EXHIBIT 11

Reference Manual

Applicant: Northern Telecom Ltd.

For Certification on:

AB6UMTS1900IND

Nortel Networks UTRAN solution

iRNC

The iRNC is the e−mobility Internet RNC. It is the 3GPP−compliant UMTS RNC developed by Nortel Networks. The generic term iRNC is used throughout this document to designate the e−mobility Internet RNC.

The iRNC allows mobility between UMTS and GSM networks.

The main functions of the iRNC are to control and manage:

- the RAN (Radio Access Network)
- the signaling between the different CN elements and the RNS
- the node Bs
- the radio resources of the corresponding node Bs.

The iRNC houses the following cabinets:

- the C−Node (Control Node)

  The C−Node is an ATM−based engine that support UMTS call processing and signaling as well as OAM of both the RNC and the node Bs.

- the I−Node (Interface Node)

  This is based on Passport 15000. It is a high−capacity ATM switch, in charge of the connectivity (User Plane) of the iRNC.

- the Access Node

  This optional cabinet is used for a PCMx configuration. It is a Passport 7480 switch. The main function of the Access Node is to convert the STM1 links into PCM links and vice versa.

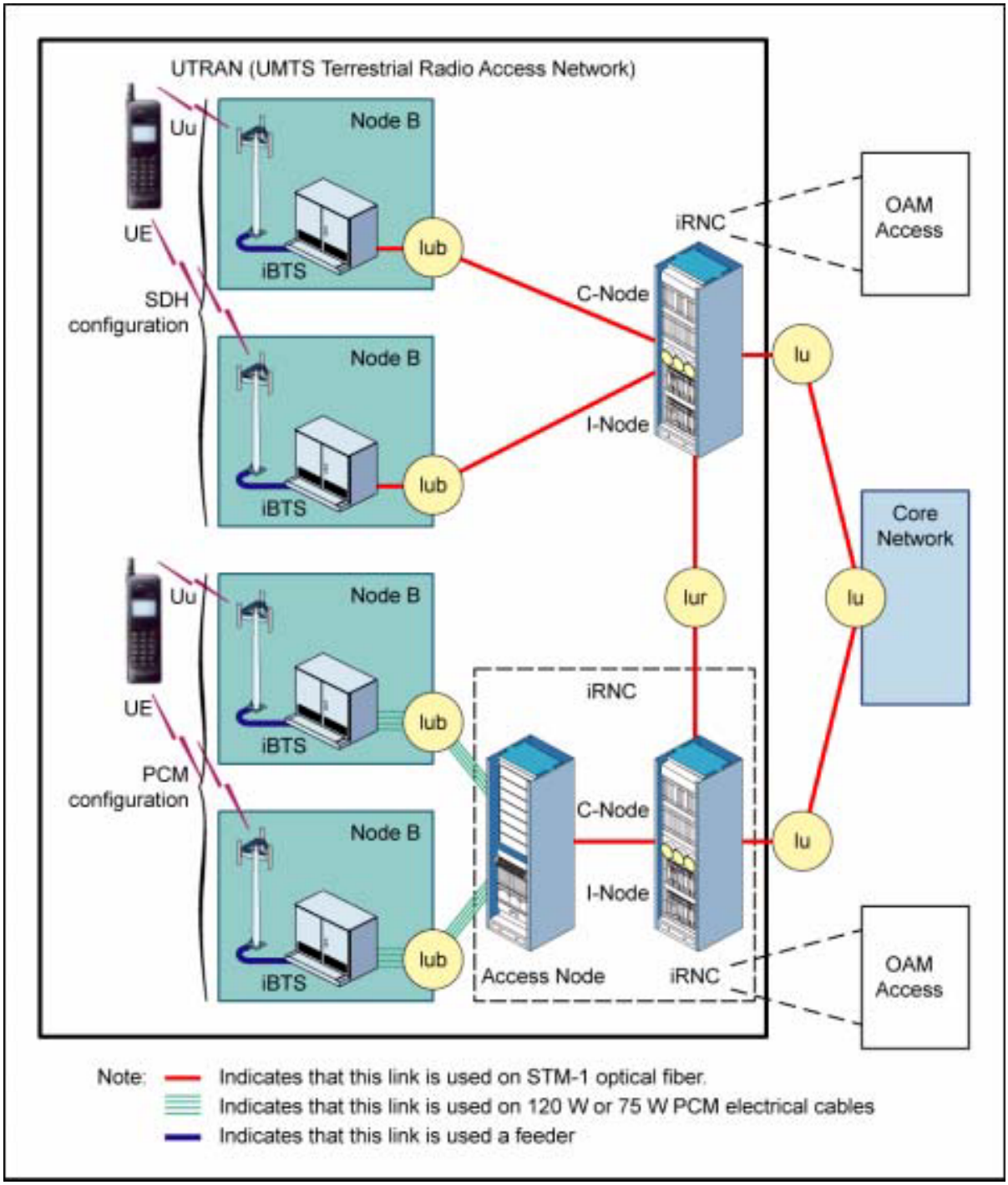
iBTS

The iBTS is the e−mobility Internet BTS. It is the 3GPP−compliant UMTS node developed by Nortel Networks. The generic term iBTS is used throughout this document to designate the e−mobility Internet BTS.

The following types of iBTS are available:

- e−mobility Internet BTS −− indoor version (600 and 700)
- e−mobility Internet BTS −− outdoor version

Figure 2
UTRAN architecture



iBTS description

Introduction

A node B is a logical node responsible for radio transmission/reception in one or more cells to/from the User Equipement.

A node B provides the following interfaces:

- the Iub interface towards the iRNC
- the Uu interface towards the User Equipment (UE)

A node B may consists of one or several iBTSs.

The iBTS product is a line of products that cover different customers requirements:

- the outdoor BTS product (iBTS outdoor)
- the indoor BTS product (iBTS indoor 600 and iBTS indoor 700)

The main functions of the iBTS are the following:

- to provide the means of communication between a UE and a network via Transport Channels.
- to provide the UE with some physical layer channels which are necessary to synchronize the downlink and also to perform cell selection/reselection and handover preparation
- to provide measurement information to the RNC for radio resource management (handover, power control)

The iBTS is modular in design for easy network growth and flexibility, to manage diverse traffic demands. Common modules are used to grow the iBTS to increase capacity as demand requires. The increase of capacity is provided via the simple addition of modules, as opposed to the entire addition of cabinets.

iBTS location

The iBTS outdoor can be installed on two types of site:

- on terraces of buildings
- at ground level

The iBTS indoor can be installed inside premises, if an air exchanger is provided in these premises.

iBTSs are connected to their controller (iRNC) in a star configuration.

iBTS operational features

The main characteristics of the iBTS are the following:

- no need for an extra site cabinet (iBTS outdoor) for user space and batteries
- easy installation and commissioning
- a flexible product: possible growth from low to high capacity without any additional cabinets
- front access only
- PCM internal protection
- most common modules between the iBTS outdoor and the iBTS indoor
- iBTS indoor powered in dc or ac

The iBTS is a low capacity solution that can grow in a modular way to full capacity.

The iBTS supports the following functions:

- radio access and modem (modulation/demodulation, frequency up/down−conversion, amplification)
- call processing (channel set−up and management for both common and dedicated channels, cell management, power control, handover and measurement)
- configuration and supervision
- synchronization (to retrieve a highly stable radio frequency from either the network interface)

iBTS tools and utilities

The iBTS has two main maintenance tools: the OAM Access (Operation, Administration and Maintenance) and the TIL (Terminal for Local Installation).

The Operation and Maintenance center for Node B is responsible for the configuring and supervising functions. The main OAM functions are the following:

- operation and maintenance
- alarm management
- configuration and supervision
- performance monitoring

The TIL is composed of a laptop PC (with Web browser) connected to the iBTS. The TIL is used to install and commission the iBTS.

The TIL performs the following:

- It displays the existing hardware of the iBTS product.
- It automatically displays new hardware.
- It provides basic maintenance and test capabilities for all iBTS modules.
- It allows users to save reports (alarm, test reports) on the PC.
- It retrieves the hardware and software module configuration.
- It downloads new software of iBTS modules.

Presentation of the iBTS outdoor

The iBTS outdoor is a single cabinet closed by two doors.

Figure 3
Outside view (iBTS outdoor)

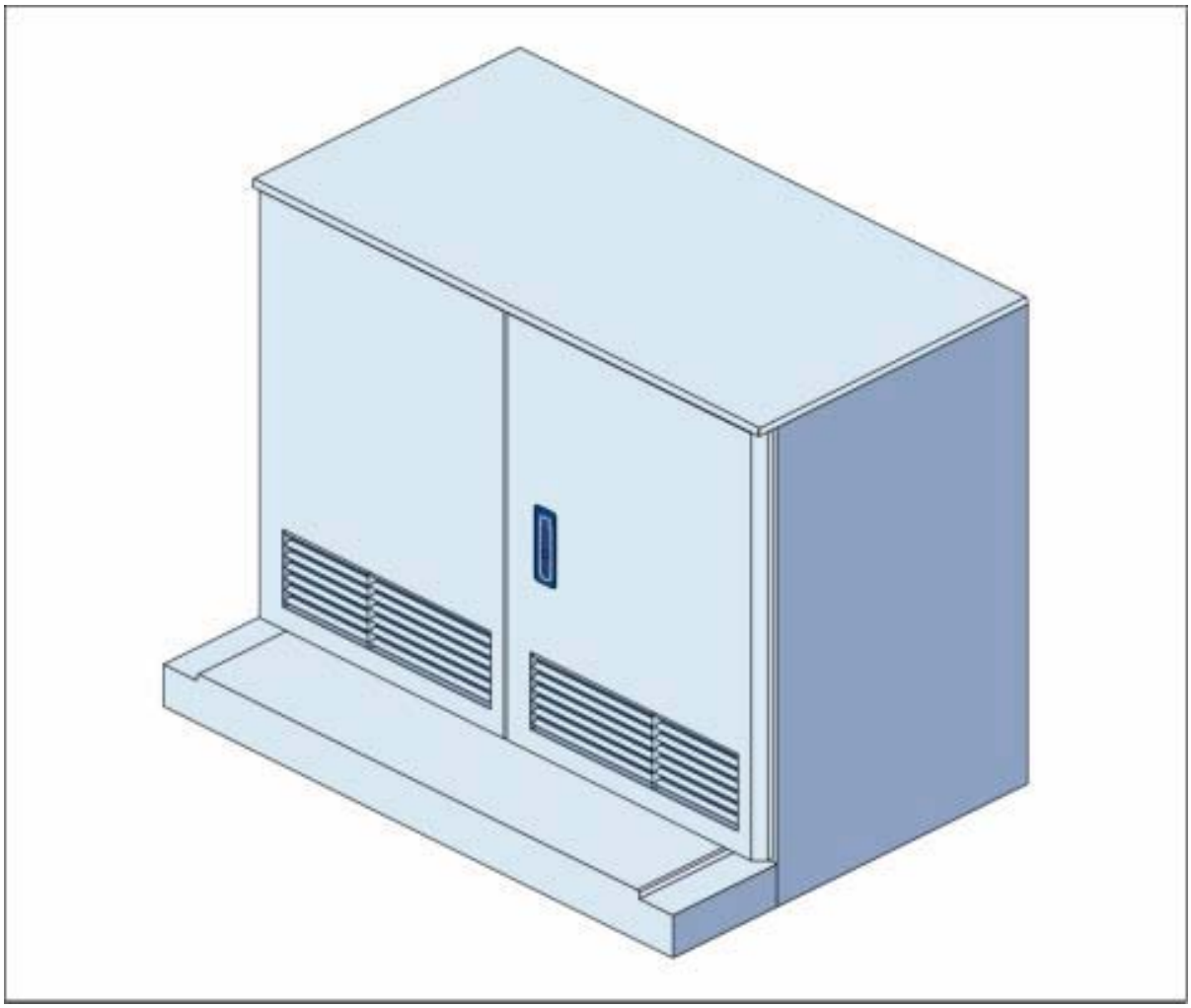
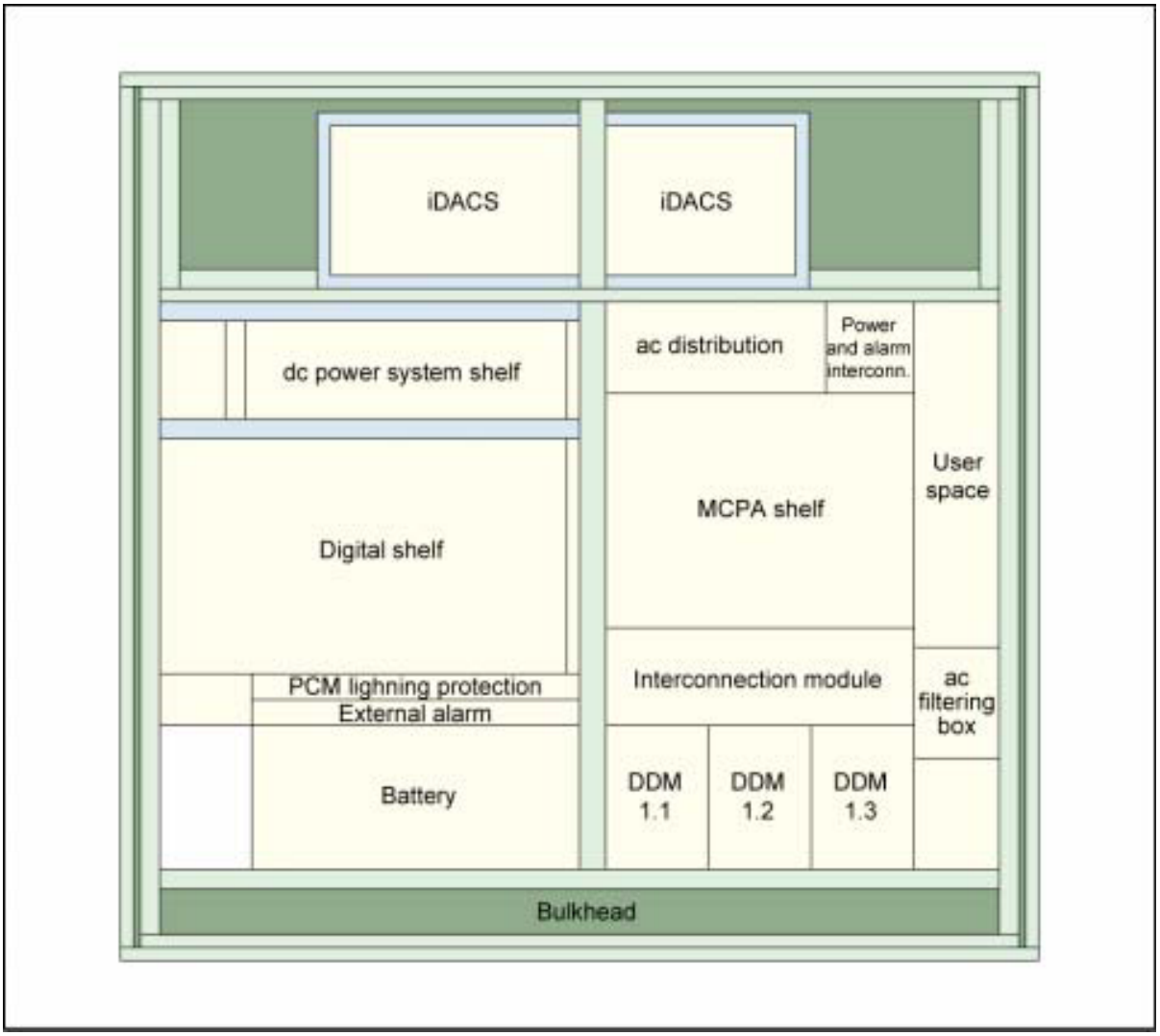


Figure 4
Inside view (iBTS outdoor)



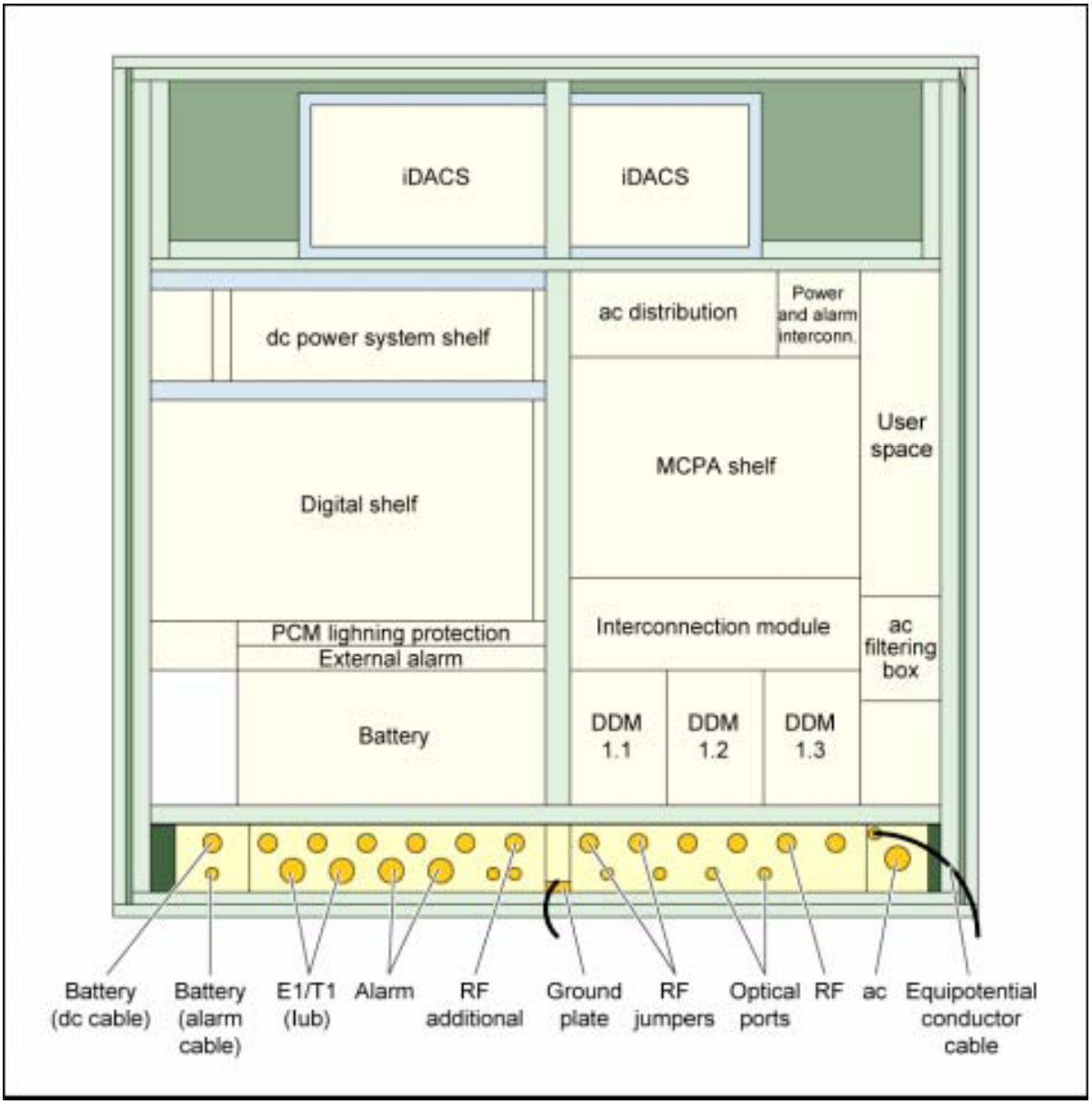
The cabinet is divided into:

- the iDACS (internet Direct Ambient Cooling System) which is the cooling unit of the cabinet
- the main compartment
- the bulkhead which allows cable connection and lightning protection

The main compartment is divided into two parts:

- the left part which includes:
  - the dc power system shelf: the dc distribution module, the SPCM (Single Power Control Module), the rectifiers (up to seven)
  - the digital shelf
  - the battery system
- the right part which includes:
  - the ac distribution module
  - the RF block
  - the user space and its ICO
  - the interconnection module
  - the ac filtering box

Figure 5
Bulkhead front view (iBTS outdoor)



Description of the digital shelf of the iBTS

The digital shelf houses all the digital modules of the iBTS. The digital shelf is common to the iBTS indoor 700 and the iBTS outdoor and houses up to 12 modules. These modules share ten slots in the iBTS indoor cabinet.

Backplane functionalities

The backplane board is part of the digital shelf. It is in charge of supporting all internal links and electrical interfaces between the modules of the digital shelf.

All modules and cables carrying external signals plug into connectors mounted on the backplane board.

The backplane board accomodates several high speed signals up to 1.3 Gbit/s. It supports −48 V or + 24 V power supply.

The backplane provides Inter−module connections and −48 V dc.

Physical description of the digital shelf

“T bar” rails are used in the digital shelf to guide the modules during insertion and removal operations.

The digital shelf houses up to 10 modules (iBTS indoor 600) or 12 modules (iBTS outdoor and iBTS indoor 700), **in complete configuration (for future versions)**, with flexible positions:

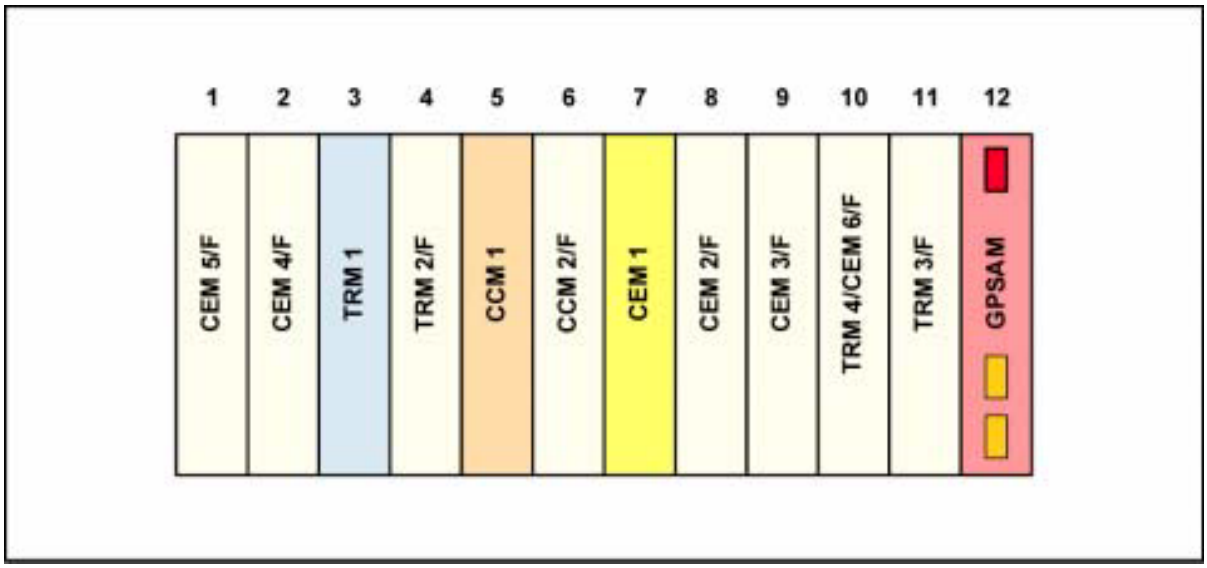
- CCM (Core Control Module)
- CEM (Channel Element Module)
- TRM (Transceiver Receiver Module)
- GPSAM (GPS interface and Alarm Module)

All the modules are removable and are 50−mm wide.

All the cables providing interconnection between the modules are mounted at the front of them.

Figure 11

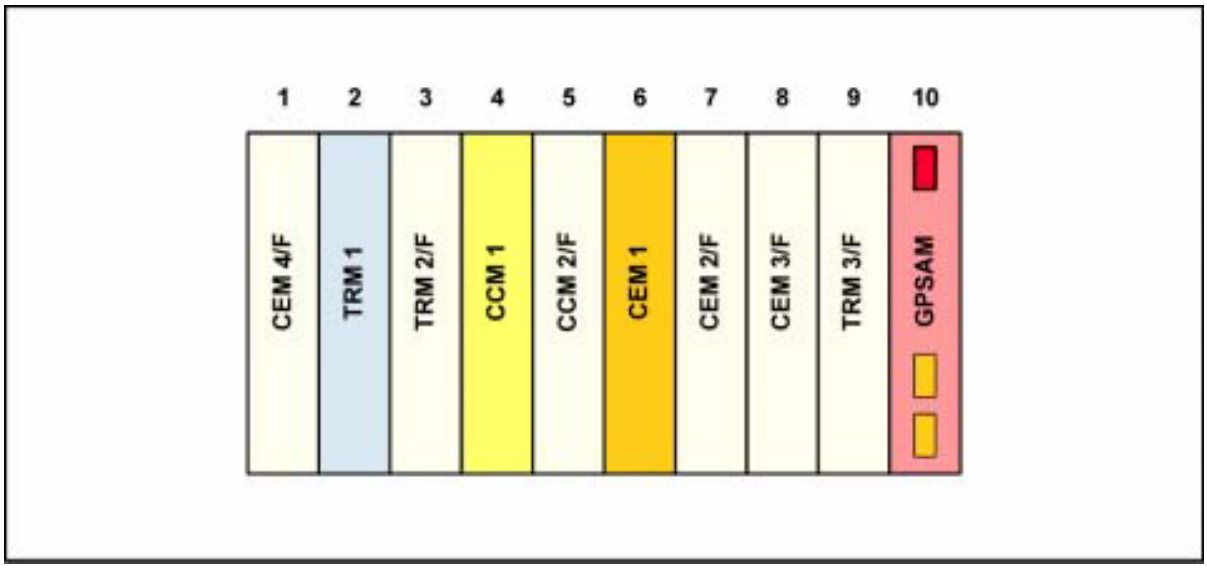
Front view of the digital shelf (iBTS outdoor and iBTS indoor 700)



F=Filler: module available for future versions

Figure 12

Front view of the digital shelf (iBTS indoor 600)



F=Filler: module available for future versions

Description of the RF block of the iBTS

The RF block contains the MCPA and the DDM modules. The RF block is common to the iBTS indoor and the iBTS outdoor. The number of modules depends on the iBTS configuration.

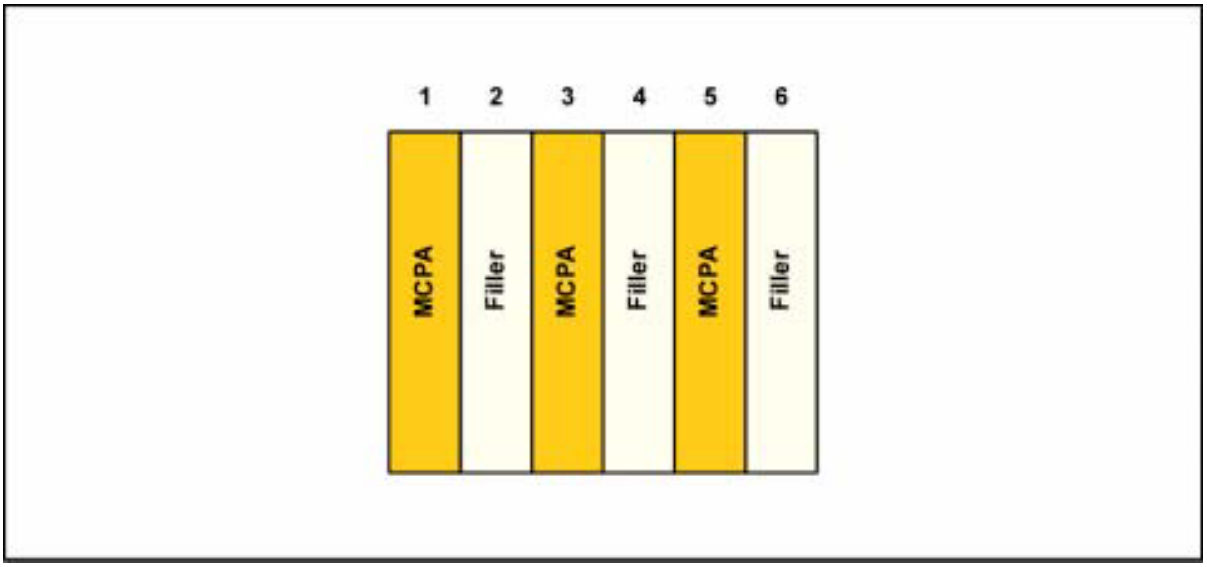
Physical description

The RF block contains the RF modules:

- One MCPA shelf that contains six slots. In the three MCPAs configuration, these MCPAs are housed in slots 1, 3, and 5. There is no electrical backplane in the MCPA shelf: all the interconnection cables are mounted at the front of the MCPAs.
- One DDM shelf that contains three DDMs.

All the cables providing interconnection between the modules are mounted at the front of them.

Figure 13
Front view of the MCPA shelf



Configuration rules of the iBTS

The iBTS has the following characteristics:

- one mode of operation: STSR
- one frequency carrier

Antenna configuration

The iBTS can be equipped with:

- two antennas for single−sector configuration
- four antennas for bi−sector configuration
- six antennas for three−sectors configuration

Frequency carriers

The iBTS supports multi−carriers configuration and allows 5 MHz operation in the STSR configuration.

STSR configuration

STSR configuration stands for Sectorial Transmit Sectorial Receive. It is the standard three-sector configuration. The iBTS is logically declared at the iRNC as three cells. The user equipment reports measurements for the three sectors and softer handover is controlled by the network.

The power allocation in STSR is independant across sectors.

The iBTS supports the STSR1 configuration: one carrier per sector.

The STSR1 configuration requires:

- one TRM which allows the reception of up to 6 signals (3x2)
- one CCM
- one CEM which is configured for three sectors x two carriers
- three MCPAs (one per sector)
- three DDMs (one per sector)

iBTS outdoor

The outdoor cabinet equipment layout follows the rules described in the following table:

45-W configuration	Digital shelf				RF shelf		Power
	CCM	TRM	CEM	GPSAM	MCPA	DDM	Rectifier
STSR1	1	1	1	1	3	3	4+1

iBTS indoor

The indoor cabinet equipment layout follows the rules described in the following table:

Configuration	Digital shelf				RF shelf		Power
	CCM	TRM	CEM	GPSAM	MCPA	DDM	Rectifier plinth
STSR1	1	1	1	1	3	3	7+1

iBTS physical characteristics

This section gives the physical characteristics of the iBTS cabinet.

iBTS outdoor

Dimension and weight

- width: 1,35 m
- depth: 0,7 m
- height: 1,3 m
- weight :
  - fully equipped: 520 kg
  - in STSR1 configuration with internal batteries: 426,4 kg

iBTS indoor

Dimension and weight of the iBTS indoor 600

- Width: 0,6 m
- Depth: 0,6 m
- Height:1,6 m
- Weight: 260 kg (fully equipped)

Dimension and weight of the iBTS indoor 700

- Width: 0,7 m
- Depth: 0,6 m
- Height:1,6 m
- Weight: 325,5 kg (fully equipped)

Dimension and weight of the iBTS indoor 700 with ac plinth

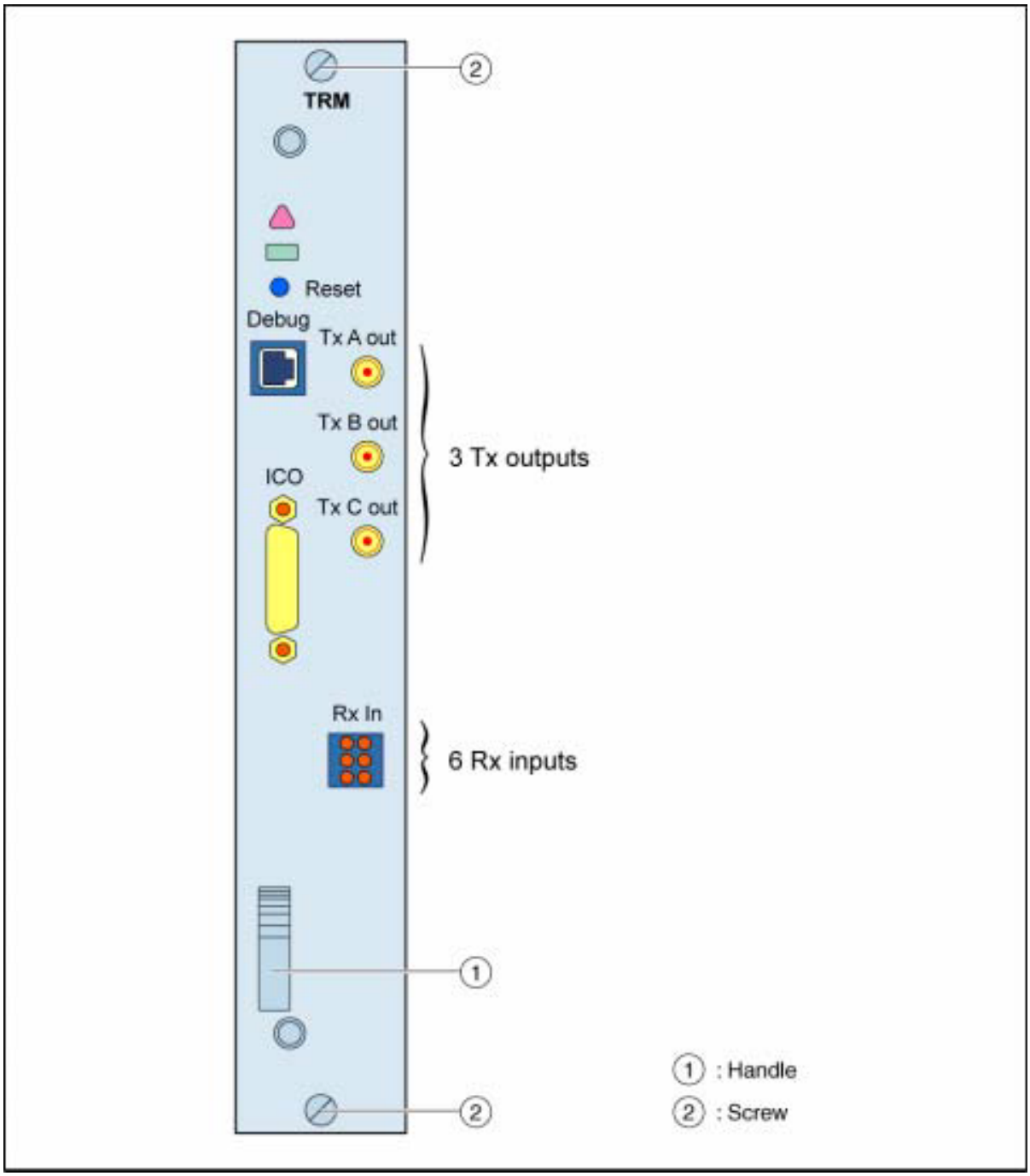
- Width: 0,7 m
- Depth: 0,6 m
- Height: 2 m
- Weight: 513,5 kg (fully equipped)

TRM (Tranceiver Receiver Module) description

The TRM is located in the iBTS digital shelf. In the complete configuration, for future versions, the highest number of TRMs is four. The present version contains only one TRM.

TRM hardware description

Figure 17
Front view of the TRM



Front panel description

The front panel of the TRM module has two corporate leds indicating the TRM status:

Green rectangular LED	Red triangular LED	Status
OFF	OFF	Sleep, unpowered or not inserted
ON	ON	Power up self–test underway
ON	OFF	Module should not be removed
ON	BLINK	Module is partially faulty
OFF	ON	Module may be removed, alarm state, BISTs NOK
OFF	BLINK	Module is waiting for Boot

The front panel also has:

- one “Debug” Ethernet connector (RJ–45 type connector)
- one “Reset” button accessible through an eye in the front panel
- three RF outputs (to MCPAs): “Tx A out”, “Tx B out”, and “Tx C out” (SMA connectors)
- six RF inputs (from DDMs): “Rx in” (radial connectors)
- one interconnection connector for digital communication between RF modules (D–sub connector)

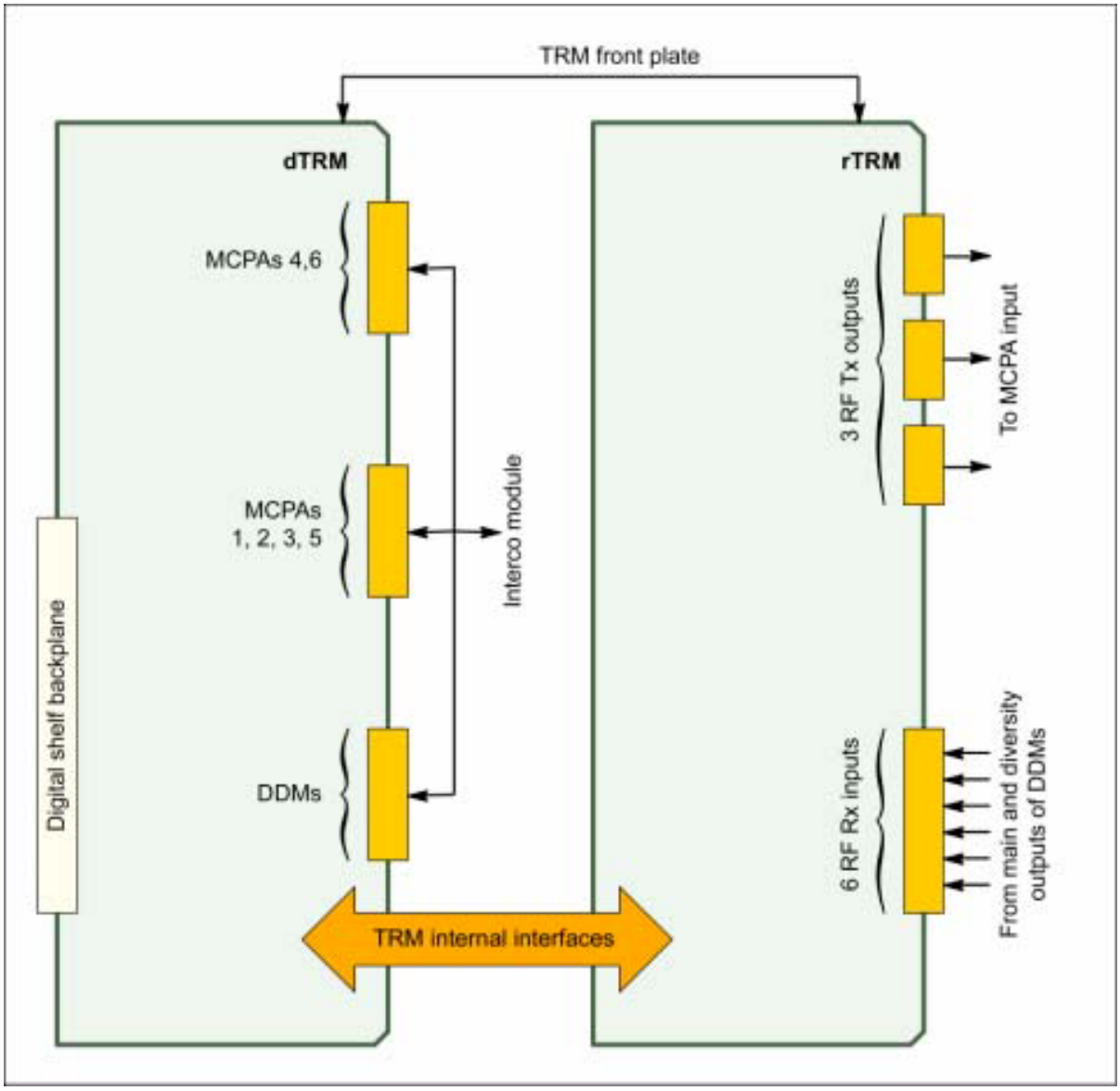
Haardware composition

The TRM is made of two boards.

- one dTRM board, including:
  - 6 Tx channelizers
  - 3 Rx channelizers
- one rTRM board, including:
  - 3 wideband transmitters
  - 3 dual 5 MHz receivers

TRM interfaces

Figure 18
TRM interfaces



Note: **This figure describes the complete configuration (available for future versions)**

Internal interfaces

The internal interfaces are the signals exchanged between the rTRM and the dTRM boards.

The samples are sent to the rTRM board and are converted into an analog signal. In the opposite direction, the rTRM board digitally converts the six received signals and sends the resulting sample flows to the dTRM board.

External interfaces

The external interfaces are the following:

- digital shelf backplane interface: based on the dTRM board
- CCM interface: based on the common HSSL interface

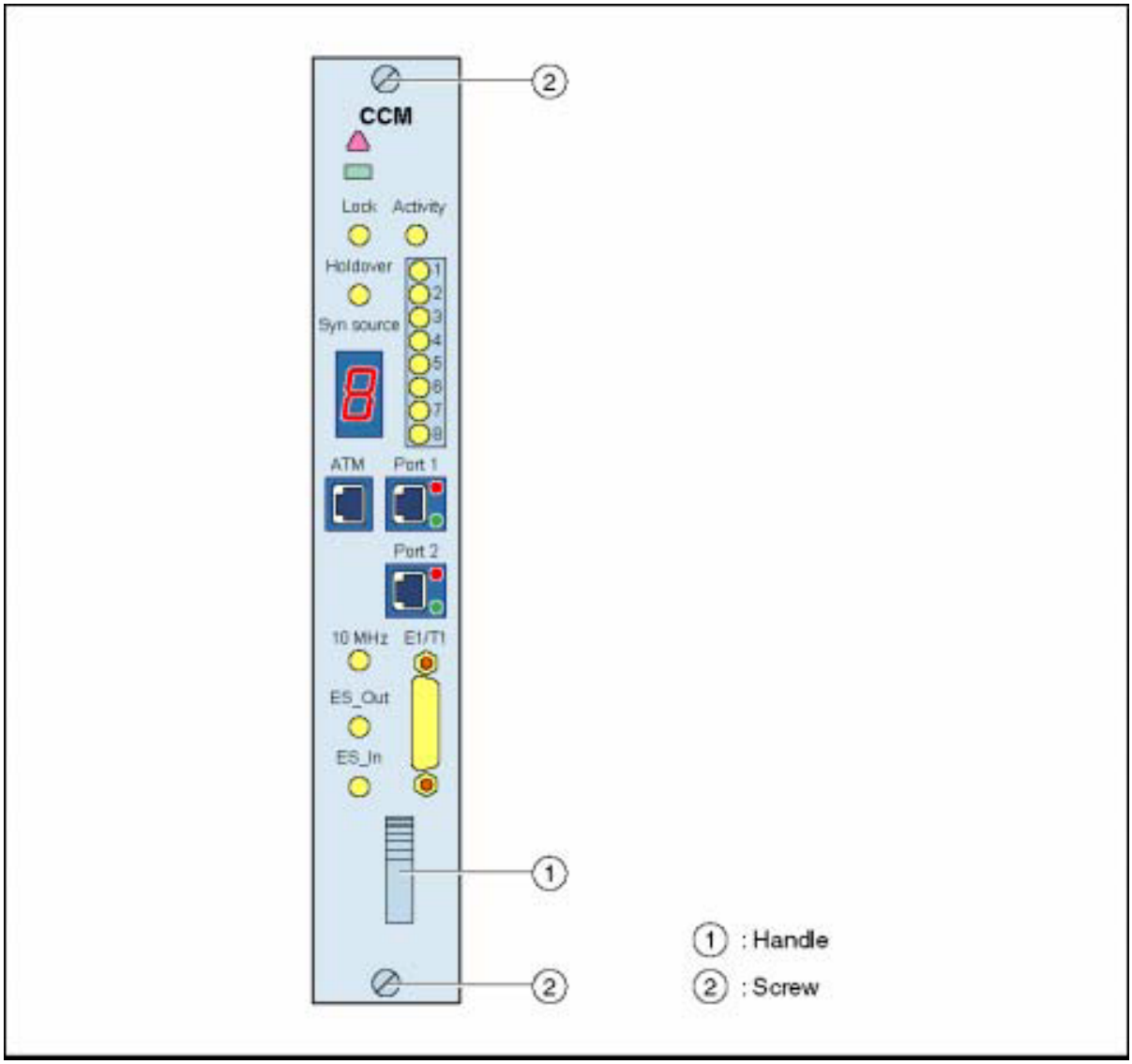
CCM (Core Control Module) description

The CCM is located in the iBTS digital shelf. In the complete configuration, for future versions, the highest number of CCMs is two. The present version contains only one CCM.

CCM hardware description

Figure 19

Front view of the CCM



Front panel description

The connectors of the front panel are the following:

- one “ATM” test port (RJ–45 connector)
- two “Port 1” and “Port 2” Ethernet ports (10/100 Base T and 10 Base T connectors) used for Ethernet access and TIL connection
- one “E1/T1” connector (44–pin D–sub female connector) used for E1/T1 connection
- three timing reference ports (SMB connector) for iBTS commissioning labelled “10 MHz”, “ES Out” (Even Second Output), and “ES In” (Even Second Input)

The leds on the front panel are the following:

- two corporate leds indicating the CCM status:

Green rectangular LED	Red triangular LED	Status
OFF	OFF	BISTs results NOK, Sleep, unpowered or not inserted
ON	ON	Power up self–test underway
ON	OFF	Module should not be removed
ON	BLINK	Module is partially faulty
OFF	ON	Module may be removed, alarm state
OFF	BLINK	Module is waiting for Boot
BLINKING	OFF, ON, or BLINK	Downloading in progress

- two synchronization status indicators: “Lock” (green led) and “Holdover” (yellow led)
- one “Activity” led which indicates the module status
- eight PCM status leds which indicate if the PCM link is OK (green led), if the PCM is in alarm (red led), or if the PCM is in tri–state (amber led)

The CCM front panel also has a display witch indicates the synchronization source. The dot on the right of the indication allows to differentiate the synchronized state.

Display	
1,2,3,4,5,6,7, 8	PCM number
a or b	GPS 0 or GPS 1
A	active CCM
E	even second external input
H	holdover mode

CCM interfaces

Signal interfaces

One CCM supports up to three wide−band carriers with transmit and receive diversity in a tri−sectored carrier configuration.

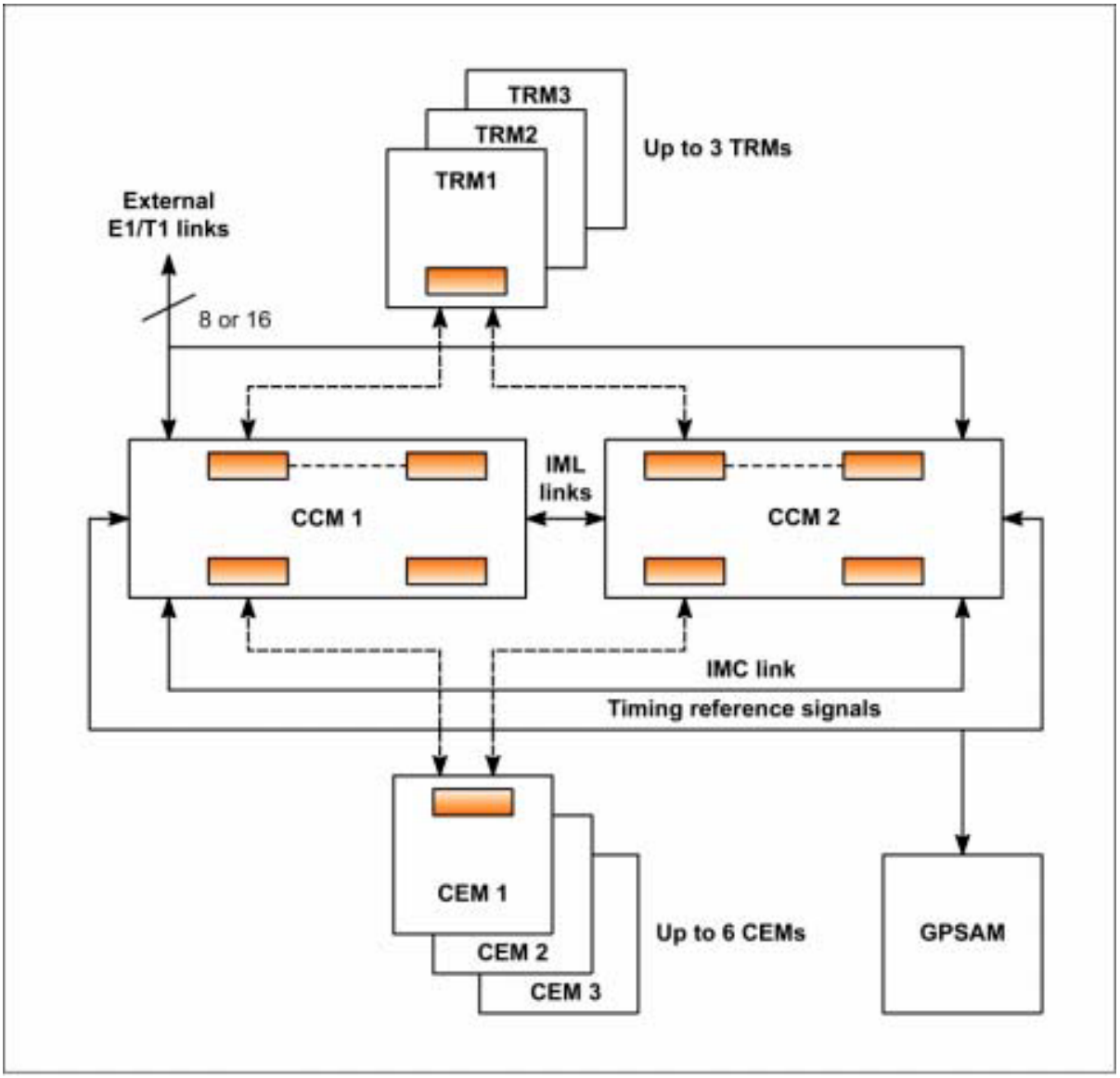
Each CCM is linked with the CEM and TRM by a point−to−point HSSL connection.

The two CCMs are linked by two signals:

- the IML ATM links: 155 Mbit/s
- the IMC links: 10 Mbit/s

The following figure shows the different interfaces of the CCM.

Figure 20
Data flow of the CCM



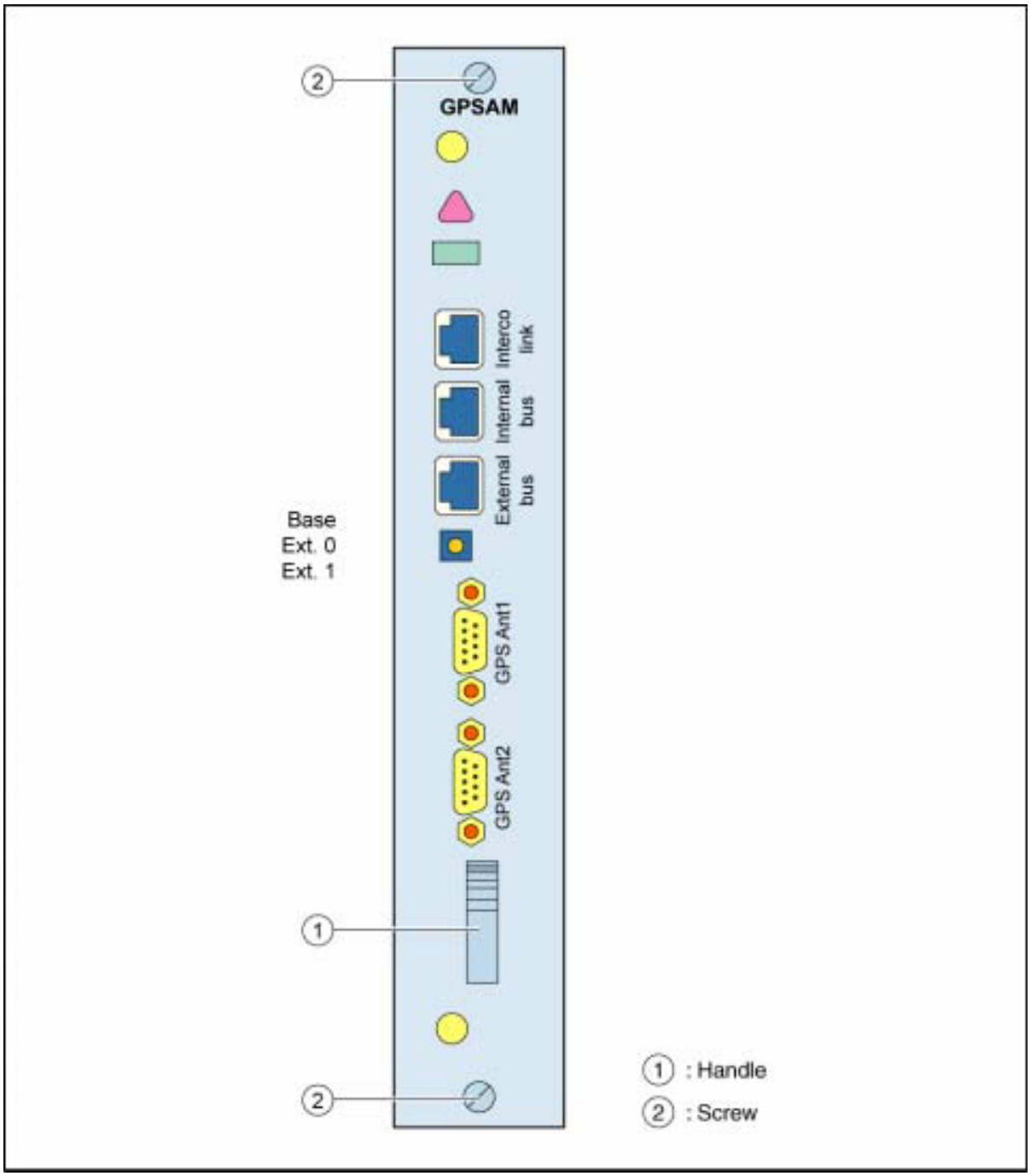
Note: **This figure describes the complete configuration (available for future versions).**

GPSAM (GPS and Alarm Module) description

The GPSAM is located on the right side of the iBTS digital shelf.

Hardware description

Figure 21
Front view of the GPSAM



The GPSAM is a single module located on the right−hand side of the iBTS digital shelf.

Front panel description

The front panel of the GPSAM module has:

- one ”interco link” (RJ−45 type connector) connector used to connect the interconnection module in case of an extension cabinet
- one ”Internal bus” (RJ−45 type connector) connector used for the iBTS internal bus link
- one ”External bus” (RJ−45 type connector) connector used for the iBTS external bus link
- one three positions switch: “Base”, “Ext. 0”, and “ Ext. 1” which indicates in which cabinet (base cabinet, first extension cabinet, or second extension cabinet) the digital boards are inserted.
- two “GPS Ant” 15−pin D−sub female connectors for the optional connection of GPS smart receivers, not used in this product release.

Leds

The front panel of the GPSAM module has two corporate leds indicating the GPSAM status:

Green rectangular LED	Red triangular LED	Status
OFF	OFF	sleep, unpowered or not inserted
ON	ON	power up self−test underway
ON	OFF	operational module
OFF	ON	alarm state

TRM interface

Power supply

The GPSAM is powered with external −48 V dc.

The maximum power is estimated at 20 W.

Hardware description of the RF block

This section describes the modules of the RF block:

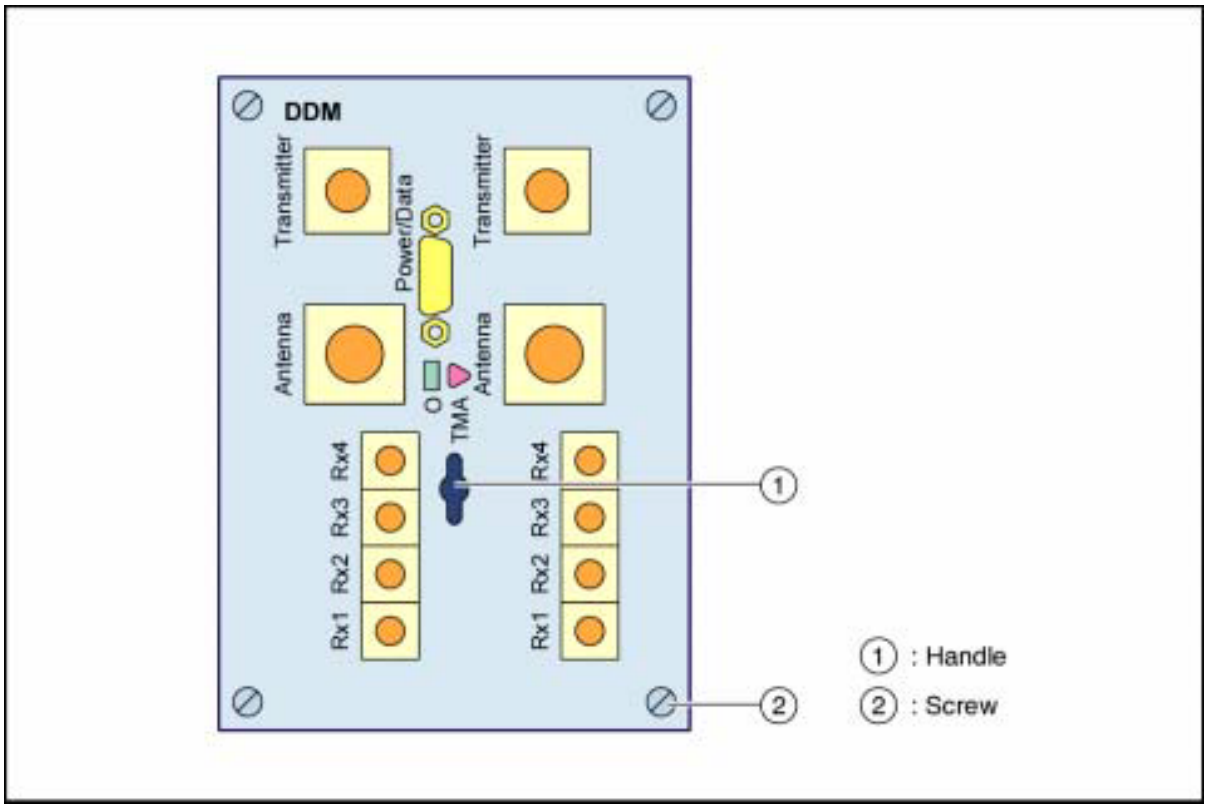
- DDM (Dual Duplexer Module)
- MCPA (Multi Carrier Power Amplifier)
- optional TMA (Tower Mashead Amplifier)

DDM (Dual Duplexer Module)

The DDMs are located in the DDM shelf which houses three DDMs. The DDM is used in outdoor or indoor configurations.

Hardware description

Figure 30
Front view of the DDM



Front panel description

The front panel of the DDM has two corporate leds indicating the DDM status:

Green rectangular LED	Red triangular LED	Status
OFF	OFF	Sleep, unpowered or not inserted
ON	ON	Power up self–test underway
ON	OFF	Module should not be removed
ON	BLINK	Module is partially faulty
OFF	ON	Module may be removed, alarm state
OFF	BLINK	Module is waiting for Boot

One two position switch indicates the functioning mode of the DDM: mode with TMA or mode without TMA.

Hardware composition

The design of the DDM allows an easy transition from receive diversity to transmit diversity.

The DDM consists of a double–duplexer LNA chain: one for the main path, the other for the diversity path.

The DDM provides the following functions:

- isolation between transmit and receive signals
- filtering of the transmitted and received signals to reduce interfering signals

DDM interfaces

All DDM interfaces are located on the front panel.

There are three types of interface:

- RF interface
- digital interface
- power supply interface

RF interface

Radio interfaces are coaxial cables:

- two “Antenna” ports, main & diversity (7/16 female connector)
- two “Transmitter” inputs (N female connector)
- eight “Rx” outputs (SMA female connector)

Digital interface

The corresponding connector is a 15–pin D–sub female connector. The digital interface allows communication with the TRM. TRM software is able to detect if a DDM is physically connected to this interface.

Power supply

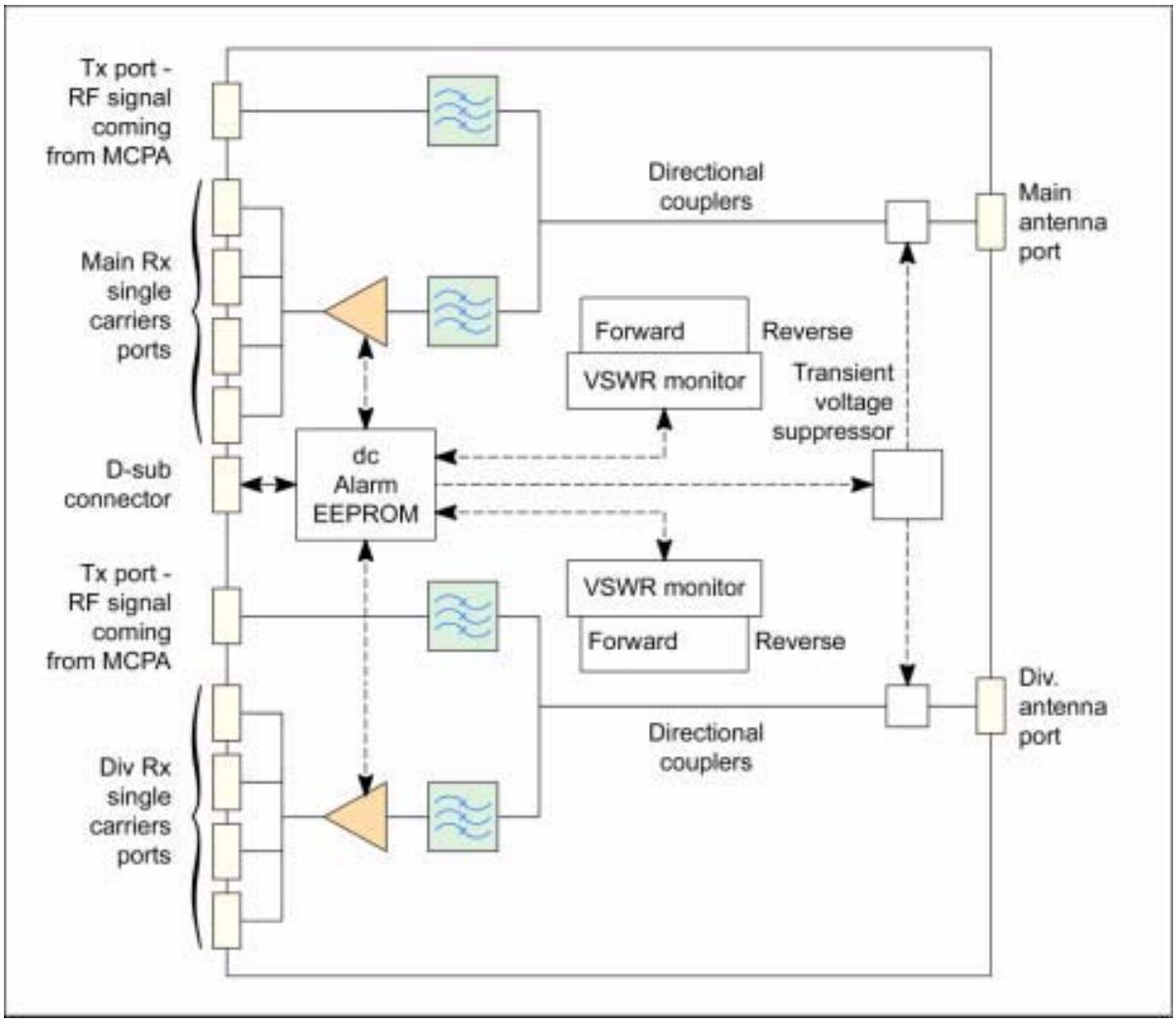
The DDM is power supplied by –48 V dc.

Detailed functional description

The main functions of the DDM are the following:

- one single antenna port for the Tx and Rx paths
- dedicated isolation between Tx and Rx frequency bands
- Tx and Rx out–of–band filtering
- low–noise amplification in Rx frequency bands and signal splitting into four local outputs
- VSWR alarm monitoring capability
- TMA dc supplying
- TMA alarm monitoring
- suppression of transient voltage suppression from the antenna port following external lightning protection
- inventory capability
- active function monitoring

Figure 31
DDM block diagram



The DDM includes two dc/dc converters dedicated to the main and diversity branches:

- one converter supplies TMA and DDM main
- the other converter supplies TMA and DDM diversity

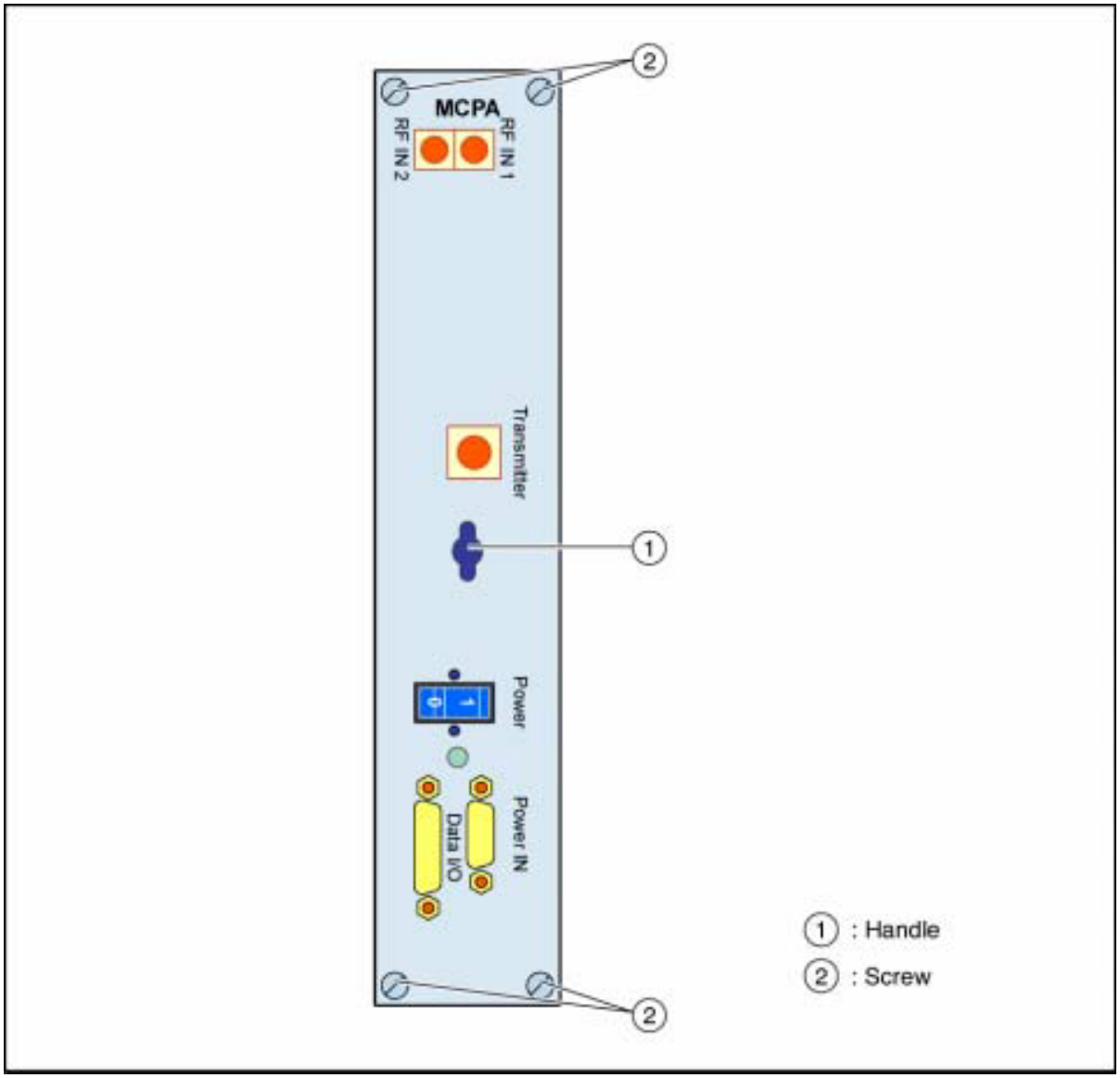
Two VSWR monitors are also included in the DDM: they are able to monitor RF matching between the antenna and the iBTS.

MCPA (Multi Carrier Power Amplifier)

The MCPAs are located in the MCPA shelf which houses up to 6 MCPAs. The present version of the iBTS contains three MCPAs.

Hardware description

Figure 32
Front view of the MCPA module



The front panel of the MCPA module has one led indicating if the MCPA module is operational: the led is green if the module is operational and red if it is not operational.

The front panel also has one on/off power switch to switch off the input dc supply.

All external connections are connected to the MCPA through the front panel.

MCPA interface

Radio interfaces

The front panel has two “RF IN” connectors (SMA 50 Ω female connector) and one “Transmitter” connector (N female type connector) for RF ouput for radio interface.

Interconnection interfaces

The front panel has one “Data I/O” connector for digital information exchange with the TRM (25−pins D−sub connector).

Power supply interface

The front panel has one “Power IN” connector (3−pin 3W3 connector).

MCPA functional description

The MCPA module provides downlink signal amplification. The aim of the MCPA is to amplify the RF signal delivered by the TRM.

The MCPA is connected to the antenna through a duplexer for sectorial configurations.

The MCPAs handle up to 1 carrier (5 MHz operation).

The MCPA mode of operation is 45 W.

Figure 33
Functional description of an MCPA (only one sector)

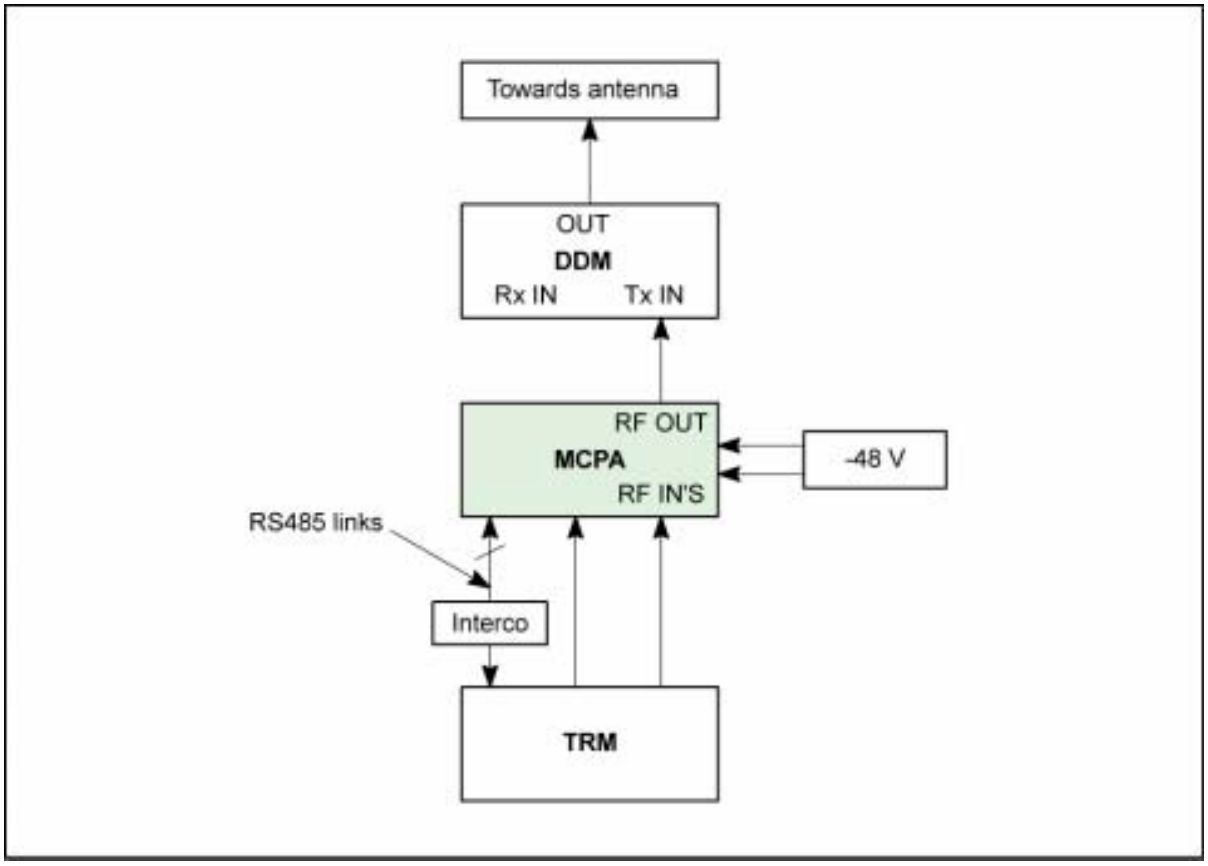
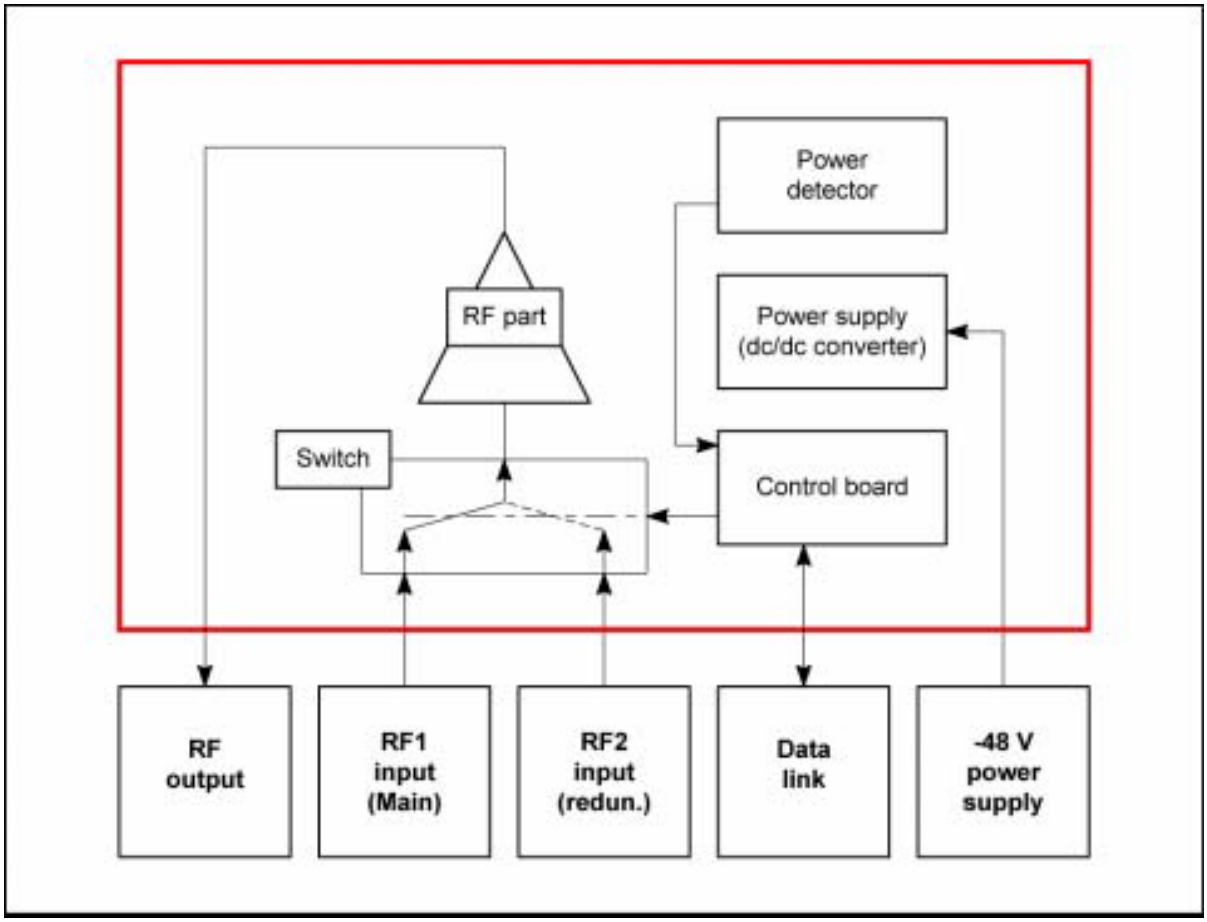


Figure 34
MCPA functional block diagram



TMA (Tower Mounted Amplifier)

In case the cable length between the iBTS cabinet and the antenna is high, an optional TMA is mounted as near as possible from the antenna system in order to improve sensibility.

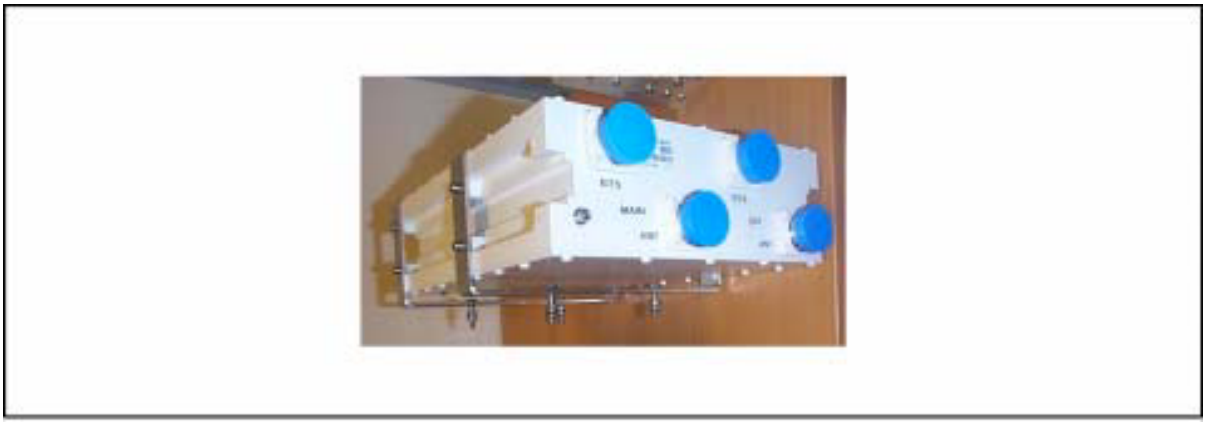
General description

The TMA module allows to decrease the overall noise figure of the system by amplifying the receive signal.The TMA module is a LNA (Low Noise Amplifier). It amplifies the received RF signal in the early stages of the reception path before going through the feeders. The TMA enables two single antennas (main and diversity) to be used for up−link and down−link.

The TMA is powered from the DDMs through the RF coaxial cable.

Figure 35

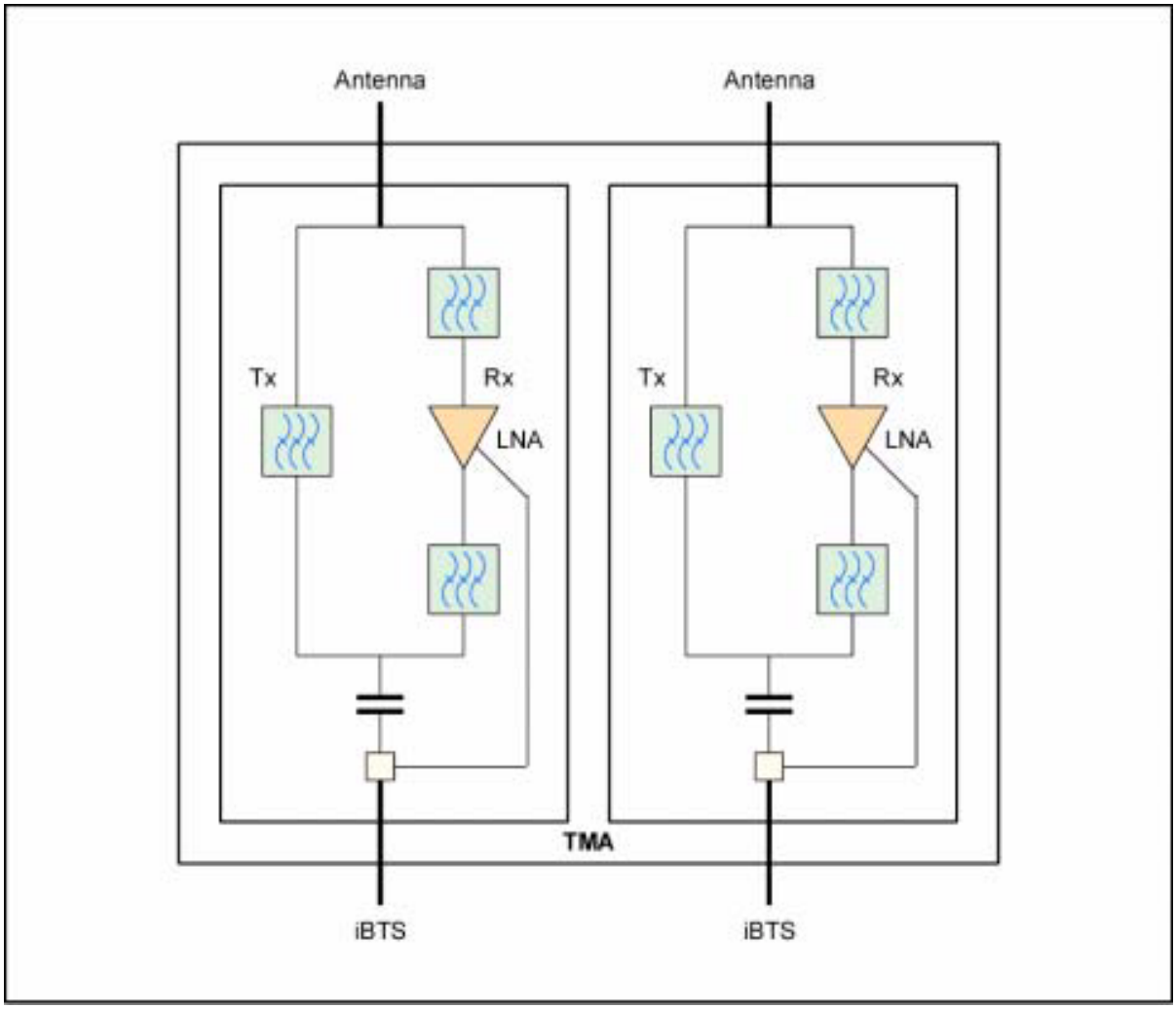
TMA outside view



All external connections are located at the bottom of the TMA module. The RF connectors are 7/16^{e} male connectors.

Figure 36

TMA block diagram



Protection

Data and RF lightning protection is performed at the iBTS connectors.

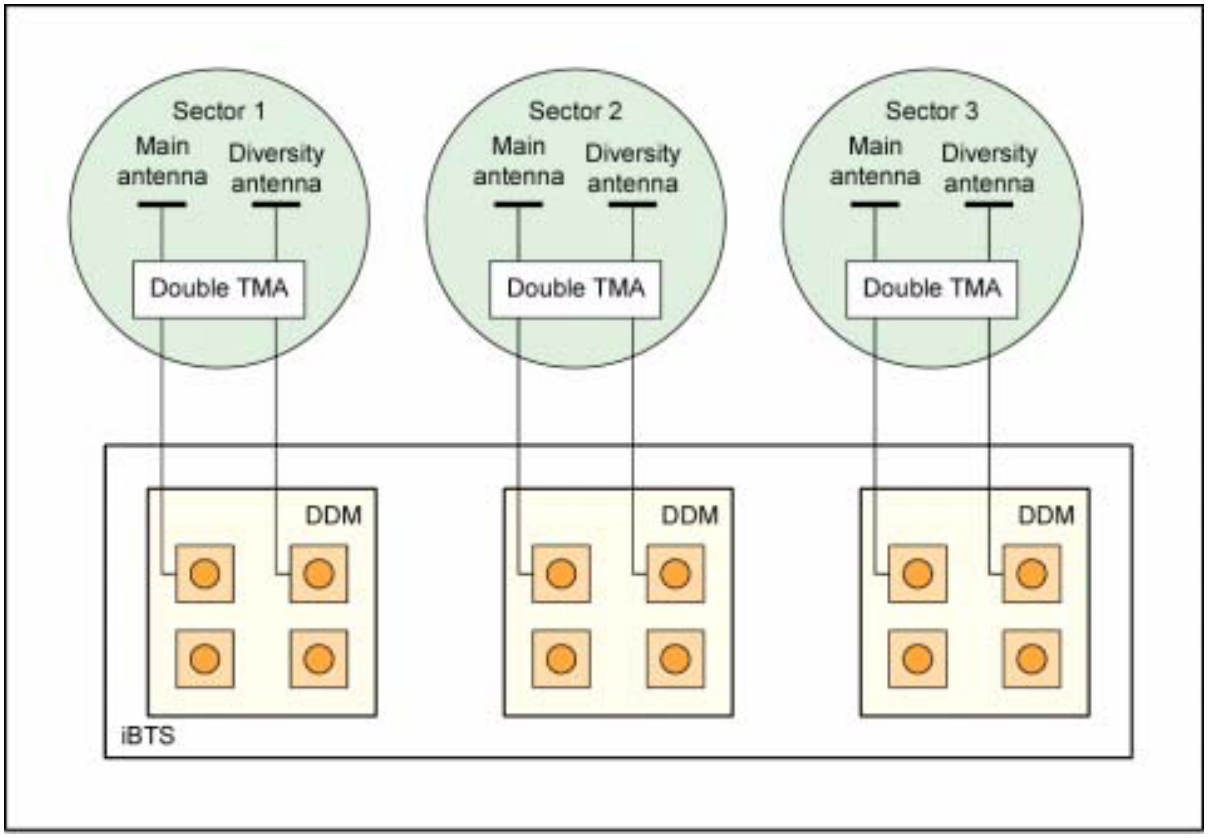
Protecting cups provide the TMA connectors with mechanical and environmental protection.

The DDMs monitor TMA alarms and report them to the digital shelf through I^2C connection.

TMA system overview

The optional TMA is a double UMTS TMA module.

Figure 37
Double TMA system overview



TRM functional description

Generalities

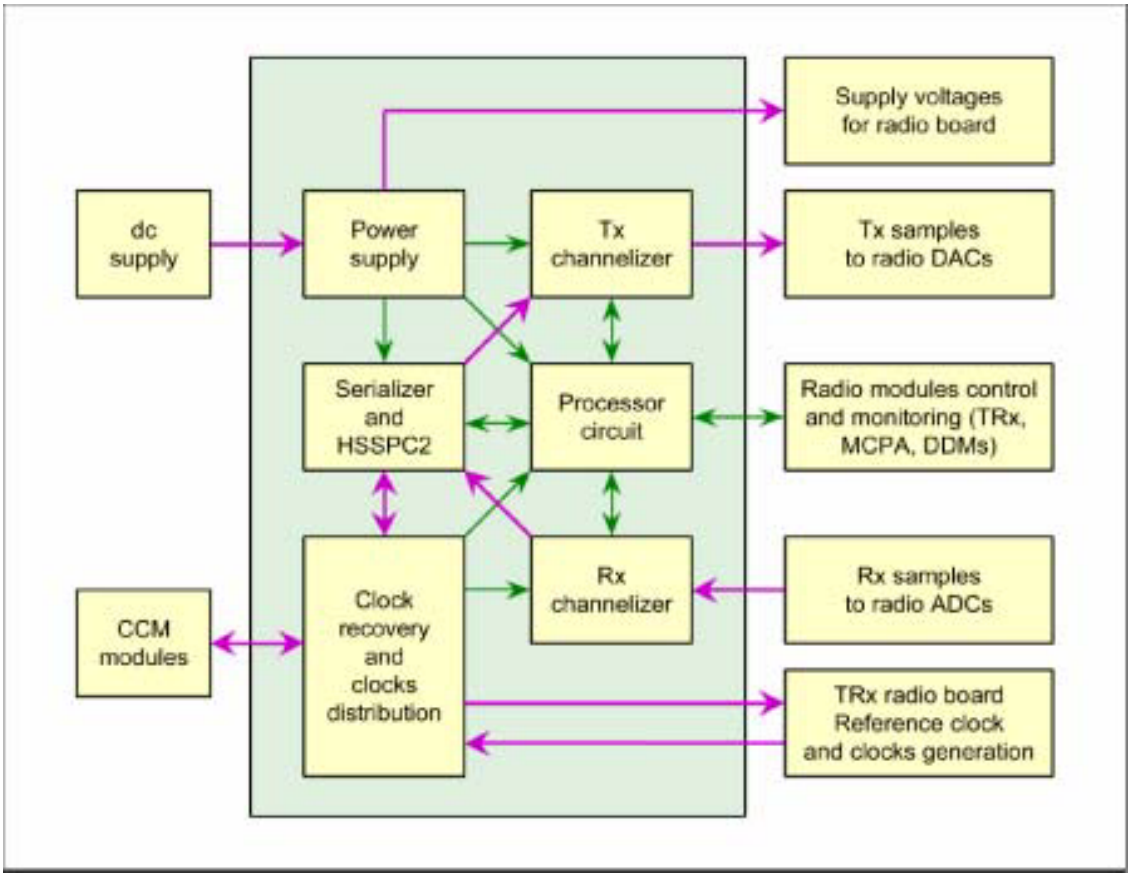
The TRM contains the transmit/receive circuitry for three transmit chains and six receive chains. It performs:

- modulation and demodulation
- clock recovery and synchronization
- digital–analog and analog–digital conversion
- up and down frequency conversion

These functions are performed with the digital and radio boards.

The functional block diagram of the TRM is shown in the following figure:

Figure 62
Functional block diagram of the TRM



Note: **This figure describes the complete configuration (available for future versions).**

Digital TRM board (dTRM)

The digital board functions are the following:

- reception of (up to) six transmit signals from the CCM
- reception of the six signals from the antennas (main and diversity)
- recovery and distribution of the clock
- control and monitoring of the radio modules (TRX, MCPA, DDM)
- supply voltages for radio board

Radio TRM board (rTRM)

The radio board performs the following functions:

- in the downlink path
  - digital−to−analog conversion
  - frequency up−conversion
  - amplification
- in the uplink path
  - frequency down−conversion
  - analog−to−digital conversion

The rTRM board consists of three transmit chains and three dual receive chains.

Detailed functional description

General

Downlink path

The dTRM board receives up to six signals from the CCM. These downlink samples are transferred to the Tx channelizers. The channelizers perform chip level modulation, peak power reduction, filtering, and then deliver the signals (three max) to the D/A converters of the rTRM board.

In the analog domain, the digital signals are transformed into RF signals through D/A conversion, modulation, filtering/amplification and translation operations. The final RF signals have the appropriate level to drive the MCPA.

The total transmitted power is proportional to the data rate of the codes and the number of these codes (communications). A power control adjusts each RF signal to optimise the total interference level noise between the iBTS and the user equipment.

Uplink branch

The uplink branch handles three pair−received signals (main and diversity) coming from the antenna via a coupling system which separates transmission from reception. These signals are filtered, amplificated, demodulated, A/D converted and then transmitted to the Rx channelizers in the digital domain.

The receive channelizer receives the six A/D converter signals. It processes the data and transmits them to the CCM.

Other functions

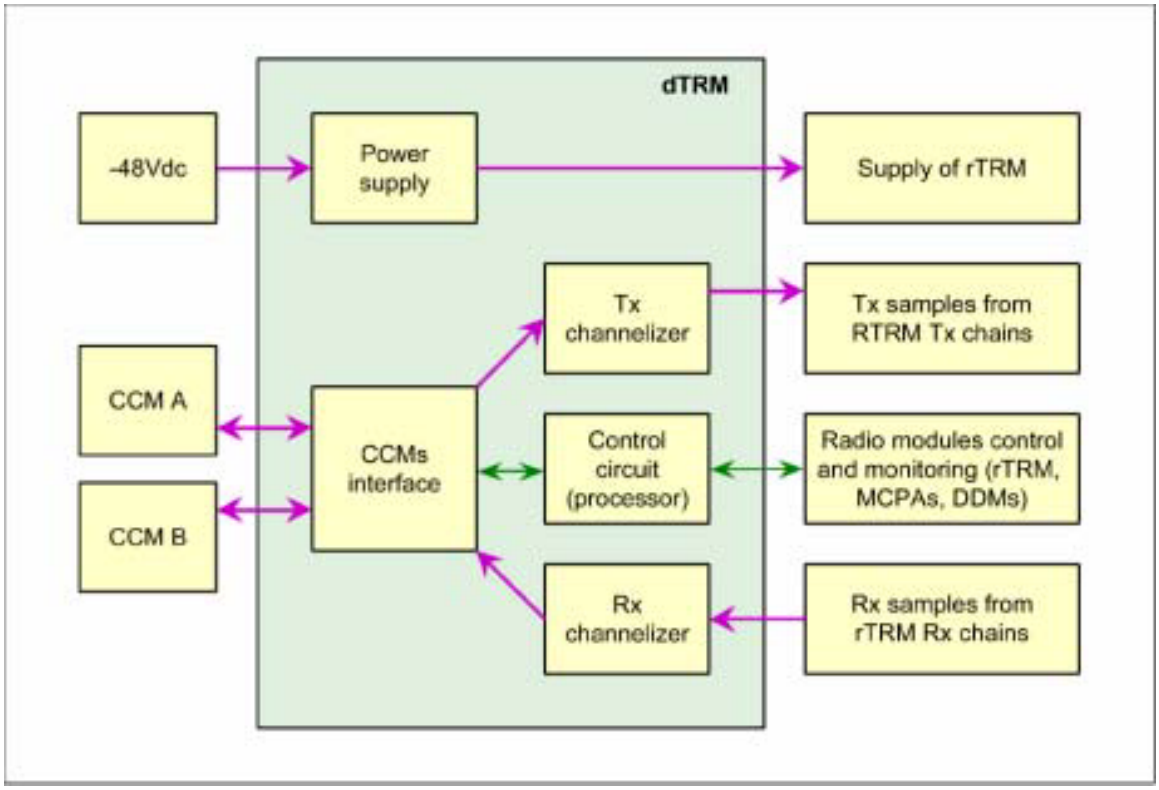
The TRM also performs the clock generation and recovery operation. The clock is recovered from the link with the CCM and sent to the rTRM board. This board generates the clock signals for the A/D converters of the receiver branch and the A/D converters of the transmitter branch.

dTRM board functional description

The functions of the dTRM board are the following:

- It receives the data samples from the CCM, performs data shaping processing on them, then drives the three transmit chains with the resulting data samples.
- It receives the data samples from the six TRM receive chains, performs data shaping processing on them, then sends the resulting data samples to the CCM.
- It performs OAM operations on the TRM, the MCPAs and the DDMs.
- It supplies the rTRM board.

Figure 63
Block diagram of the dTRM board



Note: **This figure describes the complete configuration (available for future versions).**

The dTRM Rx and Tx data processing functions are mainly implemented in the processor of the dTRM and in the channelizers.

The dTRM board includes six TX channelizers. Each of them is able to support one UMTS channel, and they can be put in cascade. The transmit possibility is three 3−carrier signals.

On the Rx side, the dTRM board allows the reception of up to six single carrier signals. It can implement one of the following solutions:

- reception of one carrier from three sectors
- reception of three carriers from an omni cell

rTRM board functional description

The functions of the rTRM board are the following:

- It receives digital samples from the dTRM, converts them into analog signals, upconverts to radio UMTS frequency, filters the signal and adjusts the output power for the MCPA input.
- It filters the input signal, downconverts, filters and samples it, then transmits the digital samples to the dTRM board.

The rTRM board consists of three transmit paths at the same radio frequency and three main/diversity paths that can be tuned to three different frequencies.

Figure 64

Block diagram of the rTRM transmit part

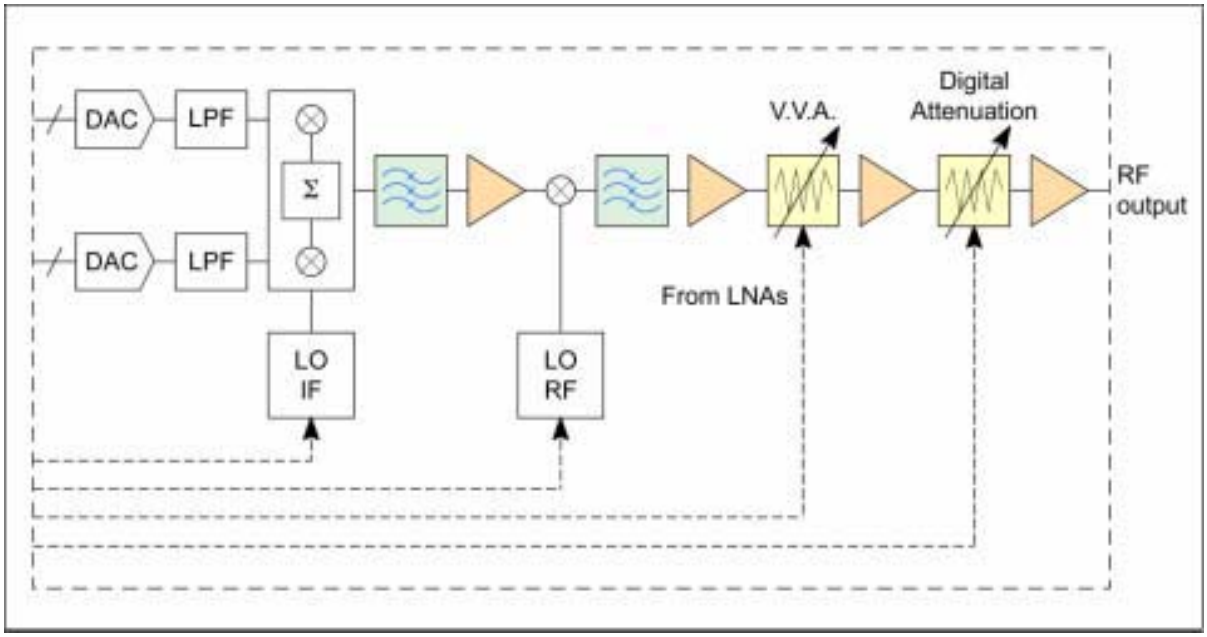
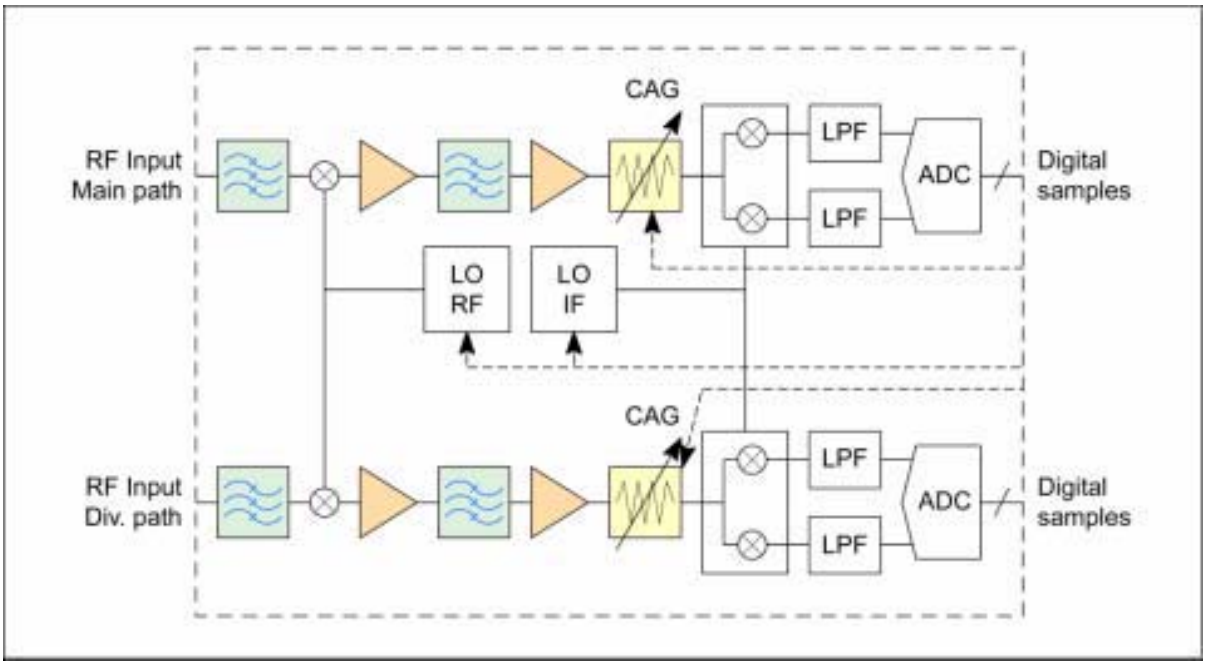


Figure 65
Block diagram of the rTRM receive part



Radio interface

The radio interface consists of six RF ports which correspond to the connection to main and diversity antenna for three sectors.

The frequency−dependent DDM module is compatible with the standard UMTS bands:

- 2110−2170 MHz for downlink
- 1920−1980 MHz for uplink

The impedance of the radio interface is 50 Ω.

Radio cabling

7/16 connectors are located:

- at the bottom of the cabinet for the iBTS outdoor (bulkhead)
- at the top of the cabinet for the iBTS indoor

The antenna feeders arrive as close as possible to the iBTS cabinet. The interconnection between the feeders and the jumpers is done outside the iBTS.

The number of feeders depends on the configuration type.