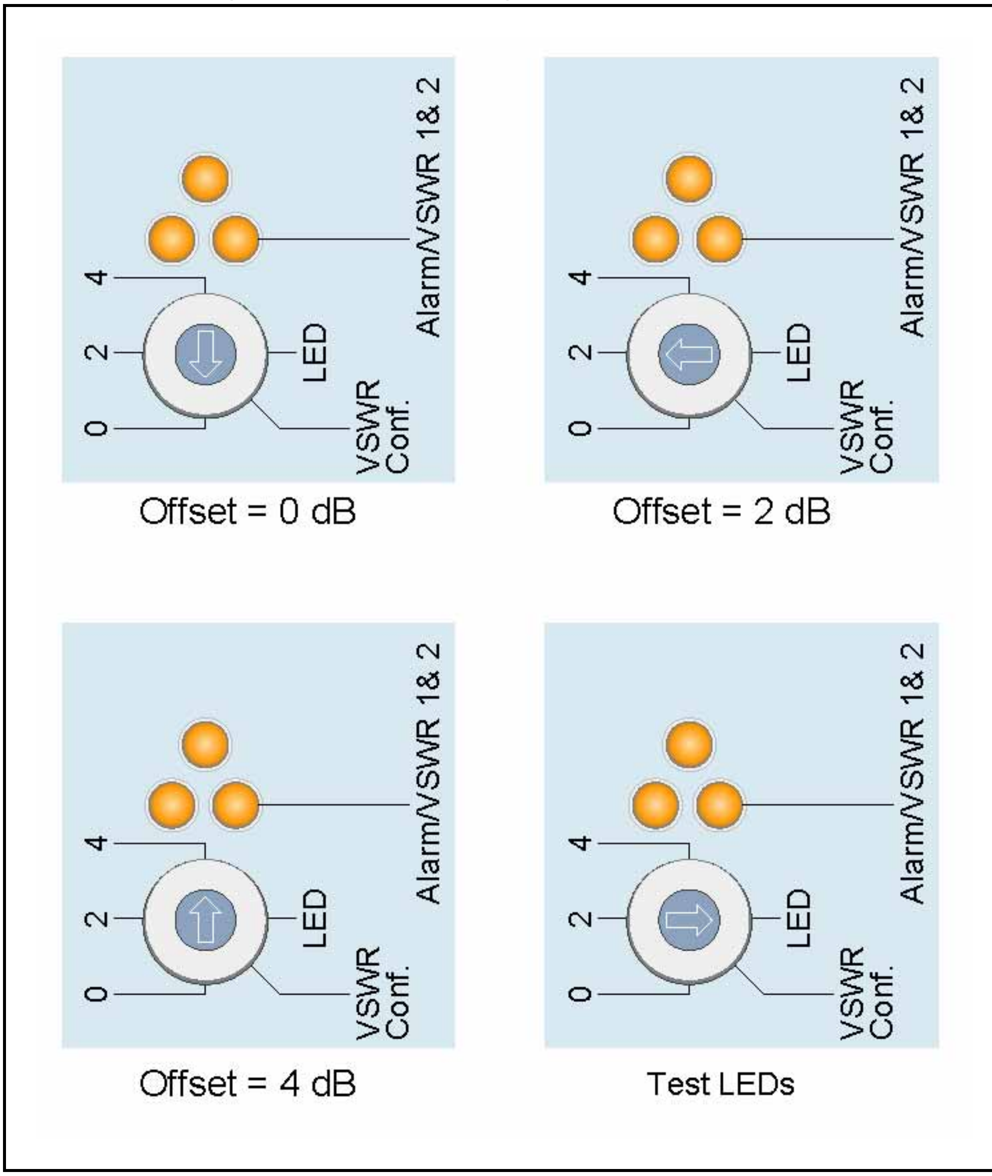
Table 63
Meaning of DDM VSWR configuration switch settings

Arrow pointing towards:	Threshold offset	Alarm level	Return Loss values
0	0 dB	3	6 ± 2 dB
		2	9.5 ± 2.5 dB
		1	12 ± 3 dB
2	2 dB	3	8 ± 2.25 dB
		2	11.5 ± 3 dB
		1	14 ± 3.5 dB
4	4 dB	3	10 ± 2.5 dB
		2	13.5 ± 3.5 dB
		1	16 ± 4 dB
LED	Test LEDs	N/A	N/A

The following figure shows the four possible switch settings.

To set the value, use a screwdriver to rotate switch until the arrow points to the desired switch position. There may be numbers in the ring surrounding the rotator switch (that is, in the ring that surrounds the arrow). These numbers are not significant to the interpretation of the switch and they are not shown in the figure. The meaning of the switch depends on the direction in which the arrow is pointing.

Figure 49
DDM VSWR configuration switch settings



4.8.6.2 Hybrid configuration switch

The hybrid configuration switch (only present on DDM H2) is used to disable one or both hybrids. There are four possible configurations. The switch is absent if there are no hybrids. The following table shows the possible settings.

Table 64
Meaning of DDM hybrid configuration switch settings

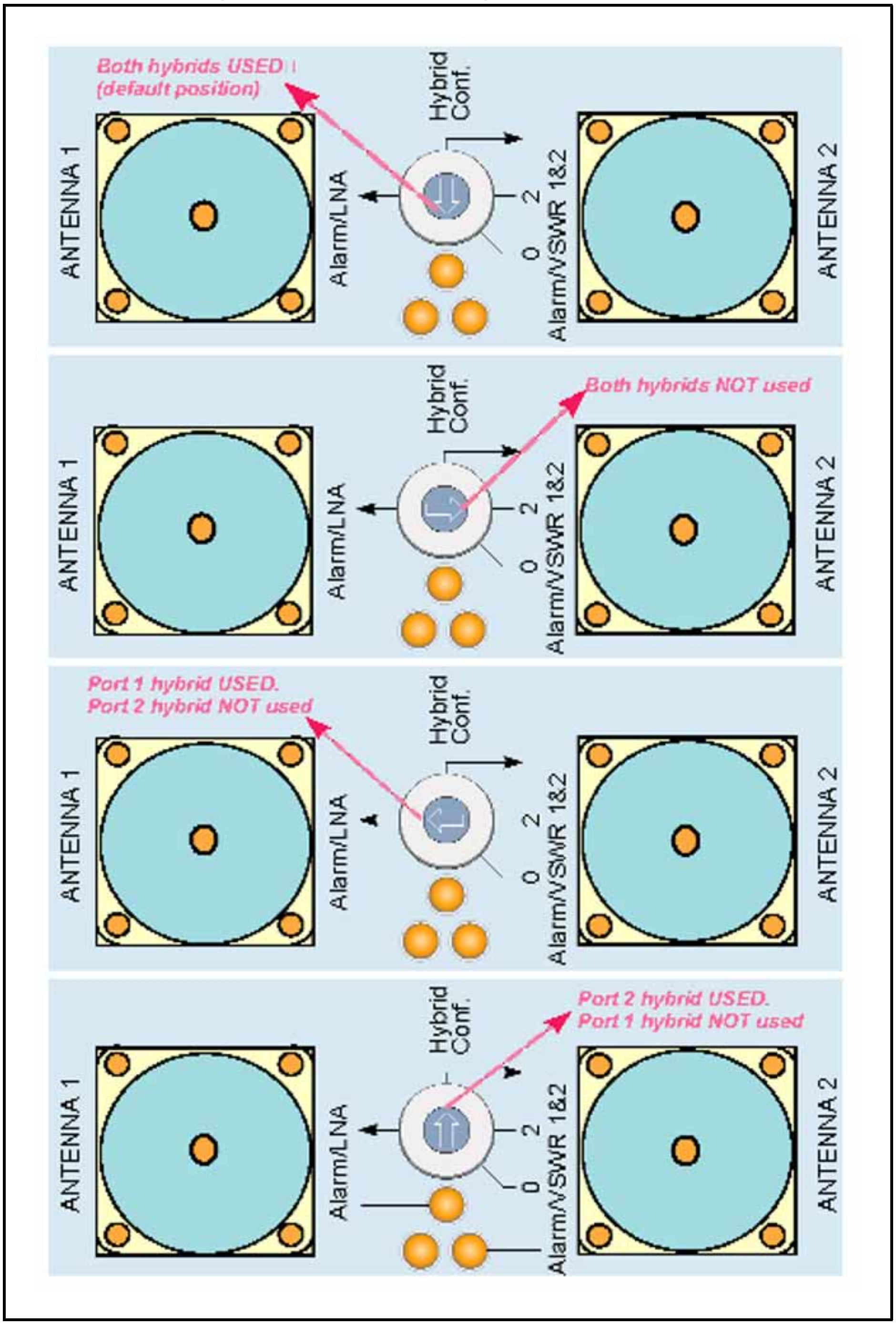
Arrow pointing towards	Meaning
0	DDM with both hybrids connected
Antenna 1 port	DDM with hybrid of port 1 disconnected and hybrid of port 2 connected
Antenna 2 port	DDM with hybrid of port 2 disconnected and hybrid of port 1 connected
2	DDM with no hybrid connected

The following table shows the hybrid configuration switch settings.

To set the value, use a screwdriver to rotate the switch until the arrow points to the desired switch position (indicated on the front panel).

There may be numbers in the ring surrounding the rotator switch (that is, in the ring that surrounds the arrow). These numbers are not significant to the interpretation of the switch and they are not shown in the figure. The meaning of the switch depends on the direction in which the arrow is pointing.

Figure 50
DDM hybrid configuration switch settings



4.8.7 Reaching an S666 configuration in one cabinet with DDMs

The BTS 18000 supports up to six RMs per cabinet.

The corresponding maximum configuration per cabinet (S666) can be reached with DDM_H2 couplers. However, if DDM couplers are used, the maximum configuration per cabinet is S555. To reach the S666 maximum configuration, three additional TX Filters are necessary in the cabinet.

4.9 Transmit Filter (TxF)

4.9.1 Main functions

The TxF is used, as a complement to the DDM, each time extra transmit capacity is required without need of receive capacity. It allows direct connection from the RM output to the antenna.

The TxF only filters the signal transmitted from the PA to the antenna and does not provide the reception path.

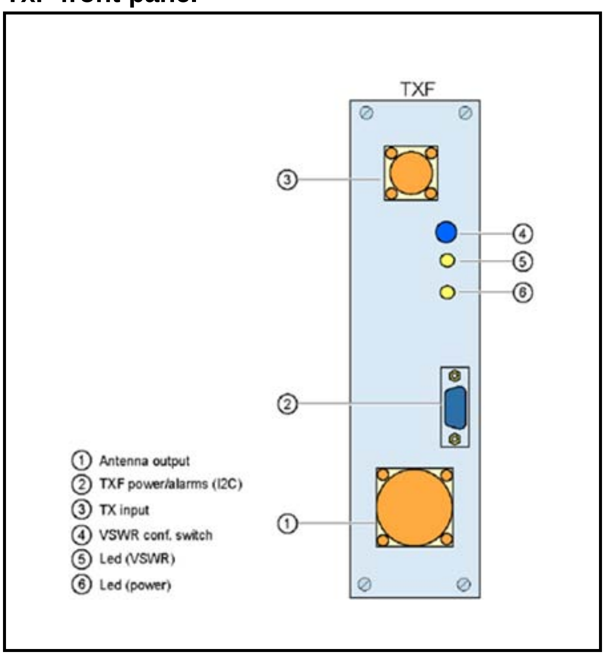
The TxF accommodates the same options as the DDM:

- H2 coupling
- VSWR meter

4.9.2 Front panel

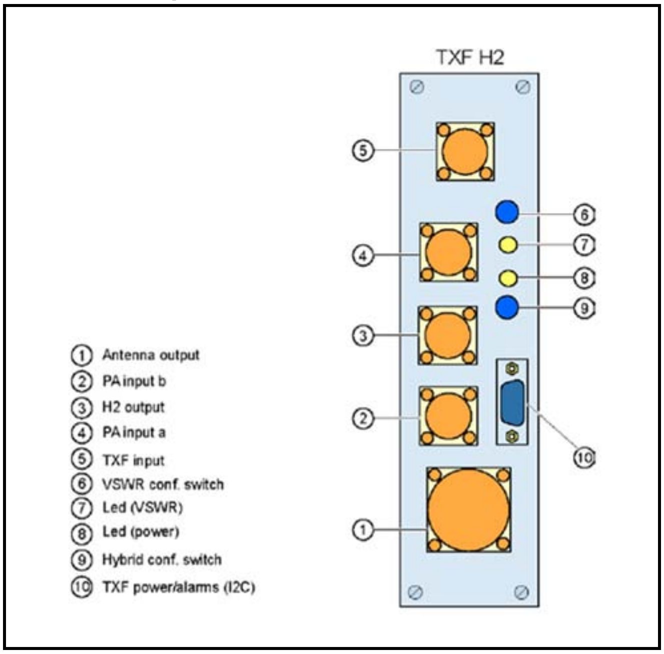
4.9.2.1 TxF

Figure 51
TxF front panel



4.9.2.2 TxF H2

Figure 52
TxF H2 front panel



4.9.3 Physical and electrical characteristics

Table 65
TxF / TxF H2 dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
TxF / TxF H2	190.7	49.7	400	< 5

Maximum number per cabinet: 18

Maximum power consumption:

- 0.6 W, on RF voltage (5 V). This power is supplied by the DDM.

Input voltage range:

- 4.7 V to 5.5 V

Associated breaker: digital breaker

4.9.4 Interface description

The TxF provides the following interfaces:

- radio interface:
  - antenna port: one 7/16 coaxial 50 ohms connector
  - TX input port: one QN type 50 ohms connector
- digital/power interface:
  - board presence detection
  - inventory I2C link to the ABM

4.9.5 TxF specific LEDs behavior

Two LEDs are located on the TxF font panel in order to monitor TxF alarm:

- One LED is dedicated to DC power status.
- One LED is dedicated to VSWR meter.

The following table describes the TxF specific LEDs behavior.

Table 66
TxF specific LEDs behavior

LED Name	Color	Meaning
Power	(green)	ON when TxF is powered on
VSWR	(red) (amber)	Red: VSWR alarm level 3 Amber: VSWR alarm level 2 OFF: no alarm or level 1

4.9.6 Configuration of the TxF switches for commissioning

Two switches are located on the TxF front panel. These switches must be positioned on site:

- The hybrid configuration two-position switch (only present on TxF H2) is used to inform the system about the use of the hybrid (by-passed or not).

  The following table gives the switch position meaning.

Table 67
TxF switches configuration

Hybrid configuration switch	Switch position
TxF with hybrid	0
TxF without hybrid	1

- The VSWR four-position switch allows, on site modification of the VSWR meter thresholds on both antenna ports. The three first positions (positions 0, 1, and 2) are used to offset VSWR thresholds of respectively 0, 2, or 4 dB.

  The fourth position (test position) checks that the two LEDs operate correctly.

The mechanism of setting these two switches is similar to that for the DDM. For the DDM, this mechanism is described in 4.8.6.1 “VSWR configuration switch” (page 165) and 4.8.6.2 “Hybrid configuration switch” (page 167).

4.9.7 Using additional TxFs to reach an S666 configuration in one cabinet with DDMs

The BTS 18000 supports up to six RMs per cabinet.

The maximum configuration per cabinet (S666) can be reached with DDM_H2 couplers.

To reach the S666 maximum configuration in one cabinet with DDMs, three additional TxFs are necessary. As the three DDMs of the cabinet leave six RICO alarm connectors unused, three of these free connectors can be used for the three additional TxFs needed to reach the S666 configuration.

Three additional TxFs

The three additional TxFs are known as TxF 18, TxF 19, and TxF 20.

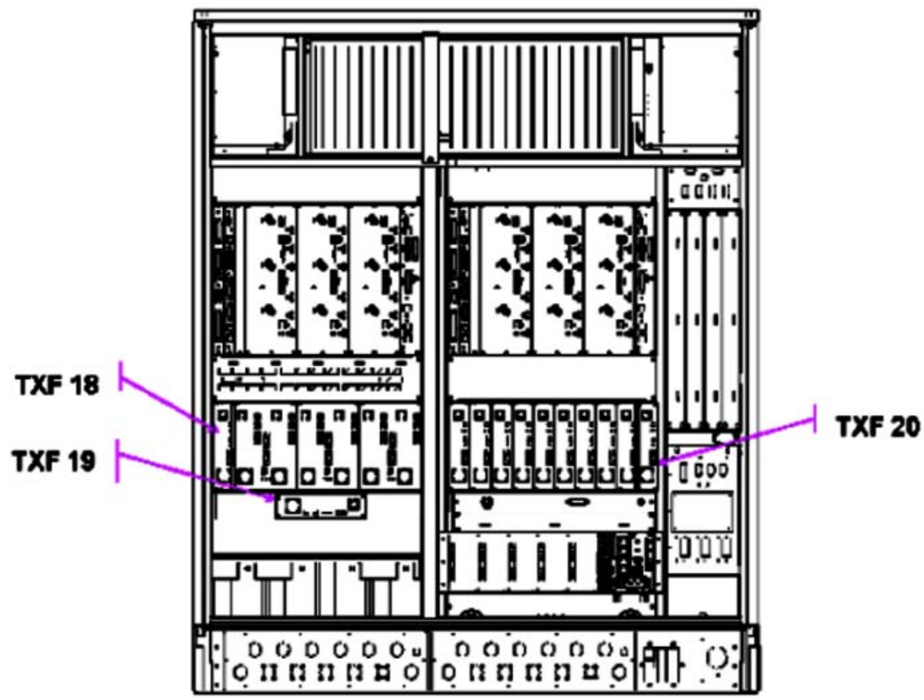
Their positions in the BTS 18020 cabinet are as follows:

- TxF 18 is plugged in the available slot to the left of the coupler rack of the even shelf.
- TxF 19 is plugged in the ALPRO slot under the coupler rack of the even shelf.
- TxF 20 is plugged in the available slot to the right of the coupler rack of the odd shelf.

Positions of the additional TxFs

The positions of these TxFs are shown in the following figure.

Figure 53
Positions of the additional TxFs in the BTS 18020



4.10 H3 and H4 modules

4.10.1 Main functions

Note: The H3 module is not proposed for the BTS 18010 NG2.

A H3 or H4 module should be used each time medium and high capacity configurations are required with minimized antenna count.

The H3 module combines up to three carriers coming from RM outputs.

The H4 module combines up to four carriers coming from RM outputs.

As no filtering is integrated, the H3 or H4 module is always associated with a DDM or TxF. Then, H3/H4 single output is connected to the DDM or TxF input through dedicated RF cables on the front panel.

DDM, TxF, DDM H2 or TxF H2 can be used but integrated H2 shall be by-passed.

The VSWR and Hybrid configuration switches (that may be present on a DDM or TxF module) are not present on an H3 or H4 module.

An H3/H4 module is dedicated to only one frequency band.

For the H3, three versions are available:

- 900 MHz
- 1800 MHz
- 1900 MHz

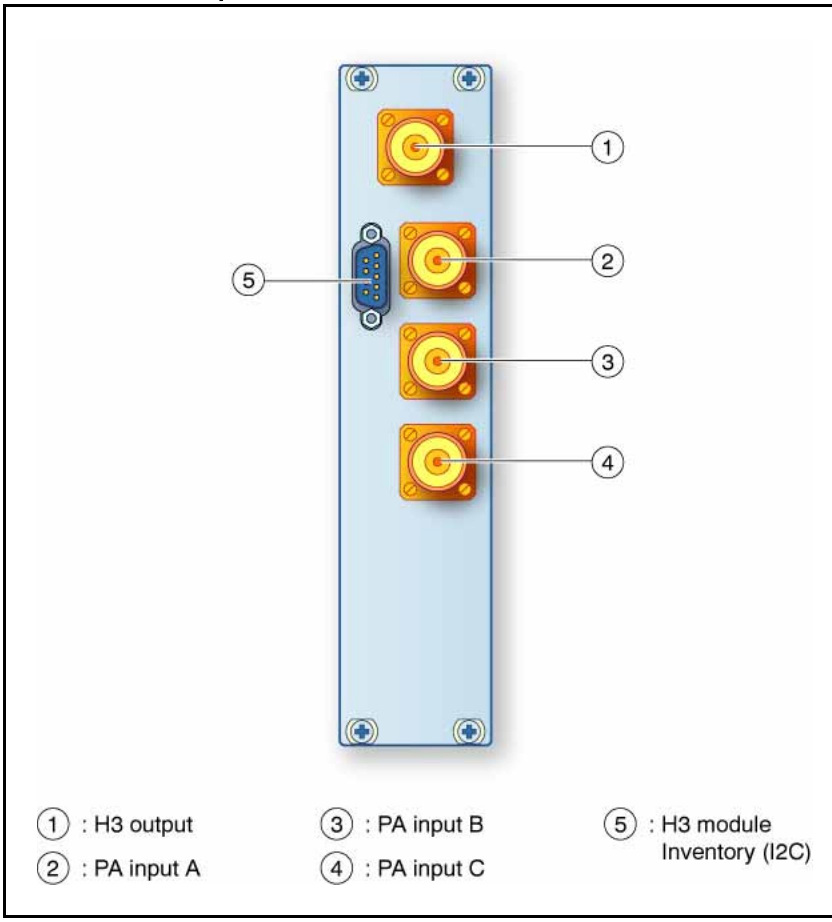
For the H4, three versions are available:

- 850 MHz
- 900 MHz
- 1800 MHz

4.10.2 Front panel

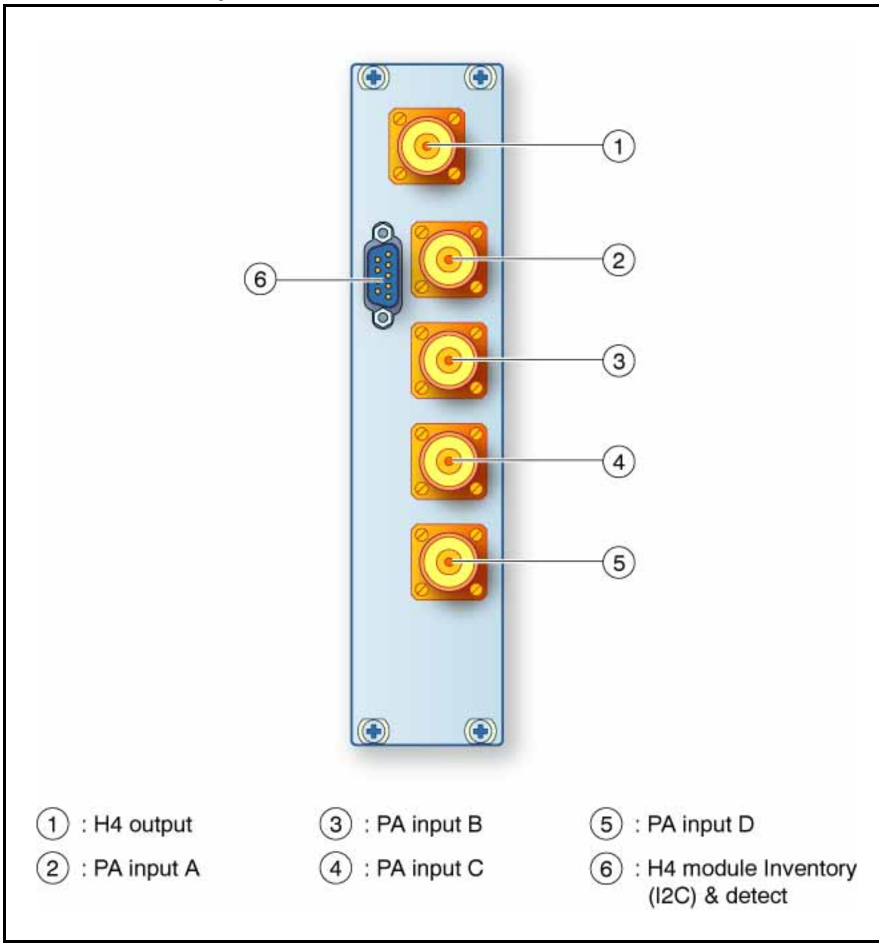
The following figure shows the H3 module front panel.

Figure 54
H3 module front panel



The following figure shows the H4 module front panel.

Figure 55
H4 module front panel



4.10.3 Physical and electrical characteristics

Table 68
H3/H4 module dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
H3 or H4	190.7	49.7	400	< 5

Maximum number per cabinet: 18

Maximum power consumption:

- 0.4 W, on RF voltage (3.3 V). This power is supplied by the DDM.

Input voltage range: 3.3 V

- Associated breaker: digital breaker

4.10.4 Interface description

The H3/H4 module provides the following interfaces:

- radio interface:
  - H3/H4 output port: one QN type 50 ohms connector
  - PA input ports: four QN type 50 ohms connectors
- digital/power interface:
  - board presence detection
  - inventory I2C link to the ABM

4.10.5 H3/H4 module specific LEDs behavior

There are no LEDs on H3 or H4 modules (as only passive elements are used, no alarm is provided).

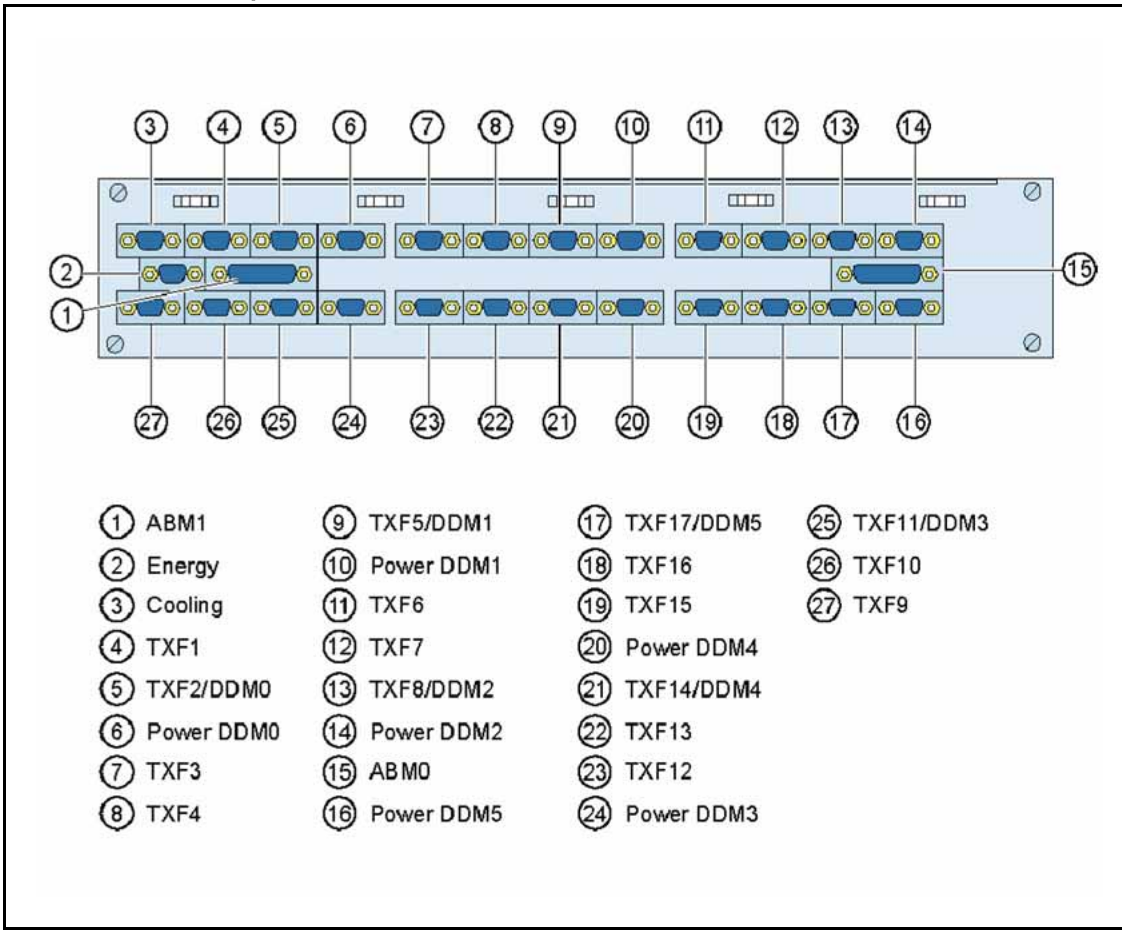
4.11 Radio InterCOnnect module (RICO)

4.11.1 Main functions

The RICO provides the electrical interfaces that support DC power distribution and communication between all radio coupling modules and ABM, using front panel cables.

4.11.2 Front panel

Figure 56
RICO module front panel



4.11.3 Physical and electrical characteristics

Table 69
RICO dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
RICO	70	500	35	0.8

Maximum number per cabinet: one

Associated breaker:

- Digital breaker (BTS 18010, BTS 18010 NG2)
- CB3 digital/RICO/user breaker (BTS 18020, BTS 18020 NG)

Power consumption: N/A

There is no LED on RICO.

4.11.4 Interface description

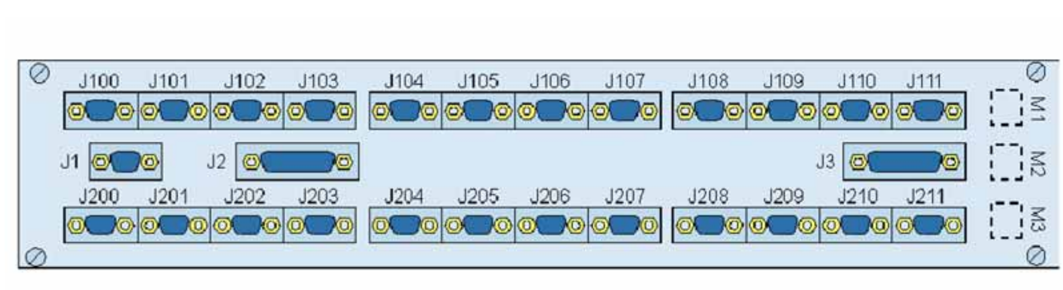
The RICO interfaces with the following modules using multiple digital and power connectors:

- up to two ABMs
- up to six DDMs/18 TxFs
- one cooling system (BTS 18010 SICS or SICS-S, BTS 18010 NG2 SICS-S, BTS 18020 ECU, or BTS 18020 NG ECS)
- one energy system (BTS 18020 UCPS CCU or BTS 18020 NG ngUCPS CCU)

4.11.4.1 Connectors

The following figure shows the location of the connectors on the RICO module. They are front panel connectors, except for M1, M2, and M3, which are back panel connectors.

Figure 57
RICO connectors location



The following table indicates the type and the use of all the connectors.

Table 70
RICO connectors type and use

DDM-RICO power connectors	Use	Type
J103	DDM power connection - PWR0	SUBD 9 pins female
J107	DDM power connection - PWR1	
J111	DDM power connection - PWR2	
J203	DDM power connection - PWR3	
J207	DDM power connection - PWR4	
J211	DDM power connection - PWR5	
Inventory connectors towards the RF couplers	**Use**	**Type**
J103	Inventory connection through inventory/alarms I2C link - COOLING	SUBD HD 15 pins female
J101	Inventory connection through inventory/alarms I2C link - TXF1	
J102	Inventory connection through inventory/alarms I2C link - TXF2/DDM0	
J104	Inventory connection through inventory/alarms I2C link - TXF3	
J105	Inventory connection through inventory/alarms I2C link - TXF4	
J106	Inventory connection through inventory/alarms I2C link - TXF5/DDM1	
J108	Inventory connection through inventory/alarms I2C link - TXF6	
J109	Inventory connection through inventory/alarms I2C link - TXF7	
J110	Inventory connection through inventory/alarms I2C link - TXF8/DDM2	
J200	Inventory connection through inventory/alarms I2C link - TXF9	
J201	Inventory connection through inventory/alarms I2C link - TXF10	
J202	Inventory connection through inventory/alarms I2C link - TXF11/DDM3	
J204	Inventory connection through inventory/alarms I2C link - TXF12	
J205	Inventory connection through inventory/alarms I2C link - TXF13	

Table 70
RICO connectors type and use (cont'd.)

DDM-RICO power connectors	**Use**	**Type**
J206	Inventory connection through inventory/alarms I2C link - TXF14/DDM4	
J208	Inventory connection through inventory/alarms I2C link - TXF15	
J209	Inventory connection through inventory/alarms I2C link - TXF16	
J210	Inventory connection through inventory/alarms I2C link - TXF17/DDM5	
Inventory connector towards the cabinet modules	**Use**	**Type**
J1	Inventory connection - ENERGY	SUBD HD 15 pins female
ABM-RICO connectors	**Use**	**Type**
J2	ABM connection - ABM1	SCSI 50 pins female
J3	ABM connection - ABM-0	
Power connectors (back panel)	**Use**	**Type**
M2	Ground connection - GND	
M1	Power supply - PWR + (V)	2x5 pins array Litton ground pad
M3	Power supply - PWR - (V)	

4.11.4.2 Digital signals

The modules are interconnected through the RICO using low speed signals. They include the following:

- nine presence detection signals from the even combiners and cooling system to the even ABM connector and nine other ones from the odd combiners to the odd ABM connector

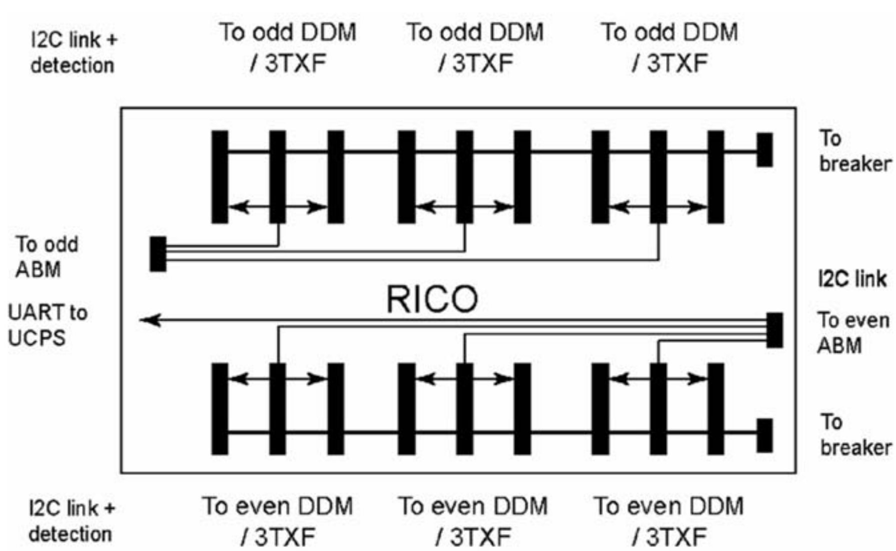
  Additional three presence detection from other cabinet modules (BTS 18020 UCPS, BTS 18020 ngUCPS) are routed.
- pseudo I2C bus (over RS422) from the even ABM connector to the three groups of even DDM/3TxF (one bus per group, the left end one also connects to the cooling system), plus local address signals to the DDM/3TxF connectors
- pseudo I2C bus (over RS422) from the odd ABM connector to the three groups of odd DDM/3TxF (one bus per group), plus local address signals to the DDM/3TxF connectors UART link (over RS422) from the

even ABM connector to the UCPS connector (only used in BTS 18020 and BTS 18020 NG cabinets)

- additional signal indicating "even position" to the even ABM connector and "odd position" to the odd ABM one

The following figure illustrates the RICO interconnection architecture.

Figure 58
RICO interconnection architecture



4.11.4.3 Power signals

Power signals include the following:

- A three-wire DC power bus carries the -48 V DC power and ground from the DC Breaker to all the DDMs. The signals are dimensioned for a 1.5 A current per DDM, and fulfill isolation rules.
- Specific signals, across the various DDM/3TxF connectors, provide the connection between the TxFs and the DDM present in the rack (all configurations need a DDM). These TxFs are remotely powered by the DDM (the DDMs have their own PUPS but not the TxFs).

  The signals are dimensioned for a 2 A current.

4.11.5 RICO connections for TxFs 18, 19 and 20

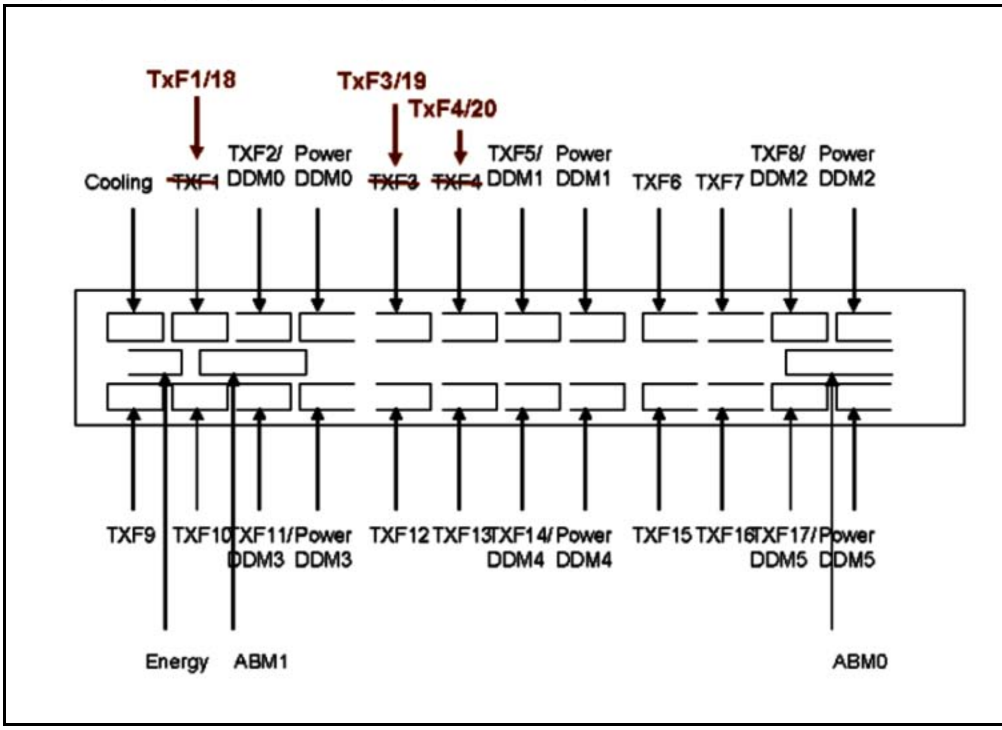
To reach the S666 maximum configuration in one cabinet with DDMs, three additional TxFs (TxF 18, TxF 19, and TXF 20) are necessary.

These TxFs are connected to the RICO board alarm as follows:

- TxF 18 is connected to the TxF1 connector, now called TxF1/18,
- TxF 19 is connected to the TxF3 connector, now called TxF3/19,
- TxF 20 is connected to the TxF4 connector, now called TxF4/20.

These connections are shown in the following figure.

Figure 59
RICO connections of the three additional TxFs



4.12 Cooling System (SICS) of the BTS 18010, Cooling System (SICS-S) of the BTS 18010 and BTS 18010 NG2

The BTS 18010 cabinet design integrates the Indoor Cooling System SICS or SICS-S.

The BTS 18010 NG2 cabinet design integrates by default the Indoor Cooling System SICS-S but it can also support the SICS.

This system is installed at the bottom of the cabinet, and accessed through an access lift off panel.

4.12.1 Main functions

The SICS/SICS-S provides a vertical upwards air flow that permits forced convection cooling of the electronic equipment housed within the BTS 18010 and BTS 18010 NG2 cabled cabinets.

A Printed Circuit Board (PCB) controls the cooling functions of the SICS-S. This control PCB senses the internal cabinet air temperature and the external ambient air temperature, and automatically selects the appropriate airflow over a continuous range to maintain full operational performance of the electronic equipment installed within the BTS 18010 and BTS 18010 NG2 cabinets.

If a fan fault condition is detected by the SICS-S control PCBA, the blower speed selection will be (S4). Under this condition the SICS-S filter clog alarm will be inhibited. Once the blower operation has been restored, the clogged filter alarm will no longer be inhibited.

The capacity switch on the SICS-S allows the user to select from two different Temperature/speed curves according to the radio configuration of the cabinet (S666 or S333) (High or Low capacity).

4.12.1.1 SICS components

The SICS is composed of the following parts:

- two speed controllable blowers
- air inlet clog switch
- temperature control sensor
- cable harness
- printed circuit assemblies for control functions, alarm LEDs and power supply. Local PUPS from wide input range 48 V power supply
- inventory EEPROM and alarm collection through a pseudo I2C over RS422 interface.

In addition, for the combo GSM-UMTS version, inventory and alarm detection are duplicated for reporting to the UMTS system through cGPSAM (Dallas one-wire bus).

The SICS inventory and alarms are polled

- by the even ABM, for GSM
- by the cGPSAM, for UMTS

The alarms generated by the SICS for the ABM are:

- blowers
- blocked air inlet
- control board operation

4.12.1.2 SICS-S components

The SICS-S is composed of the following parts:

- two speed controllable fans
- air inlet clog switch
- temperature control sensor
- cable harness
- printed circuit assemblies for control functions, alarm LEDs and power supply. Local PUPS from wide input range 48 V power supply
- inventory EEPROM and alarm collection through a pseudo I2C over RS422 interface.

  In addition, for the combo GSM-UMTS version, inventory and alarm detection are duplicated for reporting to the UMTS system through cGPSAM (Dallas one-wire bus).

The SICS-S inventory and alarms are polled:

- by the even ABM, for GSM
- by the cGPSAM, for UMTS

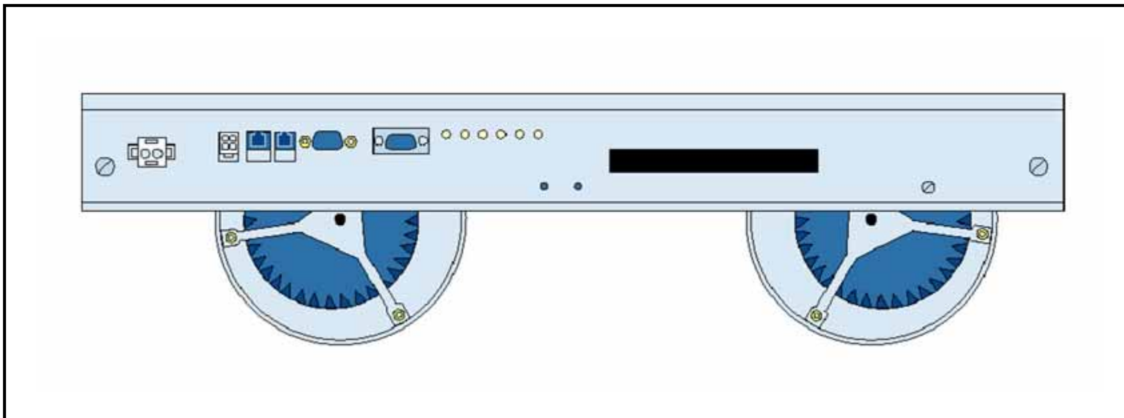
The alarms generated by the SICS-S for the ABM are:

- fans
- blocked air inlet
- control board operation

4.12.2 SICS rack front view

The following figure shows a front view of the SICS rack.

Figure 60
SICS rack front view



4.12.3 SICS-S rack front view

The following figures show a front view of the SICS-S rack and two views of the fans.

Figure 61
SICS-S rack front view redesigned

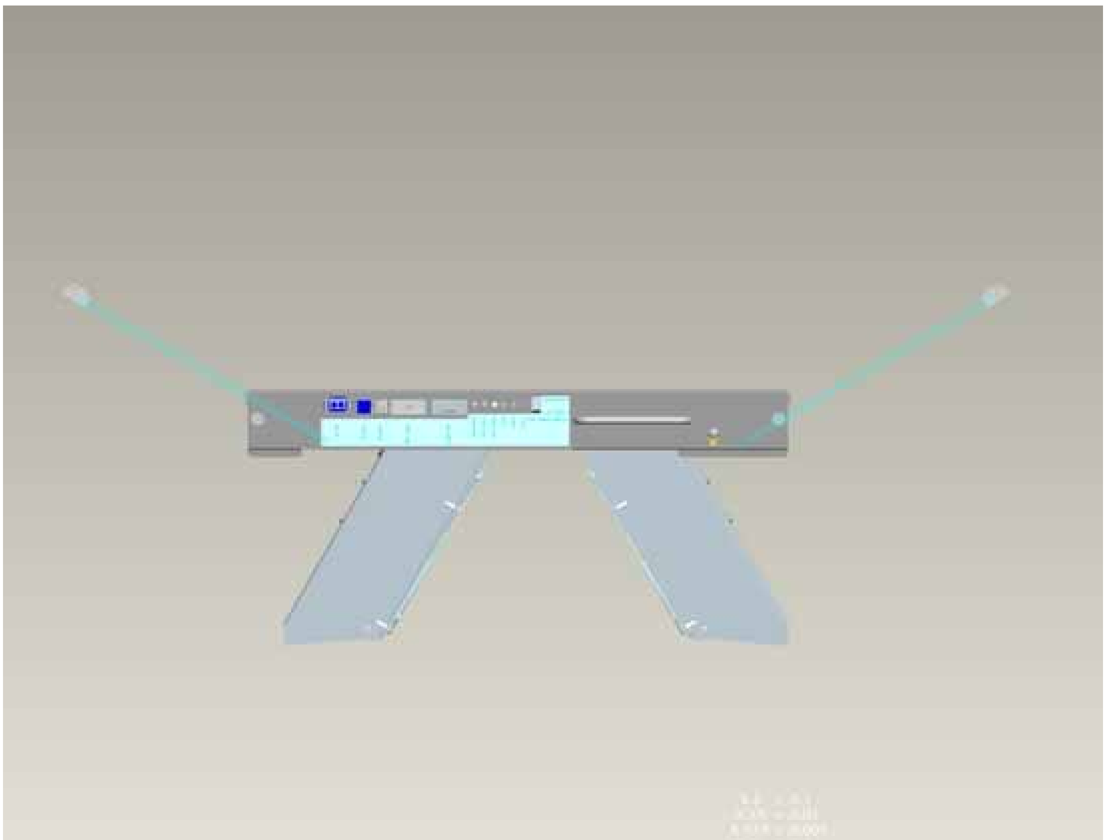
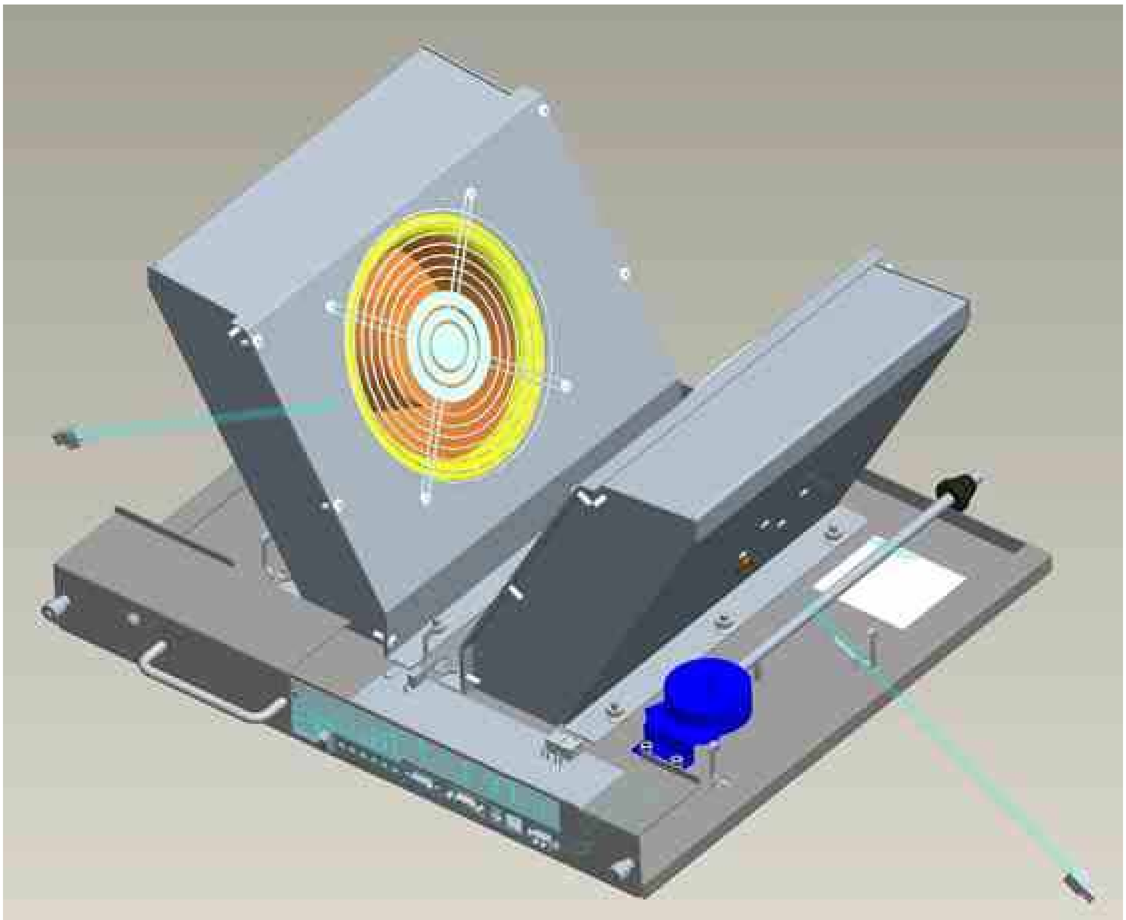


Figure 62
SICS-S fans angle view redesigned



4.12.4 Physical and electrical characteristics

Table 71
SICS dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
SICS	268	533	466	15

Maximum power consumption: 280 W

Associated breaker: breaker SICS

4.12.5 Interface description

The power connector provides a 48 V wide input range floating supply (280 W maximum).

The digital connectors provide:

- module presence detection
- pseudo I2C over RS422 link (for inventory and alarm detection (GSM))
- Dallas one-wire link (for inventory and alarm detection (UMTS))
- associated power distribution

Those digital connectors, located on the left side of the unit, have the following types: SUBD 15 pins male and SUBD 9 pins male.

4.12.6 Alarm LEDs behavior

The control PCB is fitted with five failure LEDs for on-site maintenance. All LEDs are green illuminated in normal operation and red illuminated on indication of a failure as shown in the following table.

Table 72
SICS alarm LEDs behavior

LED	Color	Meaning
0 - Blower 1	● (green) ● (red)	normal operation abnormal operation
1 - Blower 2	● (green) ● (red)	normal operation abnormal operation

Table 72
SICS alarm LEDs behavior (cont'd.)

LED	Color	Meaning
2 - Filter		normal operation abnormal operation
3 - Control PCB		normal operation abnormal operation
4 - Power supply		normal operation abnormal operation

4.13 Environmental Control Unit (ECU) of the BTS 18020

The BTS 18020 cabinet design integrates the Environmental Control Unit (ECU). This unit is installed at the top of the cabinet, and accessed through the front-hinged access doors.

4.13.1 Main functions

A damper is used to control the internal air temperature of the BTS 18020 cabinet. When fully closed, the damper excludes outside air and air is circulated within the cabinet. When the damper is fully open, there is no recirculation within the cabinet. The ECU operates by drawing in ambient air that is then routed through the electronic equipment installed in the cabinet and ejected through outlet ducts located on the sides of the ECU.

At intermediate positions, the damper is automatically adjusted to give a mix of recirculated and external air in order to achieve a nominal internal operating temperature.

For low external ambient air temperatures, the internal cabinet air temperature is maintained above +5°C by the operation of the primary and/or secondary heater circuits.

The ECU can operate in the following modes:

Two sets of speeds (5 V or 8 V and 8 V or 10 V) are available. The selection between the two sets of speed is performed by means of a switch (on the) depending on the radio configuration, respectively S333 or S666.

The ECU senses the external ambient temperature and automatically selects slow (5 V or 8 V) or high (8 V or 10 V) blower speed.

Slow speed operation of the blowers will be selected if the ambient external air temperature is below 40°C (measured on the external sensor behind the Filter) and no fault condition .

High speed operation of the blowers will be selected if the ambient external air temperature is above 40°C (measured on the external sensor behind the Filter) and no fault condition is . Under this condition the filter clog alarm will be inhibited, it will automatically reset once the slow blower speed has been reselected .

Full speed operation of the blowers (10 V) will be selected if one of the following conditions occurs:

- single blower failure
- ambient external sensor failure

Under this condition the filter clog alarm will be inhibited. It will automatically reset to 5 V when the fault is removed.

4.13.2 ECU components

The ECU is composed of the following parts:

- two speed controllable dual inlet centrifugal brush less DC blowers
- air directing damper
- modulating DC motor
- air inlet clog switch
- two temperature control sensors
- two heaters (primary and secondary), AC powered
- two heater thermostats (primary and secondary)
- cable harness
- rectification and power distribution, alarm LEDs
- air filter

The ECU inventory and alarms are polled:

- by the even ABM, for GSM
- by the cGPSAM, for UMTS

If the cabinet temperature measurement provides an out of range [0-70°C] value, a CEATS alarm is sent to the UCPS in order to stop operation of all radio and digital modules.

The other alarms generated by the ECU for the ABM are:

- blowers
- heaters
- damper motor
- blocked air inlet
- control board operation

4.13.3 Front views of the damper and ECU control board

Figure 63
Front view of the ECU damper

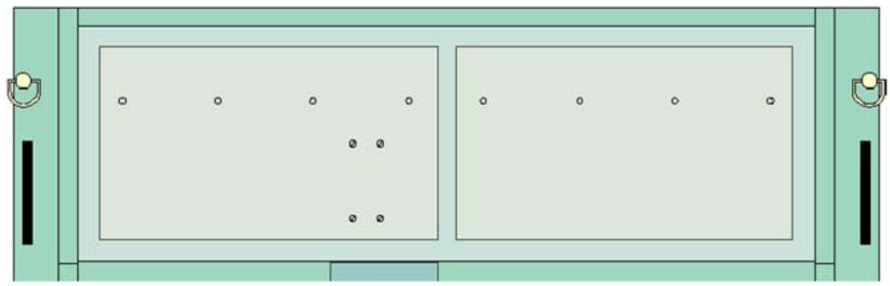
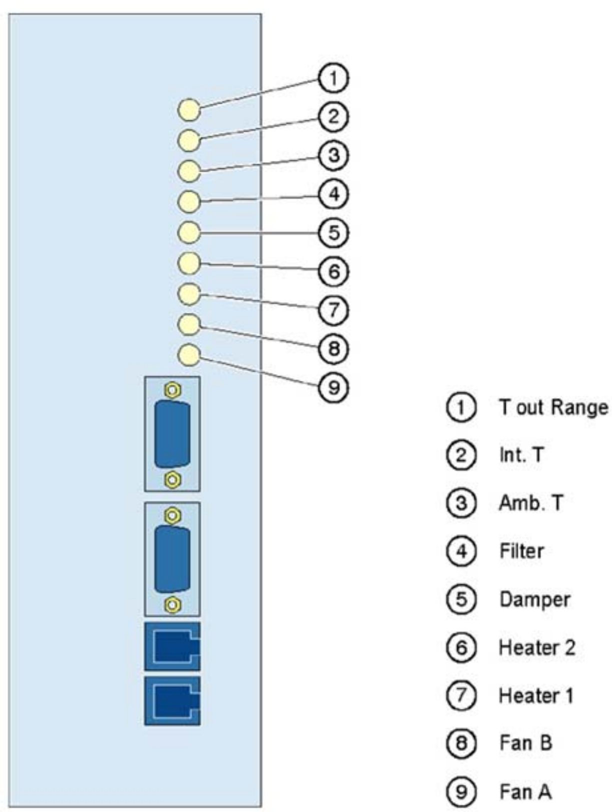


Figure 64
Front view of the ECU control board



4.13.4 Physical and electrical characteristics

Table 73
ECU components weight

ECU component	Weight (kg)
Blowers plate assembly	8.6
Front ECU	7
Air filter	2.5

Maximum DC power consumption: 360 W

ECU heaters maximum AC power consumption: 2800 W (ECU heaters are AC powered)

Associated breaker: CB4 ECU

4.13.5 Interface description

The power connector provides:

- AC input power supply for the heaters (2800 W maximum)
- 48 V DC floating supply (460 W maximum)

The digital connectors provide:

- module presence detection
- pseudo I2C over RS422 link (for inventory and alarm detection (GSM))
- Dallas one-wire link (for inventory and alarm detection (UMTS))
- associated power distribution

Those digital connectors, located on the , in the upper right compartment of the cabinet, have the following types: SUBD 15 pins male and SUBD nine pins male.

4.13.6 Alarm LEDs behavior

The is fitted with nine failure LEDs for on site maintenance. All LEDs are green illuminated in normal operation and red illuminated on indication of a failure as shown in the following table.

Table 74
ECU alarm LEDs behavior

LED	Color	Meaning
0 - Blower 1	🟢 🔴	normal operation abnormal operation
1 - Blower 2	🟢 🔴	normal operation abnormal operation
2 - Heater 1	🟢 🔴	normal operation abnormal operation
3 - Heater 2	🟢 🔴	normal operation abnormal operation
4 - Damper	🟢 🔴	normal operation abnormal operation
5 - Filter	🟢 🔴	normal operation abnormal operation
6 - Ambient thermistor	🟢 🔴	normal operation abnormal operation
7 - Internal thermistor	🟢 🔴	normal operation abnormal operation
8 - Internal temperature outside range	🟢 🔴	normal abnormal abnormal operation

4.13.7 Acoustic noise reduction kit option

There is an option to reduce the acoustic noise generated by the BTS 18020.

Depending on the operating conditions, this reduction can be one or more dBAs. This is achieved by fitting acoustic foam within the ECU area (at the top and back).

Associated with this option is an acoustic kit (PEC = NTT991TA, CPC = N0056388) which contains two sections of foam (one to be fitted vertically, the other to be fitted horizontally).

For customers who request this option, the BTS 18020 is shipped with the foam already fitted (at the factory).

4.13.8 Reducing the power consumption of the BTS 18020

There is an option to reduce the power consumed by the heating system of the BTS 18020.

Associated with this is a heater option kit (PEC = NTT991VA, CPC = N0060362) which contains the heater switch, the cables, and the label.

This is achieved by enabling the operator to deactivate one or both heaters. The operator choice is made using a three way switch located near the . Consequently, this option requires modified ECU hardware and firmware. If a heater is deactivated, the alarms associated with it are masked (that is, they are not displayed on the OMC-R) and its LEDs are not illuminated.

With this option, the operator can choose to activate:

- no heater
- one heater
- two heaters

Deactivating heaters reduces power consumption but increases the minimum start up temperature and may also increase the minimum operating temperature of the cabinet.

If only one heater is activated, the minimum startup temperature becomes -20°C and the minimum operating temperature remains -40°C.

If no heater is activated, the minimum startup temperature becomes +5°C and the minimum operating temperature becomes -10°C.

Without this option, two heaters are always activated.

4.14 Environmental Control System (ECS) of the BTS 18020 NG and BTS 18020 WW

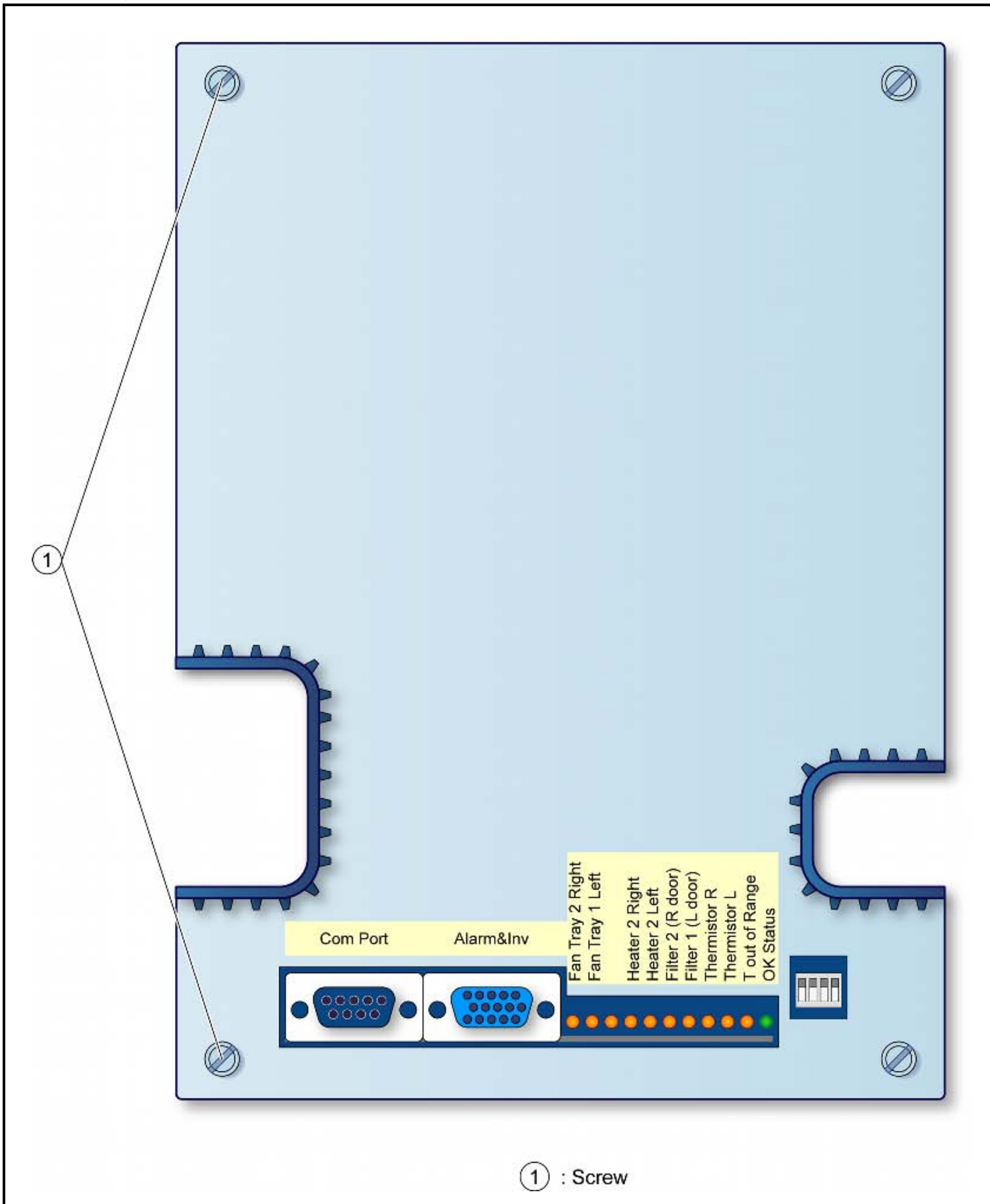
The ECS is proposed with a standard fan tray in BTS 18020 NG and CSC in BTS 18020 WW.

4.14.1 Standard cooling system components

The standard cooling system is composed of the following parts:

- a standard fan tray (including two fans)
- a filter clog detector
- an ECS control board, see Figure 65 "LED management of the ECS control board of the BTS 18020 NG" (page 200) that is a printed circuit assembly for control and alarm functions, and LED and defense management
- two air filters
- two thermistors

Figure 65
LED management of the ECS control board of the BTS 18020 NG



The ECS inventory and alarms are polled by the even ABM.

If the BTS temperature measurement provides an out of range [0-70°C] value (temperature out of range alarm), a CEATS alarm is sent to the ngUCPS to stop operation of all radio and digital modules.

In case of the BTS temperature increases:

- if the BTS temperature is lower than -5°C, the CEATS cable is "opened" so that all radio and digital modules are not powered
- if the BTS temperature is between -5°C and 70°C, the CEATS cable is "closed" so that all radio and digital modules are powered
- if the BTS temperature is greater than 70°C, the CEATS cable "opens" so that all radio and digital modules are not powered any more

In case of the BTS temperature decreases:

- if the BTS temperature is greater than 60°C, the CEATS cable is "opened" so that all radio and digital modules are not powered
- if the BTS temperature is between -10°C and 60°C, the CEATS cable is "closed" so that all radio and digital modules are powered
- if the BTS temperature is lower than -10°C, the CEATS cable is "opened" so that all radio and digital modules are not powered any more

The other alarms generated by the standard cooling system for the ABM are:

- fan trays
- blocked air inlet including two filters (right and left)
- thermistors

4.14.2 Main Functions

4.14.2.1 Standard fan tray

The standard fan tray works between -5°C and +50°C.

4.14.2.2 Fan speed

As soon as the BTS temperature is lower than 0°C, the slow speed operation of the fans will be selected.

When the BTS temperature is greater than 0°C and lower than 60°C, the speed operation of the fans varies almost linearly as a function of temperature

As soon as the BTS temperature is greater than 60°, the high speed operation of the fans will be selected.

Two failure cases can occur

- in case of a single fan failure in a fan tray, the high speed of the other fan of the same fan tray is automatically selected.
- in case of a thermistor (left or right) sensor failure, the high speed of all the fans is automatically selected.

Under this condition the filter clog alarm will be inhibited. It will automatically reset when the fault is removed.

4.14.3 Interface description

The power connector provides:

- AC input power supply for the two 950 W heaters (1900 W maximum)
- 48 V DC floating supply (460 W maximum)

The digital connectors provide:

- module presence detection
- pseudo I2C over RS422 link (for inventory and alarm detection)
- associated power distribution

The digital connectors, located on the control PCB box, in the upper right compartment of the cabinet, have the following types: SUBD HD 15 pins male and Terminal Block Pluggable.

4.14.4 Alarm LEDs behavior

The control PCB is fitted with nine failure LEDs for on-site maintenance. For more information, see Figure 65 "LED management of the ECS control board of the BTS 18020 NG" (page 200).

All the LEDs are green illuminated in normal operation and red illuminated to indicate a failure as shown in the following table.

Table 75
Alarm LEDs behavior

LED	Color	Meaning
Fan tray 2 Right	Red	LED OFF = normal operation LED ON = abnormal operation
Fan tray 1 Left	Red	LED OFF = normal operation LED ON = abnormal operation
LED not used		
Heater 2 Right	Red	LED OFF = normal operation LED ON = abnormal operation
Heater 1 Left	Red	LED OFF = normal operation LED ON = abnormal operation
Filter 2 (R door)	Red	LED OFF = normal operation LED ON = abnormal operation
Filter 1 (L door)	Red	LED OFF = normal operation LED ON = abnormal operation
Thermistor R	Red	LED OFF = normal operation LED ON = abnormal operation
Thermistor L	Red	LED OFF = normal operation LED ON = abnormal operation
T out of Range	Red	LED OFF = normal LED ON = abnormal operation
OK Status	Green	LED ON = normal operation LED OFF = abnormal operation

4.15 DC breakers panel

The DC distribution system of the BTS 18010 cabinet is designed with four separate output connections. Those connections are grouped on DC breakers panels.

The BTS 18010 cabinet includes four DC breakers (two per panel):

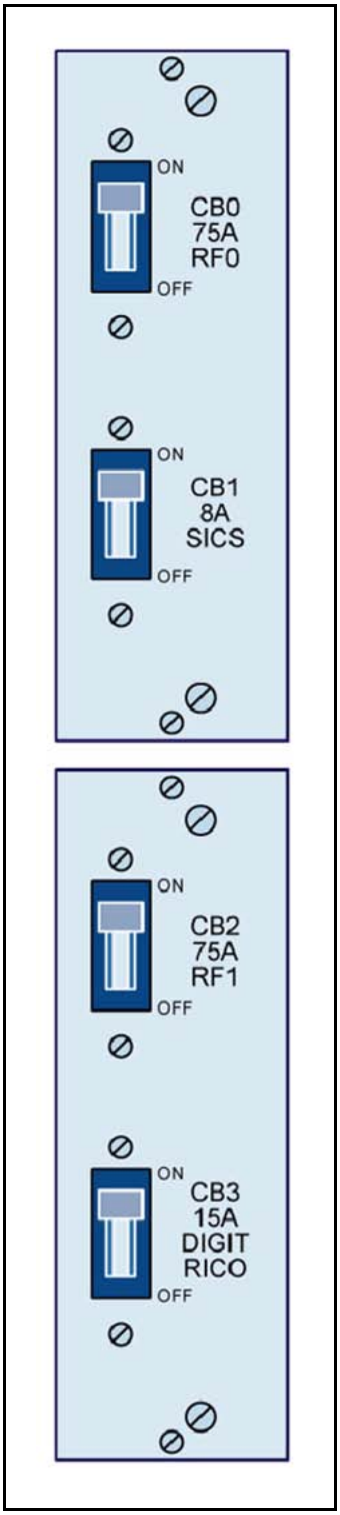
- CB RF0, for the first group of three RMs
- CB1, for SICS
- CB2 RF1, for the second group of three RMs
- CB3, for RICO/Digital modules/RF combiners

The values of overcorrect protection depend on the BTS 18010 cabinet variant for the -48 V variant:

- CB and CB2: 75 A rated
- CB3: 8 A rated
- CB1: 15 A rated

The following figure shows a front view of the DC breakers panels (-48 V variant).

Figure 66
BTS 18010 cabinet DC breakers (front view)



4.16 BTS 18020 Power System general overview

4.16.1 Univity Compact Power System (UCPS)

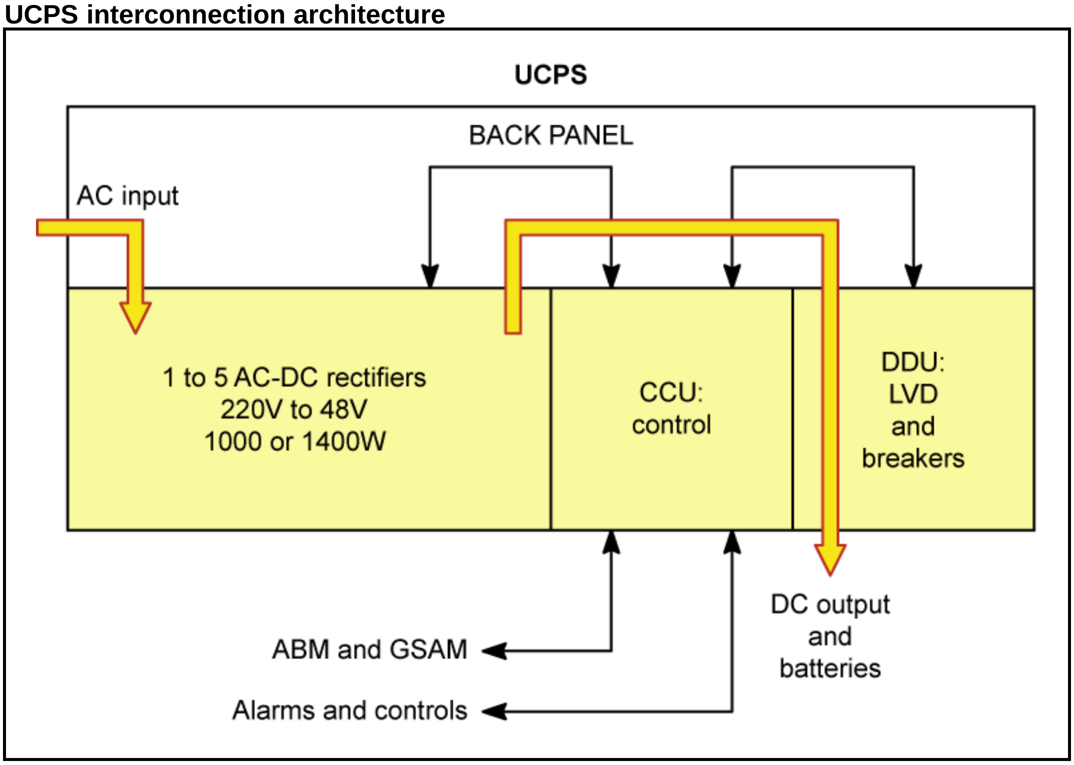
The UCPS is composed of four parts:

- the rectifiers
- the DDU
- the CCU (CDMA/GSM CCU or UMTS/GSM CCU)
- the shelf

The UCPS shelf is a passive back-plane shelf which provides the required interconnect for the rectifiers, CCU, and DDU. The UCPS shelf is a single version, common UCPS component.

The following figure shows the UCPS interconnection architecture.

Figure 67
UCPS interconnection architecture

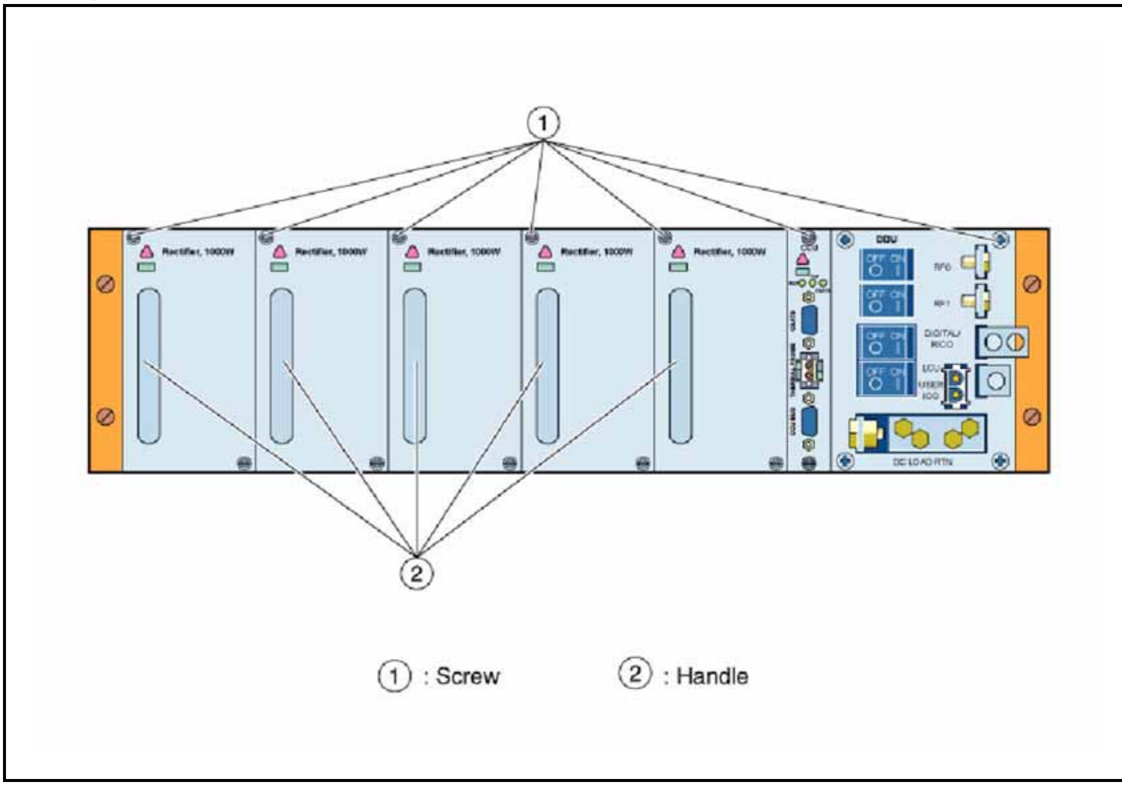


The UCPS is managed by the ABM, which can:

- get inventory information
- get alarm status

The following figure shows a global front view that allows to locate the UCPS components.

Figure 68
UCPS global front view



4.16.1.1 UCPS Rectifiers

Main functions The rectifier block is the AC to DC power conversion component of the UCPS. It interfaces with the DDU for DC output and the CCU for control.

Up to five rectifiers (4+1 for redundancy, 5+0 without redundancy) receive AC power directly through the passive shelf AC distribution.

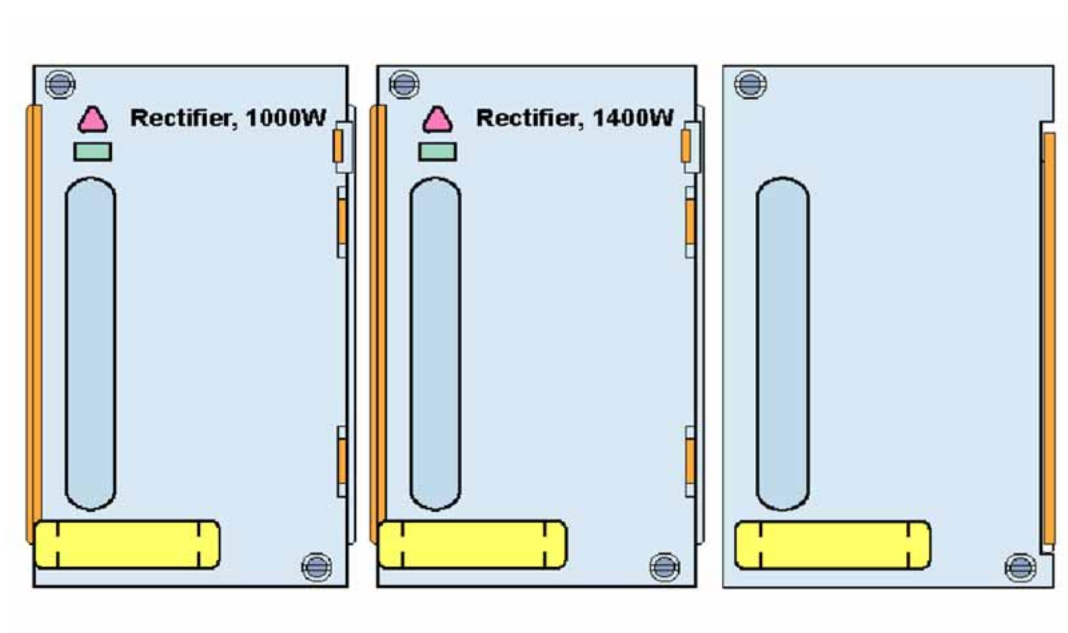
Two types of rectifiers can be provided, delivering either 1000 W or 1400 W at the 48 V DC output. 1400 W rectifiers provide the capability to handle faster battery charging for the highest capacity configurations.

The rectifiers have a large input voltage range with integrated power factor correctors. The output floating voltage automatically adjusts to the level of a control signal that is proportional to the battery temperature. Each rectifier has its own AC, DC and over-heating alarm signals.

Rectifiers' -48 V outputs are tied together to the DC Distribution Unit (DDU).

Front panel The following figure presents the front panels of UCPS rectifiers (1000 W and 1400 W) and their associated filler.

Figure 69
UCPS Rectifier (1000 W, 1400 W) front panels and filler



Physical characteristics

Table 76
Rectifier dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
Rectifier (1000 W)	133	69	359	2.9
Rectifier (1400 W)	133	69	359	3

Electrical characteristics

Maximum number per cabinet: five

Input voltage range: 230 V

Associated breakers: ADU AC breakers:

- CB1 for rectifiers 1 and 2
- CB2 for rectifiers 3 and 4
- CB3 for rectifier 5

Rectifiers corporate LEDs behavior The following table shows the UCPS rectifiers detailed status information.

Table 77
Rectifiers corporate LEDs behavior

Green LED	Red LED	Rectifiers status / condition
■	switched off	normal operation, no faults
flashing	switched off	serial communications fault
■	flashing	INH active
■	▲	display functionality test This condition will take precedence over all other display conditions.
switched off	▲	OT, DCUV (except when combined with INH assertion), DCOV, DCBIF, ACOV or ACUV alarm conditions This condition will take precedence over a serial communications fault condition. Indication from an ACUV alarm will be limited in duration.
switched off	switched off	- very low or no AC input- Rectifier critical fault

4.16.1.2 UCPS DC Distribution Unit (DDU)

Main functions The DDU performs:

- DC distribution and protection
- DC connection/disconnection under CCU control
- secure disconnection at 40 Vdc

  In case of CCU replacement, the operation does not stop live traffic. When the CCU is unplugged more than 5s +-0.5s, the voltage falls to 50 V +-0.8V but live traffic is still going on. However, if an AC network failure occurs during this operation, and if the battery voltage reaches 40 Vdc +-3%, the secured LVD allows the disconnection of all loads to prevent a deep battery discharge.
- voltage and current sense for CCU
- internal or external battery connection
- inventory

The BTS 18020 DDU is the same whatever the configurations (full GSM, combo GSM-UMTS).

Front panel The following figure presents the UCPS DDU front panel.

Figure 70
UCPS DDU front panel

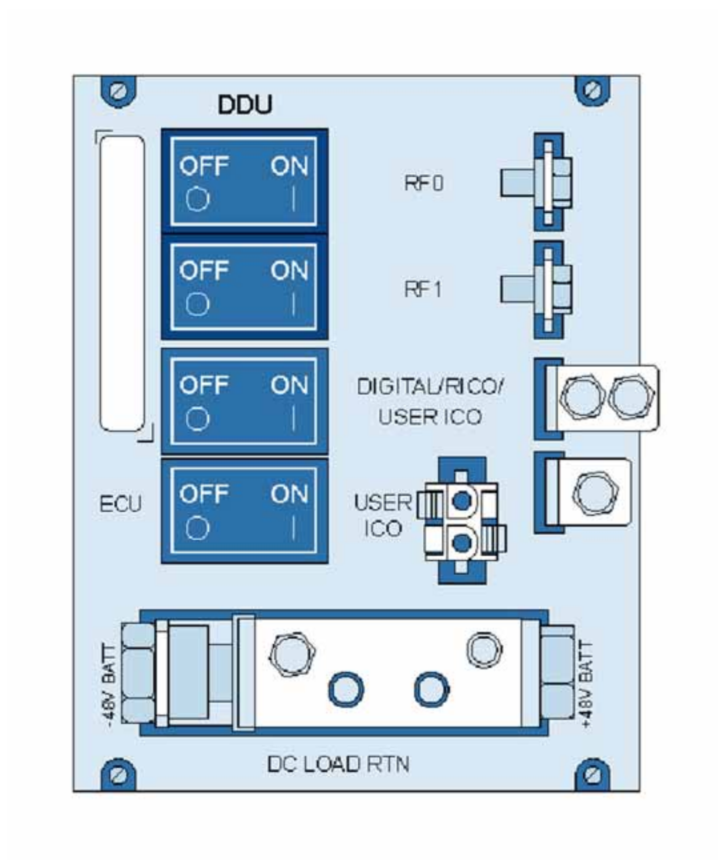


Table 78
DDU dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
DDU	133	108	359	5.5

Electrical characteristics

Maximum number per cabinet: one

DC rated voltage (normal continuous rated operation, full performance):

- minimum: -40.0 V
- nominal: -48.0 V
- maximum: -57.0 V

DC abnormal voltage (no damage or degradation):

- abnormal continuous, including full rated output load:
  - minimum: 0 V
  - maximum: -60 V
- abnormal continuous, no output load:
  - minimum: 0 V
  - maximum: +60 V

DC rated current (Input/Output):

- DC In: 167 A (minimum), 183 A (maximum)
- DC Out 1 and DC Out 2: 60 A (maximum)
- DC Out 3: 30 A (maximum)
- DC Out 4: 15 A (maximum)
- DC Battery In/Out: 167 A (minimum), 183 A (maximum)

DC output overcurrent protection breakers:

- CB1 RF0 and CB2 RF1: 60 A rated
- CB3 digital/RICO/user: 30 A rated
- CB4 ECU: 15 A rated

Associated battery breaker: 150 A

There is no LED on DDU.

Interface description The following table indicates the type and the use of the DDU connectors.

Table 79
DDU connectors type and use

DDU connectors	Use	Type
J1	DDU Control	FCI Metral 48 pins
J2	DC In Power	16 mm diam. threaded stud with nut and lock washer
J3		
J4	Loads	Bus bar
J5	Loads RTN	Bus bar

Table 79
DDU connectors type and use (cont'd.)

DDU connectors	Use	Type
J6	DC Battery In/Out Power (-48 V BATT and +48 V BATT)	Bus bar
J7		
J8	User ICO	Tyco Standard Mate-n-Lock socket cap

4.16.1.3 UCPS Cabinet Control Unit (CCU)

There are two possible versions of the CCU:

- the UCPS CDMA/GSM CCU for BTS 18010
- the UCPS UMTS/GSM CCU for BTS 18020

Main functions Whatever the version, CDMA/GSM CCU or UMTS/GSM CCU, the CCU performs the following main functions:

- rectifier module control through an I2C based digital communication interface for the purposes of module alarm monitoring, output current monitoring, inventory information gathering, and output voltage control
- system back-up battery management for basic features such as float voltage temperature compensation and charge current control
- rectifier output current sharing control for enhanced system performance and rectifier reliability
- system back-up battery temperature measurement
- system back-up battery current monitoring through a system resistive shunt
- communication with the BTS system controller:
  - for any CCU, through the even ABM, through an RS-422 interface for alarm reporting, configuration, monitoring and control
  - in case of UMTS/GSM CCU, through the cGPSAM, through a Dallas one-wire interface for inventory and alarm reporting
- system ambient temperature monitoring:
  - in case of CDMA/GSM CCU, through an on-board sensor
  - in case of UMTS/GSM CCU, through a dedicated input (CEATS from the cooling system)
  - local temperature measurement (CAT), used only for alarms
- BTS system equipment shutdown control for protection from extreme voltage (LVD thresholds at 44 and 42 Vdc) or temperature conditions

  The CCU shuts off of the system DC loads to prevent a deep discharge of the back-up batteries. In order to carry this out, the CCU manages two disconnection thresholds: LVD44 (-44 V +/-0.5%) and LVD42 (-42 V +/-0.5%).

  After an AC power network failure or when the AC circuit breaker is switched-off, the battery voltage decreases slowly until the LVD thresholds.

  - When the battery output voltage reaches LVD44 (-44 V +/-0.5%), the power system cuts off power supply to the boards in the cabinet that are connected to RMs ouputs (RF0 and RF1 loads): an alarm is generated.

— If the battery output voltage continues to decrease and reaches LVD42 (-42 V +/-0.5%), the power system cuts off power supply to the digital boards (IFM, ICM, ABM, RICAM), the ECU cooling system, the DDMs, and the USER ICO.

— If the rectifiers recover power supply, the batteries are charging. When voltage is equal to 50.6 +/-1%, the power system reconnects the cabinet boards with its four outputs.

- monitoring of general BTS (user alarm points are unused)
- communication with a flexible module (hardware support only) through a second RS-422 interface (only kept in spare)

In GSM-UMTS combo mode, the GSM keeps full control of the CCU. UMTS can only collect alarm and inventory.

Figure 71
CDMA/GSM CCU front panel

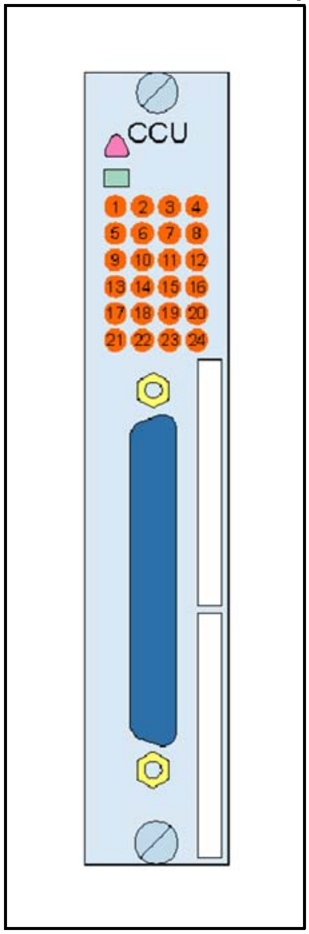
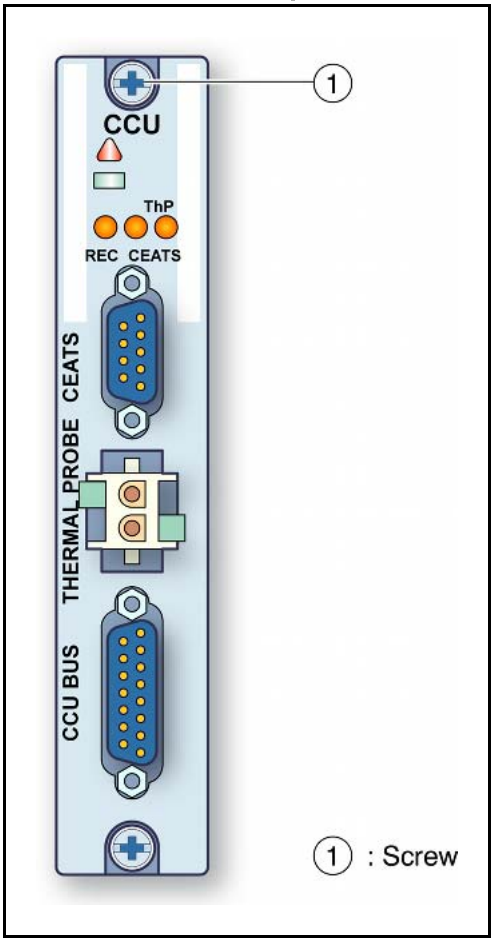


Figure 72
UMTS/GSM CCU front panel



Physical characteristics

Table 80
CCU (CDMA/GSM or UMTS/GSM) dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
CCU (CDMA/GSM or UMTS/GSM)	133	25	359	1.1

Electrical characteristics

Maximum number per cabinet: one

Input voltage range: 32 V to 60 V

Maximum DC power consumption: 10 W

There is no associated breaker.

CDMA/GSM CCU connectors The following table indicates the type and the use of the CDMA/GSM CCU connectors. J1 is a CCU front panel connector, J2 is located on the CCU back panel.

Table 81
CDMA/GSM CCU connectors type and use

CDMA/GSMCCU connectors	Use	Type
J1	Customer input alarms (ALV1 to ALV24), Battery thermistor, Battery thermal probes, Battery detect...	SUBD HD 62 pins female 30 µin min gold with 4-40 fixed screw locks
J2 (back panel)	Rectifiers presence detection, I2C enable control line to rectifiers, Battery current sense	FCI 48 pins Metral, pin 8B last-make-first-break

UMTS/GSM connectors The following table indicates the type and the use of the UMTS/GSM connectors. They are front panel connectors, except for J2, which is located on the back panel.

Table 82
UMTS/GSM connectors type and use

UMTS/GSM CCU connectors	Use	Type
J1	UART link, battery detect - CCU BUS	SUBD HD 26 pins female 30 µin min gold with 4-40 screw locks
J2 (back panel)	Rectifiers presence detection, I2C enable control line to rectifiers, Battery current sense	FCI 48 pins Metral, pin 8B last-make-first-break
J3	CEATS and one-wire connectivity - CEATS BUS ALARM	SUBD 9 pins female 30 µin min gold with 4-40 fixed screw locks
J4	Battery thermal probe - THERMAL PROBE	AMP universal Mate-n-lock pin header assembly

The default cabling of the BTS is for UMTS/GSM CCU. If CDMA/GSM CCU is used, an adaptation cable is supplied with the board.

CCU corporate LEDs behavior The following table gives CCU (CDMA/GSM or UMTS/GSM or GSM) detailed status information.

Table 83
CCU (CDMA/GSM or UMTS/GSM) corporate LEDs behavior

Green LED	Red LED	CCU status / condition
■	switched off	None of the following alarms asserted: CCU_FAULTISEnBTHMn, BAT_T_Hn, BAT_T_Ln, BAT_T_DIFLV, HVHT, LTBODBAT_BRK or LOAD_BRKRFAn
■	▲	No CCU_FAULT alarm asserted AND one or more of the following alarms asserted: ISEnBTHMn, BAT_T_Hn, BAT_T_Ln, BAT_T_DIFLV, HVHT, LTBODBAT_BRK or LOAD_BRKRFAn
		CCU initializing, indicator functionality test
switched off	flashing	CCU in LCOD command mode
switched off	▲	CCU_FAULT alarm asserted, CCU running in application code
		POST fault, CCU running in bootloader code
		LCOD command process fault, CCU running in bootloader code
switched off	switched off	Critical CCU fault or no input power

CDMA/GSM CCU specific LEDs behavior The customer alarm input status LEDs (1 through 24) are unused in the BTS 18020.

UMTS/GSM CCU specific LEDs behavior The UMTS/GSM CCU has three red specific LEDs: REC LED, ThP LED and CEATS LED. The following table gives UMTS/GSM CCU detailed status information.

Table 84
UMTS/GSM CCU specific LEDs behavior

REC	ThP	CEATS	UMTS/GSM CCU status / condition
●	off	off	Any of the PIO_DCFn or PIO_I2Cn alarms is asserted
off	●	off	Any battery thermal probe is missing or out of operating range (BAT_T_FAULT = 1)
off	off	●	CEATS connector is removed (CEATS_PRESENCE =0) or CEATS is out of range (CEATS_STATUS=0)

4.16.2 AC Distribution Unit (ADU)

The ADU is for the BTS 18020 cabinets.

4.16.2.1 Main functions

The ADU distributes the AC power towards:

- the UCPS shelf
- the ECU heaters
- an optional User AC plug (plug kit)

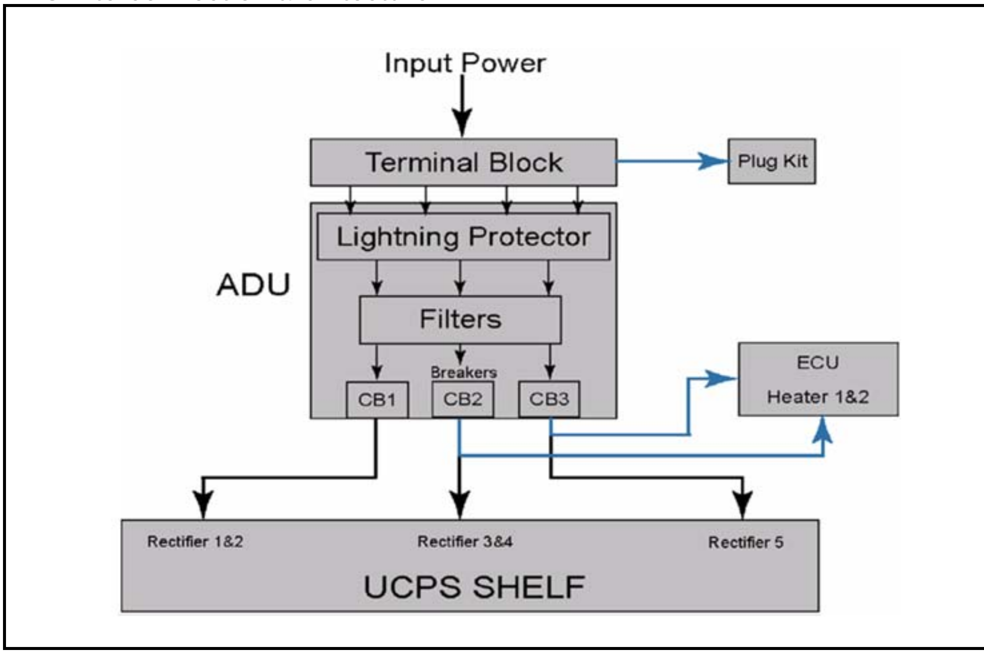
The ADU box implemented in the BTS 18020 includes an AC input terminal block, for adaptation to three different types of AC power networks (split, single and three phases).

ADU components The ADU is composed of the following parts:

- AC network configuration terminal block including optional user AC socket kit
- system level circuit breaker for rectifiers power on/off and overload protection
- circuit breaker for ECU power on/off and overload protection
- Electromagnetic Interference (EMI) filtering
- lightning protectors

The following figure illustrates the ADU interconnection architecture.

Figure 73
ADU interconnection architecture



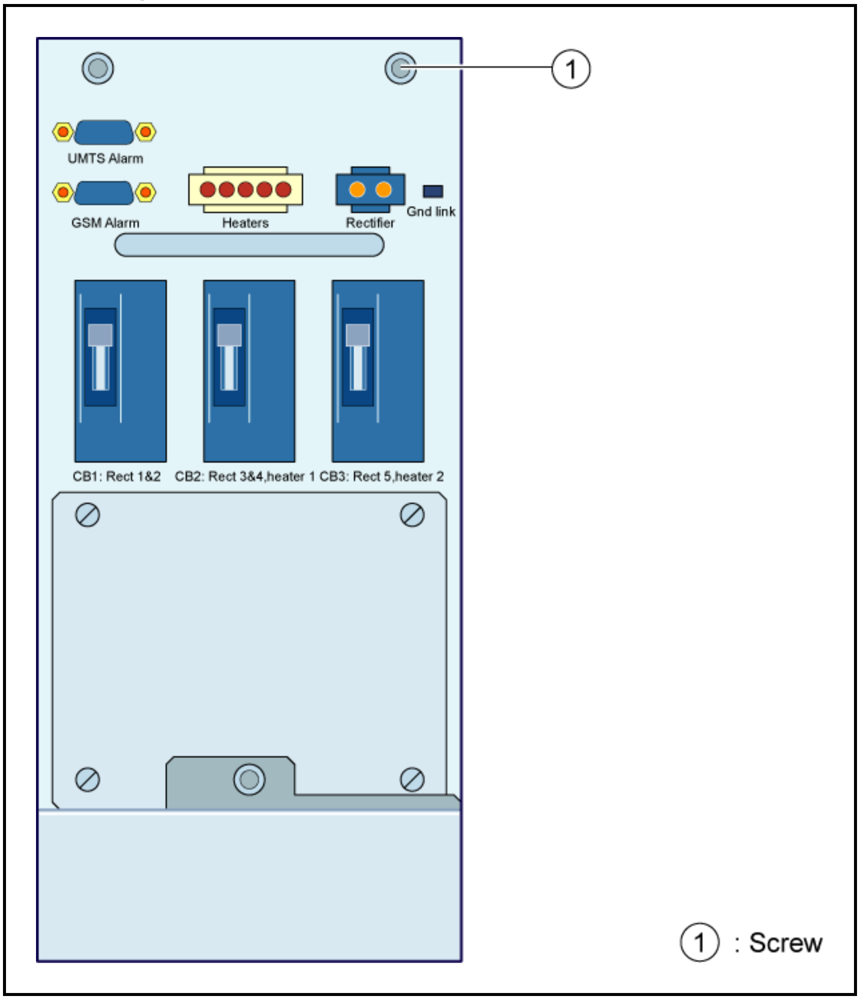
AC plug types The optional AC plug kit enables user devices to be plugged during the installation phase. A differential circuit breaker protects the service personnel against injury.

Four types of AC plug are available:

- European Single-Phase
- European Three-Phase
- North American Split-Phase
- European Split-Phase

4.16.2.2 Front panel

Figure 74
ADU front panel



4.16.2.3 Physical characteristics

Table 85
ADU dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
ADU	350.4	175.8	152.0	3.6

4.16.2.4 Electrical characteristics

Maximum number per cabinet: one

Maximum current drawn from the optional AC plug: 6 A

BTS 18020 AC source voltage range:

- Normal operation, full performance:
  - — minimum: 176 V
  - — nominal: 200-240 V
  - — maximum: 264 V
- Abnormal conditions (no damage):
  - — minimum: 0 V
  - — maximum: 300 V

4.16.2.5 Interface description

The ADU features surge suppression and provides an AC input cable, and a connector for the ECU and a connector for the UCPS rectifiers.

Alarms (surge protectors, breakers) are reported to the even ABM through DALI (GSM), and duplicated, on a Dallas one-wire link, to the cGPSAM (UMTS).

4.17 BTS 18020 NG/BTS 18020 WW Power System general overview

4.17.1 New generation Univity Compact Power System (ngUCPS)

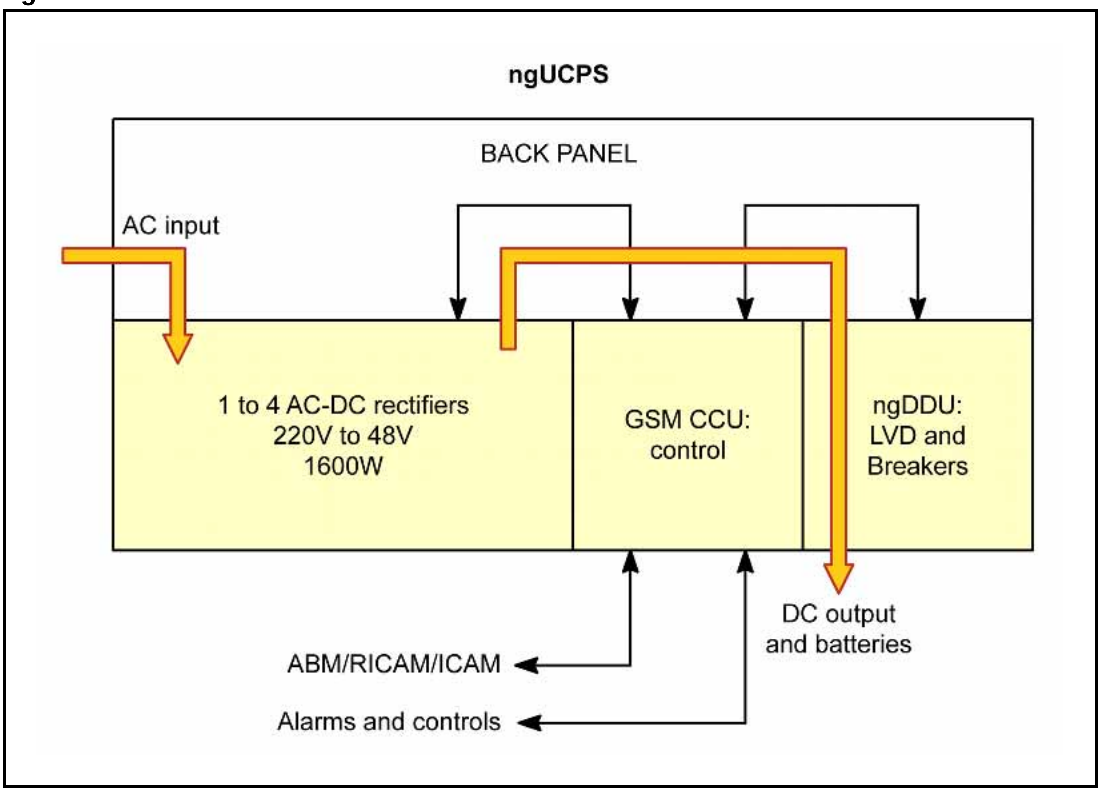
The ngUCPS is composed of three parts:

- the rectifiers
- the GSM CCU
- the shelf including the ngDDU

The ngUCPS shelf is a passive back-plane shelf that provides the required interconnect for the rectifiers, the GSM CCU, and the ngDDU. The ngUCPS shelf is a single version, common ngUCPS component.

The following figure shows the ngUCPS interconnection architecture:

Figure 75
ngUCPS interconnection architecture

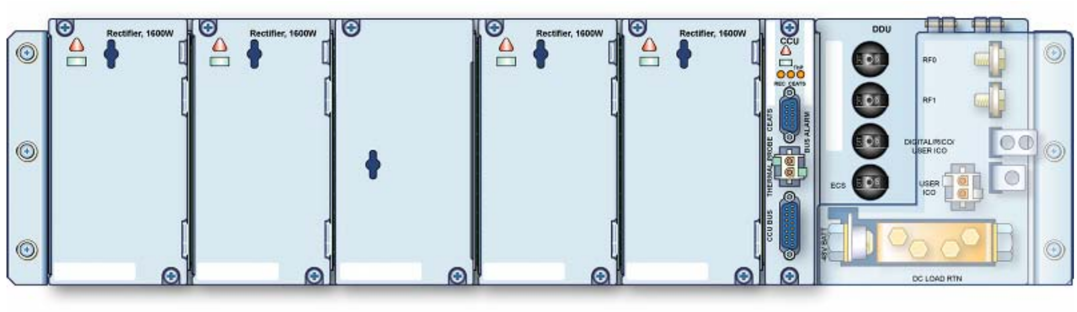


The ngUCPS is managed by the ABM, which can

- get inventory information
- get alarm status

The following figure shows a global front view of the ngUCPS components:

Figure 76
ngUCPS global front view



4.17.1.1 ngUCPS Rectifiers

Main functions The rectifier block is the AC to DC power conversion component of the ngUCPS. It interfaces with the ngDDU for DC output and the GSM CCU for control.

Up to four rectifiers (3+1 for redundancy, 4+0 without redundancy) receive AC power directly through the passive shelf AC distribution.

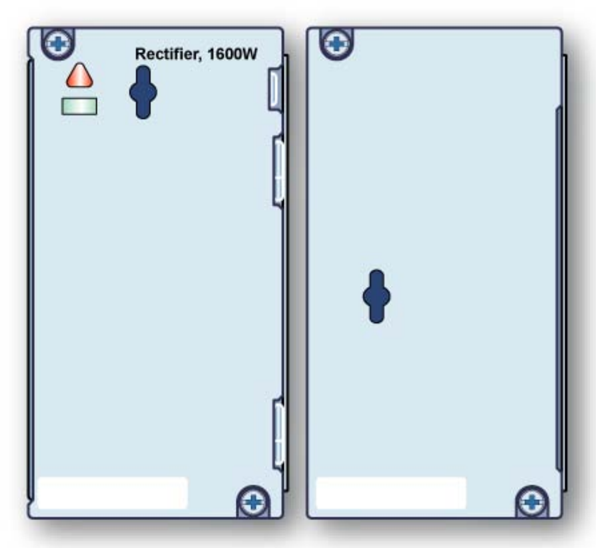
Only one type of rectifier can be provided, delivering 1600 W at the 48 V DC output. 1600 W rectifiers provide the capability to handle faster battery charging for the highest capacity configurations.

The rectifiers have a large input voltage range with integrated power factor correctors. The output floating voltage automatically adjusts to the level of a control signal that is proportional to the battery temperature. Each rectifier has its own AC, DC and over-heating alarm signals.

Rectifiers' -48 V outputs are tied together to the DC Distribution Unit (ngDDU).

Front panel The following figure presents the front panels of ngUCPS rectifiers (1600 W) and its associated filler.

Figure 77
ngUCPS Rectifier (1600W) front panel and filler



Physical characteristics

Table 86
Rectifier dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
Rectifier (1600 W)	133	69	359	3

Electrical characteristics Maximum number per cabinet: four

Input voltage range: 230 V

Associated breakers: ADUng AC breakers:

- CB1 for rectifiers 1 and 2
- CB2 for rectifier 3
- CB3 for rectifier 4

Rectifiers corporate LEDs behavior The following table shows the ngUCPS rectifiers detailed status information.

Table 87
Rectifiers corporate LEDs behavior

Green LED	Red LED	Rectifiers status / condition
	switched off	normal operation, no faults
flashing	switched off	serial communications fault
	flashing	INH active
		display functionality test This condition will take precedence over all other display conditions.
switched off		OT, DCUV (except when combined with INH assertion), DCOV, DCBIF, ACOV or ACUV alarm conditions This condition will take precedence over a serial communications fault condition. Indication from an ACUV alarm will be limited in duration.
switched off	switched off	- very low or no AC input- Rectifier critical fault

4.17.1.2 ngUCPS DC Distribution Unit (DDU)

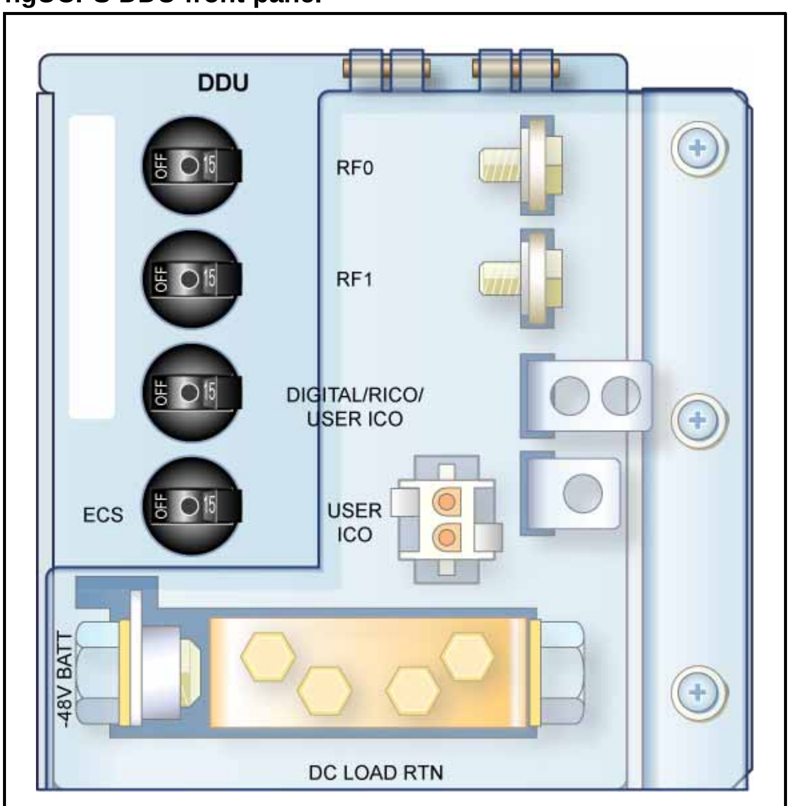
Main functions The DDU performs:

- DC distribution and protection
- DC connection/disconnection under CCU control
- secure disconnection at 40 Vdc

  In case of CCU replacement, the operation does not stop live traffic. When the CCU is unplugged more than 5s +-0.5s, the voltage falls to 50 V +-0.8V but live traffic is still going on. However, if an AC network failure occurs during this operation, and if the battery voltage reaches 40 Vdc +-3%, the secured LVD allows the disconnection of all loads to prevent a deep battery discharge.
- voltage and current sense for CCU
- internal or external battery connection
- inventory

Front panel The following figure presents the ngUCPS DDU front panel.

Figure 78
ngUCPS DDU front panel



Physical characteristics

Table 88
DDU dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
DDU	133	108	359	5.5

Electrical characteristics Maximum number per cabinet: one

DC rated voltage (normal continuous rated operation, full performance):

- minimum: -40.0 V
- nominal: -48.0 V
- maximum: -57.0 V

DC abnormal voltage (no damage or degradation):

- abnormal continuous, including full rated output load:
  - minimum: 0 V
  - maximum: -60 V
- abnormal continuous, no output load:
  - minimum: 0 V
  - maximum: +60 V

DC rated current (Input/Output):

- DC In: 152 A (minimum), 168 A (maximum)
- DC Out 1 and DC Out 2: 50 A (maximum)
- DC Out 3: 15 A (maximum)
- DC Out 4: 15 A (maximum)
- DC Battery In/Out: 152 A (minimum), 168 A (maximum)

DC output overcurrent protection breakers:

- CB1 RF0 (DC Out 1) and CB2 RF1 (DC Out 2): 50 A rated
- CB3 digital/RICO/user (DC Out 3): 15 A rated
- CB4 ECU (CD Out 4): 15 A rated

Associated battery breaker: 150 A

There is no LED on DDU.

Interface description The following table indicates the type and the use of the DDU connectors.

Table 89
DDU connectors type and use

DDU connectors	Use	Type
J1 /J2 / J3 / J4	Rectifier power control	FCI PwrBlade
J5	CCU power control	FCI Metral 48 signal pins, pin 8B last make, pins 3C 3D first make
J6	DDU control	FCI Metral 48 pins
J7 / J8	DDU DC power	Bus bar clearance holes for 16 mm stud
GP1	PEG	M5 stud
J9 / J10 / J11	AC Power	AC cables soldered
J12 / J13	DC Battery In/Out	Bus bar solution
J14	DC loads RTN	Bus bar solution
J15 / J16 / J17 / J19	DC loads	Bus bar solution
J18	User ICO	Standard Mate-n-lok socket

4.17.1.3 ngUCPS Cabinet Control Unit (CCU)

Main functions The GSM CCU performs the following main functions:

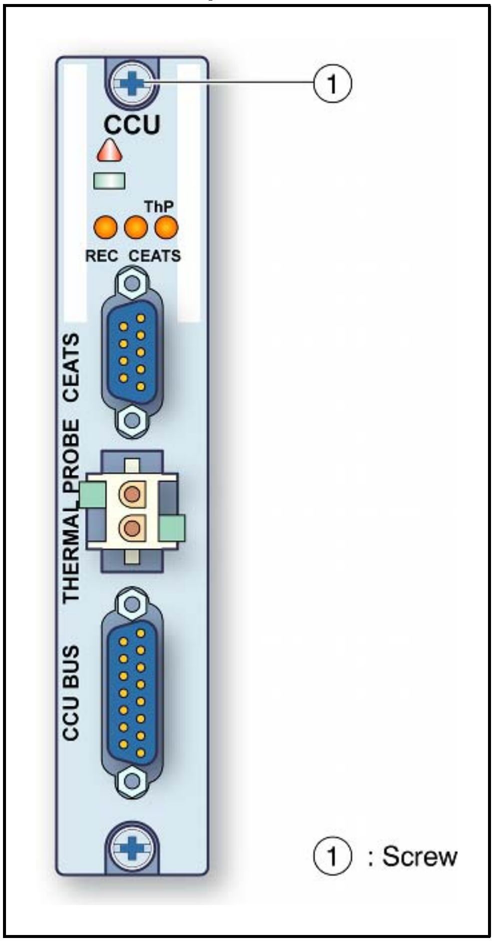
- rectifier module control through an I2C based digital communication interface for the purposes of module alarm monitoring, output current monitoring, inventory information gathering, and output voltage control
- system back-up battery management for basic features such as float voltage temperature compensation and charge current control
- rectifier output current sharing control for enhanced system performance and rectifier reliability
- system back-up battery temperature measurement
- system back-up battery current monitoring through a system resistive shunt
- communication with the BTS system controller:
  - — for any CCU, through the even ABM, through an RS-422 interface for alarm reporting, configuration, monitoring and control
- system ambient temperature monitoring: through a dedicated input (CEATS from the cooling system)
- BTS system equipment shutdown control for protection from extreme voltage (LVD thresholds at 44 and 42 Vdc) or temperature conditions

  The CCU shuts off of the system DC loads to prevent a deep discharge of the back-up batteries. In order to carry this out, the CCU manages two disconnection thresholds: LVD44 (-44 V +/-0.5%) and LVD42 (-42 V +/-0.5%).

  After an AC power network failure or when the AC circuit breaker is switched-off, the battery voltage decreases slowly until the LVD thresholds.

  - — When the battery output voltage reaches LVD44 (-44 V +/-0.5%), the power system cuts off power supply to the boards in the cabinet that are connected to RMs ouputs (RF0 and RF1 loads): an alarm is generated.
  - — If the battery output voltage continues to decrease and reaches LVD42 (-42 V +/-0.5%), the power system cuts off power supply to the digital boards (IFM, ICM, ABM, RICAM), the ECU cooling system, the DDMs, and the USER ICO.
  - — If the rectifiers recover power supply, the batteries are charging. When voltage is equal to 50.6 +/-1%, the power system reconnects the cabinet boards with its four outputs.
- monitoring of general BTS (user alarm points are unused)
- communication with a flexible module (hardware support only) through a second RS-422 interface (only kept in spare)

Figure 79
GSM CCU front panel



Physical characteristics

Table 90
GSM CCU dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
GSM CCU	133	25	359	1.1

Electrical characteristics Maximum number per cabinet: one

Input voltage range: 32 V - 60 V

Maximum DC power consumption: 10 W

There is no associated breaker.

GSM connectors The following table indicates the type and the use of the GSM connectors. They are front panel connectors, except for J2, which is located on the back panel.

Table 91
GSM connectors type and use

GSM CCU connectors	Use	Type
J1	UART link, battery detect - CCU BUS	SUBD HD 26 pins female 30 µin min gold with 4-40 screw locks
J2 (back panel)	Rectifiers presence detection, I2C enable control line to rectifiers, Battery current sense	FCI 48 pins Metral, pin 8B last-make-first-break
J3	CEATS and one-wire connectivity - CEATS	SUBD 9 pins female 30 µin min gold with 4-40 fixed screw locks
J4	Battery thermal probe - THERMAL PROBE	AMP universal Mate-n-lock pin header assembly

The default cabling of the BTS is for GSM CCU.

CCU corporate LEDs behavior The following table gives GSM CCU detailed status information.

Table 92
GSM CCU corporate LEDs behavior

Green LED	Red LED	CCU status / condition
	switched off	None of the following alarms asserted: CCU_FAULTISEnBTHMn, BAT_T_Hn, BAT_T_Ln, BAT_T_DIFLV, HVHT, LTBODBAT_BRK or LOAD_BRKRFAn
		No CCU_FAULT alarm asserted AND one or more of the following alarms asserted: ISEnBTHMn, BAT_T_Hn, BAT_T_Ln, BAT_T_DIFLV, HVHT, LTBODBAT_BRK or LOAD_BRKRFAn
		CCU initializing, indicator functionality test
switched off	flashing	CCU in LCOD command mode
switched off		CCU_FAULT alarm asserted, CCU running in application code
		POST fault, CCU running in bootloader code
		LCOD command process fault, CCU running in bootloader code
switched off	switched off	Critical CCU fault or no input power

GSM CCU specific LEDs behavior The GSM CCU has three red specific LEDs: REC LED, ThP LED and CEATS LED. The following table gives GSM CCU detailed status information.

Table 93
GSM CCU specific LEDs behavior

REC	ThP	CEATS	GSM CCU status / condition
	off	off	Any of the PIO_DCFn or PIO_I2Cn alarms is asserted
off		off	Any battery thermal probe is missing or out of operating range (BAT_T_FAULT = 1)
off	off		CEATS connector is removed (CEATS_PRESENCE =0) or CEATS is out of range (CEATS_STATUS=0)

4.17.2 AC Distribution Unit (ADUng)

The ADUng is for the BTS 18020 NG cabinets.

4.17.2.1 Main functions

The ADUng distributes the AC power towards:

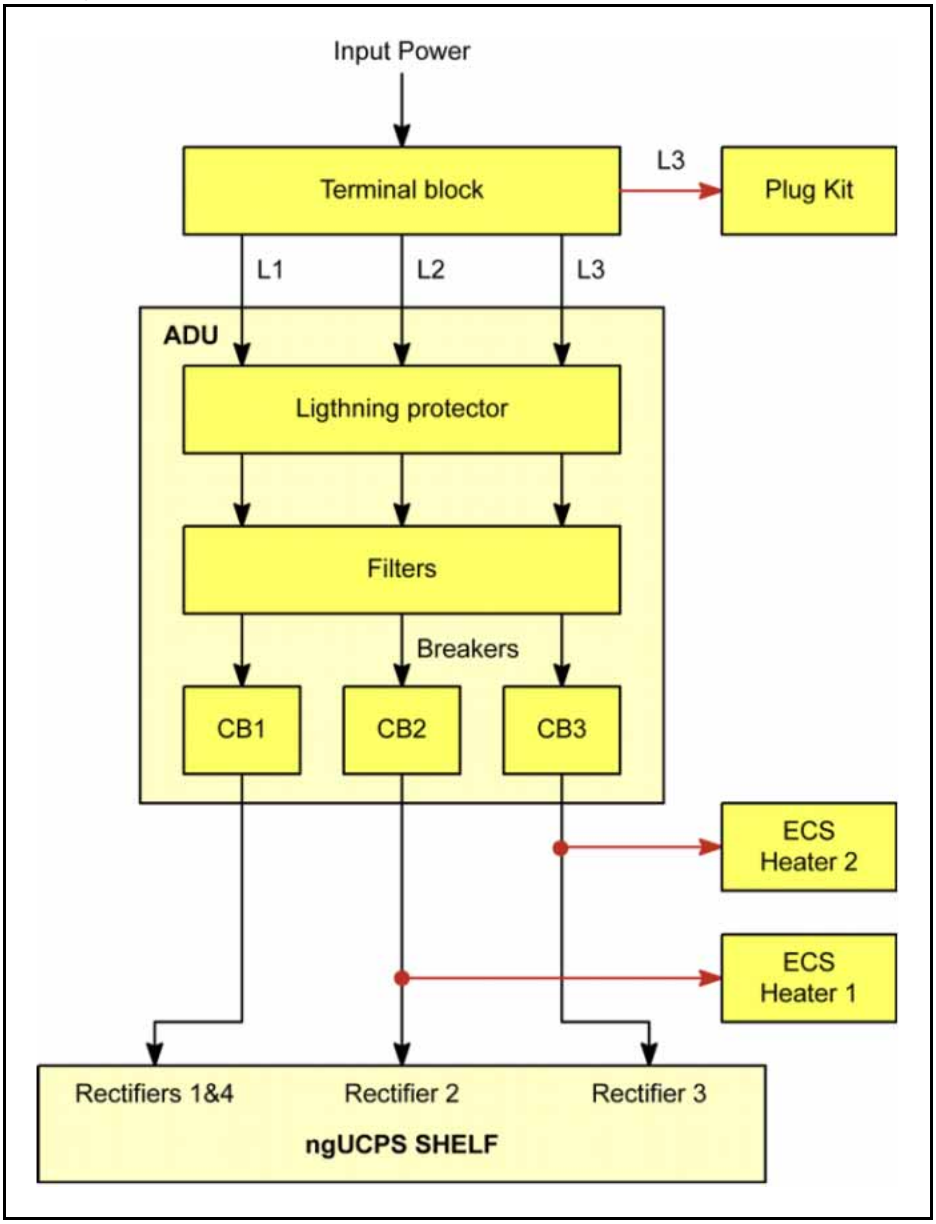
- the ngUCPS shelf
- the ECS heaters
- an optional User AC plug (plug kit)

ADUng components The ADUng is composed of the following parts:

- AC network configuration terminal block including optional user AC socket kit
- system level circuit breaker for rectifiers power on/off and overload protection
- circuit breaker for ECS power on/off and overload protection
- Electromagnetic Interference (EMI) filtering
- lightning protectors

The following figure illustrates the ADUng interconnection architecture.

Figure 80
ADUng interconnection architecture



AC plug types The optional AC plug kit enables user devices to be plugged during the installation phase. A differential circuit breaker protects the service personnel against injury.

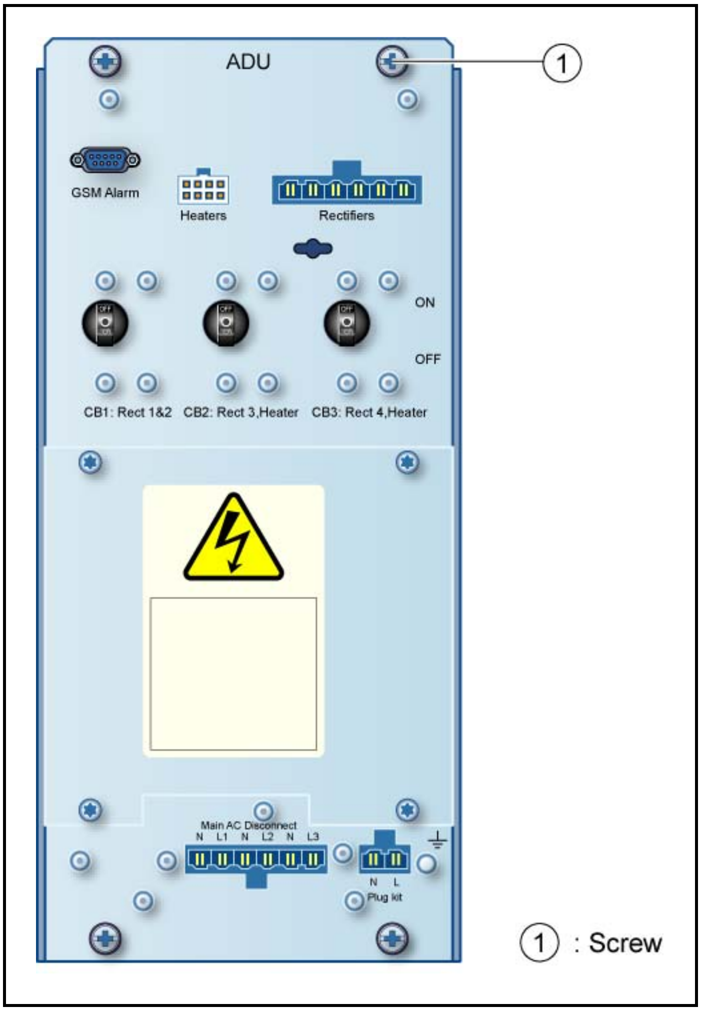
Four types of AC plug are available:

- European Single Phase
- European Three-Phase

- North American Split-Phase
- European Split-Phase

4.17.2.2 Front panel

Figure 81
ADUng front panel



4.17.2.3 Physical characteristics

Table 94
ADUng dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
ADUng	350.4	175.8	152.0	3.6

4.17.2.4 Electrical characteristics

Maximum number per cabinet: one

Maximum current drawn from the optional AC plug: 6 A

BTS 18020 AC source voltage range:

- Normal operation, full performance:
  - minimum: 176 V
  - nominal: 200-240 V
  - maximum: 264 V
- Abnormal conditions (no damage):
  - minimum: 0 V
  - maximum: 300 V

4.17.2.5 Interface description

The ADU features surge suppression and provides an AC input cable, and a connector for the ECS and a connector for the ngUCPS rectifiers.

4.18 Internal batteries

4.18.1 Main functions

Internal batteries can be hosted inside the BTS 18020, BTS 18020 NG or BTS 18020 WW cabinet as an option.

For the BTS 18020 cabinet, one string of four SBS15, SBS40 or SBS60 batteries can be used with various back up time. SBS15 string option is limited to configurations below S333 or S222.

For the BTS 18020 NG cabinet, the batteries can be either SBS60 or Narada TTG12V52.

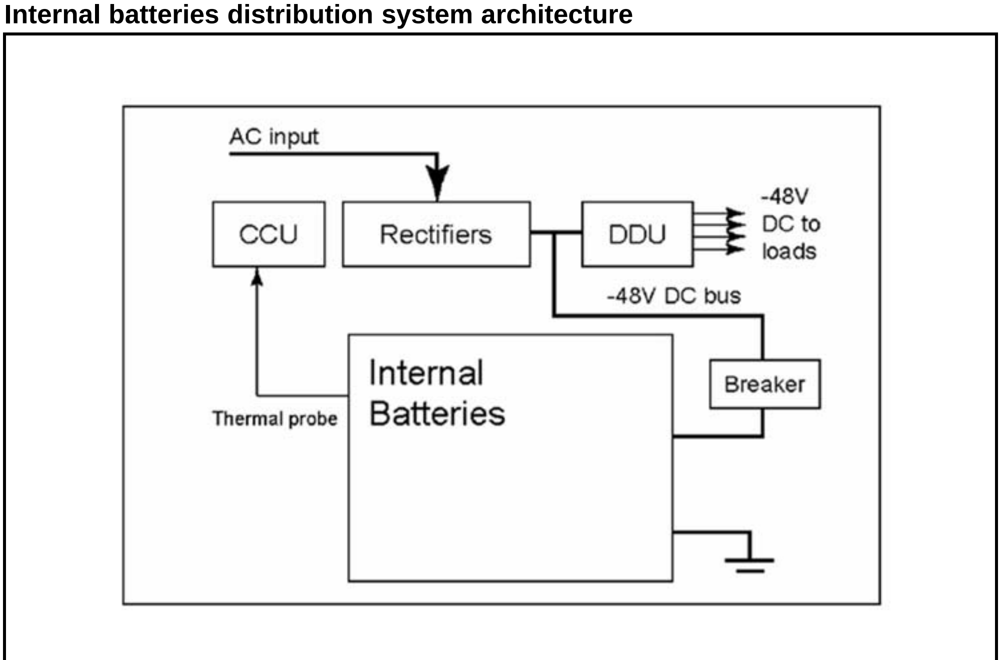
For the BTS 18020 WW cabinet, the optional battery used is SBS 60.

The internal batteries are plugged on the 48 V bus of the UCPS or ngUCPS DDU. They are protected by a dedicated alarmed breaker (150 A).

Battery charge is performed under UCPS or ngUCPS management at power up, when rectifiers DC output ramp up is performed. Thermal measurement and compensation of the internal battery is managed by the UCPS or ngUCPS.

The following figure illustrates the internal batteries distribution system architecture.

Figure 82
Internal batteries distribution system architecture



4.18.2 Front view

4.18.3 Physical characteristics

The following table gives the weight of each type of battery.

Table 95
Internal batteries weight

Battery type	Weight per unit (kg)
Battery SBS15	5.1
Battery SBS40	12.8
Battery SBS60	18.1
Narada TTG12V52	17.8

4.18.4 Back up time

The backup times assume new batteries, 100% charged, which have been stored and operated in accordance with both Nortel's and the battery manufacturer's operating, environmental, and maintenance policies.

Table 96
Back up time of internal batteries

Full GSM with RM 1/2 (30/30) 1800 and 1900 MHz				
BTS 18020 Radio configuration	**DC power (W)**	**1xSBS15 internal**	**1xSBS40 internal**	**1xSBS60 internal**
S111	**1400**	**15 min.**	**55 min.**	**1 h 25**
S222	**1926**	**10 min.**	**36 min.**	**55 min.**
S333	**2451**	**6 min.**	**25 min.**	**37 min.**
S444	**2976**	**-**	**19 min.**	**28 min.**
S555	**3501**	**-**	**15 min.**	**22 min.**
S666	**4027**	**-**	**12 min.**	**18 min.**
Full GSM with RM1/2 (40/40) 900 MHz				
BTS 18020 Radio configuration	**DC power (W)**	**1xSBS15 internal**	**1xSBS40 internal**	**1xSBS60 internal**
S111	1448	14 min.	50 min.	1 h 20
S222	1990	9 min.	34 min.	50 min.
S333	2533	5 min.	24 min.	35 min.
S444	3075	-	18 min.	26 min.
S555	3618	-	14 min.	21 min.
S666	4160	-	11 min.	17 min.

Full GSM with RM1/2 (50/30) 1800 and 1900 MHz				
BTS 18020 Radio configuration	**DC power (W)**	**1xSBS15 internal**	**1xSBS40 internal**	**1xSBS60 internal**
S111	1504	13 min.	50 min.	1 h 15
S222	2132	8 min.	31 min.	45 min.
S333	2761	4 min.	22 min.	31 min.
S444	3390	-	15 min.	23 min.
S555	4019	-	12 min.	18 min.
S666	4647	-	9 min.	13 min.

Full GSM with RM2 (60/45) 900 MHz				
BTS 18020 Radio configuration	**DC power (W)**	**1xSBS15 internal**	**1xSBS40 internal**	**1xSBS60 internal**
O2	1407	15 min.	55 min.	1 h 25
S22	1910	10 min.	36 min.	55 min.
S222	2412	6 min.	26 min.	38 min.
S224	2914	-	20 min.	29 min.
S334	3416	-	16 min.	23 min.
S444	3919	-	12 min.	19 min.

Combo GSM with MPRM (40/40) 900 MHz				
BTS 18020 - GSM-UMTS Radio configuration	**DC power (W)**	**1xSBS15 internal**	**1xSBS40 internal**	**1xSBS60 internal**
S222 / STSR-1	3528	-	14 min.	22 min.
S222 / STSR-2	3513	-	14 min.	22 min.
S333 / STSR-1	4071	-	12 min.	18 min.
S333 / STSR-2	4056	-	12 min.	18 min.

Combo GSM with RM (30/30) 1800 and 1900 MHz				
BTS 18020 - GSM-UMTS Radio configuration	**DC power (W)**	**1xSBS15 internal**	**1xSBS40 internal**	**1xSBS60 internal**
S222 / STSR-1	3464	-	15 min.	23 min.
S222 / STSR-2	3449	-	15 min.	23 min.
S333 / STSR-1	3989	-	12 min.	18 min.
S333 / STSR-2	3974	-	12 min.	18 min.

Combo GSM with HPRM (60/45) 900 MHz				
BTS 18020 - GSM-UMTS Radio configuration	**DC power (W)**	**1xSBS15 internal**	**1xSBS40 internal**	**1xSBS60 internal**
O2 / STSR-1	2945	-	20 min.	29 min.
O2 / STSR-2	2930	-	20 min.	29 min.
S222 / STSR-1	3950	-	13 min.	19 min.
S222 / STSR-2	3935	-	13 min.	19 min.

TriHPRM (60/45) 900 MHz			
BTS 18020 NG Radio configuration	**DC power (W)**	**SBS60 internal**	**TTG12V52 internal**
S111	1223	1 h 45	1 h 30

TriHPRM (60/45) 900 MHz			
BTS 18020 NG Radio configuration	**DC power (W)**	**SBS60 internal**	**TTG12V52 internal**
S222	1761	1 h 05	50 min.
S333	2298	43 min.	32 min.
S444	3046	29 min.	21 min.
S555	3584	24 min.	15 min.
S666	4122	19 min.	13 min.

TriHPRM (40/40) 900 MHz			
BTS 18020 NG Radio configuration	**DC power (W)**	**SBS60 internal**	**TTG12V52 internal**
S111	1139	1 h 50	1 h 35
S222	1594	1 h 15	55 min.
S333	2048	55 min.	39 min.
S444	2713	35 min.	26 min.
S555	3167	28 min.	20 min.
S666	3622	23 min.	15 min.

TriHPRM (50/30) 1800 MHz			
BTS 18020 NG Radio configuration	**DC power (W)**	**SBS60 internal**	**TTG12V52 internal**
S111	1203	1 h 50	1 h 30
S222	1751	1 h 05	50 min.
S333	2298	43 min.	32 min.
S444	3056	29 min.	21 min.
S555	3604	23 min.	15 min.
S666	4152	19 min.	13 min.

TriHPRM (30/30) 1800 MHz			
BTS 18020 NG Radio configuration	**DC power (W)**	**SBS60 internal**	**TTG12V52 internal**
S111	1119	1 h 55	1 h 40
S222	1584	1 h 15	55 min.
S333	2048	55 min.	39 min.
S444	2723	34 min.	26 min.

TriHPRM (30/30) 1800 MHz			
BTS 18020 NG Radio configuration	**DC power (W)**	**SBS60 internal**	**TTG12V52 internal**
S555	3187	28 min.	19 min.
S666	3652	23 min.	15 min.

4.18.5 Interface description

The power connector provides a 48 V bus connection with the DDU.
A thermal probe connector enables the CCU to measure the battery temperature and process thermal correction.

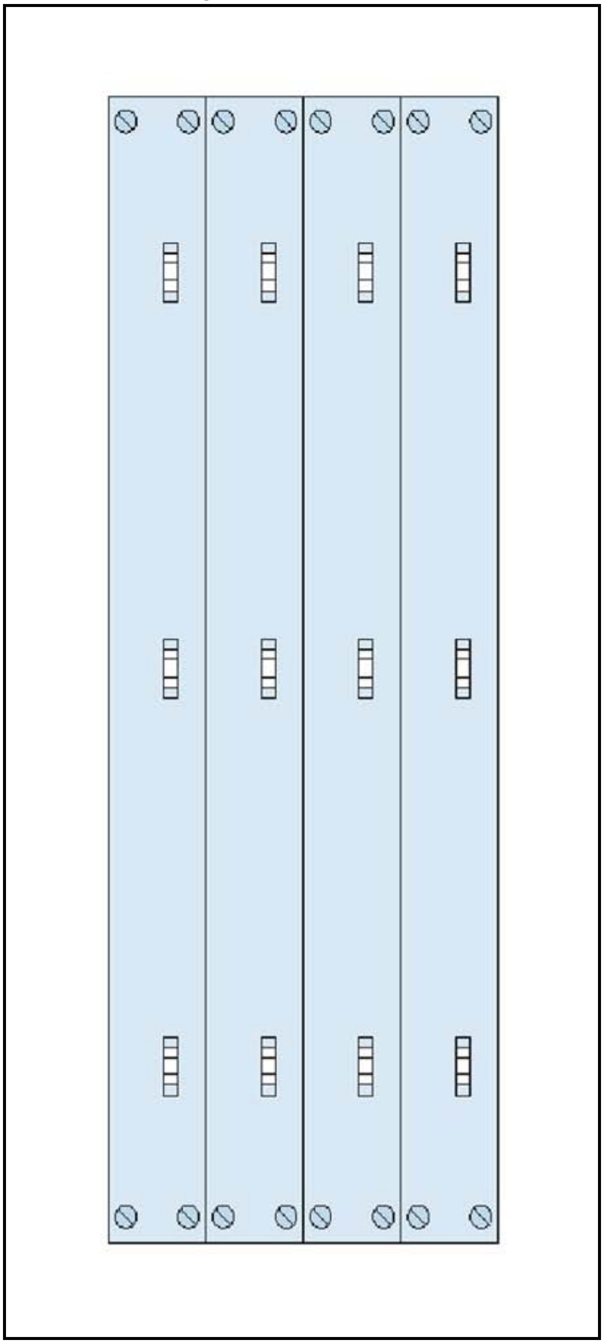
4.19 User rack

4.19.1 Main functions

4.19.2 Front panel

The following figure shows a front view of the User rack.

Figure 83
User rack front panel



4.19.3 Physical and electrical characteristics

Table 97
User rack dimensions and weight

Module name	Height (mm)	Width (mm)	Depth of the user modules (mm)	Weight (kg)
User rack	482.6	4 x 44.45 (4U)	< 470	< 4 (per 1U)

Maximum number per cabinet: one

Maximum current drawn from the optional AC plug: 6 A

Maximum DC power consumption: 300 W

4.20 User InterCOnnect module (User ICO)

The User ICO module is located just above the User rack.

4.20.1 Main functions

The User ICO module is required as soon as user specific modules are installed in the User rack. There are two versions of the module: a version with one fuse, a version with four fuses.

In the one fuse version, the four DC output ports are protected by one fuse (10 A). In the four fuse version, there is a fuse for each DC output port (2.5 A). Otherwise, both versions provide the same functionality.

The User ICO module performs

- protection and DC distribution to user modules
- collection of alarms from user modules

4.20.2 Front panel

Figure 84
User ICO front panel for BTS 18020 (version with one fuse)

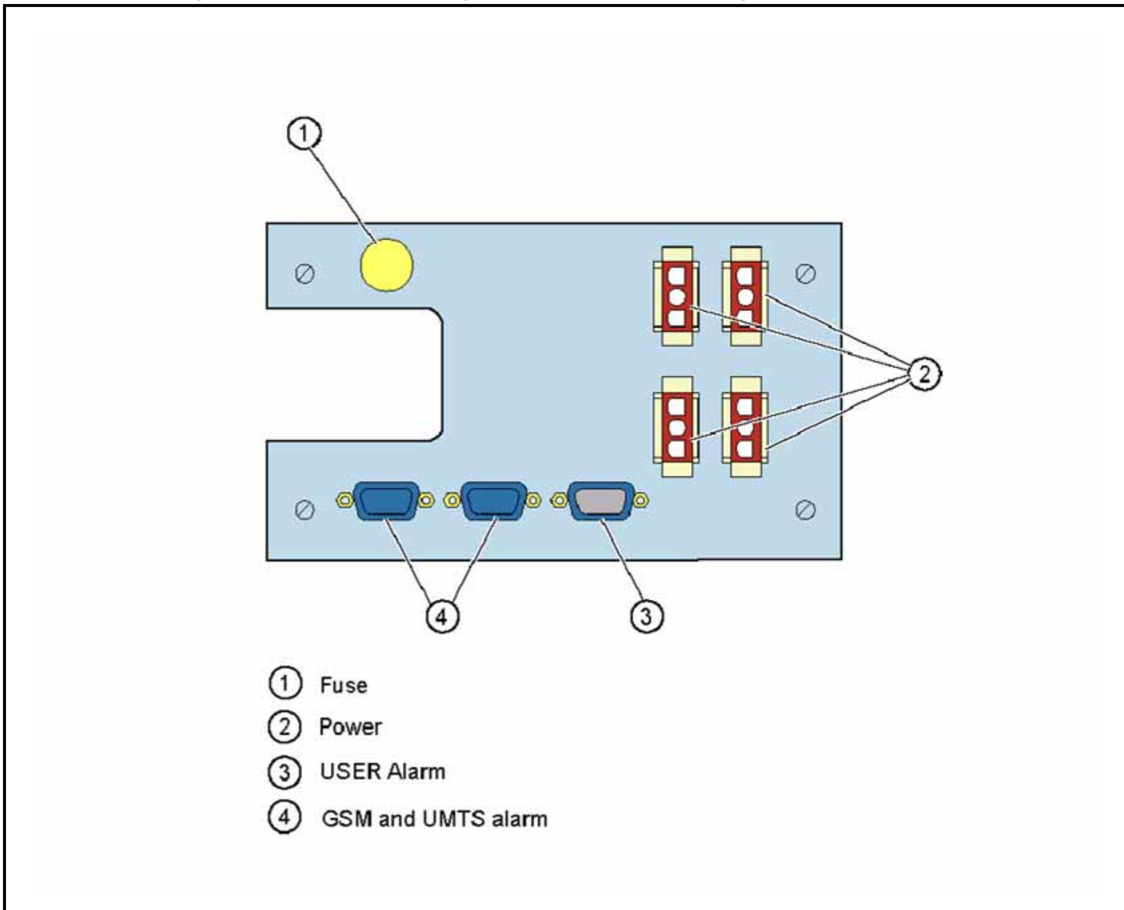
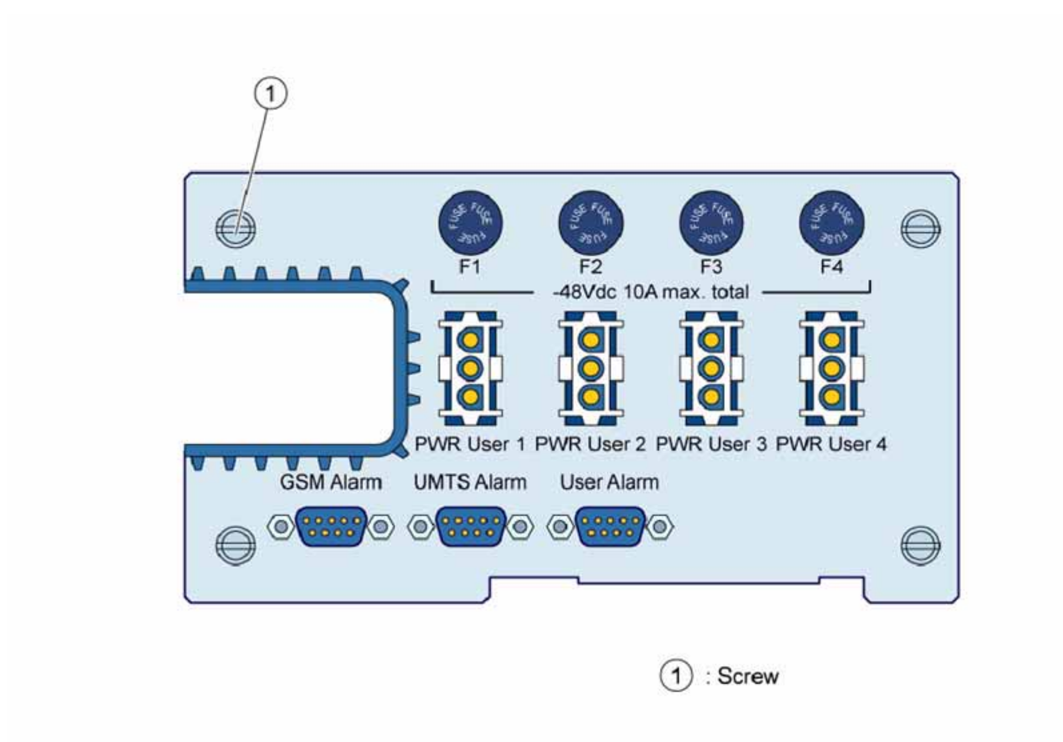


Figure 85
User ICO front panel for BTS 18020 (version with four fuses)



4.20.3 Physical and electrical characteristics

Table 98
ngUser ICO dimensions and weight

Module name	Height (mm)	Width (mm)	Depth (mm)	Weight (kg)
ngUser ICO	102	177	-	< 1

Maximum number per cabinet: one

Associated standard fuse (version with one fuse): Little fuse™ 10 A: T 10 A 48 V (slow blow), 5x32 type

Associated standard fuses (version with four fuses): Little fuse™ 2 A: T 2 A 48 V (slow blow), 5x32 type

Power consumption: N/A

There is no LED on the ngUser ICO.

4.20.4 Interface description

The ngUser ICO front panel has:

- four power connectors for -48 V DC.
- three alarm connectors:
  - — one User alarm connector, on which customer equipment alarms are connected
  - — one GSM alarm connector, connected to even ABM for GSM system alarms collection

  For GSM application, a maximum of six alarms can be processed for fault management.

The following table indicates the type of the ngUser ICO front panel connectors.

Table 99
ngUser ICO connectors type

ngUser ICO connectors	Type
Power	Mate-n-lock with locking lances and locating pin, female housing
User alarm	SUBD 9 pins female
GSM alarm	SUBD 9 pins female

4.20.5 User alarm pin connections for GSM use

The following table shows the pin numbers and the corresponding signals for the user alarm connectors in the case of GSM.

Table 100
User alarm pin connections for GSM use

Pin	Signal
1	User 0
2	User 1
3	User 2
4	GND
5	GND
6	GND
7	User 3
8	User 4
9	User 5
Legend: GND: Ground	

Alarms 0 to 3 of the USER alarm connector are connected by the User ICO to the UMTS alarms collected by GPSAM (on the one-wire bus) in the case of the combo.

Alarms 0 to 5 of the USER alarm connector are connected by the User ICO to the GSM (DALI 1 to 6) alarms collected by the ABM.

4.21 Ancillary modules

4.21.1 Primary protection

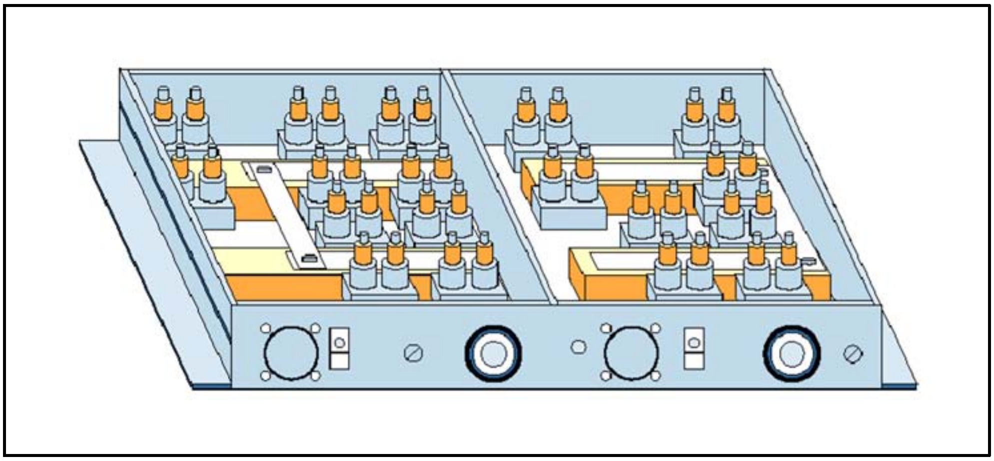
Depending on installation configuration, primary protection may be provided for Abis, external alarms and remote controls.

Like for other Nortel Networks indoor products, no place for primary protection modules is provided on the BTS 18010 cabinet. Those protections must be provided by site solution outside the cabinet.

For BTS 18020 cabinet, it is possible to keep existing PRIPRO module on a site where the BTS 18000 is mounted on a former S8000/S12000 plinth. Otherwise one or two PRIPRO2 modules can be located under the cable cover.

The PRIPRO2 module protects 18 signals (typically, 4x2 PCM + eight DALE + two RC). The PRIPRO2 module is located under the stepper.

Figure 86
PRIPRO2 module view (front and inside)



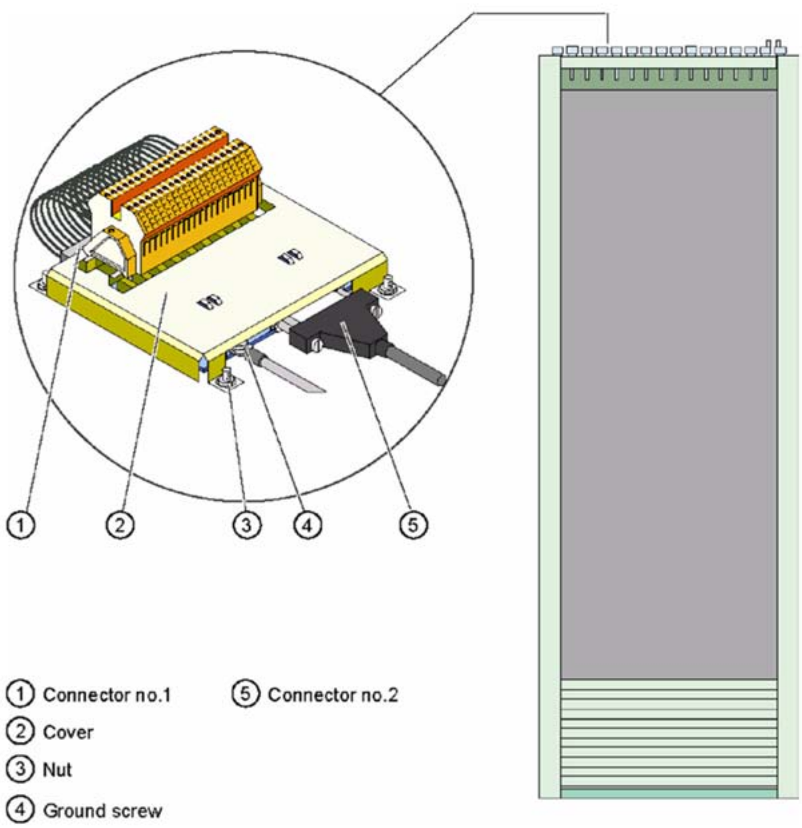
4.21.2 Secondary protection

Optional secondary protection may be provided for external, user alarms and remote controls.

One or two S8000/S12000 ALPRO modules (one per ABM) can be mounted on top of the BTS 18010 and BTS 18010 NG2 cabinet.

The ALPRO module protects ten signals (eight DALE + two RC). The ALPRO module is located under the stepper.

Figure 87
ALPRO module view and location (BTS 18010 cabinet)

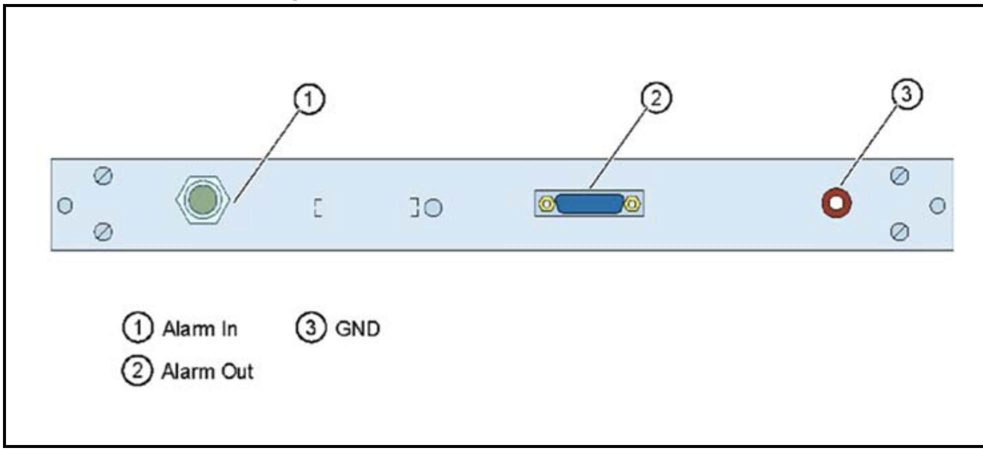


Inside the BTS 18020 cabinet, secondary protection is provided by the ALPRO2 module (see the preceding figure for the location of ALPRO2 module inside the BTS 18020 cabinet).

The ALPRO2 module protects ten signals (eight DALE + two RC). The ALPRO2 module is located under the stepper.

The ALPRO2 module front panel is shown in the following figure.

Figure 88
ALPRO2 module front panel



4.21.3 75 Ohms kit

Some markets may require 75 Ohms coaxial cables for E1 Abis.

The IFM is designed for interfacing to 100/120 Ohms twisted pairs. If 75 Ohms coaxial cables are used, some specific adaptation baluns must be used (one per differential pair).

4.22 DC supply option

The BTS 18020 is available in an AC/DC variant for customers who want to power it from an external -48 Vdc power supply source.

The AC network is still required to activate heating of the cabinet and the user AC Plug option.

The AC/DC variant of the BTS 18020 cabinet and the standard AC powered cabinet have a similar compartment layout.

Compared to the standard AC powered cabinet, the AC/DC variant integrates the following changes:

- The internal batteries are removed.
- The battery space houses a DC Connection Block.
- The rectifiers are removed and replaced by fillers.

The DC input voltage range is -40.5 V up to -57 V dc with the following behavior:

- Limitation associated to the cabinet start up: the DC power supply voltage must be higher than 52 V at the power plant level to start up the BTS.
- The Low Voltage Disconnect threshold is unchanged from the AC version and is set to -44 Vdc. The BTS operates only if the DC power supply voltage is higher than -44 V at the entry of the BTS at the UCPS level.

4.23 Internet Protocol Module (RIPM/IPM)

4.23.1 Functional description

The IPM is in charge of interfacing the TDM centric BTS with the packet network used for supporting the Abis interface. The BTS18000, supporting the Abis over IP feature, is populated with one IPM or RIPM. RIPM proposes a hardware redundancy for most functional blocks of the module.

ATTENTION
Each IPM supports only one btsSiteManager object.

The RIPM/IPM performs the following tasks:

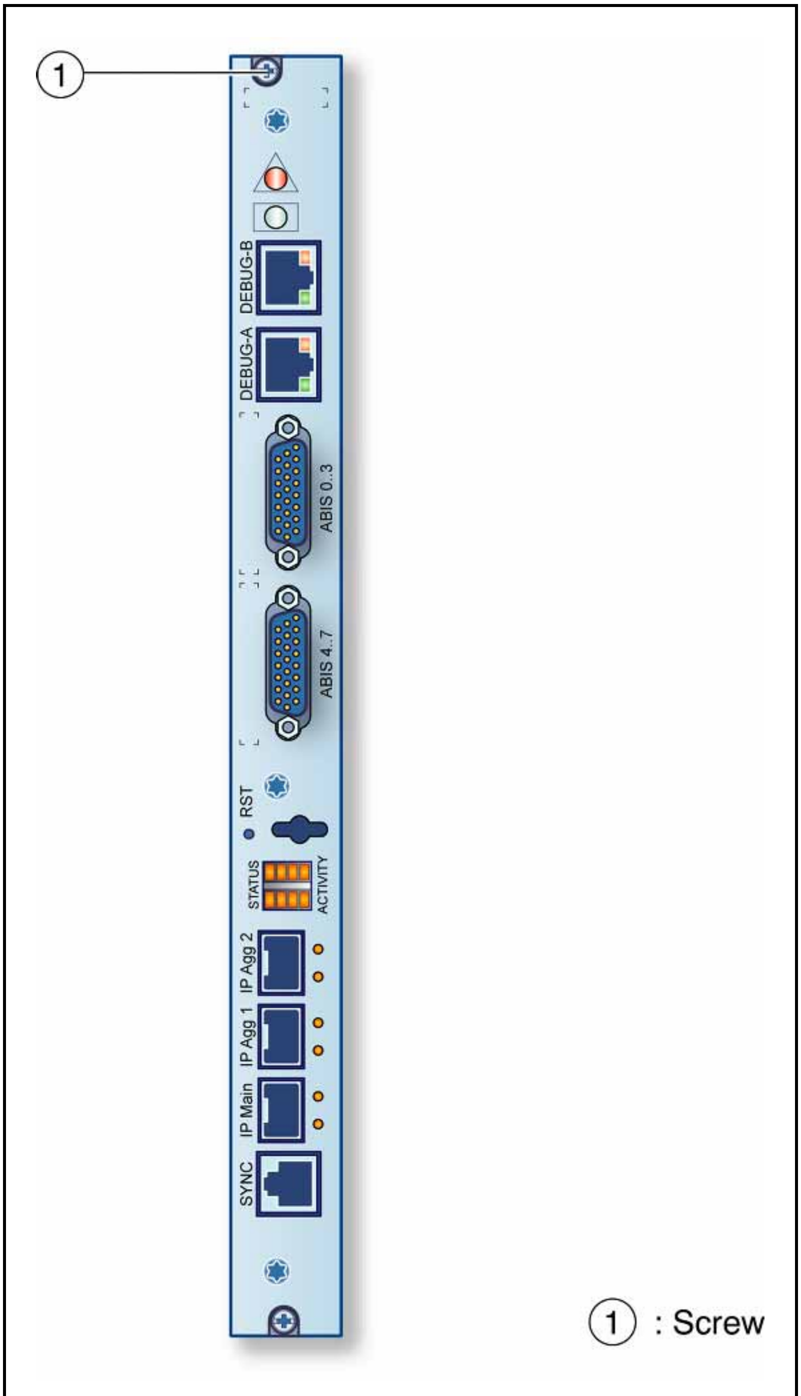
- carries an equivalent of up to six E1 (or six T1) Abis trunks
- converts Abis traffic from PCM to packet-based traffic (IP over Ethernet) for transmission to the BSC and packet-based Abis traffic to PCM, to be forwarded to the CBCF
- contains an internal 100BaseT Ethernet switch which provides switching of the Ethernet frames on the Abis packet interface
- manages IP, TCP, UDP, FTP, IPSec, and proprietary protocols associated with the Abis over IP interface
- receives a timing reference signal from the IPG at the BSC, which provides a stratum-1 traceable clock to be used for BTS synchronization
- provides a reference frequency to the existing BTS oscillator. The IPM oscillator gives the BTS a temporarily source of hold-over timing when the timing source at the BSC is unavailable

4.23.2 Physical description

This section describes the LEDs, connectors, and the electrical characteristics of the IPM.

4.23.2.1 Front Panel

Figure 89
RIPM Front Panel



4.23.2.2 Interface description

The following connections are available on each IPM board or module:

- two connectors supporting up to six PCMs to be connected on BTS.
- one SFP cage for Abis packet network connection. Dedicated modules may be populated according to the kind of available Ethernet connection.
- two SFP cage for Aggregated Traffic connection. Dedicated modules may be populated according to the kind of available Ethernet connection.
- two RJ45 connections for PQ2 debug purpose (one per processing chain, so only one is functionally available on IPM and IPM-USER)

ATTENTION
The debug port is intended for point-to-point connections.

Any Equipment that accesses the IPM through the debug port must be directly connected to it with no intervening network equipment.

4.23.2.3 Physical and electrical characteristics

Table 101
RIPM/IPM dimensions and weight

Module name	Width (mm)	Length (mm)	Height (mm)	Weight (kg)
RIPM/IPM	24.4	412	325.7	< 2

Max per cabinet: one

Max power consumption:

- Spare slot: 50 W
- IPM: 25 W
- RIPM: 40 W

Input voltage: floating -48 V from backplane.

4.23.2.4 RIPM/IPM corporate LEDs behavior

As shown in the following table, an upper triangle-shaped red LED and a lower rectangle-shaped green LED are used to indicate the status for some BTS 18000 modules.

Figure 90
RIPM/IPM corporate LEDs

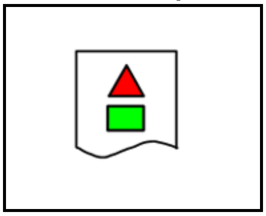


Table 102
RIPM/IPM corporate LEDs behavior

Green LED	Red LED	Module state	RIPM/IPM
▭	△	Sleep, unpowered or not inserted (default hardware value). Or powered but SW not able to start-up for example, due to bad commissioning.	used
■	▲	Starting, BISTs in progress.	used: 1 to 2 (resp1) cores are in «starting/bists» state; other cores are OK.
■	△	Module OK (should not be removed)	used: 2 (resp1) cores are OK
▭	▲	Alarm state: module is NOK and may be removed and replaced.	used : 1 to 2 (resp.1) cores are in « KO» state; whatever state of other cores.

4.23.2.5 RIPM/IPM specific LEDs behavior

There are ten LEDs on the front panel of the IPM:

- One green LED (ON) indicates that the module is operating normally.
- One red LED (AL) indicates that there is a fault.
- Other eight status LEDs that are tricolor (red, green, and amber), see Table 103 "RIPM/IPM specific LEDs behavior" (page 260).

By default the core 0 controls the eight LEDs listed below, unless core 0 is inactive and core 1 is active.

Table 103
RIPM/IPM specific LEDs behavior

LED name	Color	Signification
ACTIVITY A & b (activity)		One ACT LED per IPM core for Passive or Active Status: • Green: the corresponding IPM core is active. • OFF: the corresponding IPM core is passive. • Amber: during bists.
STATUS 2 & 3		2 SYN LEDs (for active IPM core): • OFF/OFF = init state • GREEN/OFF = synchronous ethernet mode. Reserve for future use. • OFF/ON = E1/T1 mode, reserved for lab (TIPM mode). Blinking during convergence, solid state when locked. — GREEN = TIPM (lab only) — AMBER = Bus test (factory only) • ON/ON = ABIS over IP mode: — Amber: at startup until CRPn flow is established + holdover — Green: Blinking during convergence, solid state when locked — Red: alarm

LED name	Color	Signification
STATUS 4		IBOS Service Channel Status • OFF = at init and when TML is connected in stand alone. • GREEN = blinking during authentication trial, then solid state when service channel ON. • AMBER = solid state during bists, blinking during RIPM SW upgrade. • RED = blinking if authentification failed, solid state if IBOS connection failed or if service channel is lost.
STATUS 5		IPG service channel status: • OFF = init, remains off as long as IPM is locked • GREEN = blinking during connection trial, then solid state when service channel ON • AMBER = during bist, then at IPG swact. • RED = service channel lost.
STATUS 6 & 7		OFF, reserved for future use

All the LEDs are OFF when the RIPM is unpowered.

All the RIPM LEDs are amber during bists except for passive core.

Chapter 5 BTS 18000 functional architecture

The BTS 18000, through its modular architecture, reaches the best compromise between the following constraints:

- flexible growth from S111 up to S16.16.16
- high reliability and easier maintenance

  Only front access to the BTS 18000 cabinet is needed for maintenance and capacity growth.
- maximized RF power output.
- improved mobility from BSC to BTS Abis interface.

The BTS 18000 architecture is based on the modules described in Chapter 4 “BTS 18000 modules description” (page 77).

Figure 91
BTS 18010 block diagram for a S333 configuration (not supporting Abis over IP)

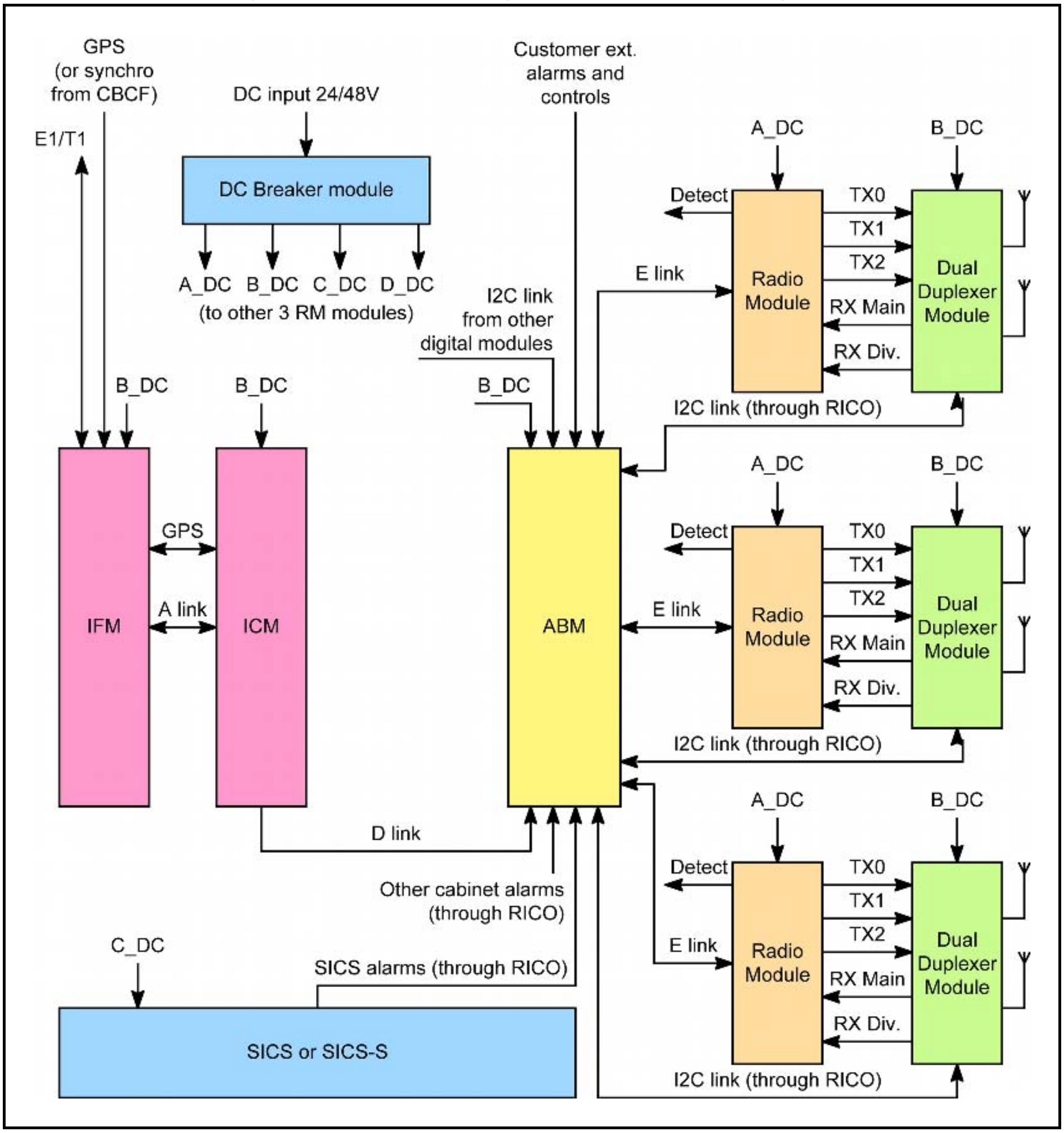


Figure 92
BTS 18010 block diagram for a S333 configuration (supporting Abis over IP)

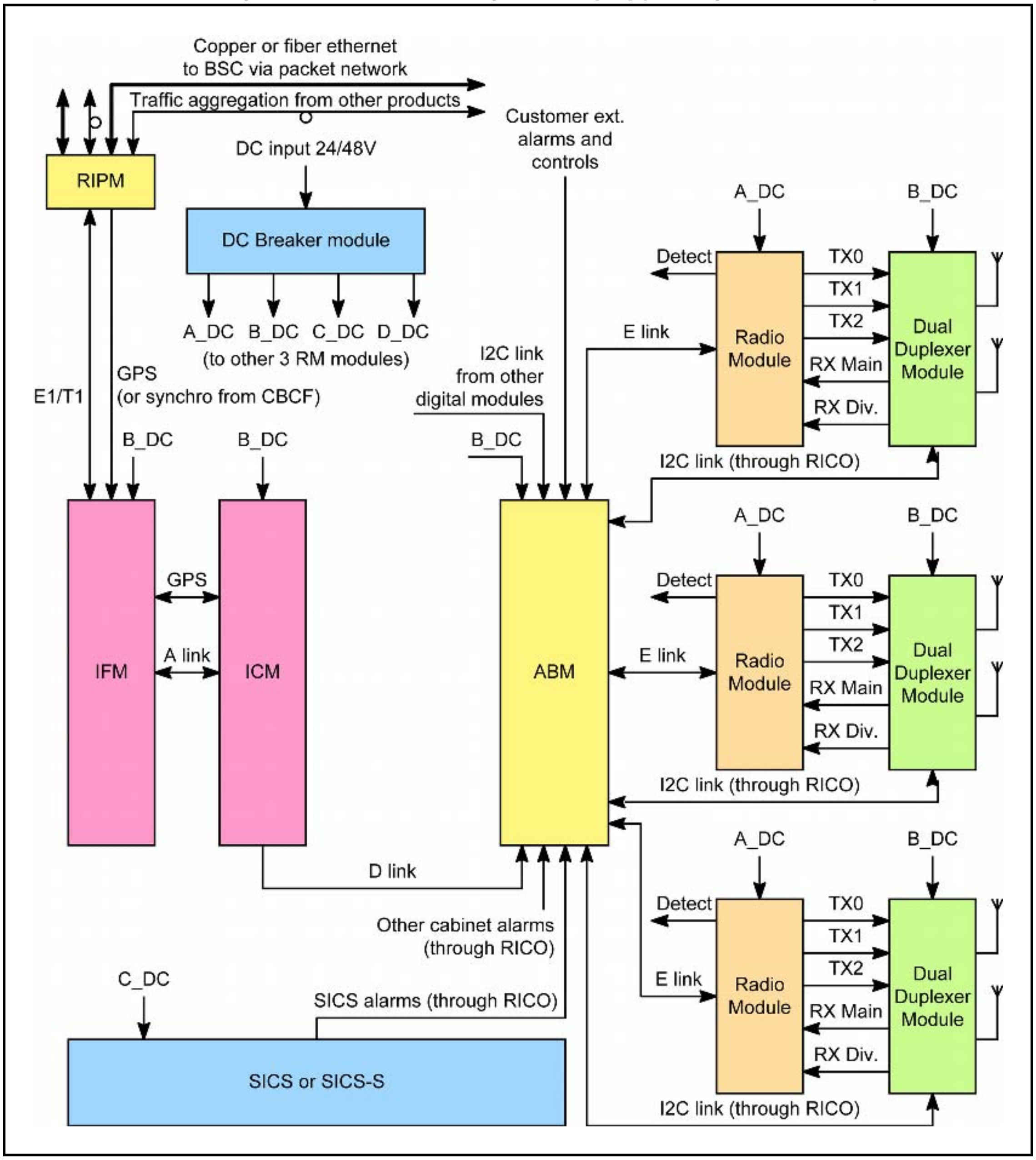


Figure 93
BTS 18020 block diagram for a S333 configuration (not supporting Abis over IP)

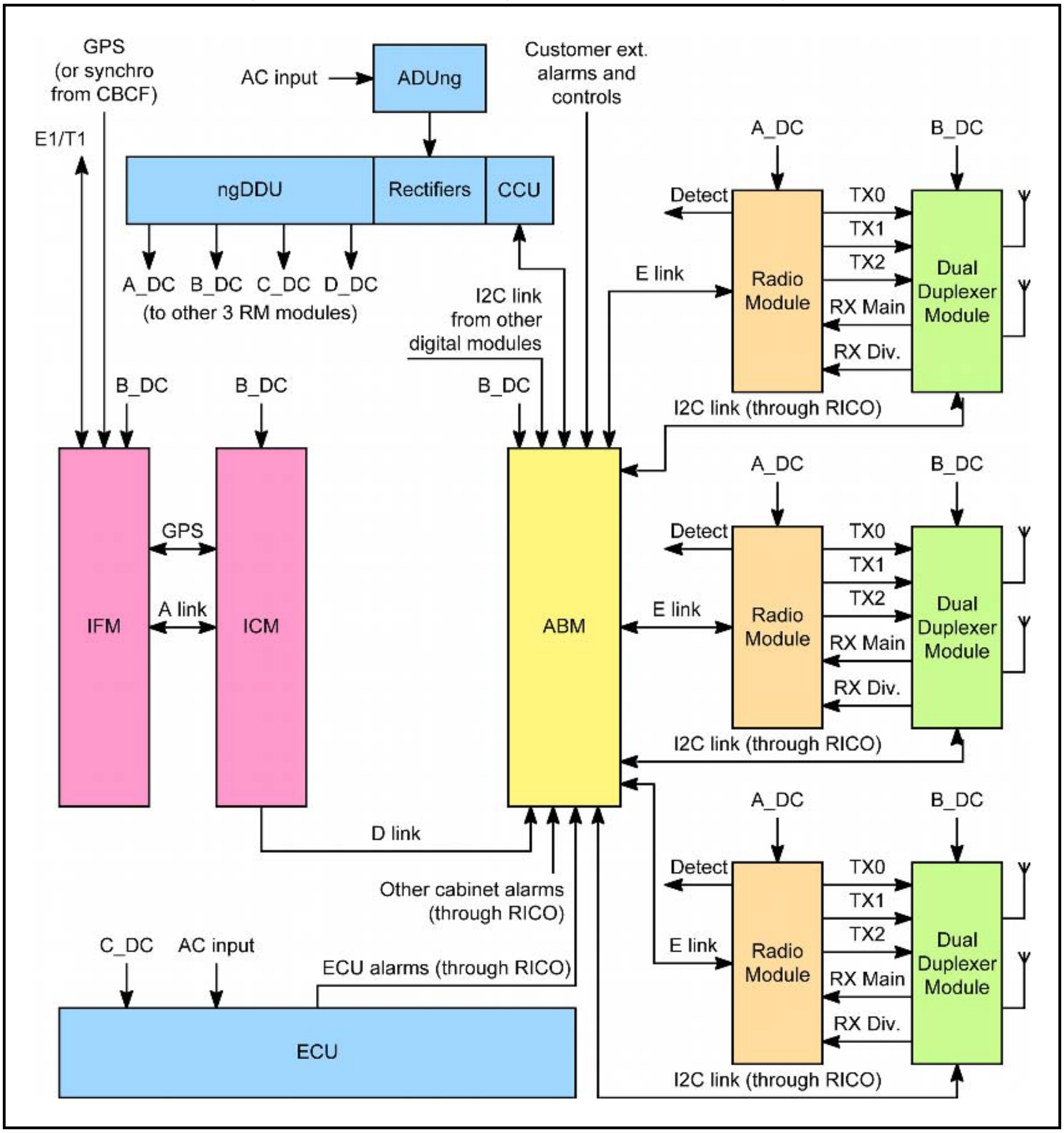


Figure 94
BTS 18020 block diagram for a S333 configuration (supporting Abis over IP)

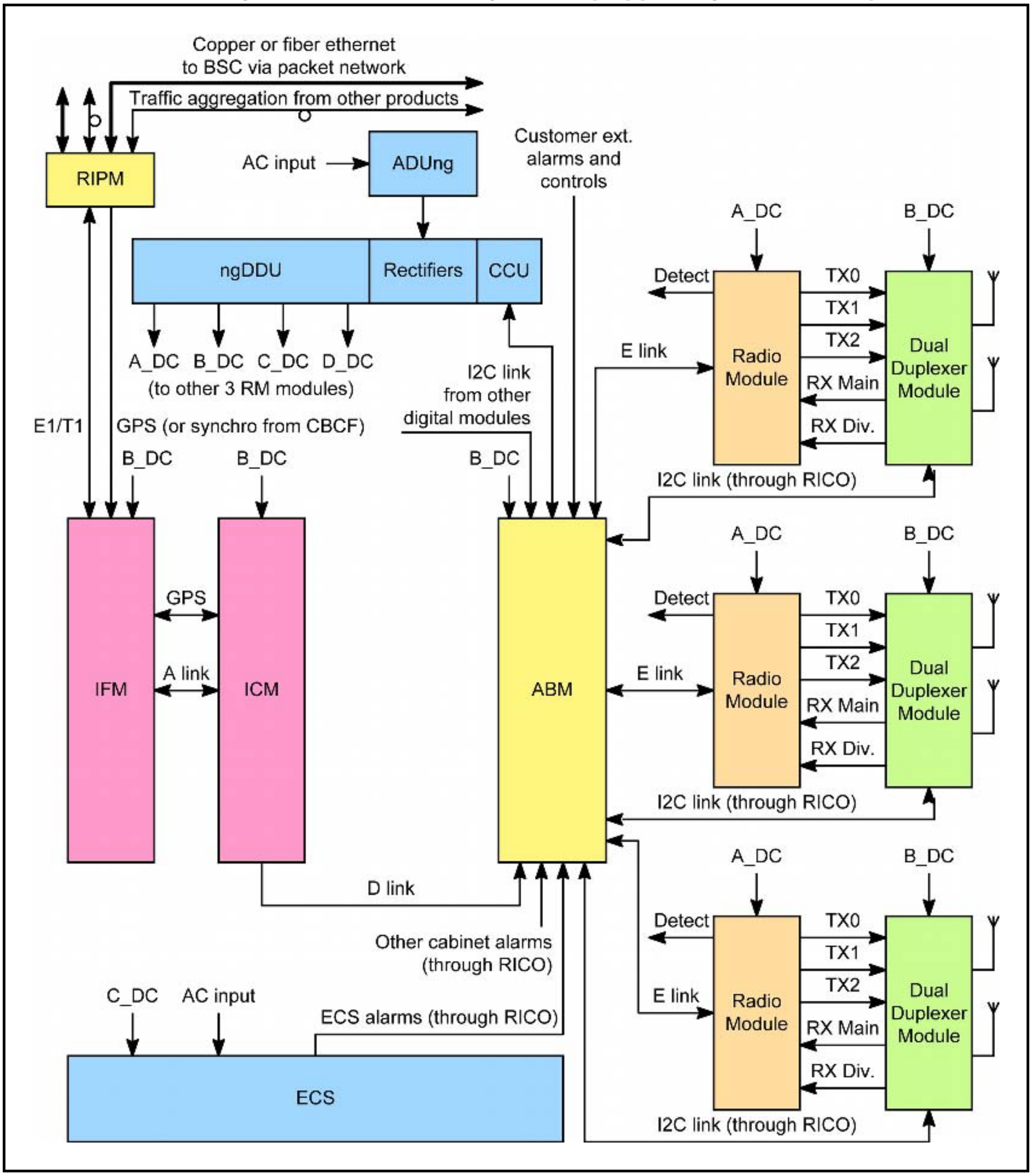


Figure 95
BTS 18020 NG block diagram for a S333 configuration (supporting Abis over IP)

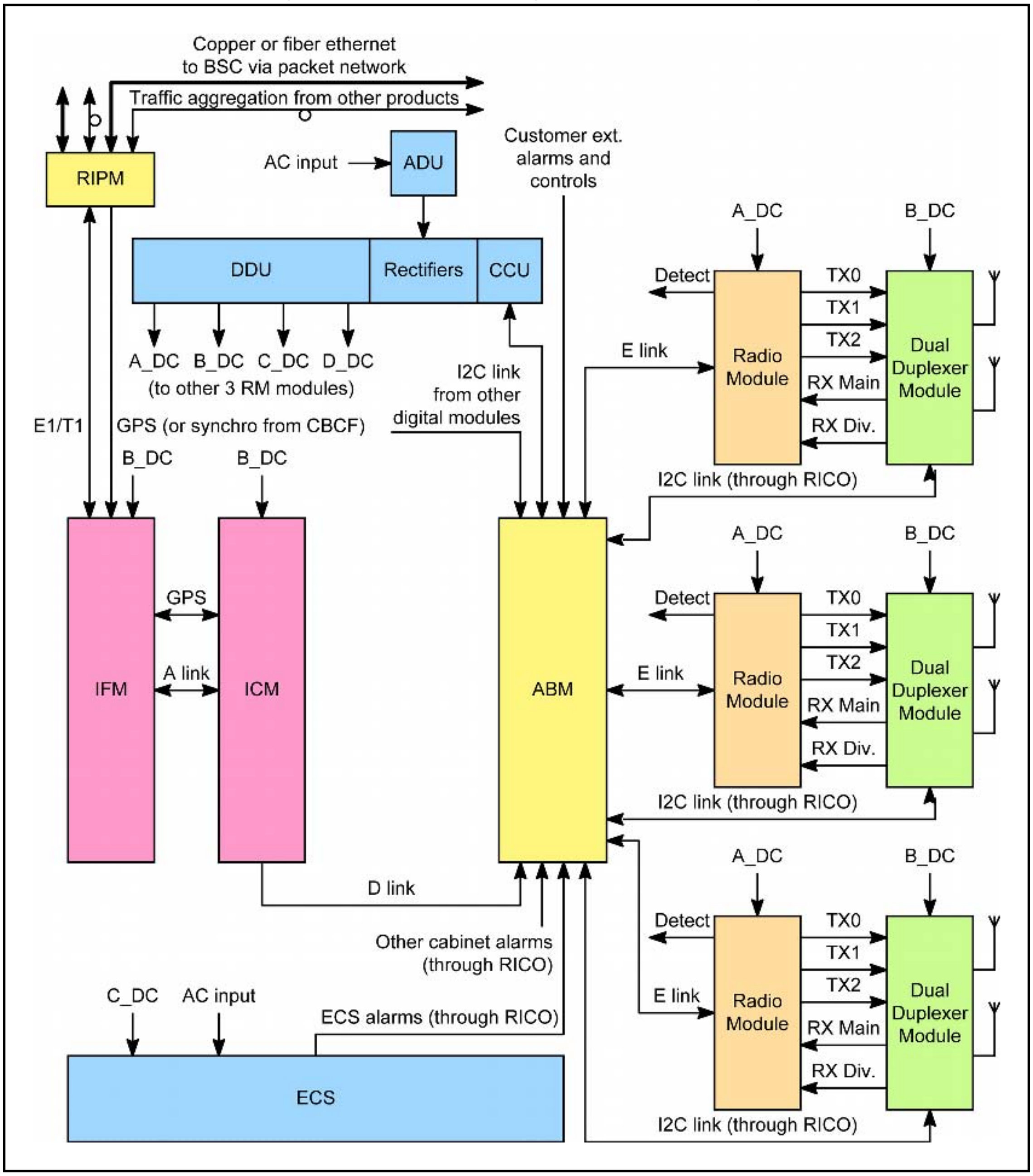


Figure 96
BTS 18020 block diagram for a S333 configuration with RICAM(2)/ICAM (supporting Abis over IP)

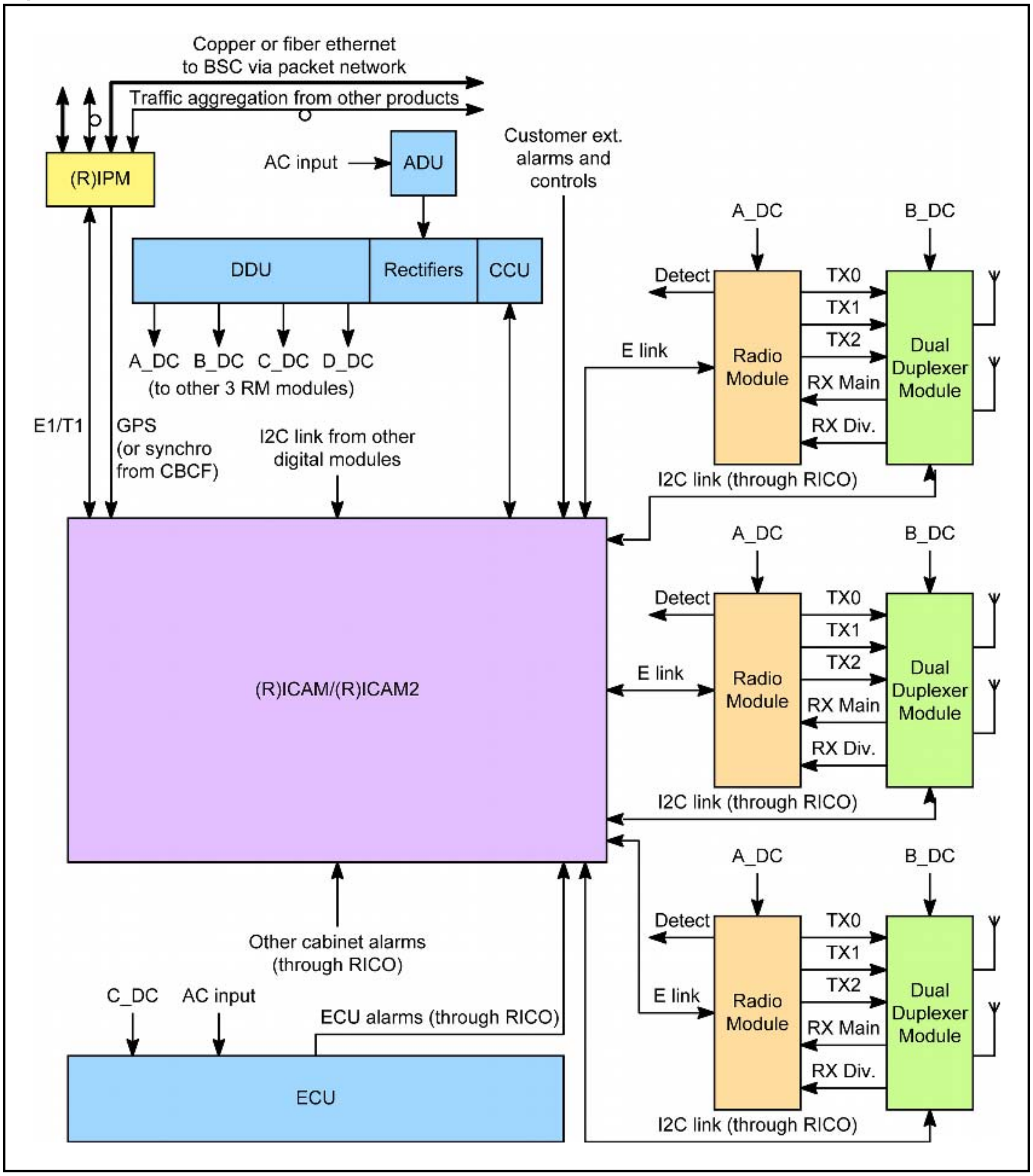
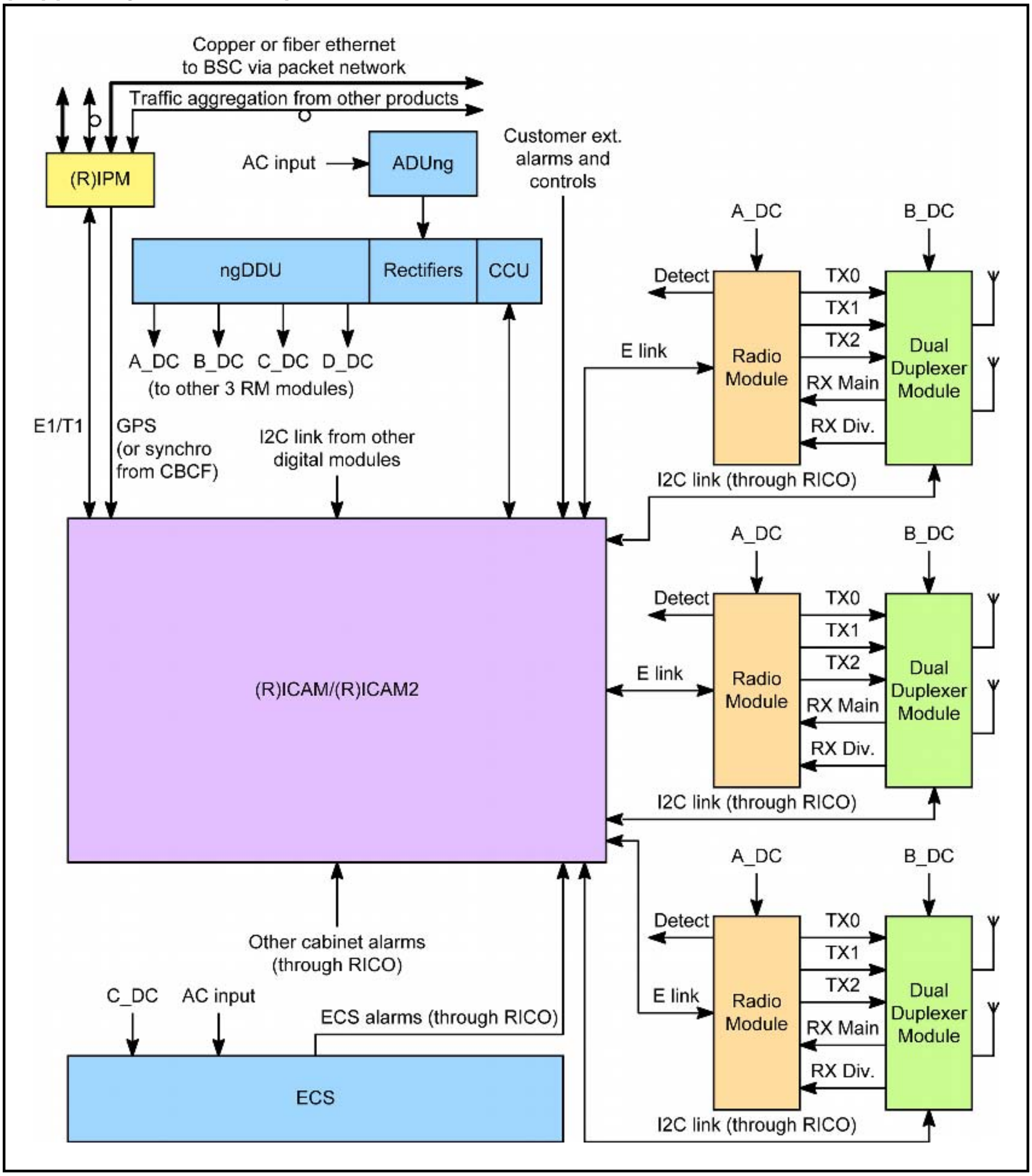


Figure 97
BTS 18020 NG/BTS 18020 WW block diagram for a S333 configuration with RICAM(2)/ICAM (supporting Abis over IP)



Most of the interfaces between IFM, ICM, ABM and the Radio Modules, as well as primary DC (-48 V) distribution, are performed through the back-planes (IBP/CIBP or DBP).

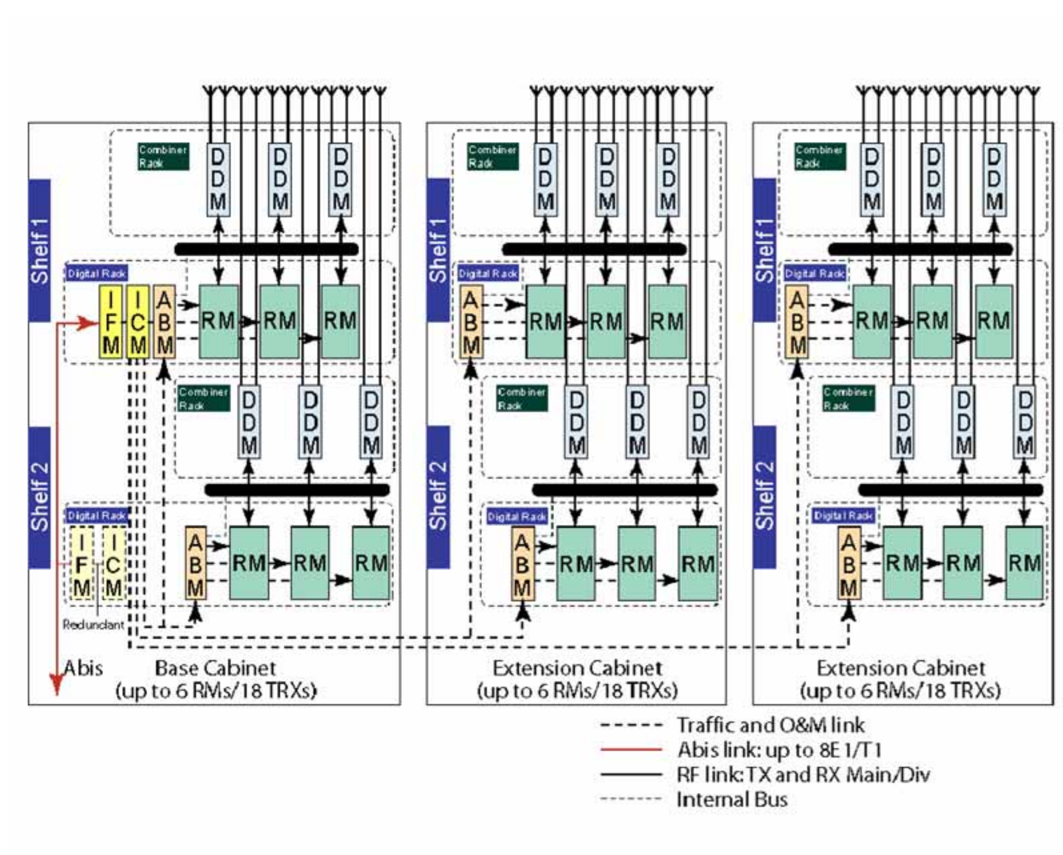
The DDMs constitute the standard solution for RF coupling. These modules are connected to ABM through RICO board through pseudo I2C links, for alarms polling and inventory purpose.

In addition to the DDM, an RM integrated RX splitter function is used to distribute RX signals from all RM RX inputs to RX RF chains.

The ABM is connected to the ICM through front panel cable (D link).

For configurations with extension cabinets, the ICM can provide up to four additional D links to the corresponding number of ABMs. Figure 98 "BTS 18000 architecture (three-cabinet configuration example)" (page 271) illustrates the BTS 18000 architecture, in a three-cabinet configuration (base cabinet plus two extension cabinets).

Figure 98
BTS 18000 architecture (three-cabinet configuration example)



Chapter 6 BTS 18000 software

6.1 Definitions

The following terms are used in this chapter:

- **Flash memory**

  Flash memory is a type of nonvolatile storage device that can be electrically erased and reprogrammed.

  Flash memory combines the benefits of Random Access Memory (RAM) (data blocks writing, reading and erasing) and Read-Only Memory (ROM) (content permanency, even switched off).

  Flash memory is a later form of EEPROM.

- **EEPROM**

  EEPROM stands for Electrically-Erasable Programmable Read-Only Memory.

  EEPROMs are nonvolatile storage chips used in a variety of applications, including networking and telecom equipment, industrial controls and instrumentation.

  An EEPROM is a special type of PROM that can be erased by exposing it to an electrical charge. Like other types of PROM, EEPROM retains its contents even when the power is turned off. Also like other types of ROM, EEPROM is not as fast as RAM. Unlike an EPROM, an EEPROM can be programmed and erased multiple times electrically.

  EEPROM is similar to flash memory (sometimes called flash EEPROM). The main difference is that EEPROM requires data to be written or erased one byte at a time, whereas flash memory allows data to be written or erased in blocks. This makes flash memory faster. Moreover, EEPROM is dedicated to low volume data, whereas flash memory is dedicated to program mass storage.

- **FPGA**

  FPGA stands for Field-Programmable Gate Array.

  FPGA is like an Application-Specific Integrated Circuit (ASIC) that can be reprogrammed after it is manufactured - a programmable logic device.

An FPGA consists of an array of logic elements, either gates or lookup table RAMs, flip-flops and programmable interconnect wiring.

FPGA content is part of the modules applicative software. FPGA content is lost at power down as FPGA is RAM based.

- **Downloadable software**

  A downloadable software is a software that can be modified on site through a BSC downloading, through the Abis interface.

- **Downloading**

  A process which consists of installing, into a module, software from an external entity (terminal, Ethernet network, BSC, and so on).

- **Loading**

  A process used to load, into the subassemblies of a module, the software it requires for its nominal operation.

- **BIST**

  Basic hardware self-test programs of a BTS subsystem subassembly. These tests validate a subassembly intrinsically, without disturbing the other subassemblies.

- **Self-tests**

  Global, functional test programs, which use several subassemblies in order to validate an assembly. These tests can be broken down into tests of more or less elementary functions. This may require external equipment (so the term may be misleading).

6.2 BTS 18000 software presentation

BTS software is divided into downloadable files.

6.2.1 Downloadable files

The BSC downloads these files through the Abis interface.

There are two sets of files: TRX and BCF. Each set is arranged in a file catalogue that contains the list of files and the files themselves.

- The TRX set of files contains files that must be uploaded into radio modules (including the RM applicative software and its slaves).
- The BCF set of files contains files that must be uploaded into ICM and ABM(including the OM applicative software).

The TRX and BCF sets of files must be compliant together in a BTS. The files upload must be performed as recommended in the BTS upgrade procedures.

A BTS upgrade procedure progresses through multiple steps, and the different functions are enabled as each step is completed. The BTS 18000 site contains:

- one active ICM
- one passive ICM, in case of configuration with redundancy
- up to 18 RMs
- up to six ABMs

  In a RICAM/ICAM configuration, there is a maximum of three ABMs.

The BTS 18000 site contains three types of modules with flash EEPROM:

- ICM
- ABM
- RM

ICM and ABM software components are downloaded in BCF set of files. RM software components are downloaded in TRX set of files.

6.2.2 BTS 18000 ICM software

Table 104 "ICM software product names" (page 276) lists the ICM software products used in the BTS 18000.

Those software products can be seen at the OMC as a result of DISPLAY MARKER command.

Table 104
ICM software product names

Board	Software product name	Software product type
ICM	MB_BOOTBOOTICM	BOOTBOOT (not downloadable)
	PE_ICM_L	ICM BootLoad
	PE_D02	DLU Code
	PE_ICM_F	BIST + FPGA (ICM)
	PE_ABM	ABM BootLoad
	PE_BIST_ABM	BIST + FPGA (ABM)
	PE_DBG_ABM	ABM Debug
	PE_ABM_CCU_CDMA	CDMA_CCU (ABM)
	PE_ABM_CCU_UMTS	UMTS_CCU (ABM)
	PE_DBG_ICM	ICM Debug

6.2.3 BTS 18000 RM software

Table 105 "RM software product names" (page 277) lists the RM software products used in the BTS 18000.

Table 105
RM software product names

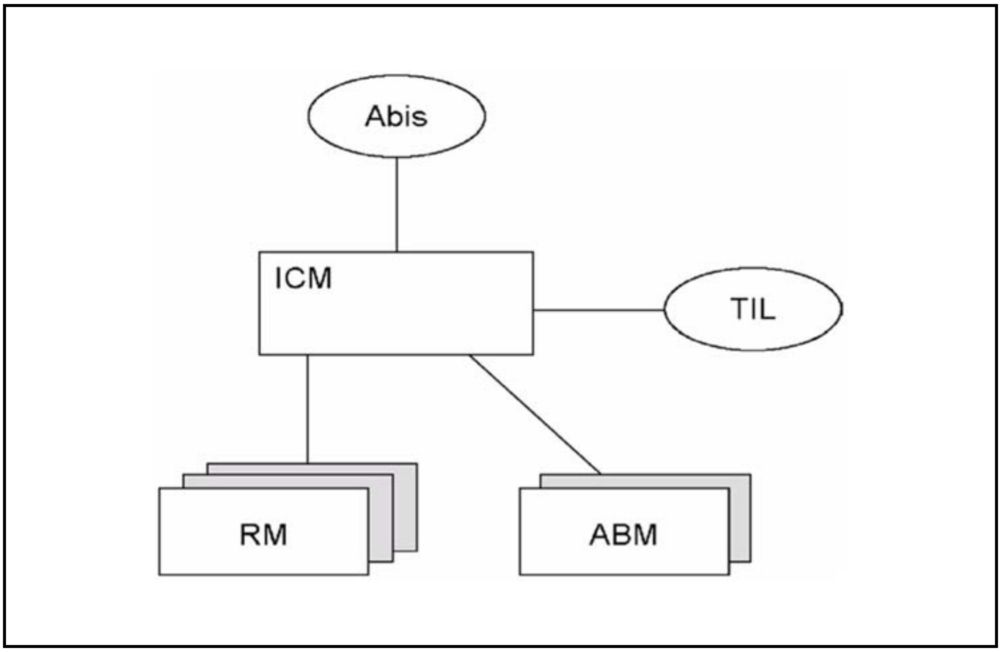
Board	Software product name	Software product type
RM	PE_RMNU_B	AMNU BOOT
	PE_SPU2_SG_L	SPU
	PE_RMNU_COAM_L	OM
	PE_TOOLS	TOOLS
	PE_RMNU_RSL_L_NC or PE_RMNU_RSL_L_C	RSL
	PE_BISTFPGA	BIST + FPGA
	PE_TESTCFG	Debug file

6.3 BTS 18000 software functions

BTS 18000 software is distributed among three major units. For more information, see Figure 99 "BTS 18000 software functions" (page 278):

- The RM unit is designed to transmit and receive (modulate and demodulate) and manage three TDMA frames on the radio channel.
- The BCF is controlled by ICM and manages its slave units:
  - ABM
  - RM
- The TIL unit is used for in-factory testing of the BTS, and to configure, control, and supervise the BTS on site.

Figure 99
BTS 18000 software functions



6.3.1 RM software functions

The RM software is downloaded by the BSC, configured and supervised by the BSC through a LAPD link and a serial link. It serves as a gateway between the radio channel and the BSC. It handles both signaling and voice for all the logical channels carried by a given TDMA frame.

The module has four functions:

- The AMNU (LAPDm, L3 RSL, L3 OAM, equipment identification, defense) is the RMs management unit.
- The SPU is a gateway between the radio network and the BSC.
- TX/RX and PA manage radio transmission and power amplification.
- The BDT manages the GSM TIME.

L3 OAM AMNU This software unit centralizes the operating and maintenance functions:

- initialization and monitoring of BISTs
- connection with Abis and BCF
- downloading and software marking
- configuration
- defense and alarms
- tool functions
- transmission of GSM TIME to BDT, and of OM to TX

L3 RSL This software unit represents the Radio Resource (RR) and the radio measurements function (L1M) in the BTS:

- radio link layer management
- dedicated channel management
- common channel management
- TRX management
- error handling
- measurement collecting
- measurement preprocessing (for power control by the BTS, and for call clearing and handover decision for the BSC)

LAPDm This software unit provides the LAPDm radio level 2 protocol with the mobile.

SPU This software unit enables the level 1 radio communication with the mobile to transmit and receive:

- gateway between radio and terrestrial network (Abis) for the traffic channel
- multiplexing and demultiplexing of the logical channels on physical channels

RX This software unit provides the radio-electrical reception function.

L3 TX This software unit manages and monitors radio transmission. It is installed in each RM board. It sets the transmitter operation mode and defines the transmission power to be used. It also controls the Power Amplifier (PA).

L1 BDT This software unit extracts the GSM TIME carried on the PCMp (GSM TIME TS) for the BDT unit.

LAPD This software unit manages the LAPD link level 2 protocol on PCM between RM and BSC.

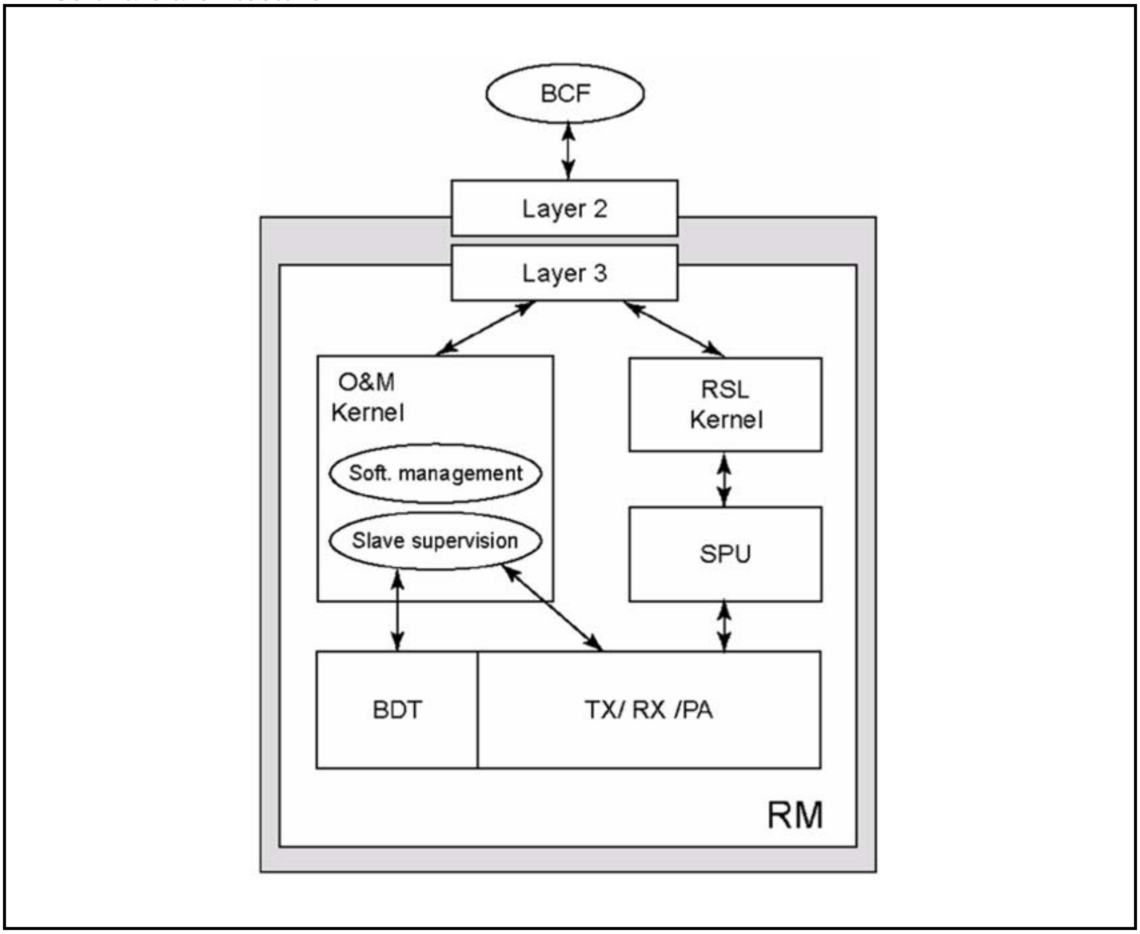
Equipment identification The RM software can detect the type of RM and PA. The BTS recovers it during connection with respect to the BCF and the RM. Note the following restrictions:

- If a RM is not yet connected to the BCF, its type is set to "RM type" until it is connected.
- If a fault beginning has been sent on the RM type of equipment, because the real equipment type was unknown, the fault ending is sent on a RM type, even if the RM has connected itself between the fault begin and fault end.

Defense The RM board carries out no defense actions by itself.

The RM software architecture is shown in Figure 100 "RM software architecture" (page 281).

Figure 100
RM software architecture



6.3.2 BCF software functions

BCF software is composed of ICM software and ABM software.

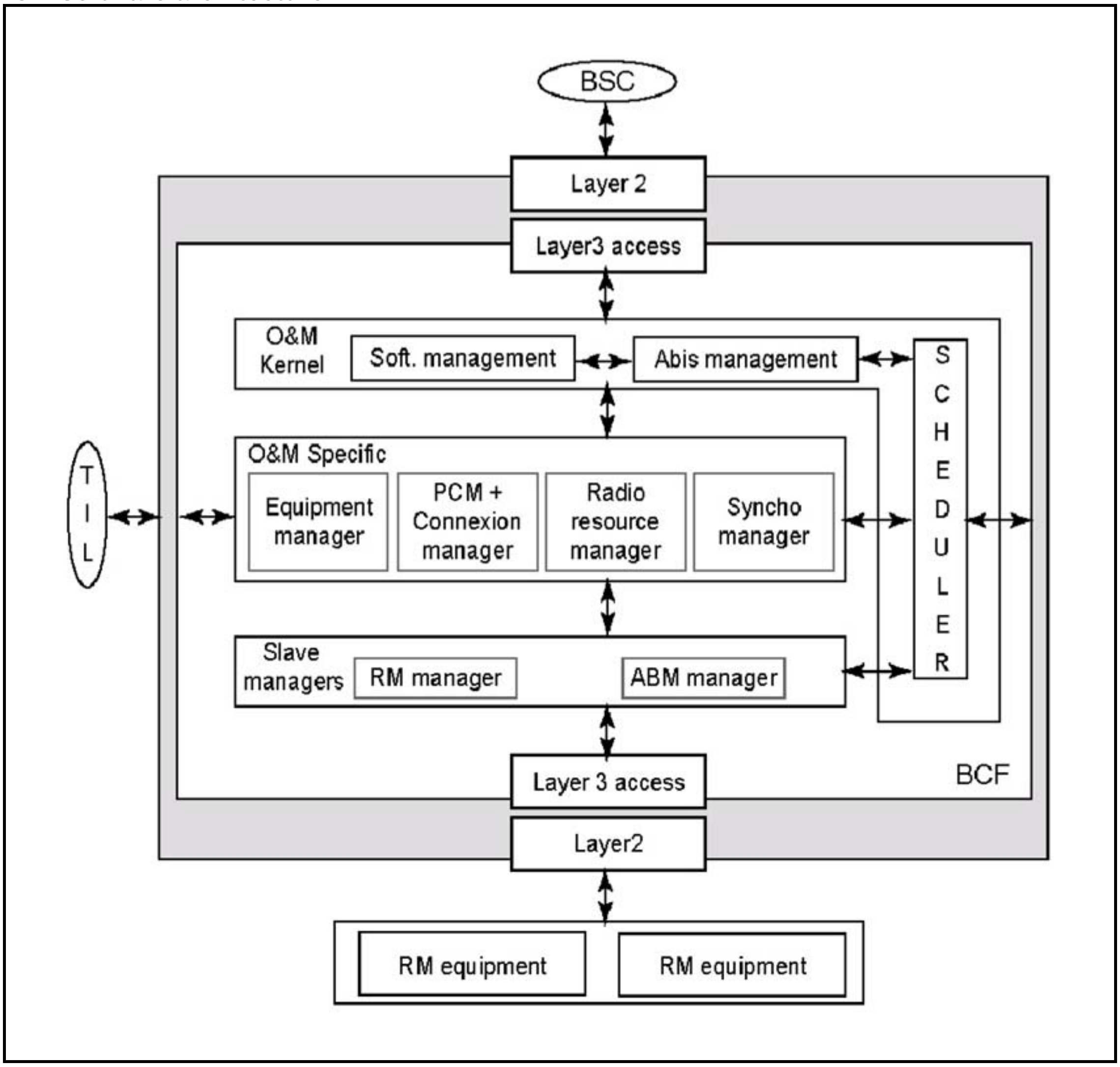
- ABM software functions are as follows:
  - alarms
  - inventory
  - gateway for RM access
- BCF software manages the following OM functions:
  - PCM and connection management
  - configuration and supervision management
  - software management
  - synchronization management
  - test management
  - cold duplex management
  - equipment identification

ICM software is based on a COAM software architecture, which is composed of three main parts:

- common software for various BTS products:
  - OS Kernel
  - OM Kernel
- BTS-specific software dedicated to a BTS product:
  - OS-specific
  - OM-specific
- slave managers

The ICM software architecture is shown in Figure 101 "ICM software architecture" (page 283). The RM manager manages radio modules.

Figure 101
ICM software architecture



6.3.2.1 PCM and connection management

This function selects one of the incoming PCMs for communication with the BSC. It then routes PCM TSs to the appropriate equipment in the BTS as the BSC requests. Other PCM TSs are routed toward another PCM to allow drop and insert functionality.

This function also ensures LAPD concentration.

6.3.2.2 Configuration and supervision management

This function translates the OML Abis model into a physical model to offer a standardized configuration and supervision to the BSC. The BCF acts as an Abis front end toward the BSC for configuration and supervision purposes. It is the only link for configuration messages coming from the BSC. The ICM uses the ICM/RM protocol to drive any actions concerning the RM.

6.3.2.3 Software management

The BCF performs software management for the BTS and provides the link for downloading messages from the BSC. When ABM board is downloaded, the ICM/Slave protocol is used.

6.3.2.4 Synchronization management

The BCF builds the GSM time and provides it to the RM through a TS or a private PCM. External PCMs ensure long term stability.

6.3.2.5 Test Management

The BCF coordinates all BTS tests. When an installation or maintenance action affects an RM, the RM is driven by the ICM using the ICM/RM Protocol.

6.3.2.6 Duplex Management

The software manages a cold duplex mode.

6.3.2.7 Equipment identification

A BCF feature allows the user to identify the type of RM to be replaced in case of failure.

6.3.3 TIL software functions

For detailed information on TIL, see *Nortel GSM BTS Commissioning—TML User Guide* (411-9001-051).

The TIL application is connected to the active ICM through an Ethernet connection.

The TIL is designed to do the following:

- Validate the BTS in the factory.
- Install the BTS site.
- Perform diagnostics of hardware problems.
- Check hardware and software status.
- Check equipment substitution.
- Check the equipment extension within a cabinet
- Perform inventory.

Inventory is a new function that does not exist on other products.

This software unit manages all the boards of the BTS by establishment of a network with all the GSM entities of the BTS. It integrates the factory and installation test environment.

The TIL takes the following testing into consideration:

- the conformity of the cabinet configuration
- the validity of the data links
- the external BTS PCM
- the connectors in the cabinet for cabinet extensions

The TIL can also be used to display the following information (in connected mode):

- the Configuration Reference (DLU) being used by the BTS
- the sector-wise distribution of Radio Module/TDMA
- identification of the BCCH carrying TDMA per sector

For more detailed information on the TIL, see *Nortel GSM BTS Commissioning—TML User Guide* (411-9001-051).

Chapter 7 BTS 18000 used in synchronized co-location mode

The BTS 18000 can be operated to increase the capacity of existing S8000 or S12000 sites, in a synchronized co-location mode.

7.1 Operating principle

7.1.1 Synchronizing several BTS sites

The operating principle is to synchronize up to two BTS 18000 sites, called "slave" or "synchronized" BTS sites, with the synchronization signal received from a S8000 or S12000 site, called the "master" or "synchronizing" BTS site, instead of from the BSC through the Abis link.

This configuration enables to perform the equivalent of a high capacity site, based on up to three co-located S8000/S12000 and BTS 18000 sites, which share the same GSM time base on the RF layer. There is no share of radio sector between S8000/S12000 site and BTS 18000 site.

The master BTS site and the slave BTS 18000 site are managed as separate sites. The master BTS and the slave BTS 18000 must be connected to the same BSC.

This external synchronization is compatible with redundant ICM configurations. The same external synchronization interface enables BTS 18000 to be synchronized on either CBCF or GPS.

Only S8000/S12000 BTS with CMCF phase 2 can support BTS 18000 cabinet’s synchronization.

In a master/slave synchronization, the BTS 18000 can only be a slave BTS; it cannot be the master BTS.

7.1.2 Full BTS synchronization

With this feature synchronization is activated through the OMC-R and can be monitored through events visible on the OMC-R MMI. Master and slave modes are activated through a parameter (btsSMSynchroMode).

If the master BTS is synchronized using GPS, it can broadcast the GPS time to its slaves (cable delays are compensated at the slave level). In this case, the master BTS is configured to use "Burst Synchronization" or "Time Synchronization", see 8.1 “Network synchronization” (page 293) and the slaves are configured just as slaves. Instead of synchronizing the BTSs through cable, they could be synchronized through GPS; in this case, each BTS is configured to use "Time Synchronization".

7.2 Master/synchronizing BTS site

The synchronizing or master BTS site remains unchanged. It receives its synchronization (SY) from the BSC through the Abis link and generates its own GSM time as any BTS does.

7.3 Slave/synchronized BTS site

The synchronized or slave BTS 18000 gets its synchronization (SY) and GSM time from an external signal coming from the master BTS, through a specific cable.

The received GSM time reference is regenerated and sent to the TRX with zero delay so that the radio frames of the slave BTS 18000 are in phase with the radio frames of the master BTS.

7.3.1 Examples of synchronization connections

Figure 102 "Example: synchronization connections between master S12000 and slave BTS 18000 (maximum configuration)" (page 289) and Figure 103 "Example: synchronization connections between master S12000 and slave BTS 18000 (small configuration)" (page 290) illustrate two examples of synchronization connections between master and slave BTSs:

- If the master BTS CBCF supplies unused private PCM connectors (no extension cabinets), the slave BTS 18000 can be connected there.
- If all private connectors are used in the master CBCF, the slave BTS 18000 must be plugged on the existing private PCMs towards extension cabinets, using a specific "Y" cable.

Figure 102
Example: synchronization connections between master S12000 and slave BTS 18000 (maximum configuration)

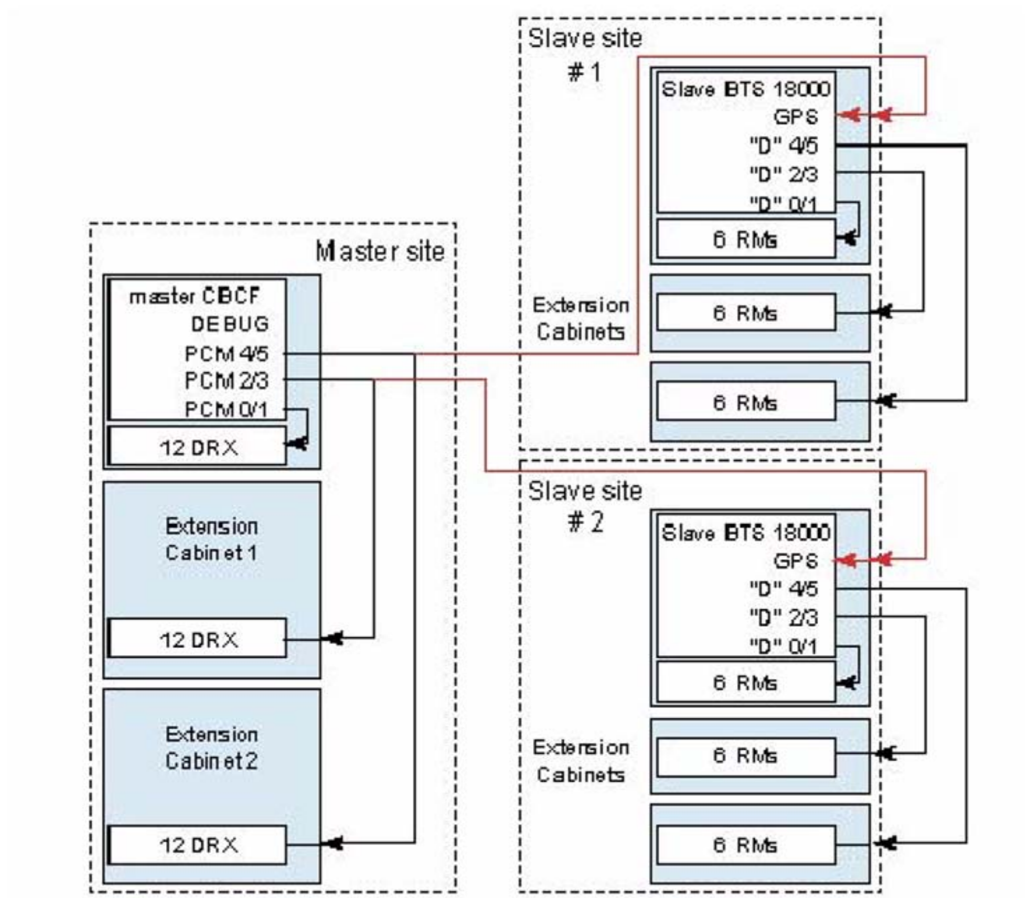
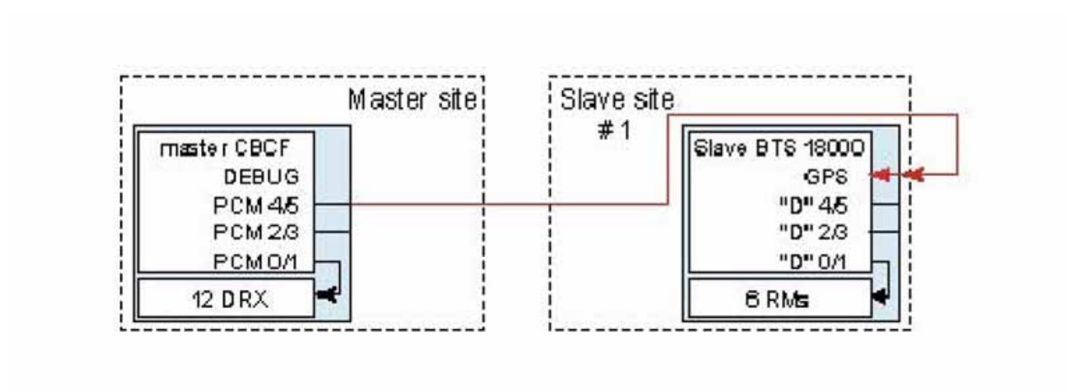


Figure 103
Example: synchronization connections between master S12000 and slave BTS 18000 (small configuration)



A specific cable is needed between the master and slave BTSs. This cable is a derivation of the PCM between base and extension cabinets of the master BTS that is connected to the GPS connector of the slave BTS 18000 base cabinet.

The length constraints for this synchronization cable are the same as for the intercabinet cable: the synchronized and synchronizing BTSs must not be more than ten meters apart.

The slave BTS 18000 needs to be restarted after connection of the cable in order to synchronize itself on external synchronization signals.

7.3.2 Slave BTS 18000 LEDs behavior

When the slave BTS 18000 is correctly synchronized with the signal coming from the master BTS:

- The four SYN LEDs blink three times when synchronization signals are newly detected.
- The four SYN LEDs of the active and passive ICMs are switched on.
- The G LED is switched on (amber).

If a synchronized BTS 18000 loses its external synchronization, the four SYN LEDs are no longer switched on at once and the G LED of the active ICM is switched off. For more information, see Table 18 "ICM specific LEDs behavior" (page 102). The behavior of the ICM LEDs in the case of synchronization is described in more detail in 4.3.10 “Summary of ICM LED behavior during BTS 18000 synchronization” (page 107).

7.4 Defense mechanism

The slave BTS 18000 turns into stand alone mode to cope with temporary lost link from the master S8000/S12000. There is no impact on traffic as long as the master GSM time is not regenerated with a discontinuity.

Chapter 8 Using GPS synchronization

GPS can be used as a source of synchronization for the BTS 18000.

8.1 Network synchronization

Network synchronization means that all network entities have a common time source. Such a time source requires:

- a clock, and/or
- a value for GSM time

A GPS receiver must be installed to provide the GPS time and clock.

Two types of network synchronization are available:

- **Burst Synchronization:** enslaves the network on a source clock and ensures that all bursts are aligned in time.
- **Time Synchronization**: enslaves the network on a source clock and forces the GSM time to be deduced from a unique source time.

8.2 GPS equipment

The network synchronization feature described in 8.1 “Network synchronization” (page 293), needs a GPS receiver to be installed on the site. On the BTS 18000, this receiver is connected to the ICM.

The following configurations are supported:

- BTS 18010 with TMU
- BTS 18010 with LMU + EIU
- BTS 18020 with TMU
- BTS 18020 with LMU + EIU

where:

TMU = Timing Measurement Unit

LMU = Location Measurement Unit

EIU = External Interface Unit

In the case of BTS 18010 (indoor), the TMU or LMU + EIU is installed outside the cabinet. In the case of BTS 18020 (outdoor), the TMU or LMU + EIU is installed inside the cabinet (in the user rack).

The use of GPS equipment has an effect on the start-up of the BTS 18000. This is described in the Chapter on startup in *Nortel GSM BTS 18000 Troubleshooting* (411-9001-162).

The TMU, LMU, and EIU are not in the Nortel portfolio (of products) and they are not installed or maintained by Nortel. If required, they should be purchased directly from their manufacturer.

Chapter 9 GSM-UMTS dual mode configurations

9.1 BTS 18000 - GSM - UMTS overview

The BTS 18000 is proposed in a GSM-UMTS dual mode variant, for both BTS 18010 and BTS 18020 versions.

This is known as the BTS 18000 - GSM-UMTS (also referred to as a combo).

GSM and UMTS components are housed within the same cabinet. This cabinet is based on GSM classical BTS 18010 and BTS 18020 cabinet.

The BTS 18000 - GSM-UMTS configurations are built with one shelf (one combiner rack plus one digital rack) for GSM and one shelf for UMTS. These configurations are based on the following:

- BTS 18000 modules, for the GSM shelf
- iBTS modules, for the UMTS shelf

The GSM part of the BTS 18000 is connected to the Nortel Networks Base Station Controller (BSC) through PCM links using current Nortel Networks Abis interface.

The UMTS part of the BTS 18000 is connected to the Nortel Networks Radio Network Controller (RNC) through ATM transmission using current Nortel Networks Iub interface.

The GSM shelf contains only one ICM, and thus, does not provide ICM redundancy. Abis capacity is limited to S333 and four E1/T1 (only one IFM is available in the BTS 18000 - GSM-UMTS).

9.2 Reachable GSM radio configurations

For mono-cabinet configurations, the BTS 18000 - GSM-UMTS acts as a main GSM cabinet. The available configurations for this BTS 18000 - GSM-UMTS are the same as for standard BTS 18000 ones, reachable in only one shelf.

9.2.1 Main configurations

The main configurations available are as follows:

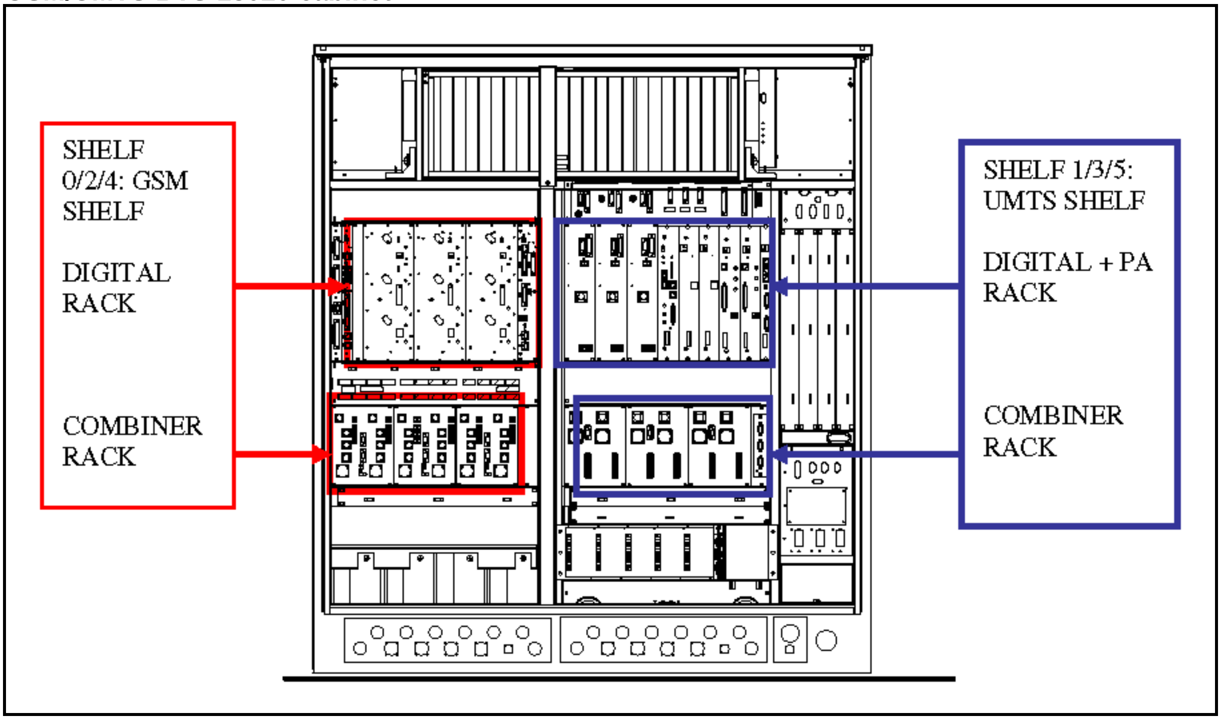
- Duplexer or TxF coupling:
  - up to S222, including configurations with RM in S111 mode (S111, S222)
  - up to O8, including configurations with RM in O3 mode (O3, O6, O8)
  - up to S22, including configurations with RM in S11 mode (S11,S22)
  - up to S42, including configurations with RM in O3 mode (S22, S24, S42)
- H2 or H4 coupling:
  - up to S333, including configurations with RM in O3 mode or S111 mode (S111, S222, S333)
  - up to O9, including configurations with RM in O3 mode (O3, O6, O9)
  - up to S33, including configurations with RM in S11 mode (S11, S22, and S33)
  - up to S36, including configurations with RM in O3 mode (S33, S36, and S63)
- H3 coupling
  - tri-sectorial 3S666/666/666 RM in O3 mode
  - tri-sectorial 3S666/666/666 RM in mixed mode (first 3 RMs in S111 mode, last 3 RMs in O3 mode)
  - omni-sectorial 3 018/18/18 or 3S99/99/99 RM in O3 mode (dual band configuration)
  - Dual mode configuration RM in O3 mode (dual band configuration)
  - omni-sectorial 3 012/12/12 or 3 S96/96/96 mixed RM in O3/O2 mode (dual band configuration)
  - omni-sectorial 3 012/12/12 or 3 S66/66/66 RM in O2 mode (dual band configuration)

9.2.2 Mono-cabinet GSM/UMTS configurations

In a mono-cabinet combo configuration, there is one GSM shelf (digital + radio) and one UMTS shelf. The UMTS equipment must be installed in the odd rack and GSM equipment in the even rack (even if ABM manages all GSM alarms for the cabinet). Logical shelf numbering starts from 0. Thus, in the combo mono-cabinet, the UMTS rack can only be in shelf 1.

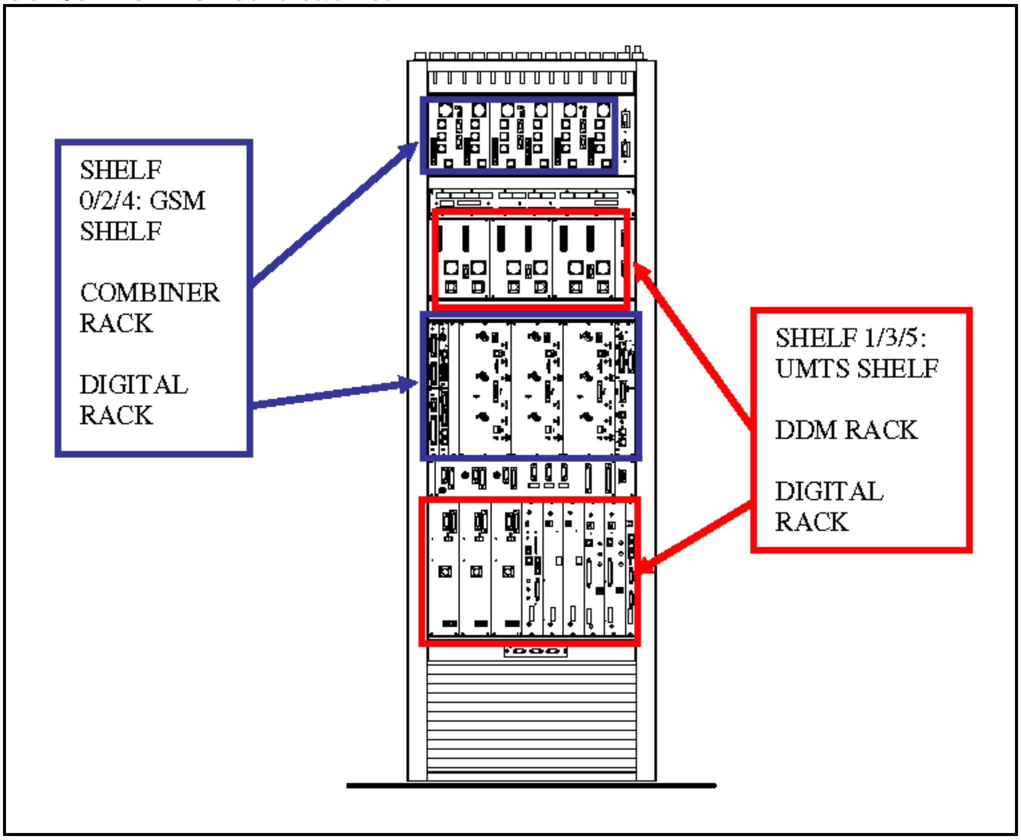
The following figure shown an outdoor combo cabinet.

Figure 104
GSM/UMTS BTS 18020 cabinet



The following figure shown an indoor combo cabinet.

Figure 105
GSM/UMTS BTS 18010 cabinet



9.2.3 Multi-cabinet GSM/UMTS configurations

For larger capacity, it is possible to have multi-cabinet combo configurations.

In a multi-cabinet configuration, there can be a maximum of three cabinets. Only one of these cabinets can be the GSM/UMTS combo cabinet (either the base or an extension cabinet), while the remaining two must be “GSM-only” cabinets.

In this case, it is better to locate the combo part in an extension cabinet (not the base one) as this permits eight Abis and ICM redundancy.

GSM/UMTS combo cabinet is the base cabinet

If the GSM/UMTS combo cabinet is the base cabinet, then in addition to the GSM configuration in the base cabinet, each extension cabinet could have up to six radio modules (RMs), two ABMs, six DDMs, and the associated RICO (as in a “GSM-only” BTS18000 extension cabinet). The extension cabinets do not have any ICM, IFM, or SPM.

In the outdoor configuration (BTS 18020), if the GSM/UMTS combo cabinet is the base cabinet and a CIBP is being used, then only a single extension cabinet can be connected due to hardware restrictions imposed by the bulkheads on the standard BTS 18000 outdoor cabinet.

GSM/UMTS combo cabinet is an extension cabinet

If the GSM/UMTS combo cabinet is an extension cabinet, then the complete GSM BTS 18000 base cabinet configuration is available, that is, two ICMs, two IFMs, and two SPMs, plus the usual radio (RM) blocks. The number of ABMs, RMs and other RF blocks remain the same as above.

There are six alarm ports in the User Rack, for each cabinet. All six alarm ports are connected to the GSM side. In the GSM/UMTS combo cabinet, only the first four ports (1, 2, 3, and 4) are connected to the UMTS side.

In multi-cabinet combo configuration, the maximum number of user alarm ports can be provided for both the GSM and UMTS sides, by using the last extension cabinet as the combo cabinet. In the case of three cabinets, this gives 12 alarm ports for the GSM side, and four alarm ports for the UMTS side.

9.3 BTS 18000 - GSM-UMTS hardware

9.3.1 Description of the BTS 18010 - GSM-UMTS and BTS 18020 - GSM-UMTS cabinets

GSM and UMTS configurations share the following equipment:

- power supply:
  - BTS 18010 DC distribution system, only available on -48 V DC input version
  - BTS 18020 UCPS plus ADU (the UCPS uses a dedicated UMTS CCU for one-wire connectivity)
- cooling system, BTS 18010 SICS or BTS 18020 ECU
- User rack

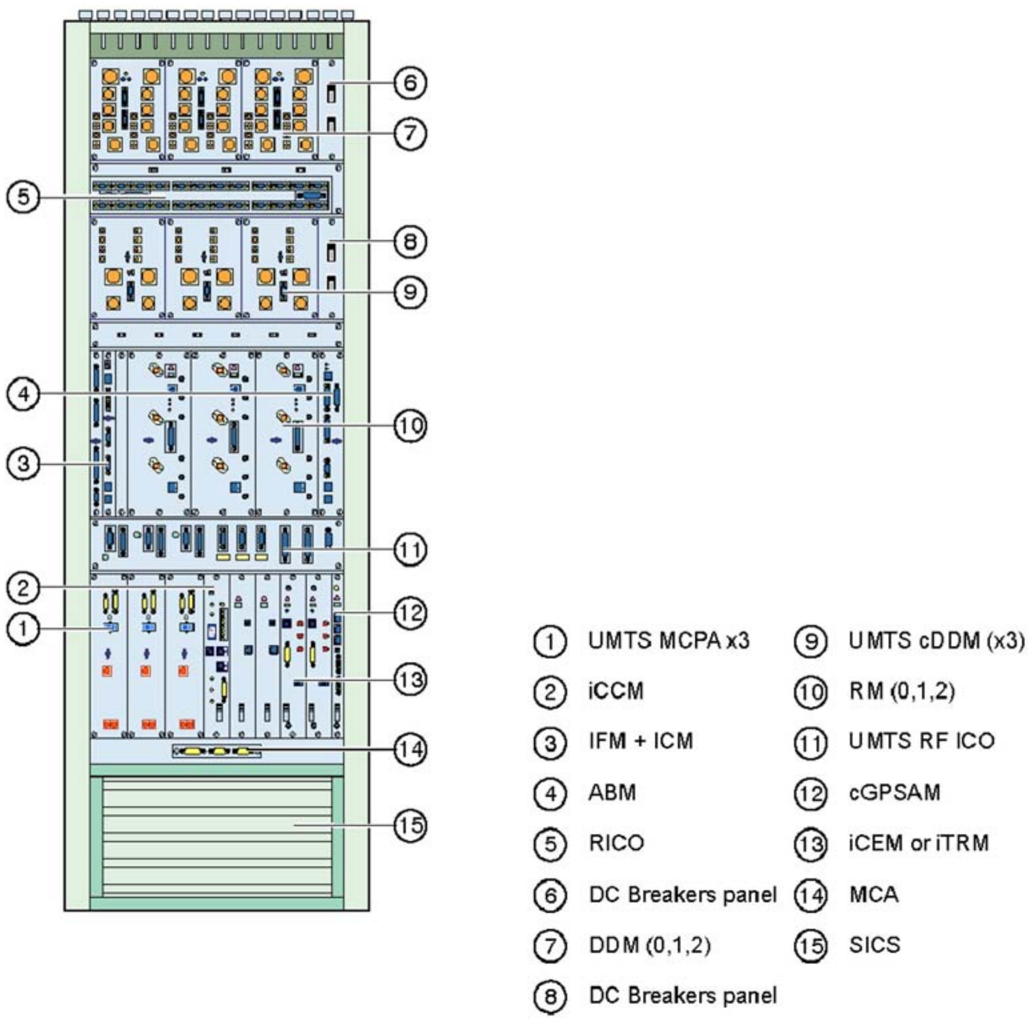
An example of one-cabinet GSM-UMTS dual mode configuration is given below. It may include the following elements:

- for the GSM part:
  - back-planes and ICO: one Interface Back-Plane (IBP) or Compact Interface Back-Plane (CIBP), one Digital Back-plane (DBP), one Radio InterCOnnect board (RICO)
  - one Interface module (IFM)
  - one Interface Control Module (ICM)
  - one Alarm Bridge Module (ABM)
  - up to three Radio Modules (RM)
  - up to three Dual Duplexer Modules (DDM) or up to nine Transmit Filters (TxF)
  - up to three H3/H4 modules
  - one RICAM (located in the ABM-0 slot)
- for the UMTS part:
  - one RF InterCOnnect board (RFICO)
  - one six-slot digital backplane
  - one UMTS Core Controller Module (iCCM)
  - one Compact GPS and Alarm Module (cGPSAM)
  - up to two UMTS Transceiver Modules (iTRM)
  - up to three UMTS Channel Element Modules (iCEM)
  - up to three Compact Dual Duplexer Modules (cDDM)
  - one Manufacturing Commissioning and Alarm (MCA)

9.3.1.1 Combo GSM configurations with BCF on IBP/CIBP

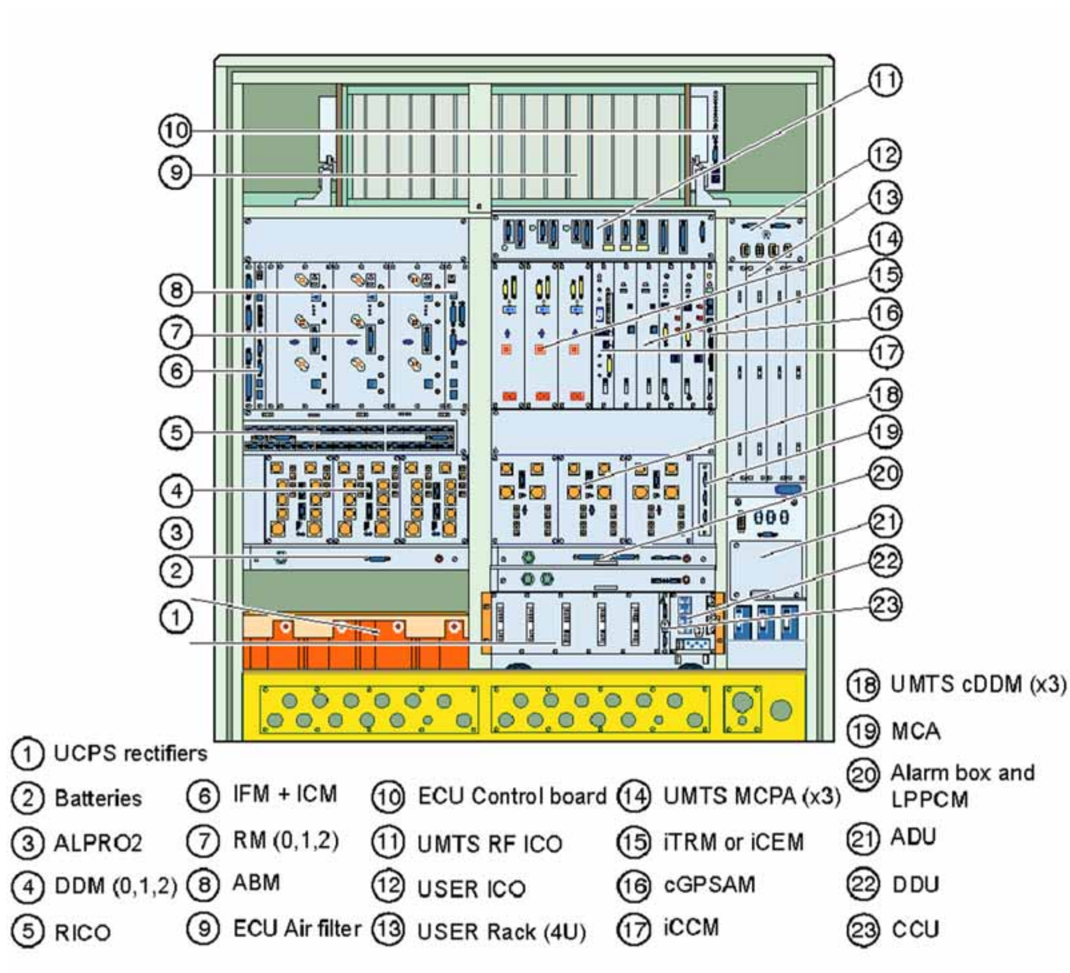
The following figure shows an example of a BTS 18010 - GSM-UMTS cabinet layout and situates the modules in a fully equipped cabinet. This is a configuration with BCF on IBP/CIBP (without RICAM or ICAM).

Figure 106
BTS 18010 - GSM-UMTS with GSM BCF on IBP/CIBP



The following figure presents an example of a BTS 18020 - GSM-UMTS cabinet layout and situates the modules in a fully equipped cabinet. This is a configuration with BCF on IBP/CIBP (without RICAM or ICAM).

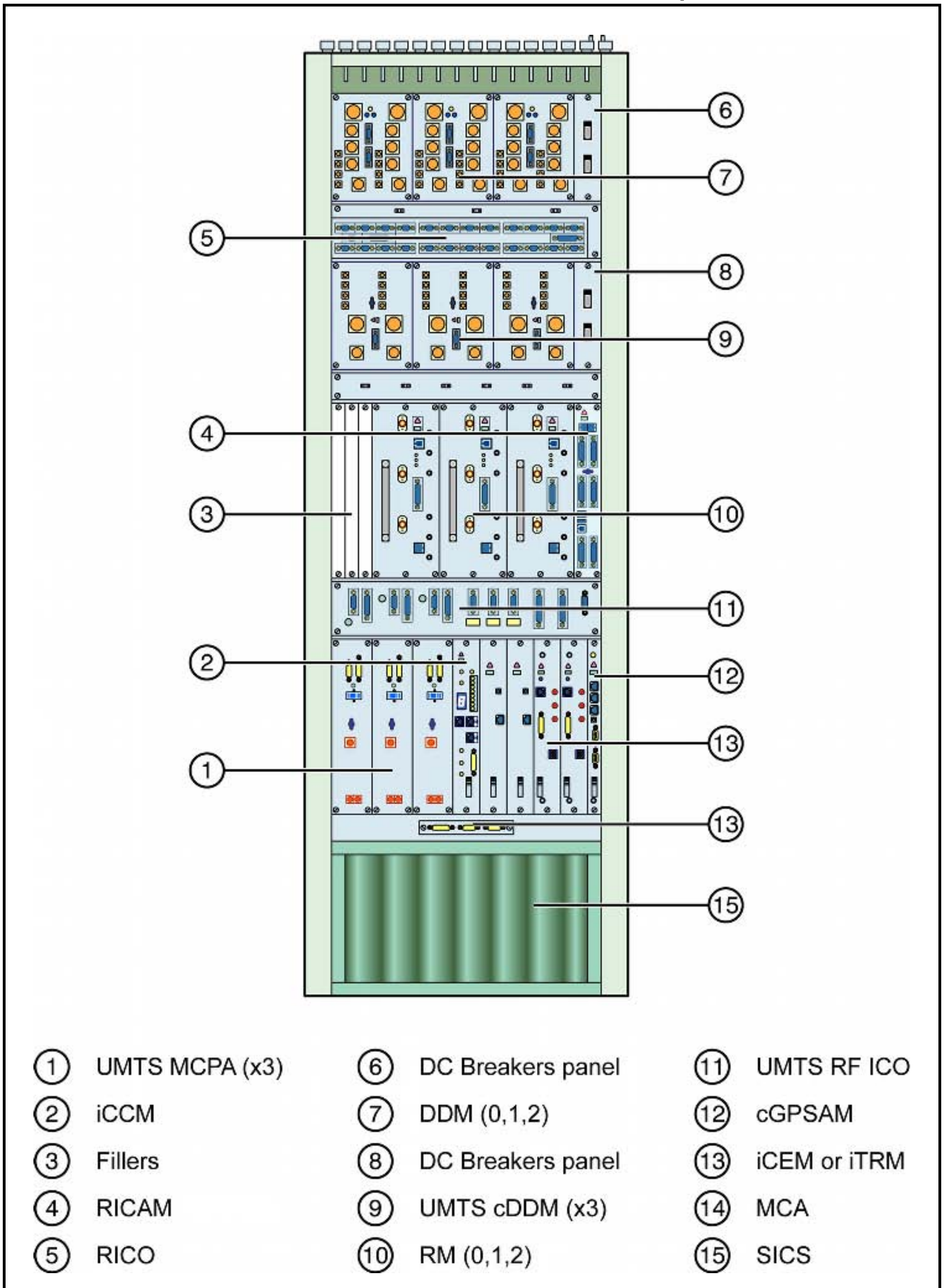
Figure 107
BTS 18020 GSM-UMTS with GSM BCF on IBP/CIBP



9.3.1.2 Combo GSM configurations using RICAM or ICAM

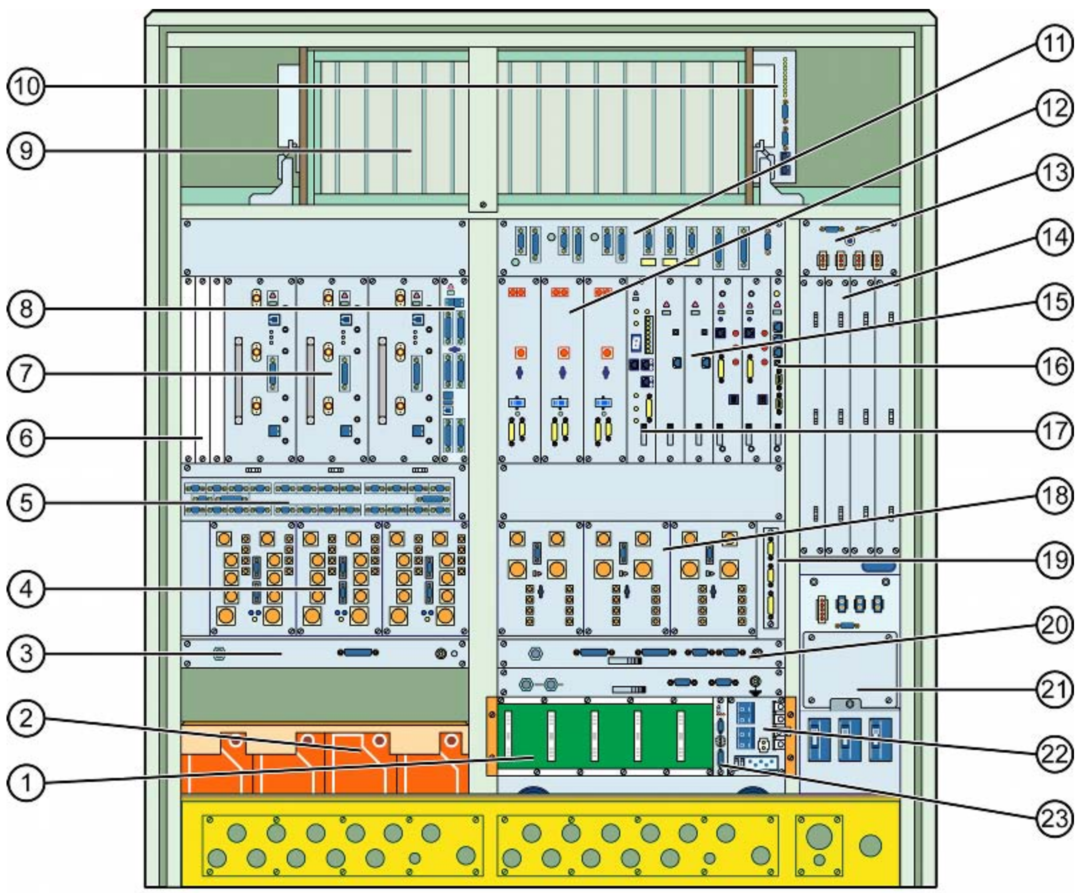
BTS 18010 - GSM-UMTS (Indoor combo) The following figure shows an example of a BTS 18010 - GSM-UMTS cabinet layout and situates the modules in a fully equipped cabinet. This is a configuration with RICAM or ICAM.

Figure 108
BTS 18010 - GSM-UMTS with RICAM or ICAM in the GSM part



BTS 18020 - GSM-UMTS (Outdoor combo) The following figure presents an example of a BTS 18020 - GSM-UMTS cabinet layout and situates the modules in a fully equipped cabinet. This is a configuration with RICAM or ICAM.

Figure 109
BTS 18020 GSM-UMTS with RICAM or ICAM in the GSM part



1. UCPS rectifiers
2. Batteries
3. ALPRO2
4. DDM (0,1,2)
5. RICO
6. Fillers
7. RM (0,1,2)
8. RICAM
9. ECU Air filter
10. ECU Control board
11. UMTS RF ICO
12. UMTS MCPA (x3)
13. USER ICO
14. USER Rack (4U)
15. iTRM or iCEM
16. cGPSAM
17. iCCM
18. UMTS cDDM (x3)
19. MCA
20. Alarm box and LPPCM
21. ADU
22. DDU
23. CCU

Use of (R)ICAM

In a configuration with RICAM/ICAM, there are at most two cabinets (main + one extension).

If the UMTS part is in the main cabinet, the ABM1 rack is occupied by a UMTS module, and RICAM/ICAM cannot use ABM1. A RICAM/ICAM board can be placed in the ABM-0 slot and it can use ABM2 (extension cabinet).

If the UMTS part is in the extension cabinet, there are no restrictions on the use of RICAM/ICAM. A RICAM/ICAM board can be placed in the ABM-0 slot (main cabinet) and it can use ABM1 (main cabinet) and ABM2 (extension cabinet).

9.3.1.3 Alarms management

Common equipment alarms and inventory as well as cabinet alarms are reported to the two systems. They are polled:

- by the ABM, for the GSM part of the cabinet
- by the cGPSAM, for the UMTS part of the cabinet

Those alarms include:

- mechanical alarms (door in BTS 18010 and BTS 18020 versions): Internal Alarm Detection (DALI), alarms duplicated through MCA module for UMTS
- user rack alarms (BTS 18020 version): GSM DALI alarms plus UMTS Dallas one-wire bus
- ADU alarms (BTS 18020 version): GSM DALI alarms plus UMTS Dallas one-wire bus
- energy (BTS 18020 UCPS) and cooling system (BTS 18010 SICS, BTS 18020 ECU) alarms

The UCPS is functionally managed by the GSM part of the cabinet. The SICS and the ECU have a common GSM/UMTS control board. The inventory and alarm collection are duplicated from the common GSM/UMTS CCU:

- to the ABM, through GSM I2C interface
- to the cGPSAM, through UMTS Dallas one-wire bus

External alarms are collected:

- by the ABM (External Alarm Detection (DALE)), for the GSM part of the cabinet
- by the cGPSAM (Dallas one-wire bus), for the UMTS part of the cabinet

External alarms cannot be electrically connected simultaneously to the two systems. If an external alarm is to be polled by both ABM and cGPSAM, it must be completely duplicated.

Secondary protection can be provided in both cases:

- through external modules on the roof of the cabinet, for the BTS 18010 cabinet
- inside the cabinet, for the BTS 18020 cabinet

Chapter 10 Dimensioning and configuration rules

For information on dimensioning and configuration, see the following engineering document: *GSM/GPRS/EDGE BSS Engineering Rules* (PE/DCL/DD/0138).

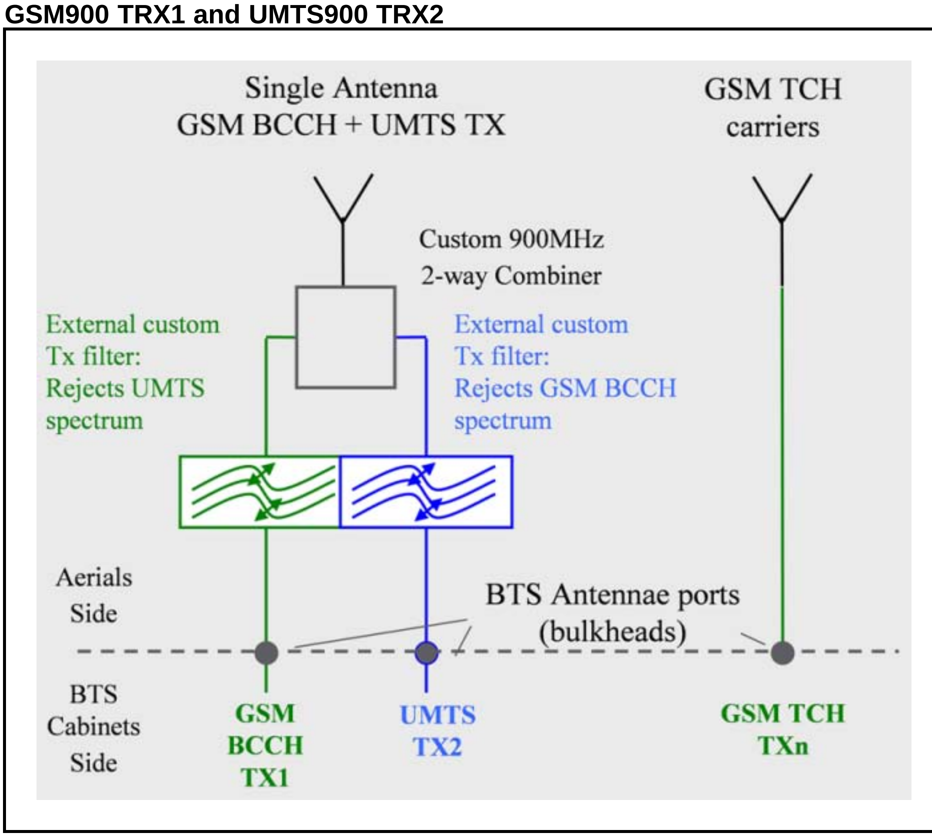
Chapter 11 GSM900-UMTS900 combination on the same antenna

This feature optimizes the TDMA mapping on TRX algorithm: it allows to allocate BCCH on a defined TEI such as to cable the combiner filter on a defined physical port (always the same feeder cable carrying by default the BCCH signal).

11.1 Functional description

A single antenna can be shared by GSM900 and UMTS900 bands as shown in Figure 110 "GSM900 TRX1 and UMTS900 TRX2" (page 309).

Figure 110
GSM900 TRX1 and UMTS900 TRX2



The main usage of this feature is to allow feeder and antennae sharing between GSM 900 MHz and UMTS 900 MHz. In such a case, dedicated frequencies can be allocated to the GSM BCCH, that need to be exclusive and different from the UMTS frequencies. A guardband of several MHz is required between the BCCH frequencies and the UMTS frequencies. Additional external transmit filters will allow, within the guardband separation, to filter out each other’s spurious signals such that both systems can then be combined into a single feeder with minimal RF performance impacts.

The feature then allows the BCCH to be physically allocated to the feeder and antennae with wich the UMTS signal is combined, hence avoiding TCH frequencies to become mixed up with UMTS signal. Only in a fault scenario (for example, a defective radio hardware), would the BCCH be reallocated to another TRX

Without this feature, a TCH may otherwise be randomly allocated to the TX1, that could generate the loss of the TCH transmit if the frequencies are filtered out by the external custom TX filter.

Another use of this feature is, when using several antennas for a single sector, to secure the BCCH to the highest antenna to allow for best coverage.

> ***Note:*** The feature only concerns the software side, but external OEM TX filters and combiners are required.

11.2 Specification

A BCCH TDMA is always mapped on the GSM TRX, when GSM and UMTS TRXs are using the 2-way combiner antenna. There is only one 2-way combiner antenna configured in a cell.

A new class-2 parameter, **GsmUmtsCombBcchTeiVal**, is introduced at a cell level specifying the TEI value of the TRX when the GSM TRX and the UMTS TRX are configured using the 2-way combiner antenna.

During the TRX and TDMA mapping, the following are performed by the supervision module:

- the TEI specified by the operator is mapped to the BCCH TDMA.
- the rest of the TRXs and TDMAs are mapped as per the existing algorithm.

11.2.1 Behavior during the cell (BTS) lock/unlock

When the cell (BTS) is unlocked, the behavior of the TRX TDMA mapping in the supervision is as follows:

- If the TEI specified by the operator **GsmUmtsCombBcchTeiVal**, comes up and is available for mapping among the vital number of TRXs (as mentioned by an exiting parameter **MinNbOfTdma**, under BTS object) awaited by the SPR.
  - The BCCH TDMA is mapped to the TRX whose TEI value is mentioned by the new parameter **GsmUmtsCombBcchTeiVal**.
  - The remaining TRXs and TDMAs are mapped as per the existing algorithm.
- If the TEI specified by the operator, **GsmUmtsCombBcchTeiVal**, does not come up and is not available for mapping among the vital number of TRXs awaited by SPR.
  - The TRX and TDMA mapping for the vital number of TRXs is performed as per the existing algorithm.
  - A degraded state change (enabled/degrade) is triggered on the BCCH TDMA. And on display dynamic data a new state is added to display the degraded status.
  - A notification (1063) is raised to OMC, informing that the BCCH TDMA is degraded, with the cause ***BCCH TDMA mapped to TEI different from operator specified***.
  - Once the TRX with TEI value **GsmUmtsCombBcchTeiVal**, comes up and is available for mapping:
    - The BCCH TDMA is unmapped from its previous TRX.
    - The BCCH TDMA is mapped to the **GsmUmtsCombBcchTeiV alTEI**.
    - Such mapping results in the cell outage for a momentary period and is acceptable.
    - A state change is triggered on the BCCH TDMA to the normal (enabled) state.
    - A notification (1063) is raised to the OMC, informing the reason for this outage as ***Bcch tdma remapped to the GSM TRX configured/combined with UMTS trx using the Type2combined antenna***. A new cause ***BCCH TDMA remapped to operator specified TEI*** is added to 1063 notification.

11.2.2 Behavior when the specified TEI goes down

If the TEI specified by the parameter **GsmUmtsCombBcchTeiVal**, goes down, faulty, or reset for some reason, the TDMA and TRX mapping is redone as per the existing algorithm in the SPR.

As the regular mapping is performed, the BCCH TDMA is mapped to the TEI which is not specified by the **GsmUmtsCombBcchTeiVal** parameter.

A degraded state change (enabled/degrade) is triggered on the BCCH TDMA, and on display dynamic data, a new state is added to display the degraded status.

A notification (1063) is raised to OMC, informing that the BCCH TDMA is degraded, with the cause ***BCCH TDMA mapped to TEI different from operator specified***.

11.2.3 Behavior when the specified TEI comes up

The behaviour when the TEI specified by **GsmUmtsCombBcchTeiVal**, comes up and is available for mapping as explained in the section 11.2.1 “Behavior during the cell (BTS) lock/unlock” (page 311).

11.2.4 Behavior when no TEI is specified (empty value at MMI)

If no TEI specified by the parameter **GsmUmtsCombBcchTeiVal**, which is the default value, the TDMA and TRX mapping is done as per the current existing algorithm in the SPR. No special checks are performed.

11.2.5 Behavior when invalid TEI is specified on the MMI

If an invalid TEI is specified by the parameter **GsmUmtsCombBcchTeiVal**, then the TDMA and TRX mapping is done as per the current existing algorithm in the SPR. No special checks are performed.

11.3 Feature locking

This feature is eligible for feature lock mechanism.

A specific “RFF-35265: GSM-UMTS combination on same antenna”, feature lock is created at OMC-R.

In case of no valid RFF license, the following actions must be forbidden on the involved BSS:

- Setting a value to the new parameter **GsmUmtsCombBcchTeiVal**.
- Build BDA with a non-empty value for the parameter **GsmUmtsCombB cchTeiVal**.

- Reset BDA (online, offline) with a non-empty value for the parameter **GsmUmtsCombBcchTeiVal**.
- Unlock TRX, Bts, BtsSM objects with a non-empty value for the parameter **GsmUmtsCombBcchTeiVal**.

During license verification only working objects must be taken into account (in other words, the object must be unlocked, all its parents must be unlocked and related BSC must be built).

A new error message has been added on semantic check failure on setting the new **GsmUmtsCombBcchTeiVal** parameter.

“No valid GSM-UMTS combination license available to perform this action”.

The use of this feature is controlled by the OMC-R and is locked by default. In order to un-lock the RFF a key is needed for each OMC-R. These keys are provided by Nortel against a proof of purchasing (either a Purchase Order or Contract).

On the license verification, to set a value for the new parameter the respective BTS needs to be locked.

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