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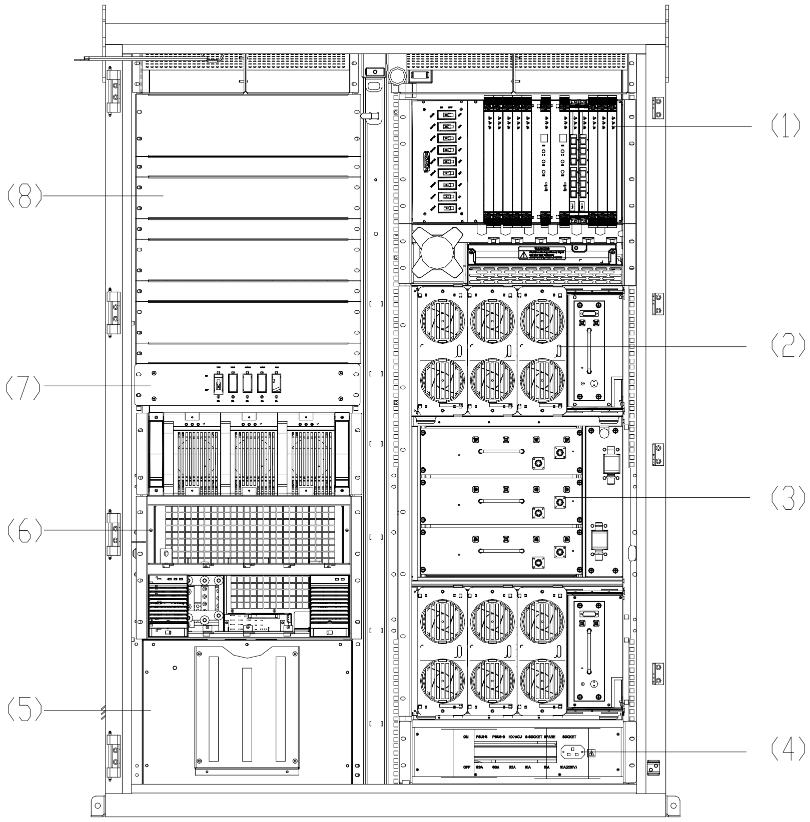
Chapter 1 Overall Structure

1.1 Physical Structure

A BTS3612A cabinet in full configuration is composed of two parts, as shown in Figure 1-1. The right half is the main cabinet, while the left half is for the auxiliary devices.



(1) Baseband subrack (2) Carrier subrack
(3) Duplexer subrack (4) AC distribution/lightning protector/wave filter unit
(5) Battery subrack (6)Power supply subrack
(7) Auxiliary cabinet secondary power switch box (8) Transmission equipment subrack

Figure 1-1 BTS3612A cabinet in full configuration

I. Main cabinet

The main cabinet is used to hold the baseband processing boards, Radio Frequency (RF) modules, etc.

- Baseband subrack

The baseband subrack is configured with various baseband processing boards, such as BCIM, BCPM, BCKM and BRDM.

A main cabinet secondary power switch box is configured to the left of the subrack. With the secondary power switch box, each board and module can be separately powered by the $PSU_{DC/DC}$. All the baseband processing boards share one power switch. Each pair of BTRM and BHPA boards share one power switch. The RLDU has its own power switch.

- Carrier subrack

There are two carrier subracks used to configure the carrier units, each of which is composed of one BTRM and one BHPA. Each subrack can be configured with one RLDU.

- Duplexer subrack

The duplexer subrack is located between the upper and lower carrier subracks. It is configured with duplexer units DFU or DDU as needed.

To the right of the subrack is a lightning protector connecting to the GPS/GLONASS synchronization antenna.

- Other devices

Between the baseband subrack and the upper carrier subrack are the fiber flange, cabling trough, fan box and air inlet.

The cabling trough is used to route the satellite signal receiving cable and fibers (connecting the BRDM and carrier modules). The extra fibers can be coiled on the fiber flange.

The fan box, the air inlet and air outlet (on the top of the cabinet) form a ventilation path to discharge the heat in the baseband subrack.

II. Auxiliary cabinet

The auxiliary cabinet is configured with the $PSU_{AC/DC}$, $PSU_{DC/DC}$, storage batteries, and built-in transmission equipment.

- Transmission equipment subrack

Standard space is reserved in this subrack to accommodate microwave, High-speed Digital Subscriber Line (HDSL), or SDH transmission equipment so as to support various networking modes.

- Power supply subrack

The power supply subrack is configured with $PSU_{DC/DC}$ and $PSU_{AC/DC}$. A Power Monitoring Unit (PMU) can also be installed.

- Battery subrack

The battery subrack can be configured with storage batteries or DC lightning protector/wave filter, based on actual configuration requirements.

- Other devices

A lightning protection board and an auxiliary cabinet secondary power switch box are configured between the transmission equipment subrack and the power supply subrack.

E1 Surge Protector (BESP) or SDH surge protector can be used, according to the transmission equipment configured.

The secondary power switch box is used to control the power supply to the $PSU_{AC/DC}$.

III. Cabinet door

Temperature-control device, such as air conditioner or heat exchanger, are equipped on the cabinet door.

1.2 Functional Structure

Functionally, the BTS3612A system is composed of the baseband subsystem, Radio Frequency (RF) subsystem, antenna & feeder subsystem, and power & environment monitor subsystem, as shown in Figure 1-2.

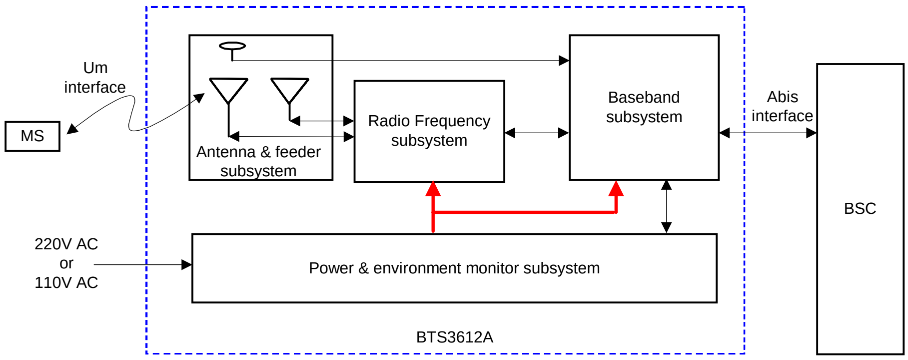


Figure 1-2 BTS3612A system structure

Standard space is reserved in the cabinet to accommodate transmission equipment such as microwave and SDH so as to support different networking modes.

The following chapters will detail each subsystem of BTS3612A.

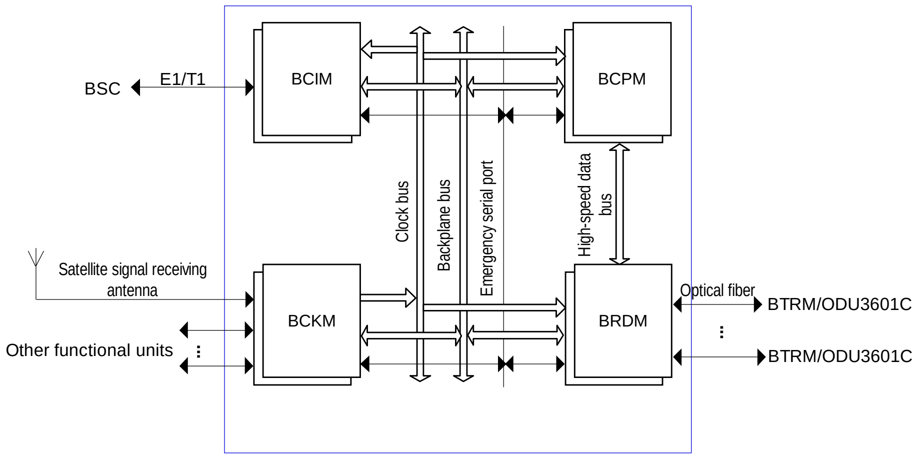
Chapter 2 Baseband Subsystem

2.1 Overview

Baseband subsystem consists of BTS Control & Clock Module (BCKM), BTS Resource Distribution Module (BRDM), BTS Channel Processing Module (BCPM), BTS Control Interface Module (BCIM) and Baseband Backplane (BASB).

2.1.1 Functional Structure

The functional structure of baseband subsystem is shown in Figure 2-1.



BCIM: BTS Control Interface Module
BCKM: BTS Control & Clock Module
BTRM: BTS Transceiver Module
BCPM: BTS Channel Process Module
BRDM: BTS Resource Distribution Module
BSC: Base Station Controller

Figure 2-1 functional structure of baseband subsystem

Baseband subsystem accesses transmission system through E1/T1 interface provided by the BCIM so as to connect to BSC equipment. It connects to carrier units through optical interface provided by the BRDM. Carrier units can be BTRM modules of the same BTS, or MTRM module of the ODU3601C extended afar.

2.1.2 Introduction to Baseband Boards

Baseband subsystem is held in the baseband subrack. The full configuration of baseband subrack is as shown in Figure 2-1

Baseband subrack supports the following boards:

- BCKM: BTS control & clock module, providing clock for BTS system and realizing the control of BTS system resource.
- BCIM: BTS control interface module, used for accessing transmission system to connect to the BSC. It supports E1/T1 transmission.
- BCPM: BTS channel process module, processing the data of CDMA forward channel and reverse channel.
- BRDM: BTS resource distribution module, connecting BCPM to BTRM to realize the work mode of BCPM resource pool.

In addition to the boards introduced, this section also covers the backplane of baseband subrack, E1 lightning-protection board and fan module.

2.2 BCKM

2.2.1 Overview

BCKM controls and manages the entire BTS system. Its functions are listed as follows:

Main control functions: Call procedure control, signaling processing, resource management, channel management, cell configuration, etc.

Operation & maintenance functions (O&M): BTS operation and maintenance, such as software download, status management, data configuration, test management, interface tracing, fault management, log management, maintenance console interface, active/standby BCKM switchover, etc.

Clock function: It provides high-precision oscillation clock and can be synchronized with an external clock (such as GPS/GLONASS clock). Thus it provides the entire BTS system with reference clock signal.

In addition, BCKM also provides external interfaces. See the following sections for detail.

2.2.2 Structure and Principle

The structure of BCKM module is as shown in Figure 2-2.

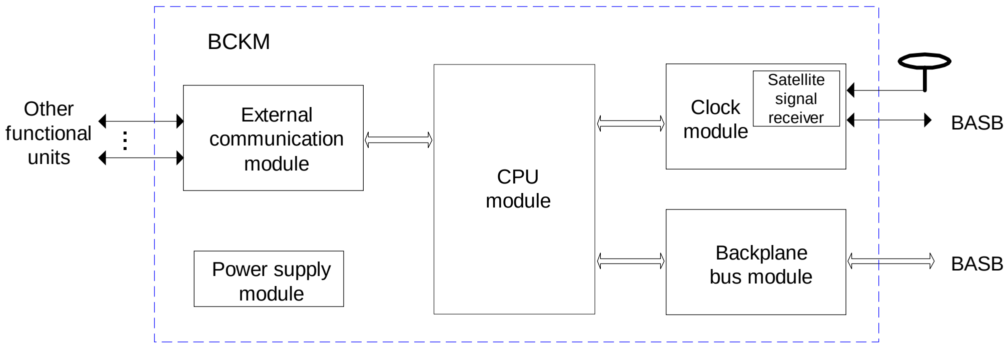


Figure 2-2 Structure of BCKM module

The BCKM comprises the following parts:

I. Clock module

Clock module is the clock source of BTS, which provides working clock for various boards.

Clock module supports two work modes: External synchronization mode (locked mode) and free oscillation mode (holdover mode). In the former mode, it receives GPS/GLONASS clock signals through its satellite signal receiver. In the latter mode, it provides clock reference through high precision oscillator (oven control & voltage control oscillator).

For the introduction to satellite signal receiver, see "4.3.5 Receiver".

II. CPU module

CPU module controls logical circuits to initialize relevant components. The management and control of BTS system is implemented through its system software, which includes main control software and operation & maintenance software. For specific function, see "2.1 Overview".

III. Backplane bus module

The communication port of the Central Processing Unit (CPU) is connected with other boards of BTS through the backplane bus module, and processes or transmits O&M signaling from other boards of BTS (BRDM, BCPM and BCIM).

IV. External communication module

External communication module utilizes the multiple communication control ports provided by the main control CPU to implement functions such as maintenance console interface, environment monitoring interface, test interface and external synchronization interface.

V. Power supply module

The power supply module converts +24V input power into +5V, +3.3V and +2.5V for various modules of local board.

2.2.3 External Interfaces

- Local maintenance console interface

This interface is a 10/100M compatible Ethernet interface to connect with local maintenance console.

- Remote maintenance serial port

This port is a RS232 serial port to connect with the Modem so as to provide remote monitoring and maintenance in case of interruption of OML link.

- Environment alarm interface

This port is a RS485 serial port to connect with an external monitoring device so as to collect and process the equipment room environment information (such as fire, water, temperature and humidity alarms).

- GPS/GLONASS antenna interface

It is used to receive satellite signal from the GPS/GLONASS so as to provide GPS/GLONASS antenna with +5V feed.

- External synchronization interface

If the GPS/GLONASS is not available, the system clock can keep synchronization with external clock system.

- Test interface

It is an interface for BTS test, providing 10MHz and 2s signals

- Backplane interface

It includes backplane bus interface, clock bus interface, and emergency serial port. The board management is accomplished through backplane bus. Other boards are provided with clock signal through clock bus. Boards can still keep communication through emergency serial port in case of board fault.

- Fan module interface

Fan module interface is a RS485 serial port, used to monitor the fan module and power supply module of baseband subrack.

- Power supply interface

Led out from the power connector on the backplane, the interface is connected with +24V power, +24V power ground and PGND.

2.2.4 Indices

- Power voltage: +24V.
- Power consumption: <20W.
- Dimensions: 460mm×233.35mm (Length×Width).

2.3 BCIM

2.3.1 Overview

The BCIM is located in BTS baseband subrack. It is a functional entity for the connection of BTS and BSC. Its major functions are as follows:

- In uplink direction, backplane bus receives O&M command from BCKM and traffic data from BCPM, and transmit ATM cells on the multiple E1 links to BSC with IMA technology in compliance with G.804 standards.
- In downlink direction, it receives ATM cells distributed on the multiple E1/T1 links from BSC, multiplexes them into a single ATM cell flow with IMA technology and finally sends them to corresponding processing boards through the backplane bus.
- Each BCIM provides 8 E1/T1 links, which can support at the most 4 IMA link sets. In BTS, there are two BCIMs, working in load sharing mode and providing physical interfaces to BSC. At the most 16 E1/T1 links can be provided.
- It communicates with BSC through IMA state machine program on the local board and monitors the working status of E1/T1 link to ensure the implementation of IMA protocol.
- It transmits O&M command through backplane bus or emergency serial port, reports the status information of the local board to BCKM and provides interface for board maintenance and network management.

2.3.2 Structure and Principle

BCIM is available in two specifications:

- BCIM with E1 interface.
- BCIM with E1/T1 interface. This type of BCIM works either in E1 mode or T1 mode according to the setting of the DIP switches.

Figure 2-3 illustrates the structure of BCIM with E1/T1 interface.

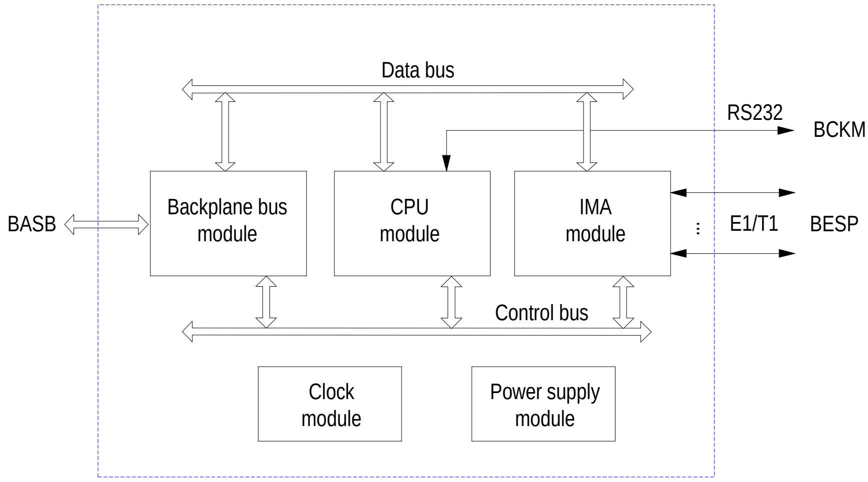


Figure 2-3 Structure of BCIM

BCIM comprises the following parts:

I. IMA module

IMA module inversely multiplex an ATM cell flow based on cells into multiple physical links for transmission, and remotely multiplex the cell flows transmitted on different physical connections into a single ATM cell flow.

In uplink direction, IMA module receives AAL2 traffic cells from BCPM and AAL5 signaling cells from BCKM through the backplane bus. It splits the ATM cell flow into cells, transmits them on multiple E1/T1 link according to G.804 standard before sending them to BSC.

In downlink direction, it receives ATM cells from BSC that are distributed on multiple E1/T1 trunk lines, inversely multiplexes them into a single ATM cell flow. Then it sends AAL2 traffic cells to BCPM and AAL5 signaling cells to BCKM through the backplane bus.

II. CPU module

The CPU module implements such functions as IMA protocol processing, executing OAM function of IMA, as well as E1/T1 link management and communication with BCKM.

III. Backplane bus module

BCIM communicates with other boards in the baseband part through the backplane bus module, including control information communication with BCKM and traffic data communication with BCPM.

IV. Clock module

It provides working clock for the local board.

V. Power supply module

The power supply module converts +24V input power into +3.3V for various modules of local board.

2.3.3 External Interfaces

- E1/T1 interface

Interface with BSC. BTS can be connected to the transmission system to connect to the BSC.

- Backplane bus interface

Interface with the other boards in the baseband part.

- Emergency serial port

Emergency serial port is an RS-232 serial port, works as a slave node and is used for communication with BCKM when other part of the board is faulty.

- Power supply interface

Led out from the power connector on the backplane, the interface is connected with +24V power, +24V power ground and PGND.

2.3.4 Indices

- Power voltage: +24V.
- Power consumption <15W.
- Dimensions: 460mm×233.35mm (Length×Width).

2.4 BCPM

2.4.1 Overview

The BCPM is logically located between the BRDM and the BCIM. The BCPM is the traffic processing board of the system. In full configuration, six BCPMs are needed. Data from various forward and reverse channels are processed by this board.

The BCPM also processes digital signals, including encoding/decoding baseband signals and one-time modulation and demodulation of baseband signals. In addition, it processes high layer control signals. The main functions are as follows:

- In forward direction, after ATM cell data from the network side are processed by the high performance processor, BCPM performs functions such as encoding (convolutional code, TURBO code), interleaving, spreading, modulation and data multiplexing, and converts them into high-speed signals. Then the signals are processed by a dedicated processing chip and transmitted through the radio interface side of the channel processing board.

- In reverse direction, data received by BCPM are demultiplexed, demodulated, de-interlaced and decoded (convolutional code, TURBO code). Then under the control of the high performance processor, the data are sent to BSC via BCIM in the form of ATM cells.
- The BCPM supports in-board and inter-board daisy chains, forming a resource-processing pool.
- High performance processor with two kernels and internal cache.

2.4.2 Structure and principle

The BCPM comprises the following parts as shown in Figure 2-4:

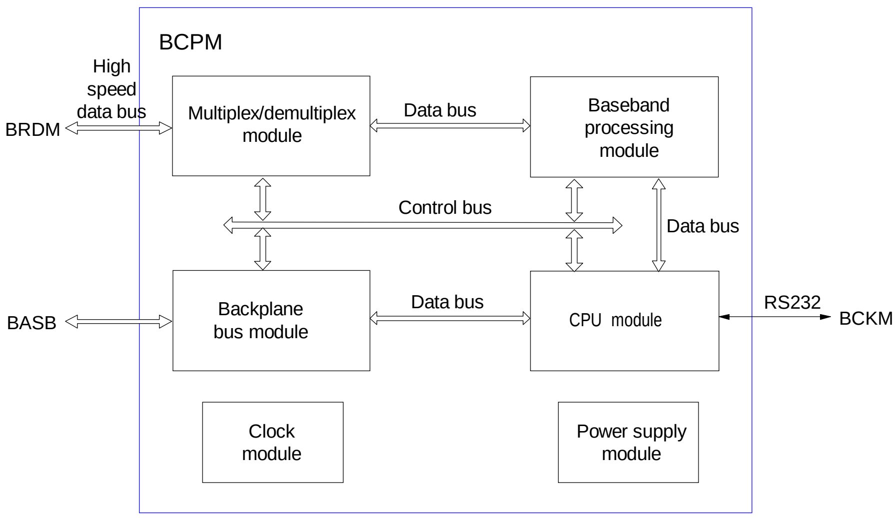


Figure 2-4 Structure of BCPM

I. Multiplex/demultiplex module

In forward direction, baseband data in the channel processing board are multiplexed into high-speed signals and sent to radio side in the form of differential signals. In reverse direction, the high-speed differential signals are demultiplexed and sent to baseband processing chip.

II. Baseband processing module

The QUALCOMM new generation processing chip is used to perform forward and reverse baseband data processing. With the help of in-board and inter-board data daisy chains, channel processing capability is increased greatly. Maximally 6 sectors can be supported.

III. CPU module

The high performance control CPU on BCPM mainly processes the forward & reverse high-speed traffic data and control data and reports board status. At the network side, the processing module receives control signaling, receives/transmits ATM cells and communicates with BSC through BCIM. At the radio side, it controls the dedicated baseband processing chip to generate orthogonal (IQ) data. After multiplexing, the data pass BRDM as high-speed differential signals, to implement data exchange with radio side.

IV. Backplane bus module

The BCPM communicates with other boards in the BTS baseband part through backplane bus, including control information communication with BCKM and traffic data communication with BCIM.

V. Clock module

The clock module performs double-frequency phase-locking to the clock signals from the backplane, provides clock for boards, and drives and co-phases the clock signals generated on the local board, to get satisfactory clock signals.

VI. Power supply module

The power supply module converts +24V input power into +3.3V for various modules of local board.

2.4.3 External Interfaces

- High-speed data bus interface

Interface with BRDM.

- Backplane bus interface

Interface with other boards of baseband part

- Emergency serial port

Emergency serial port is an RS-232 serial port, works as a slave node and is used for communicating with BCKM when other part of the board is faulty.

- Power supply interface

Led out from the power connector on the backplane, the interface is connected with +24V power, +24V power ground and PGND.

2.4.4 Indices

- Power voltage: +24V.
- Power consumption <30W.
- Dimensions: 460mm×233.35mm (Length×Width)

2.5 BRDM

2.5.1 Overview

The BRDM is logically located between BTRM and BCPM, providing path for orthogonal data connection (IQ) and exchange between the two so as to support the flexible configuration relation between BCPM and BTRM. The BRDM also support daisy chain cascading between BCPMs.

Data from the BTRM is sent to the BRDM through optical fibers. Then the BRDM distributes the data before sending them to BCPMs via the high-speed data bus. With the function of building cascades of daisy chain for BCPMs, the BRDM connects the short daisy chain cascades to form standard daisy chain cascades of a certain length. This facilitates the utilization of channel resource and flexible configuration of the channel capacity of each sector carrier.

The BRDM has the following functions and features:

- Optical interfaces are configured to provide high-speed data paths to BTRM/ ODU3601C.
- Six pairs of high-speed data bus interfaces are provided to six BCPM slots through the backplane.
- Flexible data distribution and exchange between BTRM/ODU3601C and BCPM are enabled.
- Flexible data exchange between BCPMs is enabled. It can be cascaded to form daisy chains, so BCPM resource pool can be achieved. The resource pool improves the utilization ratio of channel resource and makes the configuration of channel capacity of each sector carrier flexible.
- It exchanges O&M information with the BCKM through the backplane bus or emergency serial port.

It forwards and receives O&M information of BTRM/ODU3601C via optical fibers and provides O&M links between the baseband subrack and BTRM/ODU3601C.

2.5.2 Structure and Principle

The BRDM has two specifications as follows:

- The BRDM configured with six pairs of multi-mode optical interfaces used to connect to the BTRM.
- The BRDM with three pairs of single-mode optical interfaces used to cascade with ODU3601C.

The two specifications differ in optical modules configured.

The structure of BRDM is shown in Figure 2-5.

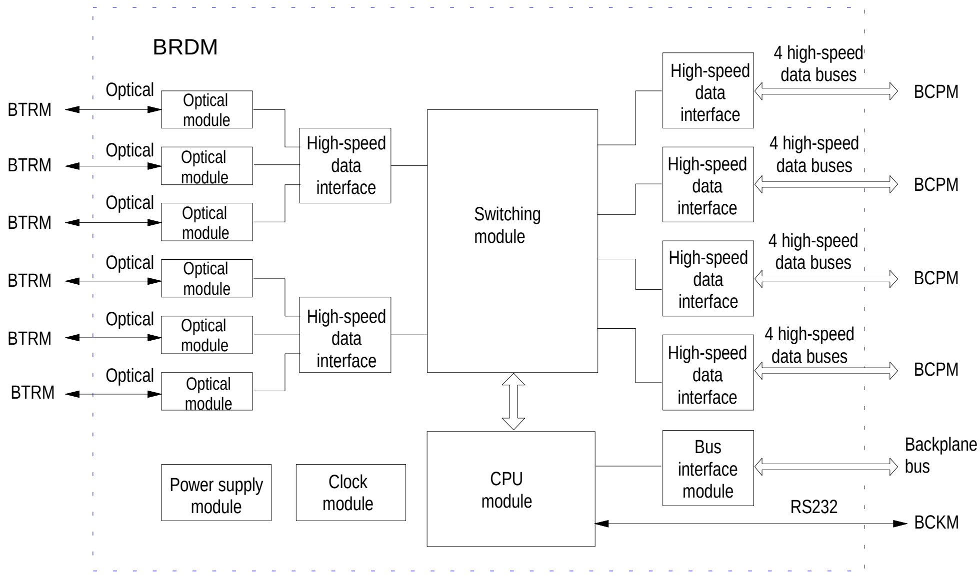


Figure 2-5 Structure of BRDM module (6 pairs of multi-mode optical interfaces)

The BRDM is composed of optical module, high-speed data interface module, switching module, CPU module, bus interface module, power supply module and clock module.

I. Optical module

The optical module converts optical signals into electrical signals. The BRDM can be classified into single-mode BRDM and multi-mode BRDM according to different types of optical module.

The multi-mode BRDM is equipped with six optical modules and provides six pairs of optical interfaces. It is used to connect to the BTRM in the same BTS.

The single-mode BRDM is equipped with three optical modules and provides three pairs of optical interfaces. It is used to cascade with ODU3601C.The single-mode BRDM can be further classified into two kinds, namely 10km and 70km, according to the transmission capability of the optical module.

II. High-speed data interface module

The high-speed data interface module converts rates of high-speed signals for the convenient processing of the switching module.

III. Switching module

The switching module segments and paste data as required. It is a core processing module of this board. Data from BTRM/ODU3601C are sent to this board, where the switching module will distribute and paste them before sending them to the BCPM. The switching module can also provide daisy chain cascading for the BCPMs through the distribution and pasting of data.

IV. CPU module

The CPU module processes O&M information and configures switching parameters. The O&M information from the BCKM is sent to this board via the bus interface module. Then the CPU module processes the information and sends some specific O&M information to the corresponding BTRM/ODU3601.

V. Bus interface module

This module provides the conversion of interfaces between the board and the backplane, and provides a path for O&M information between this board and the backplane.

VI. Clock module

The clock module performs double-frequency phase-locking to the clock signals from the backplane. It provides clocks for boards, and drives and co-phases the clock signals generated on the local board to get satisfactory clock signals.

VII. Power supply module

The power supply module converts +24V input power into +3.3V and 1.8V for various modules of the local board.

2.5.3 External Interfaces

- Optical interface

There are two specifications of optical interface available according to optical modules: 6 pairs and 3 pairs. They connect to the BTRM and the ODU3601C respectively, transmitting orthogonal (IQ) data and O&M information.

- High-speed data interface

The interfaces are connected with six traffic slots (BCPM slots) through the backplane, for transmitting baseband orthogonal (IQ) data.

- Backplane bus interface

The interface is used for transmitting O&M information between BCKMs.

- Clock interface

The interface is connected with the BCKM via the backplane. It receives 2s, 16 ×1.2288MHz clock signals and active/standby clock selection signal.

- Emergency serial port

Emergency serial port is an RS-232 serial port, works as a slave node and is used for communicating with the BCKM when other parts of the board are faulty.

- Power supply interface

Led out from the power connector on the backplane, the interface is connected with +24V power, +24V power ground and PGND.

2.5.4 Indices

- Power voltage: +24V.
- Power consumption <45W.
- Dimensions: 460mm×233.35mm (Length×Width)

2.6 BASB

2.6.1 Overview

The baseband backplane (BASB) is used to make interconnection of high-speed data links among the boards of baseband part, and exchanges various management and control information of boards with high-speed backplane technology.

Specifically, the backplane:

- Realizes interconnection of various signals between boards.
- Supports hot plug/unplug of all boards.
- Supports active/standby switchover of the BCKM.
- Leads in system power supply and distributes the power to all boards.
- Leads in signal monitoring lines for the fan subrack and the power subrack.
- Provides protection against misplugging.

2.6.2 Structure and Principle

Functions of the slots in the BASB are as shown in Figure 2-6.

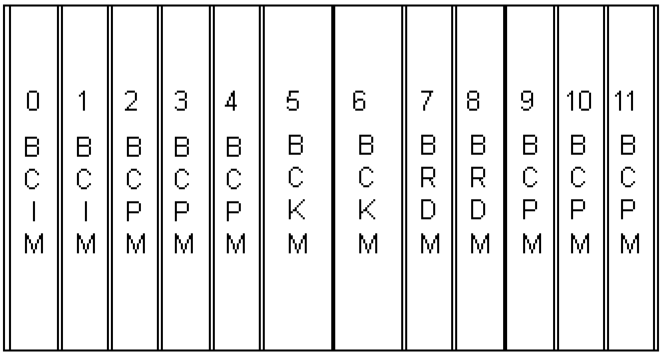


Figure 2-6 Functions of all slots in the BASB

A backplane includes two parts: connector and board slot.

The connector part includes 2 input connectors of backplane +24V power/ground, and 3 DB37 D-connectors. Power input connector, D-connector are all crimped devices.

The slots of the backplane are defined as follows:

- Slots 0~1 are for BCIMs.
- Sots 5~6 are for BCKMs.
- Slots 7~8 are for BRDMs.
- Slots 2~4, 9~11 are for BCPMs.

2.6.3 External Interfaces

The interfaces between the backplane and external devices include:

- System power interface
- Remote maintenance serial port
- Environment alarm interface
- Fan alarm serial port in baseband subrack
- System external synchronization interface
- Sixteen E1/T1 interfaces

2.6.4 Indices

- Dimensions: 368mm ×262mm (Length×Width)

2.7 BESP

2.7.1 Overview

The E1 Surge Protector (BESP) is placed between the transmission equipment subrack and the power supply subrack. It is a functional entity for the BTS to implement lightning protection with E1/T1 trunk line. The 8 pairs of lightning protection units of the BESP are used to discharge transient high voltage on the sheath and core of E1/T1 trunk line to the PGND.

2.7.2 Structure and Principle

I. Structure

The structure of BESP is shown in Figure 2-7.

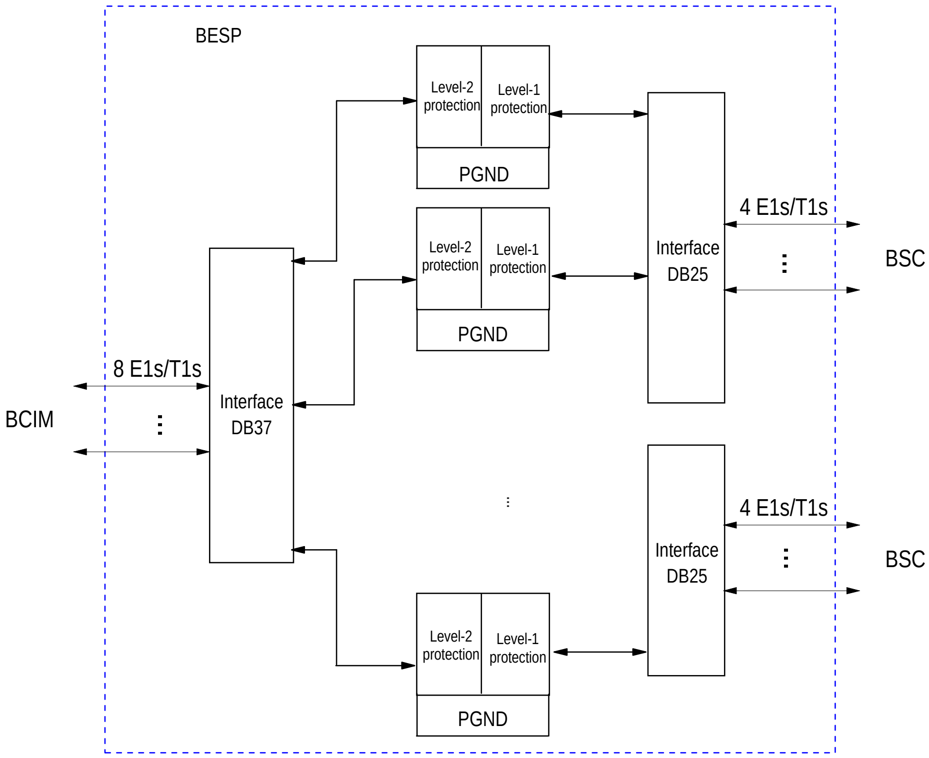


Figure 2-7 Structure of BESP

The board consists of three parts: DB25 connector, lightning protection unit and DB37 connector.

- Lightning protection unit

E1/T1 lightning protection unit has two inbound lines connected with DB25, two outbound lines connected with DB37, and one PGND. Here PGNDs of all lightning protection units can be interconnected.

- DB37 connector

The DB37 is a male connector, connected with eight E1/T1 cables.

- DB25 connector

The DB25 is a female connector. There are two DB25 connectors, respectively connected with four E1/T1 cables.

II. Principle of lightning protection

The principle of lightning protection is shown in Figure 2-8.

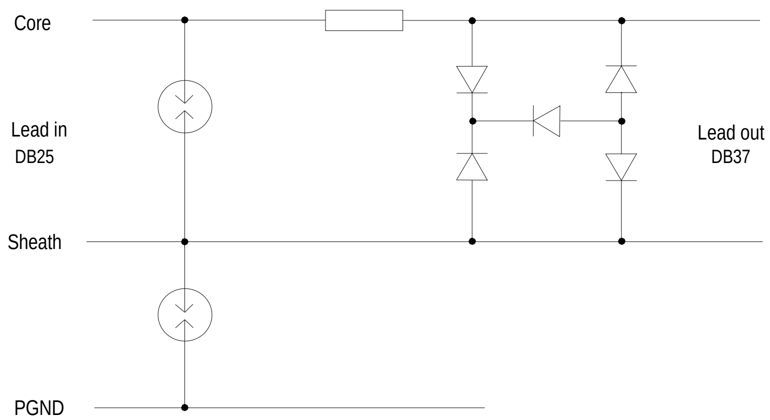


Figure 2-8 Principle of E1/T1 lightning protection

When the BTS E1 trunk line is struck by lightning, high voltage will arise first on the DB25 and then spread to the lightning protection units. The lightning protection units have two protection levels: air discharge tube and voltage limit mesh. The air discharge tube discharges the high voltage to the ground and lowers it to 600V below. Then the voltage limit mesh further lowers the voltage to 30V below.

2.7.3 External Interfaces

- E1/T1 interface

  Interface with the BSC (DB25).

  Connection with the BCIM (DB37)

2.7.4 Indices

- Bearable surge current: >10kA (common mode), >5KA (differential mode)
- Output residual voltage: <30V.
- Dimensions: 140mm ×120mm (Length×Width)

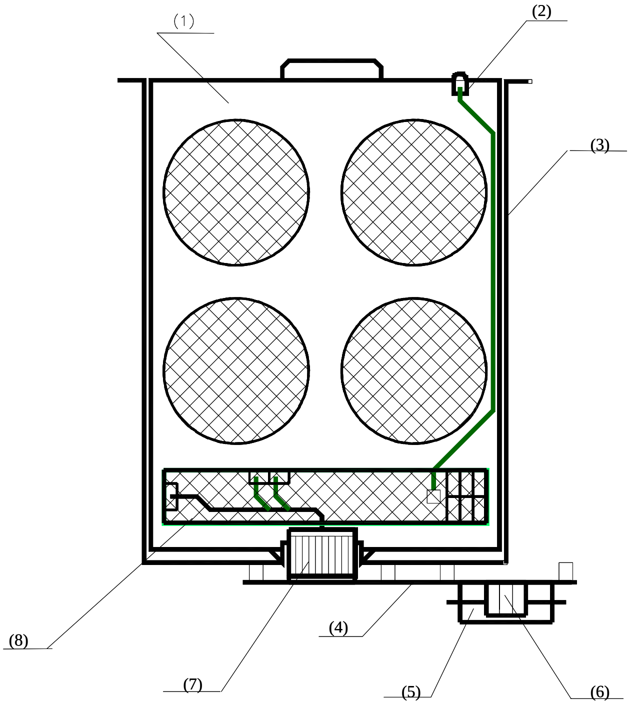
2.8 BFAN

The fan module (BFAN) is installed right under the baseband subrack, serving as a part of the blower type cooling system of the baseband subrack. The BFAN consists of fan boxes and fan enclosures.

Each fan box contains four fan units (24V DC brush-free fan) and one BTS Fan Monitor Module (BFMM). .

The fan enclosure is used for installation of fan boxes, whose outside is the BTS3612A Fan Block Interface Board (BFIB) providing a system interface.

The structure of BFAN is shown in Figure 2-9.



(1) Fan box (2) LED indicator (3) Fan enclosure
(4) BFIB (5) System signal interface (6) Power input interface
(7) Blind mate connector (8) BFMM

Figure 2-9 Structure of BFAN

2.8.1 BFMM

I. Overview

Built in the fan box, the BTS Fan Monitor Module (BFMM) communicates with the BCKM and receives instructions from the BCKM. It can make speed adjustment of the PWM on the fan units and report board status information to the BCKM when it is queried. It can also guarantee a safe and proper cooling system and lower the system noise. Its main functions are as follows:

- Control rotating speed of the fans.
- Check whether fan units are in position and report their information.
- Check and report fan unit blocking alarm.
- Drive fan operating status indicator.
- Communicate with the Main Control Unit (MCU) of BCKM and report in-board status information.

II. Structure and principle

The position of BFMM is shown in Figure 2-9. And its function is shown in Figure 2-10.

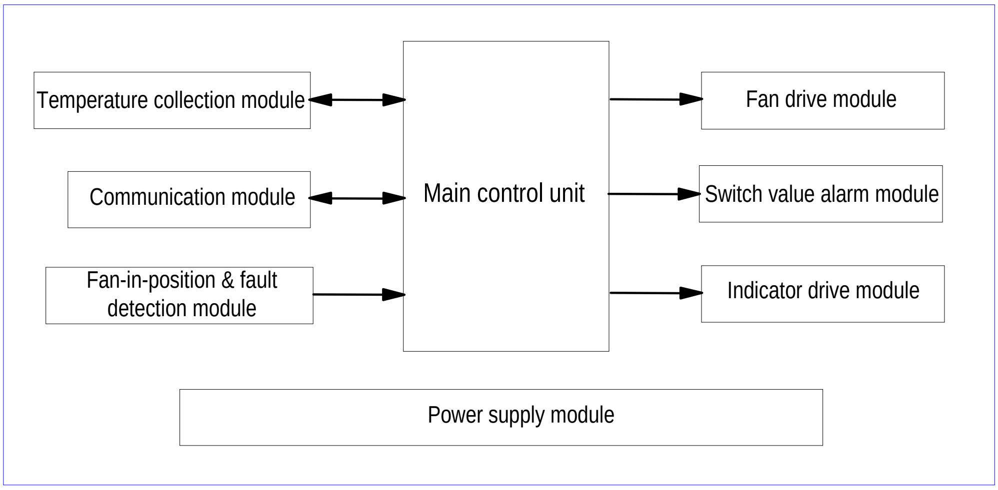


Figure 2-10 Functions of BFMM

- Power supply module

The power supply module converts +24V input power into the voltage required by various modules of local board.

- Main Control Unit (MCU)

The MCU controls the fans and communicates with the BCKM. That is:

- Generates control PWM signals according to the instruction sent from the BCKM to control the speed of fans.

- Detects fan alarm signal and in-board logic alarm signal, and reports them to the BCKM.

- Generates panel indicator signals.

- Communication module

The module performs serial communication with the BCKM.

- Fan driving module

The PWM control signal generated in the MCU provides controlled power input for fans by isolating driving circuits.

- Fan in position and fault detection module

This module isolates the fan-in-position signal and fan blocking alarm signal, then converts them into logic level for the MCU to sample and analyze.

- Temperature collection module

The module collects the ambient temperature information of BFMM in real time, which is realized by the MCU in query operation.

- Indicator driving module:

When a functional alarm (such as communication interruption in main control mode) occurs to the board or a fan blocking alarm occurs to the motor, this module provides a LED optical alarm interface inside the fan block, to drive the LED indicator on the fan block front panel.

III. External interface

- Power interface

The interface is used to lead in working power for the BFMM.

- Communication serial port

Serial port communication ports 0 and 1 provide access for system active/standby serial port. When the system has only one serial port, only port 0 is used.

- LED indicator driving output interface

This is the driving interface for LED status indicator on the panel of the fan box.

- Fan unit driving interface

Maximally six such interfaces are provided. They also serve as the interfaces for fan-in-position detection and fan blocked detection.

IV. Indices

- Power voltage: +24V.
- Power consumption <5W.
- Dimensions: 280mm×35mm (Length×Width)

2.8.2 BFIB

I. Overview

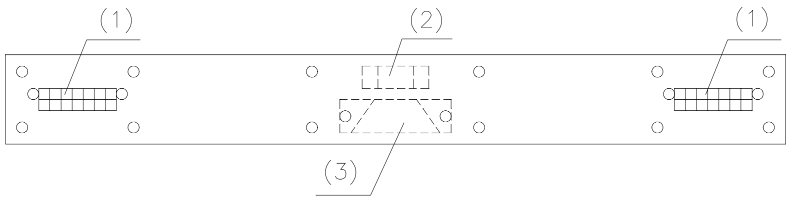
The BTS Fan Block Interface Board (BFIB) provides electrical connection between fan boxes and the system. On one hand, it provides blind mate interfaces for the fan boxes. On the other hand, it provides the system with power interfaces and serial communication interfaces.

II. Structure and principle

The position of BFIB is shown in Figure 2-9.

The BFIB implements interface conversion function. Refer to "3) Interface" for the definition of interfaces.

Its structure is shown in Figure 2-11.



(1) MOLEX connector (2) Large 3PIN power socket (3) DB-15 signal socket

Figure 2-11 Illustration of BFIB structure

III. External interface

- Fan box electrical interface

Power supply ports and serial port communication ports are provided for the fan boxes through MOLEX connectors.

- System power supply interface

The interface leads in the system power through big 3-pin connectors.

- System serial communication interface

External serial communication interface is provided through the DB-15.

IV. Indices

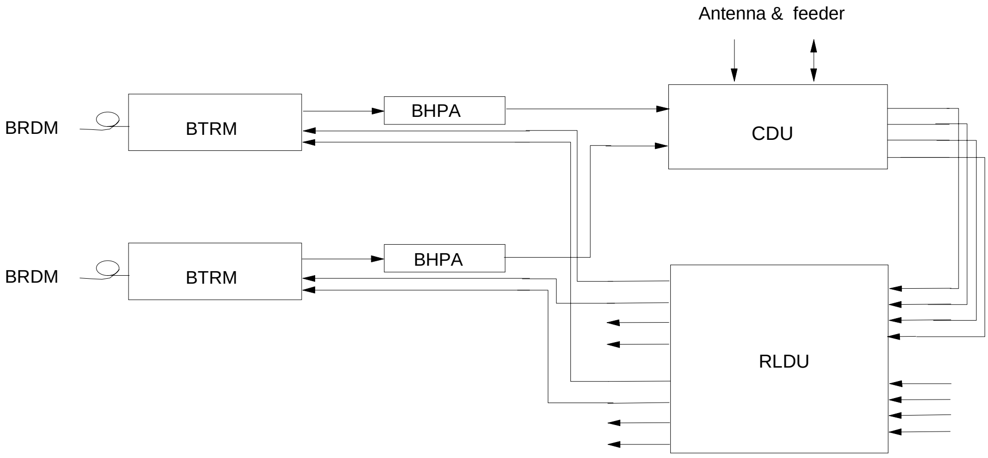
Dimensions: 230mm×30mm (Length×Width)

Chapter 3 Radio Frequency Subsystem

3.1 Overview

3.1.1 Radio Frequency Subsystem Functional Structure

The structure of RF (radio frequency) subsystem is shown in Figure 3-1.



BRDM: BTS Resource Distribution Module
BTRM: BTS Transceiver Module
BHPA: BTS High Power Amplifier Unit
CDU: Combining Duplexer Unit
RLDU: Receive LNA Distribution Unit

Figure 3-1 Structure of RF subsystem

Note:

The above figure illustrates the duplexer configuration for 800MHz band. For 800MHz band, the duplexer can also be DDU. For 450MHz band, the duplexer can be DFU, DDU or CDU. For 1900MHz band, the duplexer can be DDU or CDU.

The RF subsystem is connected with the BCIM of the baseband subsystem via the optical interface provided by the BTRM, and connected with the antenna & feeder subsystem via the feeder interface provided by a CDU, DDU, or DFU. It implements the following functions:

In forward link, it performs power adjustable up-conversion and linear power amplification to the modulated transmission signals, filtering the transmission signals to meet the corresponding air interface standard.

In reverse link, it filters the signals received by the BTS antenna to suppress out-band interference, and then performs low-noise amplification, noise factor adjustable frequency down-conversion, and channel selective filtering.

3.1.2 Introduction to RF Modules

The RF subsystem is composed of RF modules. Figure 8-3 shows the RF subsystem in full configuration.

RF modules include:

- BTRM: Complete the modulation/demodulation of baseband signal and up/down conversion.
- BHPA: Complete the high-power linear amplification of transmitting carrier signals.
- DFU: Complete the wave filtering and duplex isolation of one main transmitting/receiving signal, and the wave filtering of diversity receiving signal. It is one of the RF front-end modules.
- DDU: Complete the isolation and duplex filtering of two receiving/transmitting signals. It is one of the RF front-end modules and is not equipped with the combiner function.
- CDU: Complete the combination and wave filtering of two transmitting signals, duplex isolation of main transmitting and receiving signals, and the wave filtering of diversity receiving signal. It is one of the RF front-end modules.
- RLDU: Complete the low noise amplification and dividing of receiving signals.

Besides the above modules, the backplane of RF module and the RF fan module will also be introduced in this chapter.

3.2 BTRM

3.2.1 Overview

In reverse link, the BTS Transceiver Module (BTRM) receives the main/diversity RF signals from the RLDU, and then changes the RF signals into baseband signals through down-conversion, wave filtering and multiplexing. Finally the BTRM sends the baseband signals to the baseband subsystem through the BRDM.

In forward link, the BTRM receives the baseband signals from the BRDM, then changes the baseband signals into RF signals through de-multiplexing, wave filtering and up-conversion. Finally the BTRM sends the RF signals to the RF subsystem through the RF front module such as CDU.

The BTRM also receives the management and configuration information from the BCKM, and reports the status and alarms of itself to the BCKM.

3.2.2 Structure and Principle

The BTRM consists of BTS Intermediate Frequency Module (BIFM) and BTS Radio up-down Converter Module (BRCM). Its structure is shown in Figure 3-2.

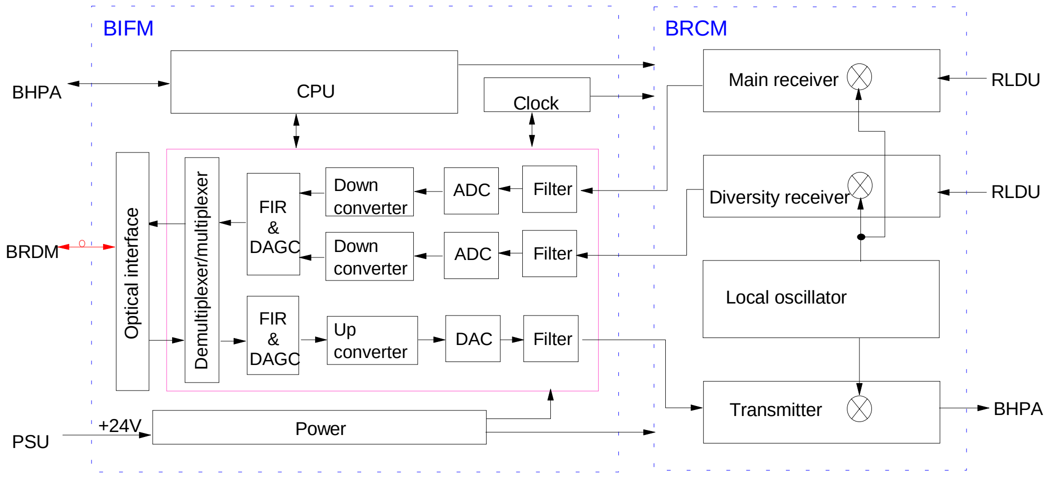


Figure 3-2 Structure of BTRM

I. BIFM

The BIFM consists of up-converter, down-converter, multiplexer/demultiplexer, optical interface, clock, CPU, and power supply sub-unit. It is in charge of the conversion between the analog intermediate frequency signal and the digital baseband signal, and the control of the BTRM. The functions of each sub-unit are as below:

- Up-converter

The up-converter accomplishes the wave filtering, digital up-conversion and digital-analog conversion of the signals in the transmit path.

On receiving the baseband I/Q signals that have been de-multiplexed, the up-converter performs digital up-conversion after baseband filtering. Then the digital intermediate frequency signals are converted into analog intermediate frequency signals after digital-analog conversion and wave filtering. At last, the analog intermediate frequency signals are sent to the transmitter in BRCM via radio frequency (RF) interface.

- Down-converter

The down-converter accomplishes the analog-digital conversion, digital down-conversion and baseband filtering of the signals in the receive path.

On receiving the analog intermediate frequency signals via the radio interface, the down-converter converts them into digital intermediate frequency signals via analog-digital conversion. Then the digital intermediate frequency signals are converted into baseband I/Q signals via digital down-conversion and baseband filtering. As last, the I/Q signals are transmitted to the demultiplexer/multiplexer.

- Demultiplexer/multiplexer

Under the control of the CPU, the demultiplexer/multiplexer de-multiplexes the forward I/Q signals, and multiplexes the reverse I/Q signals. At the same time, it multiplexes/de-multiplexes the operation & maintenance (O&M) signals of the OML.

- Optical interface

The optical interface performs channel coding and decoding, and accomplishes optical-electrical signal conversion and electrical-optical signal conversion. It is the interface between the BIFU and the BRDM of the upper-level BTS, and the interface between the BIFU and the MTRM (Micro-bts Transceiver Module) in the lower-level SoftSite.

- Clock

The clock generates all the clock signals needed by the BIFU, which include the clocks for up/down conversion, analog-digital conversion (ADC), and digital-analog conversion (DAC), as well as other working clocks. It also provides the reference clock for the BRCM.

- CPU

The CPU is in charge of the control of BTRM, which includes the initialization upon power-on, alarm collecting and reporting, and processing operation & maintenance related messages.

- Power supply

With input voltage of +24V, the power supply sub-unit provides power supply to BIFU and BRCU.

II. BRCM

The BRCM consists of transmitter, main/diversity receiver and local oscillator. It up-converts, amplifies the intermediate frequency signals output by BIFM, and performs spuriousness-suppression wave filtering. It also performs analog down-conversion, amplification of BTS main/diversity receiving signal input from the RLDU, and channel-selection wave filtering. The functions of each sub-unit are as below.

- Transmitter

When receiving the modulated analog intermediate frequency signals output by BIFM, the transmitter converts them to specified RF band via two times of up-conversions. Before and after the up-conversion, wave filtering, signal amplification and power control are performed, so as to ensure the RF signals output meet the protocol requirements on power level, Adjacent Channel Power Radio (ACPR) and spuriousness.

- Main/diversity receiver

The main/diversity receiver converts the RF signals output by RLDU to specified intermediate frequency signals via down-conversion, and performs wave filtering, signal amplification and power control before/after the down-conversion, so as to ensure the intermediate frequency signals output can be received by BIFM.

- Local oscillator

The local oscillator consists of intermediate frequency source, transmit RF synthesizer and receive RF synthesizer.

The intermediate frequency source generates the local oscillator signals for intermediate frequency up conversion in transmit path.

The transmit RF synthesizer generates the local oscillator signals for the up-conversion of the transmit path.

The receive RF synthesizer generates the local oscillator signals for the down conversion of main/diversity receive path.

3.2.3 External Interfaces

There are interfaces between the BTRM and the BHPA/RLDU/BRDM/PSU. The descriptions of each interface are given as below:

- RF interface between the BTRM and the BHPA

The RF transmitting signal is output via this interface to BHPA, where the signal is amplified and then outputted.

- RS485 interface between the BTRM and the BHPA

This interface is used to transfer alarm and control signal, and power detection signal.

- RF interface between the BTRM and the RLDU

The main/diversity RF receiving signal output by RLDU is received via this interface.

- Optical interface between the BTRM and the BRDM

Baseband data are transmitted or received via this interface.

- Power supply interface

Interface with BTS3612A TRx Backplane (BTRB), This interface is used to provide +24V power supply to BTRM.

3.2.4 Indices

- Supported frequency band: 450MHz, 800MHz and 1900MHz
- Power voltage: +24V
- Power consumption: 51W
- Dimensions: 460mm × 233.5mm × 64mm (Length × Width × Depth)

Note:

BTRM supports the different frequency bands with different BTRM types, such as BTRM for 450MHz band, BTRM for 800MHz band, BTRM for 1900MHz band. And this principle also applies to the other RF modules including BHPA, CDU, DFU, DDU, and RLDU.

3.3 BHPA

3.3.1 Overview

Located at the left side of the BTRM, the BTS High Power Amplifier Module (BHPA) amplifies the RF modulation signals output by BTRM. Its main functions are:

- RF power amplification: The BHPA performs power amplification for the RF modulation signals from BTRM.
- Over-temperature alarm: When the temperature of power amplifier base board exceeds a specified threshold, the BBFM will process the over-temperature alarm signal generated by HPAU and report it to BTRM.
- Over-excited alarm: When the power level of BHPA input RF signal exceeds a specified threshold, the BBFM will process the over-excited alarm signal generated by HPAU and report it to BTRM.
- Gain decrease alarm: When the gain of the power amplifier drops over 6dB, the BBFM will process the gain decrease alarm signal generated by HPAU and report it to BTRM.
- Fan monitoring: The BBFM installed in BHPA performs such functions as fan alarm and power amplifier alarm signal processing & reporting, and fan speed adjustment.

3.3.2 Structure and Principle

The structure of BHPA module includes the following parts, as shown in Figure 3-3:

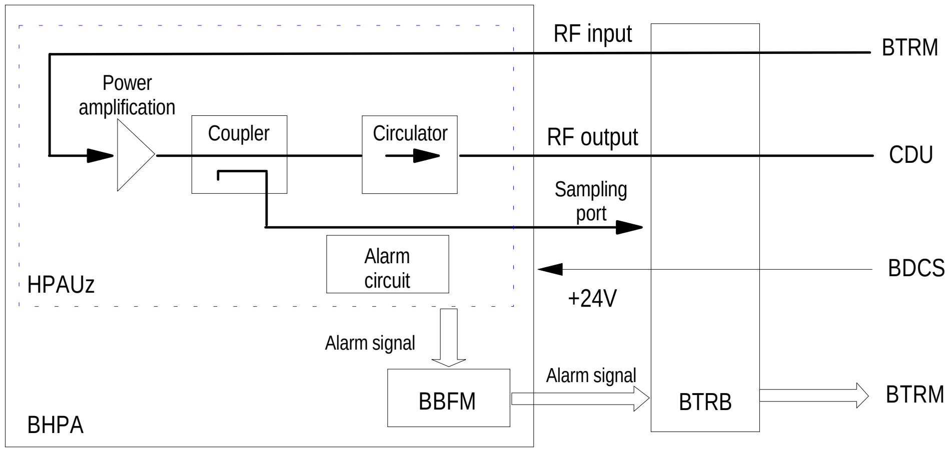


Figure 3-3 Functional structure of BHPA module

I. HPAU

The High Power Amplifier Unit (HPAU) consists of two parts: power amplifier and alarm circuit.

The power amplifier amplifies the RF signals from BTRM. The amplified RF signals are then sent to CDU or DFU via BTRB.

The alarm circuit monitors the power amplifier status and generates over-temperature alarm, over-excited alarm and gain decrease alarm signals when necessary. The alarm signals will be sent to BBFM, where they will be processed and reported to BTRB.

The coupler is used to couple the RF output signals to the sampling port for test purpose.

The output power of HPAU can be adjusted by controlling the RF output signal of BTRM.

II. BBFM

The BTS BTRM Fan Monitor (BBFM) processes fan alarm signals and power amplifier alarm signals, and sends them to BTRM via BTRB, and then BTRM will report them to upper level. BBFM can adjust the fan speed based on the ambient temperature and the actual BHPA output power in order to lower the noise of fans.

For the detail of BBFM, see "3.9 BRFM"

3.3.3 External Interfaces

External interfaces of the BHPA module are D-type combination blind mate connectors, including:

- RF interface

The RF interface of BHPA has one input port and one output port. They are connected respectively with BTRM RF output port via BTRB and CDU/DFU/DDU RF input port via coaxial cable.

- Power supply interface

Interface with BTS3612A TRx Backplane (BTRB), This interface is used to provide +24V power supply to BTRM.

The +24V power is supplied with the BTS Direct Current Switch box (BDCS).

- Alarm interface

Interface with BTRM. Fan alarm signals and power amplifier alarm signals are sent via BTRB to BTRM.

3.3.4 Indices

- Supported frequency band: 450MHz, 800MHz, and 1900MHz
- Power supply: +24V
- Power consumption: <380W
- Dimensions: 460mm ×233.5mm ×64mm (Length × Width × Depth)

3.4 BTRB

3.4.1 Overview

The BTS3612A TRx Backplane (BTRB) accomplishes the following functions:

- Fastening the connection between BTRM and BHPA.
- Fastening the RLDU.
- Monitoring BHPA temperature.
- Providing alarm signal interface between BTRM and RLDU.

Key internal parts of BTRB include connectors and temperature sensors.

3.4.2 Structure and Principle

The BTRB structure is as shown in Figure 3-4.

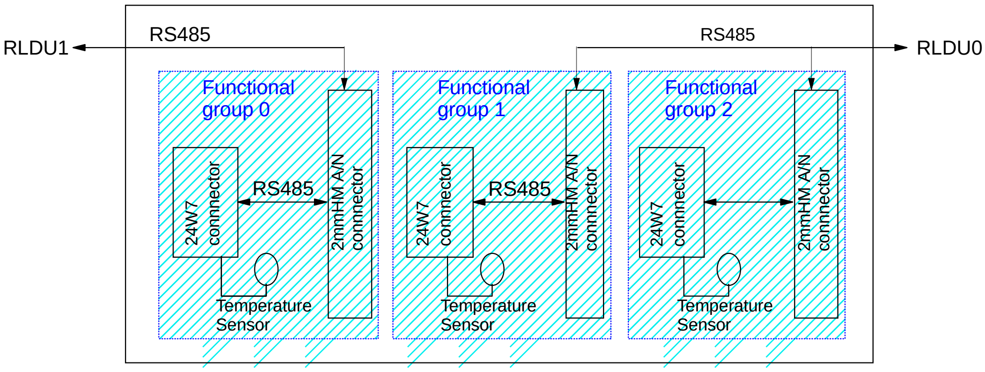


Figure 3-4 Functional structure of BTRB

I. BTRM 2mm connector

Each set of 2mm connectors includes one 5×22pin A-connector and three 3-socket-C4-connectors.

A-connector transfers RLDU alarm signals from DB9 connector and RS485 interface message from BHPA 24W7 combination DB-connector.

C4-connector transfers the main/diversity input/output RF signal of BTRM and +24V DC power signal needed by BTRM.

II. BHPA 24W7 D-type combination blind mate connector

Each 24W7 D-type combination blind mate connector includes two coaxial contacts (transferring BHPA input/output RF signals), two high-current power contacts (transferring +24V power supply and PGND signals), one set of RS485 signal contacts and a group of contacts for temperature sensor signals.

III. DB9 connector

There are two angled DB9 connectors on BTRB for two RLDUs alarm signals transferred to BTRM.

IV. Temperature sensor

There are three temperature sensors for the three BHPA slots, used for sensing the air temperature at each BHPA air outlet. They will convert the information into current and send to BFMM on BHPA for processing. In this way, fan speed can be controlled on a real-time basis.

3.4.3 External Interfaces

See the introduction to connectors in Section 3.4.2.

3.4.4 Indices

Dimensions: 664mm×262mm×3mm (Length × Width × Depth)

3.5 CDU

3.5.1 Overview

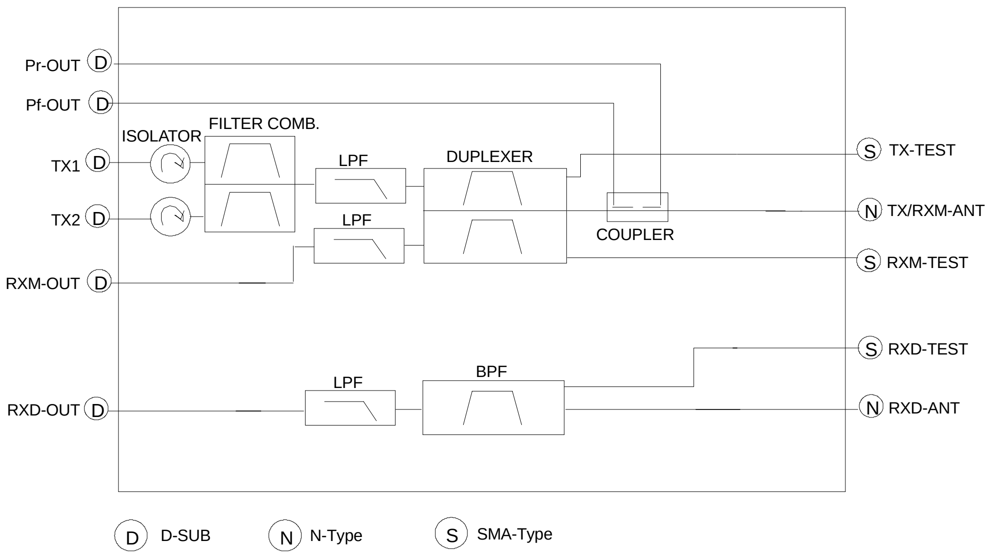
The Combining Duplexer Unit (CDU) accomplishes the following functions:

- Combining two carrier signals from the two BHPAs into one.
- Isolating and filtering the receiving and transmitting signals.
- Filtering the transmitting signals so as to suppress BTS spurious emissions.
- Filtering the receiving signals so as to suppress the interference from outside the receive band.

Key internal parts of CDU include isolator, 2-in-1 combiner, duplexer, filter and directional coupler.

3.5.2 Structure and Principle

CDU structure is as shown in Figure 3-5.



LPF: Low Pass Filter BPF: Band Pass Filter

Figure 3-5 Structure of CDU

I. Isolator

There are two isolators at each input port of the combiner in CDU. They are used to isolate the two carriers from two input ports.

II. Combiner

The combiner is a narrow band cavity filtering combiner. In comparison with broadband combiner, it features lower insertion loss and effective isolation.

III. Duplexer

The duplexer is used to isolate transmitted signals and received signals, suppress transmission spurious and reduce antenna quantity.

IV. Filter

The filter on the transmitting channel filters transmitting signal.

The filter on the main/diversity receive channel filters main/diversity receive signals respectively. Then it sends them to low-noise amplifier in the RLDU for amplification.

V. Directional coupler

The directional coupler couples forward/reverse power to RLDU, and monitors the antenna VSWR.

3.5.3 External Interfaces

The CDU is a module shared by the transmit and receive paths of the BTS. Therefore, it has interfaces with other modules both in the transmitting and in the receiving paths. Its external interfaces include a set of 8W8 D-type combination blind mate connectors on the backside, and a set of N-connectors and SMA connectors on the front side. The interface signals include:

- RF signals between CDU combiner input ports and BHPA output ports. They are transferred through the blind mate connectors on the backside.
- BTS receiving signals output from the duplexer. They are sent to RLDU via the blind mate connector on the backside.
- BTS transmitting signals, which are transferred to the cabinet-bottom antenna interface through the RF cable connected with the N-connector at the front side of CDU.
- BTS receiving signals, which are transferred from the cabinet-bottom antenna interface through the RF cable connected with the N-connector on the front side of CDU.

- Forward/reverse coupled RF signals, which are sent to RLDU via the blind mate connector on the backside.
- Forward/reverse coupled test signals, which are output through the standard SMA connector on the front side of CDU.

3.5.4 Indices

- Number of combined signals: 2
- Supported frequency band: 450MHz, 800MHz, and 1900MHz.

Module dimensions: 450mm×100mm×344.8mm (Length × Width × Depth)

3.6 DFU

3.6.1 Overview

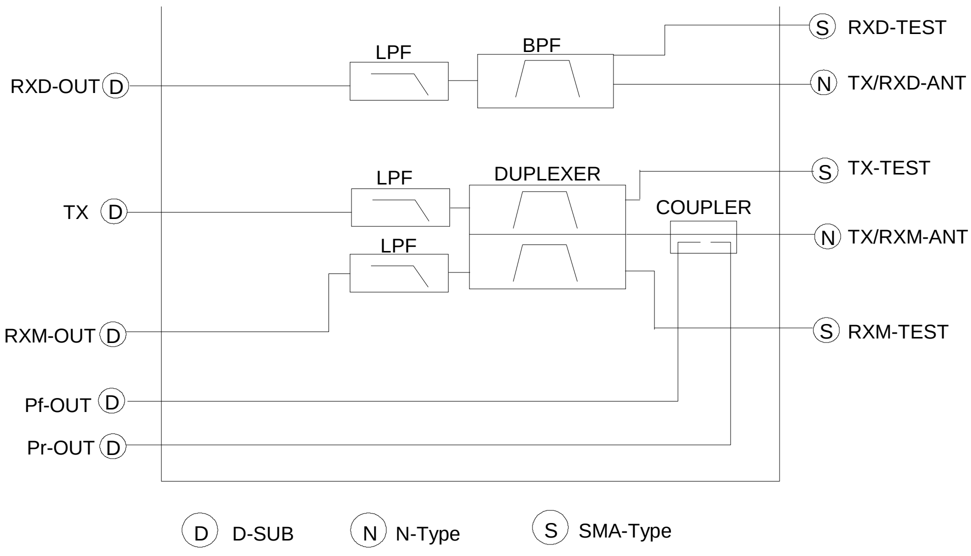
The Duplexer Filter Unit (DFU) accomplishes the following functions:

- Isolating and filtering the transmitting and receiving signals for the single carrier.
- Filtering the diversity receiving signals so as to suppress out-band interference.

Key parts of DFU include low-pass filter, duplexer, filter and directional coupler.

3.6.2 Structure and Principle

The DFU structure is shown in Figure 3-6.



LPF: Low Pass Filter BPF: Band Pass Filter

Figure 3-6 Structure of DFU

I. Filter

The filter on the transmitting channel filters transmitting signal.

The filter on the main/diversity receive channel filters main/diversity receive signals respectively. Then it sends them to low noise amplifier in the RLDU for amplification.

II. Duplexer

The duplexer is used to isolate transmitting and receiving signals, suppress transmission spurious and reduce antenna quantity.

III. Directional coupler

The directional coupler couples forward/reverse power for RLDU, and monitors the antenna VSWR.

3.6.3 External Interfaces

DFU is a module shared by the transmit and receive paths of the BTS. Therefore, it has interfaces with other modules in both the transmit and receive paths.

Its external interfaces include a set of 8W8 D-type combination blind mate connectors on the backside, and a set of N connectors and SMA connectors on the front side. The interface signals include:

- The signals between DFU and BHPA, which are transferred through the blind mate connectors on the backside.
- BTS transmitting signals, which are transferred to the cabinet-bottom antenna interface through the RF cable connected with the N-connector at the front side of the module.
- BTS receiving signals, which are transferred from the cabinet-bottom antenna interface to DFU for filtering through the RF cable connected with the N-connector on the front side of the module.
- BTS receiving signals output from the duplexer and diversity receive filter. They are sent to RLDU via the blind mate connector on the backside.
- Forward/reverse coupled RF signals, which are sent to RLDU via the blind mate connectors on the backside.
- Forward/reverse coupled test signals, which are output through the standard SMA connector on the front side.

3.6.4 Indices

- Supported frequency band: 450MHz
- Module dimensions: 450mm×100mm×344.8mm (Length × Width × Depth)

3.7 DDU

3.7.1 Overview

The Dual Duplexer Unit (DDU) implements the following functions:

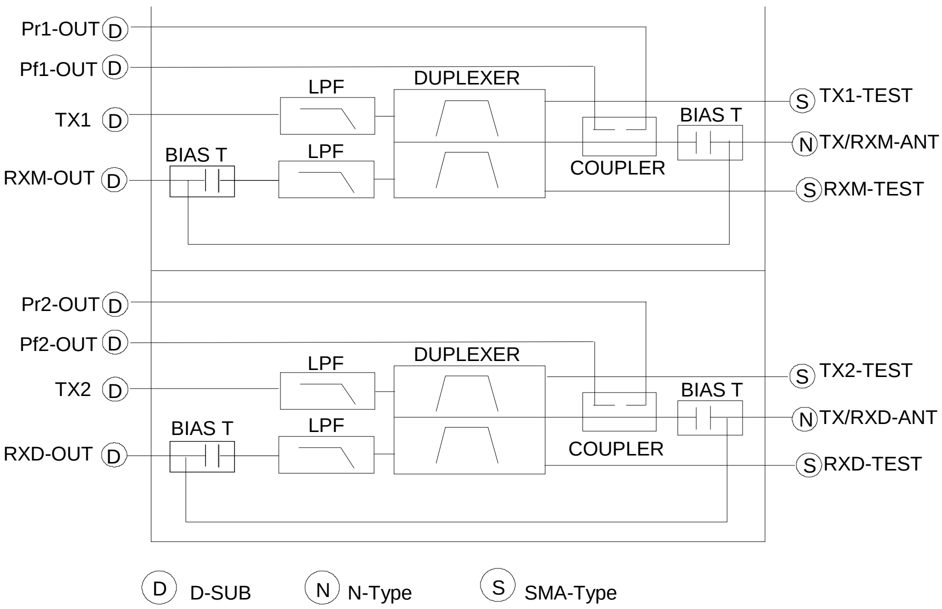
- Isolation and low-pass filtering of two receiving and transmitting signals.
- Providing two DC feeds to T-type Tower Mounted Amplifier (TMA).
- Voltage Standing Wave Ratio (VSWR) test on transmit channels in both forward and backward directions.
- Coupling test of transmitting and receiving signals.

Key components within DDU include low-pass filter, duplexer, directional coupler, and BIAS T (DC supply unit for TMA) which is optional.

3.7.2 Structure and Principle

There are two types of DDU, type A with the BIAS T, type B without the BIAS T. Type A can be selected to feeder DC to the TMA which may be used when the BTS operates at 1900MHz band.

The DDU (with the BIAS T) structure is shown in Figure 3-7.



LPF: Low-pass Filter

Figure 3-7 Structure of DDU

I. Low-pass filter

The low-pass filter is used to suppress the high-order harmonic wave. The low-pass filter on receive channel also functions to suppress the interference from the transmit channel.

II. Duplexer

The duplexer is used to isolate both transmitting and receiving signals, suppress spurious emission and save antennae.

III. Directional coupler

The bi-directional coupler couples forward and reverse power for RLDU, and monitors the antenna VSWR.

IV. DC supply unit for TMA (BIAS T)

If the BTS is applied to 1900MHz band, a TMA may be used. The BIAS T of the DDU is to combine and divide RF signals and DC feed so as to provide the TMA with DC.

3.7.3 External Interfaces

The DDU is a module shared by both the transmitting and receiving paths of the BTS. It provides interfaces with other modules both in the transmitting and receiving paths. Its external interfaces include a set of 8W8 DB combination blind mate connectors on the back, and a set of N-connectors and the SMA connectors in the front. The interface signals include:

- Signals between transmit input port and the BHPA interface. They are transmitted through the blind mate connectors on the back.
- Transmitting signals, which are transmitted to the cabinet-bottom antenna port through the RF cable connected with the N-connector in front of the DDU.
- Receiving input signals, which are transmitted from the cabinet-bottom antenna port through the RF cable connected with the N-connector in front of the DDU.
- Signals output from the receive filter. They are sent to the RLDU via the blind mate connector on the back.
- Transmitting forward and reverse coupled RF signals, which are sent to the RLDU via the blind mate connector on the back.
- Transmitting and receiving coupled test signals, which are outputted through the standard SMA connector in front of the DDU.

3.7.4 Indices

- Supported band: 800MHz, and 1900MHz

- Module dimensions: 450mm×100mm×344.8mm (Length×Width×Depth)

3.8 RLDU

3.8.1 Overview

The Receive LNA Distribution Unit (RLDU) consists of Low Noise Amplifier (LNA), distribution unit, configuration switch and alarm monitoring circuit. Its main functions are:

- Low noise amplification and distribution for BTS main/diversity receiving signals.
- Built-in electronic RF switch supporting multiple BTS configurations (3 sectors or 6 sectors).
- Antenna VSWR monitoring and alarming, BTS forward RF power detecting, LNA running status monitoring and alarming.

3.8.2 Structure and Principle

The RLDU structure is shown in Figure 3-8.

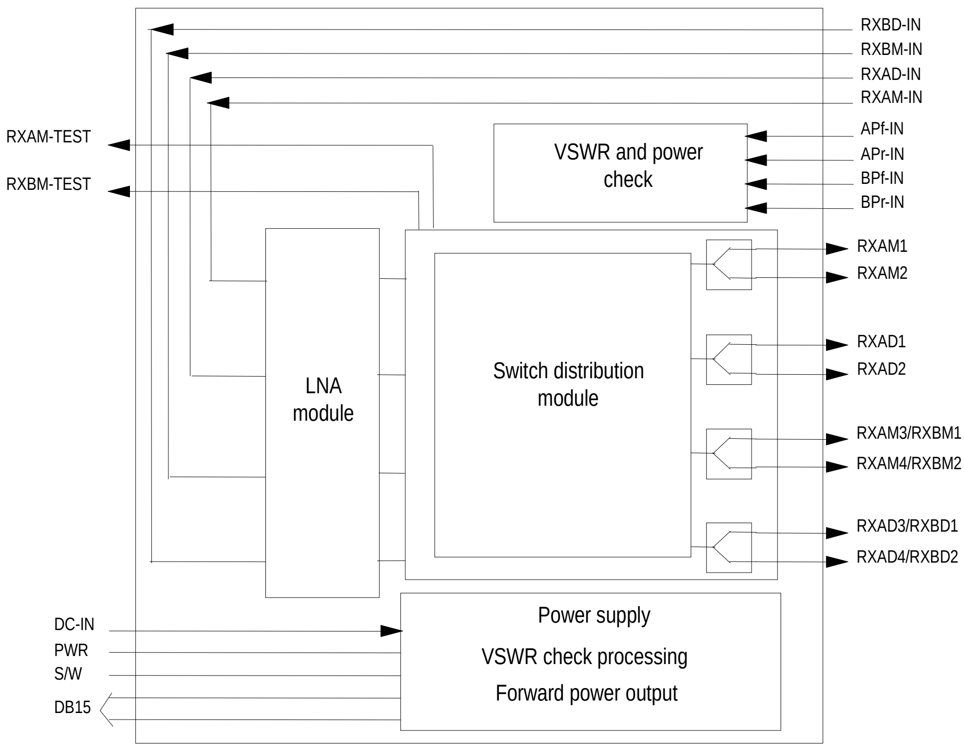


Figure 3-8 Structure of RLDU

I. Receiving signal low noise amplification and distribution unit

There are 4 LNAs and distributors inside the RLDU, which process 4 signals. The 4 LNAs have the same specifications such as gain, noise factor and dynamic to ensure the balance among 4 receive paths.

II. Configuration switch unit

The electronic switches inside the RLDU are designed for supporting different BTS configurations. When the BTS is configured in the 3-sector mode, the electronic switches can be set to make the RLDU operate in the single-sector mode that has two main/diversity receiving paths (Each path provides 1-in-4 output to support 1~4 carriers configuration for each sector). When the BTS is configured in the 6-sector mode, the electronic switches can be set to make the LDU operate in the 2-sector mode. And each sector provides 4 main/diversity receive paths (Each path provides 1-in-2 output, supporting 1~2 carriers configuration in each sector).

III. Antenna VSWR and LNA status monitoring unit

The transmitted forward/reverse power coupling signals from the CDU or the DFU or the DDU are processed in the antenna VSWR monitoring circuit inside the RLDU. When the VSWR of transmitting antenna exceeds a specified threshold, alarm will occur. At the same time, the RLDU also converts transmit coupling power signal into DC level signal through its RF power detecting circuits. Through this DC level signal, any exception of transmit signal power of antenna can be monitored in realtime. LNA status monitoring circuit monitors the voltage and current of the 4 LNAs inside the RLDU. It generates alarm when fault t is found.

3.8.3 External Interfaces

RLDU is the reverse link function module of the BTS, which interfaces with CDU/DFU and BTRM in both input and output sides through the two sets of 8W8 D-type combination blind mate connectors on the back of the module.

Interface signals between the RLDU and the CDU/DFU/DDU are:

- Main/diversity path receiving RF signals outputted from two CDU/DFU/DDU receive filters. They are amplified and distributed by the RLDU.
- The CDU/DFU/DDU coupling RF signals, which are used for antenna VSWR monitoring and forward power detection.

Interface signals between the RLDU and the BTRM are:

- Main/diversity path receiving RF signals transmitted to the BTRM after being amplified and distributed.

- Antenna VSWR, the LNA status monitoring alarm signals and forward power detection voltage signals, which are outputted to the BRCM by the RLDU through a DB15 interface in front of the module and transmitted to the BIFM for processing.

The +24V DC power is necessary for the RLDU. It is provided directly by the secondary power supply module in the BTS through a MOLEX power connector in front of the module.

3.8.4 Indices

- Supported frequency band: 450MHz band, 800MHz band, and 1900MHz band
- Power supply: +24VDC
- Power consumption: <50W
- Module dimensions: 450mm×180mm×50mm (Length×Width×Depth)

3.9 BRFM

The BTS RF Fan Module (BRFM) mainly consists of the BBFM, the BBFL and fans. The following is the introduction to the BBFM and the BBFL.

3.9.1 BBFM

I. Overview

The BTS BTRM FAN Monitor (BBFM) collects and analyzes the temperature information of BHPA module and adjusts the fan speed in realtime to lower the system noise, so as to prolong equipment service life and improve the external performance of the overall system on the premise that the system works in a safe thermal status.

The Pulse Wide Modulation (PWM) control signal regarding the fan speed can be generated by the MCU of the local board or configured by the control unit of the BTRM module. At the same time, the BBFM reports to the BCKM the gain decrease, over-temperature, over-excited alarm and fan failure alarm of the BHPA to ensure the reliability of the BHPA module. Specifically, it functions to:

- Control fan speed, monitor and report fan alarm.
- Monitor and report the BHPA alarm.
- Drive fan monitor indicator module.
- Collect temperature information of the BHPA module.
- Communicate with the BTRM module.

II. Structure and principle

The position of the BBFM in the BHPA module is as shown in Figure 3-9.

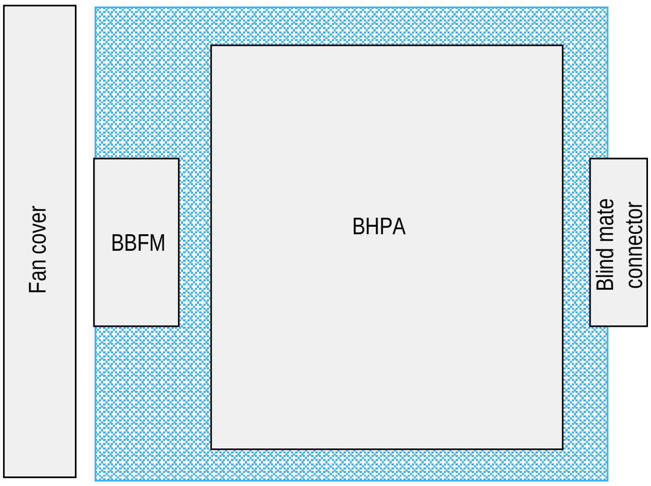


Figure 3-9 Position of BBFM in BHPA module

The structure of the BBFM is shown in Figure 3-10.

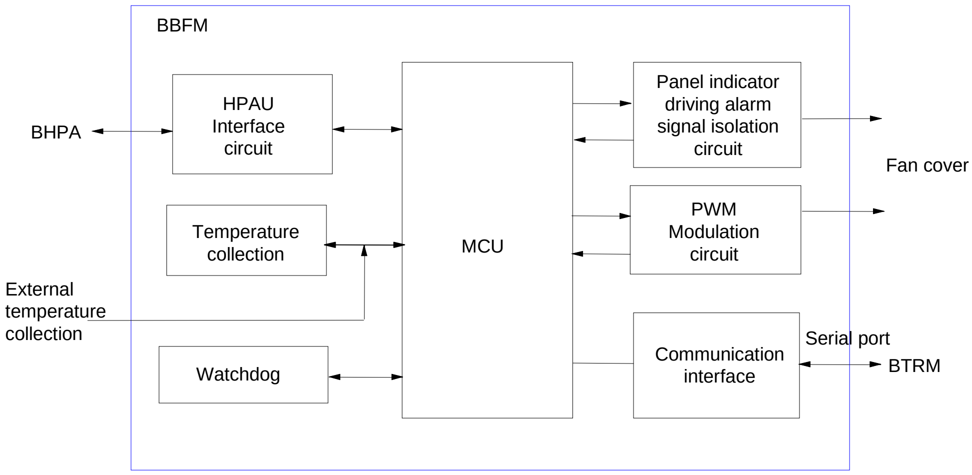


Figure 3-10 Structure of BBFM module

- MCU module

The MCU module implements the following functions:

- Collect and analyze the temperature information to generate PWM signals for controlling the fan speed.

- Receive alarm signals generated by the BHPA module and fan alarm signals and report to the BTRM module.

- Generate panel indicator signal.

- Communicate with the BTRM module.

- BHPA interface module

This module isolates and drives the interface with the BHPA.

- Temperature information collection module

This module collects the temperature information of the BHPA module in real time, which is implemented by the MCU in query mode.

- Panel indicator driving and alarm signal isolation module

This module is used to drive the panel indicator and isolate fan alarm signals.

- Communication module

The communication module performs serial communication with the BTRM module.

- Power supply module

The input power of the BFMM is +24V, and power consumption is 3.5W (excluding power for the fans).

III. External interfaces

- BHPA interface

Interface with the BHPA module, used for the BHPA alarm monitoring.

- Serial communication interface

Interface used to report the alarm of the fans and the BHPA module.

- Interface with the fan cover

Including fan alarm signal, panel indicator, and fan power interface.

IV. Indices

Module dimensions: 200.0mm×55.0mm (Length×Width).

3.9.2 BBFL

I. Overview

The BTS BTRM FAN Lamp Module (BBFL) has three RUN indicators to indicate the running status of the BTRM module, fans and the BHPA module. The board is connected with the BBFM via the fan cover interface. It is an auxiliary board.

II. Structure and principle

The structure of the BBFL is shown in Figure 3-11.

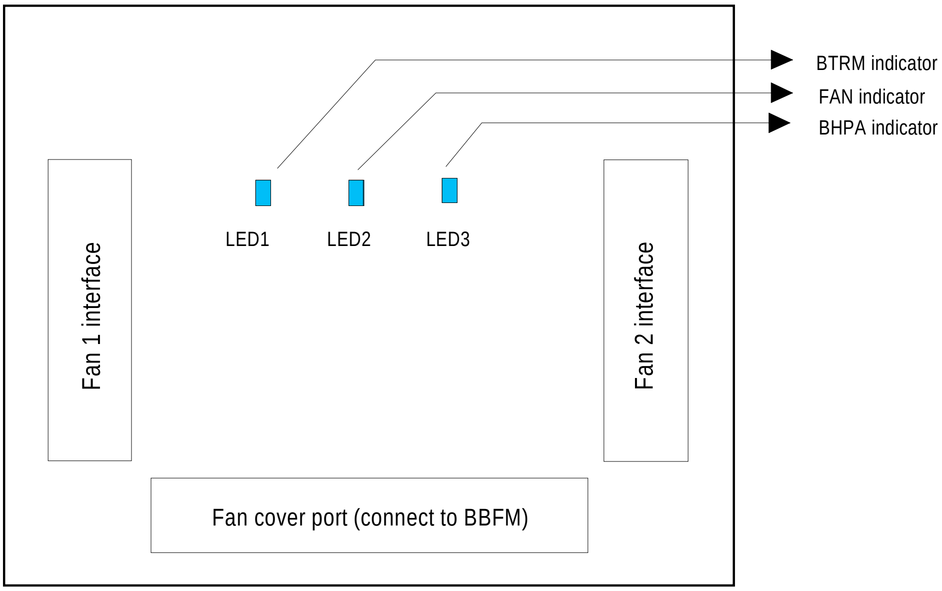


Figure 3-11 Structure of BBFL module

The BBFL consists of the following parts:

- Fan 1 interface module

It is a 4pin ordinary socket connector connected with the Fan 1, including power supply input port and fan alarm output port.

- Fan 2 interface module

It is a 4pin ordinary socket connector connected with the Fan 2, including power supply input port and fan alarm output port.

- Fan cover port interface module

It is connected with the fan cover of the BBFM.

III. Panel indicators

LED1: BTRM operating signal

LED2: Fan operating signal

LED3: BHPA operating signal

IV. Indices

BBFL dimensions: 55.0mm×25.0mm (Length×Width).

Chapter 4 Antenna & Feeder Subsystem

4.1 Overview

The BTS antenna & feeder subsystem consists of two parts: the RF antenna & feeder, and the satellite (GPS/GLONASS) synchronization antenna & feeder. The former transmits the modulated RF signals and receives MS signals, while the latter provides precise synchronization for the CDMA system.

4.2 RF Antenna & Feeder

The RF antenna & feeder of the BTS is composed of antenna, jumper from antenna to feeder, feeder, and the jumper from feeder to cabinet-bottom, as shown in Figure 4-1.

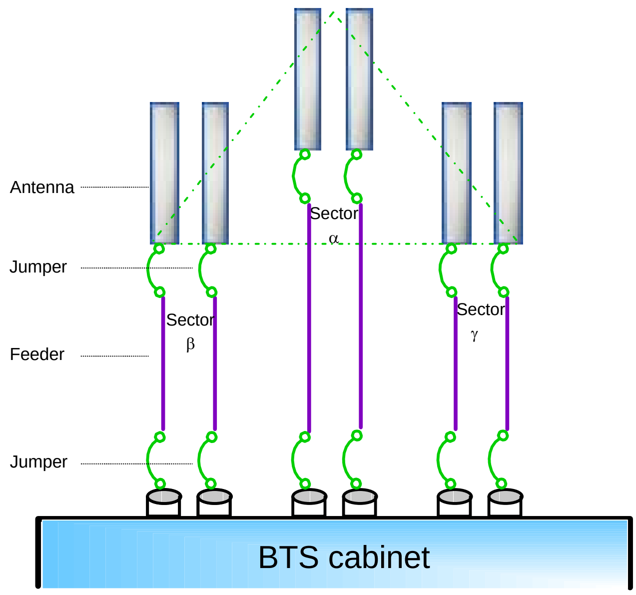


Figure 4-1 Structure of RF antenna & feeder

4.2.1 Antenna

Antenna is the end point of transmitting and start point of receiving. The type, gain, coverage pattern and front-to-rear ratio of the antenna all will affect the system performance. The network designer should select antenna properly based on the subscriber number and system coverage.

I. Antenna gain

Antenna gain is the capability of the antenna to radiate the input power in specific directions. Normally, in the direction where the radiation intensity of the antenna is the strongest, the higher the gain is, the stronger the field intensity will be in a faraway place and the larger the effective coverage area will be. But there may be blind areas in the vicinity.

II. Antenna pattern

Antenna pattern describes the radiation intensity of the antenna in all directions. The horizontal antenna pattern is often used. It is also used as a standard to classify the antennae

The BTS antenna is categorized in two types: omni antenna and directional antenna. The directional antenna includes the following types: 120°, 90°, 65° and 33°.

III. Polarization

Polarization is used to describe the change path of the direction of the electric field. The mobile communication system often uses uni-polarization antennas. Bi-polarization antennae have been used recently. It is an antenna with two cross-over antenna polarization directions. The isolation is above 30dB for both the +45° and -45° antennae. The adoption of the bi-polarization antenna can save antennae, as one bi-polarization antenna can replace two sets of independent uni-polarization antennae.

Normally bi-polarization directional antenna is used in directional cell. Compared with the uni-polarization directional antenna, the bi-polarization directional antenna is cost-effective, space saving and easy to install. However, uni-polarization omni antenna is still adopted in omni cell.

IV. Diversity technology

Electrical wave propagation in urban area has the following features:

- Field intensity value changes slowly with places and time. It changes in the rule of logarithmic normal distribution, which is called the slow attenuation.
- Field intensity transient value attenuates selectively due to the multi-path transmission. The attenuation rules falls into Rayleigh distribution, which is called the fast attenuation.

The fast attenuation, slow attenuation, multi-path effect, and shadow effect will impair the quality of communication or even interrupts the conversation. Diversity technology is one of the most effective technologies to tackle the attenuation problem. Diversity receiving and combining technology can be used to minimize the attenuation when there is little correlation between the two attenuated signals.

There are polarized diversity and space diversity. In the present mobile communication system, horizontal space diversity and polarized diversity are both supported. Space diversity is effective when the distance between two antennae is over 10 wavelengths. Polarized diversity facilitates antenna installation and saves space, therefore it is used more and more extensively.

V. Antenna isolation

The receiving/transmitting antenna must be installed with sufficient isolation to minimize the effect on the receiver. The isolation space is subject to the spuriousness of the transmitter and the characteristics of the receiver.

4.2.2 Feeder

Normally, the standard 7/8 inch or 5/4 inch feeders are used to connect the antenna and cabinet. In the site installation, 7/16 DIN connectors should be prepared based on the actual length of feeders.

Three grounding cable clips for lightning protection should be applied at the tower top (or building roof), feeder middle, and the end close to the cabinet-bottom. If the feeder is excessively long, additional cable clips should be applied evenly in the middle.

Since 7/8 inch and 5/4 inch feeders should not be bent, the tower top (or building roof) antenna and the feeder, cabinet and the feeder should be connected via jumpers. The jumpers provided by Huawei are 1/2 inch, 3.5m long, and with 7/16DIN connectors.

The attenuation of the feeder often used is listed in Table 4-1.

Table 4-1 Attenuation (dB/100m) of the feeder (ambient temperature 20°C)

Frequency Band	7/8 inch feeder	5/4 inch feeder
450MHz	2.65dB	1.87dB
800MHz	3.9dB	2.8dB
1900MHz	5.9dB	4.51dB

Standard conditions: VSWR 1.0, ambient temperature 20°C (68°F).

4.2.3 Lightning Arrester (Optional)

When the BTS3612A works at the 1900MHz band, the lightning arrester is necessary, but for other bands, it is not necessary.

The lightning arrester is used to prevent damage of lightning current to the antenna & feeder system.

Usually, there are two types of lightning arresters. The first type uses the microwave principle to conduct the low frequency lightning current to the ground so as to sink the current. The second one is a discharging tube, when the voltages at both ends of the discharging tube reach a certain value, the tube conducts to sink the large current.

The second technique is used in BTS3612A. Lightning arrester should be installed close to the BTS cabinet.

4.2.4 Tower-top Amplifier (Optional)

When the BTS3612A works at 1900MHz band, the tower-top amplifier (TA) is optional, for the other bands, it is not necessary.

The TA is a low-noise amplification module installed on the tower. It is to amplify the reverse signal from MS before the transmission loss occurs along the feeder. This helps improve the receiving sensibility of the BTS system and the reverse coverage of the system while lowering the transmitting power of MS and improving the conversation quality.

Usually the triplex TA is configured. It is installed close to the antenna. This type of TA consists of triplex filter, low-noise amplifier and feeder. The triplex filter is actually the combination of two duplex filters. The signal from the antenna is first filtered off the external interference at the triplex filter, and then is amplified by the low-noise amplifier, and finally sent to the feeder.

Features of the TA include:

- The noise factor of TA is very low.
- The TA has a wide dynamic range, which is full adaptable to the change of strength of signal received by antenna caused by different distances between the MS and the BTS.
- The TA has the alarm bypass function.
- The TA is fed with feeder, so it has the feeding detection device.
- The TA adopts strict water-proof sealing and is adaptable to a wide range of working temperatures (-40˚C~70˚C).
- The TA can sustain strong lightning strikes.

4.3 Satellite Synchronization Antenna & Feeder

4.3.1 Overview

Many important features of the CDMA system are closely related to and much dependent on the global satellite navigation system. If the global satellite navigation system stops working for a long time, the whole CDMA network will collapse.

In consideration of system security and reliability, the BTS receives signals of the GPS system or of the GLONASS system through a satellite synchronization antenna & feeder, to implement radio synchronization. In this way, the whole network can still operate normally without any adverse effect when the GPS or GLONASS system is not available.

A satellite synchronization antenna & feeder system is composed of an antenna, the jumper from antenna to feeder, feeders, a lightning arrester and the jumper from feeder to cabinet-bottom (the feeders and jumpers can be configured as needed). Figure 4-2 shows the structure.

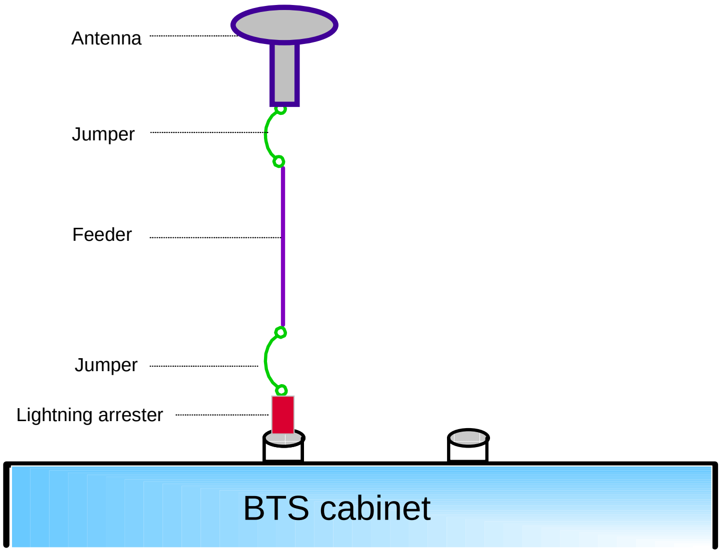


Figure 4-2 Structure of satellite synchronization antenna & feeder

Note:

When the length of the feeder is within 100m, use the 1/2" feeder, which can be directly connected to the antenna and lightning arrester without any jumper.
When the length of the feeder exceeds 100m, use the 7/8" feeder. In this case, a jumper is needed.

Generally, one BTS is configured with one set of satellite synchronization antenna & feeder. However, if two BCKM boards are configured to further enhance the reliability of the system, the two BCKMs each should be configured with one set of independent satellite synchronization antenna & feeder. In Figure 4-2, two satellite synchronization antenna & feeder interfaces are provided.

The following describes the application of the GPS and the GLONASS in a CDMA BTS.

I. GPS

The GPS is a high precision all-weather satellite navigation system based on radio communications. It can provide high precision information about 3D-position, speed and time. The 3D-position is accurate to less than 10 yards (approx. 9.1m) in space; the time is accurate to less than 100ns in time.

The GPS signals can be received and used as the reference frequency.

The whole system consists of three parts: space part, land control part and user part.

The space part is a group of satellites (altogether 24) 20,183 kilometers high, orbiting the earth at a speed of 12 hours/circle.

The land control part consists of a main control center and some widely distributed stations.

The user part includes GPS receivers and their supporting equipment.

II. GLONASS

The GLONASS is a global satellite navigation system developed by the former Soviet Union and inherited by Russia. With 24 satellites distributed on 3 orbits, it has a structure similar to the GPS, but a smaller coverage.

III. Application of GPS and GLONASS in CDMA BTS

The BTS3612A supports GPS/GLONASS satellite system synchronization mode, providing two synchronization solutions (GPS or GPS/GLONASS) as required by the user.

In the CDMA2000 1X system, the BTS is a user of the GPS or GLONASS, utilizing their timing function. BTS3612A adopts smart software phase-lock and holdover technologies to minimize interference such as signal wander and jitter caused by ionosphere and troposphere errors of GPS or GLONASS satellites.

The timing signal of the GPS or GLONASS features high reliability and long-term frequency stability. BTS3612A is equipped with a crystal clock that promises high stability. The short-term stability of this crystal clock and the long-term stability of the GPS or GLONASS combine to ensure the reliability and stability of the CDMA2000 1X system clock.

4.3.2 Antenna

I. GPS antenna

The GPS antenna is an active antenna. L1 band (1565~1585MHz) GPS signals received by the antenna are filtered by a narrow-band filter and amplified by a preamplifier. Then they are sent to a GPS receiver integrated in the BCKM.

II. GPS/GLONASS dual-satellite antenna

The GPS/GLONASS dual-satellite antenna is also an active antenna. It receives both L1 GPS and GLONASS signals (1602~1611MHz).

4.3.3 Feeder

Normally, standard 1/2 inch or 7/8 inch feeders are used to connect the antenna and the cabinet. In site installation, 7/16DIN connectors should be prepared based on the actual length of feeders.

Three grounding cable clips for lightning protection should be applied at the tower top (or building roof), feeder middle, and the end close to the cabinet-bottom. If the feeder is excessively long, additional cable clips are needed.

Since the 7/8 inch feeder should not be bent, the tower top (or building roof) antenna and the feeder, the cabinet and the feeder should be connected via jumpers. The jumpers provided by Huawei are 1/2 inch, 3.5m long, with 7/16DIN connectors.

The feeder is mainly used to transmit GPS/GLONASS signals received by the GPS/GLONASS antenna to the GPS/GLONASS receiver. It also provides power for the antenna module to make pre-amplification.

4.3.4 Lightning Arrester

Like the lightning arrester of RF antenna & feeder, the satellite uses the lightning arrester of antenna & feeder to protect the equipment from direct lightning stroke or inductive lightning. One feeder is configured with one lightning arrester.

4.3.5 Receiver

I. GPS receiver

There are many types of GPS receivers. The following introduces the one with 8 parallel paths.

This kind of GPS receiver is capable of tracking 8 satellites concurrently. It receives GPS signals of band L1 and tracks C/A codes.

Inside the receiver, the RF signal processor makes frequency down-conversion to the GPS signals received by the antenna to get the Intermediate Frequency (IF) signals. The IF signals are then converted to digital signals and sent to 8-path code and carrier correlator, where signal detection, code correlation, carrier tracking and filtering are performed.

The processed signal is synchronized and sent to the positioning Micro Processing Unit (MPU), which controls the operational mode and decoding of the GPS receiver, processes satellite data, measures pseudo-distance and pseudo-distance increment so as to figure out the position, speed and time.

The receiver should be powered with regulated 5V DC and the sensitivity of the receiver is -137dBm.

II. Dual-satellite receiver

The principle of the dual-satellite receiver is similar to the GPS receiver. It has 20 receiving paths and can be upgraded from GPS L1 to GPS/GLONASS L1+L2 or other solutions.

Chapter 5 Power & Environment Monitoring Subsystem

5.1 Overview

The functional structure of the power & environment monitoring subsystem is shown in Figure 5-1.

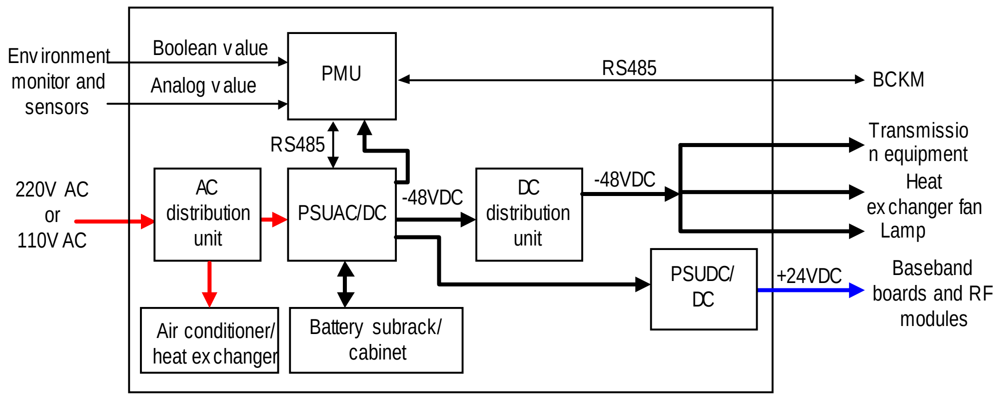


Figure 5-1 Functional structure of the power & environment monitoring subsystem

The subsystem provides functions of power distribution and environment monitoring (including temperature control).

The power distribution part includes the AC distribution unit, $PSU_{AD/DC}$, the DC distribution unit, $PSU_{DC/DC}$, PMU, and the battery subrack or cabinet.

The environment monitoring part includes the PMU and the air conditioner or heat exchanger.

The following sections describe the working principles of power distribution and environment monitoring. As the PMU mainly implements the monitoring functions, it will be introduced in Section 5.3, "Environment Monitoring"

5.2 Power Distribution

5.2.1 AC Distribution

The BTS3612A supports four types of AC power supplies: three-phase 220V AC, single-phase 220V AC, three-phase 110V AC and single-phase 110V AC.

I. Distribution of three-phase 220V AC

The three-phase 220V AC passes through the lightning protector and the ElectroMagnetic Interference (EMI) filter before reaching the AC distribution unit. From the AC distribution unit, the power is distributed to the voltage regulator, $PCU_{AC/DC}$ and power sockets (reserved). Each distribution path is protected with an air switch at the input end. Detailed distribution paths are shown in Figure 5-2.

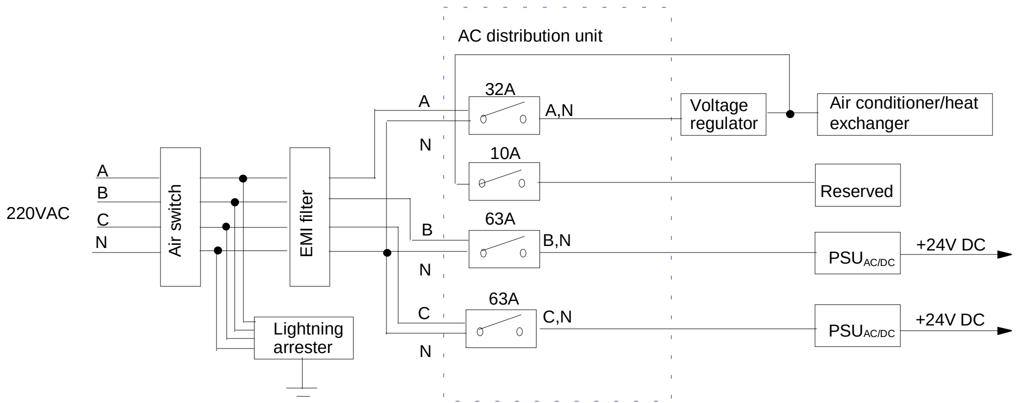


Figure 5-2 Distribution of three-phase 220V AC

The air switch, lightning protector and EMI filter are all installed in the power lightning protector/filter box.

II. Distribution of single-phase 220V AC

If the single-phase 220V AC is used for the BTS3612A, a wiring terminal for phase conversion should be equipped before the air switch to convert the single-phase power into three-phase power. The power distribution in the cabinet is the same as that of the three-phase 200V AC, as illustrated in Figure 5-3.

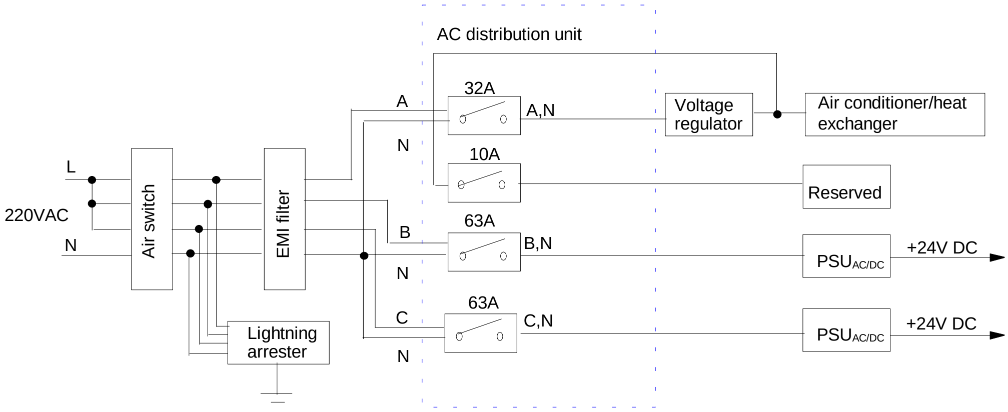


Figure 5-3 Distribution of single-phase 220V AC

III. Distribution of three-phase 110V AC

If the single-phase 110V AC is used for the BTS3612A, an air conditioner (or heat exchanger) and a $PCU_{AC/DC}$ that support 110V AC should be configured. The rest configuration is the same with the distribution of three-phase 220V AC.

IV. Distribution of single-phase 110V AC

If the single-phase 110V AC is used for the BTS3612A, a wiring terminal for phase conversion should be equipped before the air switch to convert the single-phase power into three-phase power. The rest configuration is the same with the distribution of three-phase 110V AC.

5.2.2 DC Distribution

I. Distribution of –48V DC

Figure 5-4 illustrates how the 220V AC is converted into –48V DC and then distributed. The 220V AC is output by the AC distribution unit to the 220V AC power input busbar on the backplane of the $PSU_{AC/DC}$ subrack. The $PSU_{AC/DC}$ converts the power and outputs multiple –48V DC supplies to the busbar.

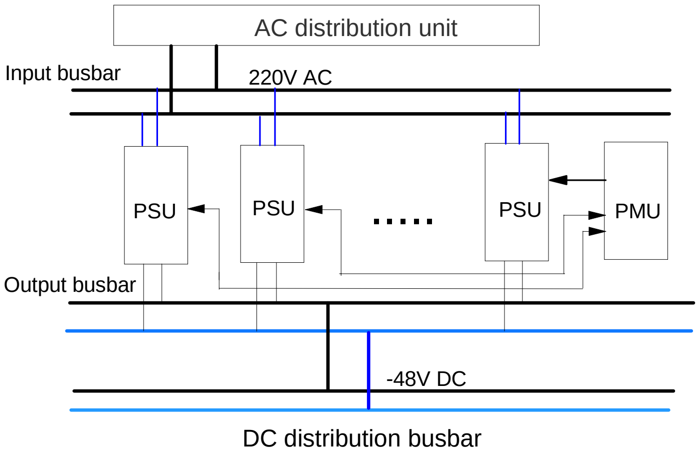


Figure 5-4 AC-DC conversion and distribution of –48V DC

Then the DC distribution busbar sends the –48V DC to the power consumption units such as the $PSU_{DC/DC}$ subrack, batteries, transmission equipment, fans, lighting equipment, and the internal and external circulation fans in the heat exchanger.

II. Distribution of +24V DC

Figure 5-5 illustrates how the –48V DC is converted into +24V DC and then distributed.

The -48V DC is output to the -48V DC power input busbar on the backplane of the $PSU_{DC/DC}$ subrack. The $PSU_{DC/DC}$ converts the power and outputs multiple +24V DC supplies to the output busbar. Then the power is sent to the distribution busbar of the DC distribution box on the top of the cabinet along the cables in the cabling trough.

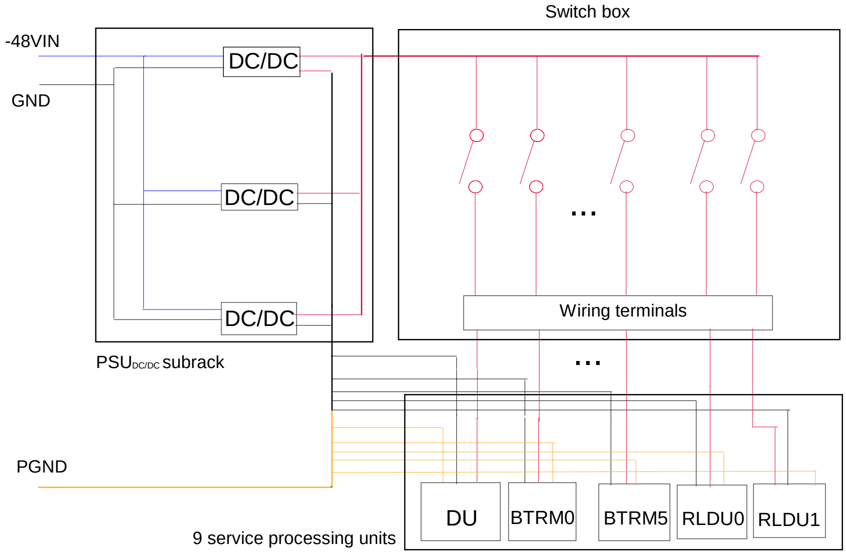


Figure 5-5 DC-DC conversion and distribution of +24V DC

To ensure the normal power supply to other power consumption units when the power to one of the unit is disconnected due to over current, a separate over-current protection unit is equipped in the distribution box for each power consumption unit. Through these protection units, the busbar distributes the power to the terminals on the back panel, which will supply the power to various consumption units.

5.2.3 Power Distribution Devices

I. $PSU_{AC/DC}$

The $PSU_{AC/DC}$ is composed of an AC-DC converter and a power monitor. The former converts the ~220V AC (local mains) into –48V DC; the later detects status of the $PSU_{AC/DC}$ and reports alarms.

II. $PSU_{DC/DC}$

The $PSU_{DC/DC}$ is composed of a Direct Current - Direct Current (DC-DC) converter and a power monitor. The former converts the –48V DC into +24V DC; the later detects status of the $PSU_{DC/DC}$ and reports alarms.

III. Batteries

Note:

Batteries are optional.

When the local mains supply fails, batteries can maintain the normal operation of the BTS for a period of time. A built-in battery subrack and an auxiliary battery cabinet are available to satisfy different requirements.

- Built-in battery subrack

The built-in battery subrack is configured in the auxiliary cabinet. It can be installed with four 12V/65Ah storage batteries to maintain the normal operation of the BTS2612A in S(1/1/1) configuration for more than 30 minutes.

- Auxiliary battery cabinet

The auxiliary battery cabinet can hold up to twenty-four 2V/650Ah or 2V/300Ah or 2V/200Ah batteries to power the system for a longer period after the mains failure. An auxiliary battery cabinet fully configured with twenty-four 2V/650Ah batteries can support the normal operation of BTS3612A in S(1/1/1) configuration for more than eight hours.

5.3 Environment Monitoring

5.3.1 Structure of Monitoring System

As an outdoor BTS, the BTS3612A provides comprehensive power & environment monitoring functions, which are implemented through sensors, TCU and PMU. The temperature inside the cabinet is controlled by an independent temperature control device.

The monitoring system is shown in Figure 5-6.

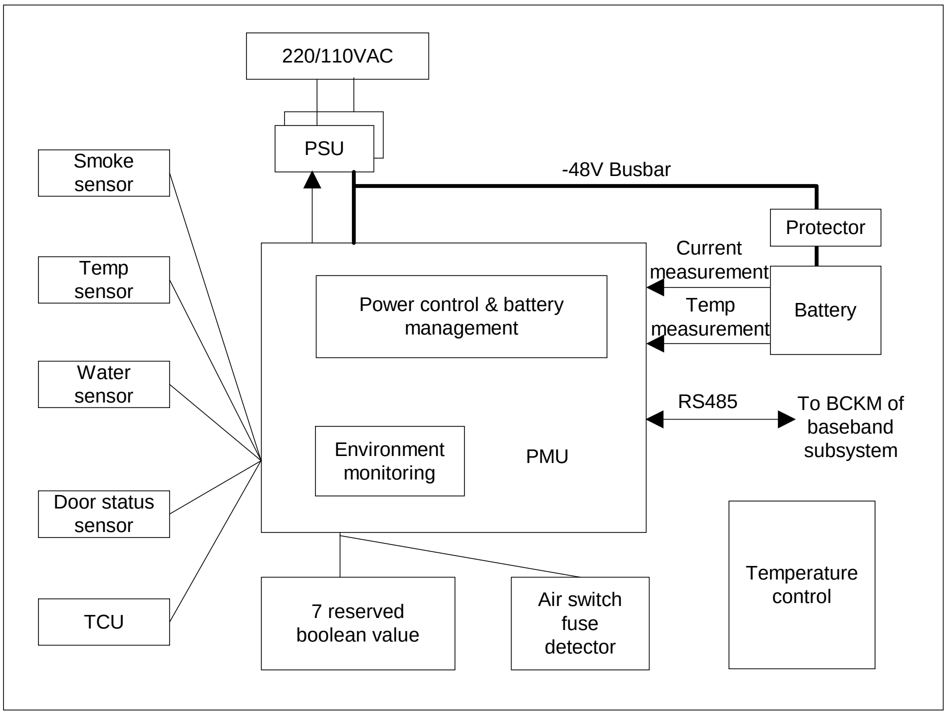


Figure 5-6 Monitoring system of BTS3612A

I. Monitoring functions of PMU

The PMU monitors on a real-time basis control value signals, Boolean value signals, current/voltage analog signals and environment value analog signals.

Control value signals include:

- Equal floating charge and current-limiting control of batteries
- Protective load connect/disconnect of batteries

Boolean value signals include:

- Air conditioner / heat exchanger failure alarm.

- AC lightening arrester alarm.
- Battery interface lightening arrester of battery cabinet.
- Cabinet smoke alarms, water alarms, and door control alarms.

Current/voltage analog signals include:

- Current of the battery group (A)
- Total load current (A)
- Busbar AC voltage (V)

Environment value analog signals include:

- Temperature (^{o}C) inside the cabinet (with sensors)
- Humidity (RH%) inside the cabinet (with sensors)

Power system management:

- PSU failure and PSU protection alarm.
- The communications (between the PSU and the PMU) failure alarm.
- Mains available or unavailable alarm.
- Mains over voltage or under voltage alarm.
- DC over voltage or under voltage alarm.
- Fuse status value of the batteries (-0.3VDC<Normal voltage difference<0.3VDC).

II. Temperature control

The BTS3612A is an outdoor BTS with a sealed structure. When it operates in a high-temperature environment, the heat generated by the devices may quickly raise the temperature inside the cabinet.

To keep the temperature inside within a normal range in the extreme (either high or low) temperature environment, an air conditioner or heat exchanger can be installed in the cabinet. The equipped air conditioner or the heat exchanger itself is highly reliable and able to report alarms when faults occur.

5.3.2 Monitoring Devices

I. Sensors

Sensors are installed inside the BTS3612A cabinet and the auxiliary battery cabinet.

The BTS3612A cabinet is equipped with temperature sensor, door status sensor, water sensor and smoke sensor, while the auxiliary battery cabinet is only equipped with temperature sensor and door status sensor.

II. TCU

The TCU supervises the temperature of the main equipment. When the temperature is too high or too low, the TCU will cut off the 220V AC input and the –48V DC output from the batteries, and shut down some boards to protect the main equipment.

III. PMU

The PMU is the core of the monitoring system. It is responsible for collecting, processing and reporting all the environment variables.

IV. Air conditioner

The air conditioner can realize closed-loop control over the temperature inside the cabinet.

When the air conditioner finds that the temperature is too low, it will start its heating plates and internal fans to heat the BTS. When the temperature is too high, the air conditioner will activate the cooling function to lower the temperature to a normal degree.

V. Heat exchanger

A heat exchanger can also be used instead of the air conditioner to control the temperature inside the cabinet. The heat exchanger has high/low-temperature alarm circuits. When the temperature inside the cabinet is higher than the temperature outside, it will discharge the heat through closed circulation. Compared with the air conditioner, the heat exchanger has a simpler structure with fewer components, and thus is more cost-effective.

Chapter 6 Lightning Protection and Grounding

6.1 Overview

I. Lightning Protection

Lightning protection system for communication equipment includes external lightning protection system and internal lightning protection system.

The external lightning protection system is to protect the equipment against direct lightning stroke, including lightning receivers, lightning down-leading cables and grounding devices.

The internal lightning protection system is to protect the equipment against indirect stroke, such as thunder bolt induction, reverse lightning stroke, lightning wave intrusion and other lightning strokes that might endanger human beings and the equipment.

II. Equipment Grounding

The purpose of equipment grounding is to provide the equipment with the capability of protecting against external electromagnetism interference and to ensure the safety of human beings and the equipment. The key of lightning protection is grounding, because a fine grounding can provide the equipment with a low-resistance lightning electricity discharging channel.

6.2 BTS Lightning Protection Principle

6.2.1 Principle and Characteristics

As an outdoor BTS, the BTS3612A adopts multiple internal and external lightning protection measures.

I. Measures of external lightning protection

The BTS3612A adopts the equalized electric potential combining/grounding technology specified by the IEC and the ITU-T. This design ensures that no grounding electric potential difference is generated during lightning striking and thus no damage is caused to the equipment.

II. Measures of internal lightning protection

The AC lightning arrester at the AC input port prevents the AC from direct lightning stroke or inductive lightning. The lightning protection index of the AC input port is 40kA.

E1 lightning protection board at the E1 port of the BTS3612A protects E1 signal ports. The lightning protection index of E1 port is 5kA.

The antenna and feeder lightning arrester at the feeder inlet protects the BTS against the striking current coupled into the feeder when the steel tower gets lightning stoke.

The equalized electric potential connection and insulation design of the cabinet prevent the cabinet from the damage of lightning stroke.

6.2.2 Lightning Protection for AC Power

The overall power supply for the BTS3612A is large, so an AC lightning arrester is used at the AC input port as the first level of lighting protection measures. This parallel lightning protection can effectively prevent the BTS3612A from the damage of lightning stroke. This protection function:

- Adopts symmetric compound circuits, applicable to the power supply environment with poor electric network quality.
- Adopts temperature-controlled circuit breaking technology with embedded over-current protection circuits to prevent the cabinet from the danger of fire.
- Adopts full protection of both common mode and differential mode.
- Adopts dual-color luminotrons to indicate the working states of the cabinet.

6.2.3 Lightning Protection for Trunk Cables

The BTS3612A supports multiple transmission modes: E1 (75Ωcoaxial cables and 120Ω twisted pairs), T1 (100Ω twisted pairs), SDH and microwave transmission.

E1/T1 ports are liable for lightning induction. Therefore, various lightning protection measures for E1/T1 ports are introduced in the following.

The BESP is added at the trunk cable inlet for the lightning protection at E1/T1 ports of the BTS3612A. The connection is shown in Figure 6-1.

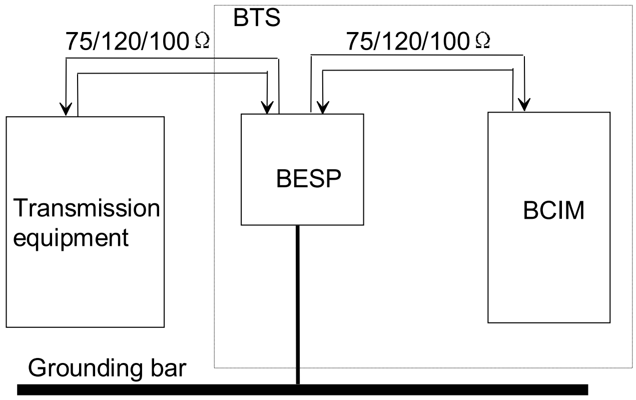


Figure 6-1 Connection to BTS via trunk cables

All E1 cables achieve the lightning protection through the E1 lightning protection board.

The circuits on the board can prevent the lightning current going into the cabinet through E1/T1 cables when the trunk lines get lightning stroke, and the circuits can also discharge most of the current through the electricity discharge tube when large current strikes the cabinet.

6.2.4 Lighting Protection for Antenna & Feeder Subsystem

The Radio Frequency (RF) equipment of the BTS shall be placed within the protection range of the lightning rod, which is the precondition to ensure the normal performance of BTS lightning protection system.

I. Lightning protection for RF antenna & feeder

The lightning protection function for the antenna & feeder protects the equipment against secondary lightning attack, i.e. the inductive lightning. Inductive lightning means that the feeder receives inductive current upon a lightning attack, which may cause damage to the equipment.

Inductive lightning can be prevented effectively in three ways:

- The feeder is grounded at least at three points. In actual implementation, the number of grounding points depends on the length of the feeder.
- For 450MHz band and 800MHz band, the RF antenna & feeder part and CDU (or DDU, DFU) are grounded through an internal path. The lightning current induced by the antenna & feeder can be directly discharged to the ground through the grounding point. In addition, the CDU (or DDU, DFU) itself features strong protection capability against lightning current, and can satisfy the normal protection requirements without extra lightning protectors.

- For 1900MHz band, when the TMA is configured, the DDU with BIAS T should be configured, the BTS provides the TMA with power supply through the DDU, so lightning arrester is needed at the feeder port of the BTS; If the TMA is not configured, the lightning arresters is also not needed.

II. Lighting protection for satellite synchronization antenna & feeder

The GPS/GLONASS satellite synchronization antenna & feeder is under the protection of lightning rods. Other lightning protection measures include:

- Grounding of feeder at three points: In actual implementation, the number of grounding points depends on the length of the feeder.
- External lightning protector: In normal condition, a lightning arrester is connected to the BTS side to avoid the possible damage to the BTS equipment caused by the lightning current induced by feeder cores.

6.3 Grounding of BTS Equipment

6.3.1 Internal Grounding of Cabinet

Grounding terminals are installed at the cable outlet port, the bottom and the door of the cabinet.

Busbars are installed in the main cabinet, with common grounding cables. Various equipment connects to the grounding system of the cabinet using the grounding cables.

Various metal components of the BTS3612A are of high electric conductivity and no insulation paint is applied to the connection points of metal components.

Cabinet frames, power distribution unit, PSU and air-conditioner regulator are all equipped with metal shells, which are reliably connected to the metal mechanical parts in the cabinet.

6.3.2 External Grounding of Cabinet

A protection grounding (PGND) cable is connected from the PGND of BTS3612A to the nearest grounding copper bar of the office.

6.3.3 Grounding of AC Lightning Arrester

Grounding device is installed in the vicinity of AC lighting arrester and connects the grounding cables of AC lightning arrester to the GND of the grounding device. The dual-color (yellow and green) plastic insulation copper-core conducting cables are adopted with the cross-sectional area less than $6mm^2$ and cable length less than 10cm.

The grounding device of the AC lightning arrester is well connected to the mechanical parts of the cabinet, and the contact resistance is less than 50mΩ.

6.3.4 Grounding of Transmission Equipment

Grounding bar is installed in the vicinity of the transmission equipment. The GND cables from the transmission equipment are directly connected to the grounding bar. The dual-color (yellow and green) plastic insulation copper-core conducting cables with the cross-sectional area less than $6mm^2$ and cable length less than 20cm are used for the grounding cables.

The grounding bar of the transmission equipment is well connected to the mechanical parts of the cabinet, and the contact resistance is less than 50mΩ.

6.3.5 Grounding of Overhead E1/T1 and HDSL Cables

Metal sheath grounding clamp for dedicated E1/T1 and HDSL overhead cables shall be used for transmission lightning protection equipment.

Necessary grounding measures shall be taken before the metal sheaths of E1/T1 and HDSL overhead cables are led into the Roxtec module.

6.3.6 Grounding of BTS Surge Protector

The grounding cables for the antenna & feeder lightning arrester are connected to the nearest grounding bar, which is connected to the grounding system of the cabinet.

The grounding cables for E1 lightning arrester and HDSL lightning arrester are grounded via the mechanical parts of the cabinet, and the length is less than 20cm.

Chapter 7 BTS Signal Flows

7.1 Overview

BTS signals include Abis traffic signal, Abis signaling message, O&M signal, clock signal, and local Man-Machine Interface (MMI) signal. These signals form various flows in the transmission from the Abis interface to the Um interface, as shown in Figure 7-1 (The flows are identified by different colors).

I. Abis signal

The Abis traffic signal, Abis signaling message and O&M signal are adapted and carried through Asynchronous Transfer Mode (ATM) protocols. At different interfaces, different physical links are used as ATM links.

- At the Abis interface, the physical links are E1/T1 links.
- Between the baseband processing boards, the physical link is cell bus.
- The physical links for the IQ data exchange between the BRDM and various BCPMs are electrical Gbit Ethernet buses.
- The physical links for the IQ data exchange between the BRDM and various BTRMs are optical Gbit Ethernet buses.

The baseband signals (including the Abis traffic signal, Abis signaling message and O&M signal) are processed by the BTRM and converted into RF signals before the transmission. In the reverse direction, the BTRM receives RF signals and converts them into baseband signals.

II. Clock signal

As a synchronous system, the CDMA2000 1X requires precise clock reference for synchronization. Figure 7-1 shows satellite synchronization signals are used as clock reference.

III. Local MMI signal

The BTS provides an interface for local maintenance, through which users can perform operations and maintenance using MMI commands. The local MMI signal is essentially a kind of O&M signal from the local maintenance terminal (compared with the signal coming from a remote terminal through the BSC), so it will not be introduced separately.

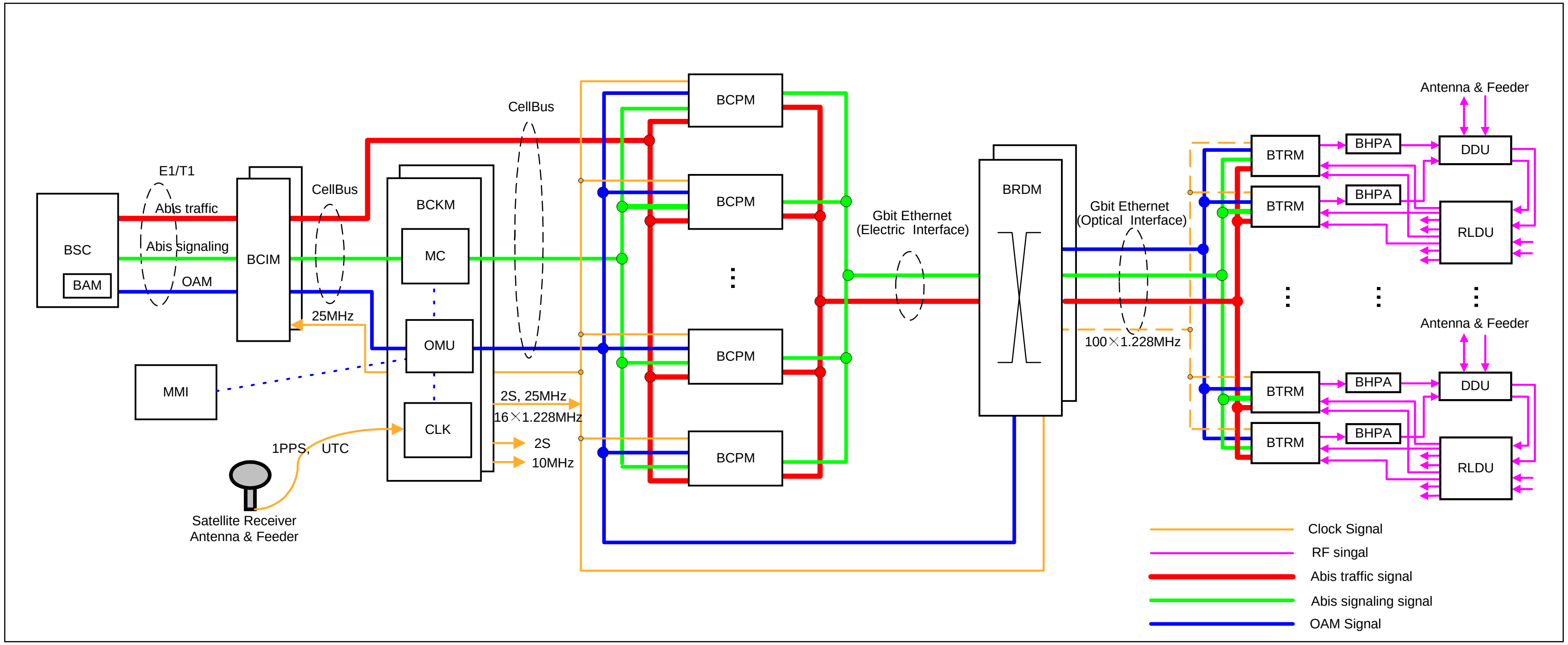


Figure 7-1 BTS signal flows

7.2 Abis Traffic Signal Flow

The Abis traffic is carried by the Fundamental Channel (FCH), the Supplemental Channel (SCH) and the Dedicated Control Channel (DCCH). The FCH and DCCH carry voice traffic and inband signal, while the SCH carries data traffic.

The Abis traffic signal flow is represented by the red continuous line in Figure 7-1. The following introduces the signals in the forward and the reverse directions respectively.

I. Forward

1) The ATM cells from the BSC are carried by E1/T1 links to the BCIM. The BCIM processes the ATM cells through the IMA, and then under the control of BCKM sends the signal to the BCPM through the Cell Bus.
2) The BCPM completes channel processing. The baseband signals carrying the Abis traffic (received over the FCH, SCH and DCCH) from the BCIM are coded, interleaved, spread, modulated and multiplexed by the BCPM before being sent to the BRDM over the electrical Gbit Ethernet interface.
3) The BRDM allocates channel resources, and sends the baseband signals over the optical Gbit Ethernet interface to the BTRM.
4) The BTRM performs demultiplexing, up-conversion and wave filtering on the received baseband signals, and sends them to the BHPA.
5) The BHPA amplifies the signals and forwards them to the DDU, from where the signals will be transmitted by the antenna.

II. Reverse

In the reverse direction the signals are handled in the reverse order.

1) Through the main and diversity antennae, the DDU receives two CDMA signals transmitted from the MS. After being divided and amplified by the RLDU, the signals are sent to the BTRM.
2) The BTRM performs wave filtering, down-conversion and multiplexing on the main and diversity signals, and sends them to BRDM over the optical Gbit Ethernet.
3) The BRDM allocates channel resources, and sends the baseband signals over the electrical Gbit Ethernet interface to the BCPM.
4) The BCPM completes channel processing. The baseband signals carrying the Abis traffic (received over the FCH, SCH and DCCH) from the BRDM are demultiplexed, demodulated, de-interleaved and decoded by the BCPM. Then under the control of BCKM, the obtained signals are sent to the BCIM over the Cell Bus in form of ATM cells.
5) The ATM cells are processed by the BCIM through the IMA, and then sent to the BSC over the E1/T1 link.

7.3 Abis Signaling Message Flow

The Abis signaling messages are carried by the Access Channel (ACH) and the Paging Channel (PCH). These messages are refer to as outband signals (compared to the inband signals in the Abis traffic).

The Abis signaling message flow is represented by the green continuous line in Figure 7-1. The following introduces the flow in the forward and the reverse directions respectively.

I. Forward

1) The ATM cells from the BSC are carried by the E1/T1 link to the BCIM. The BCIM processes the ATM cells through IMA, and then under the control of the MC of the BCKM sends the signal to BCPM through the Cell Bus.
2) The BCPM completes channel processing. The baseband signals carrying the Abis signaling messages (received over the PCH) from the BCIM are coded, interleaved, spread, modulated and multiplexed by the BCPM before being sent to the BRDM over the electrical Gbit Ethernet interface.
3) The BRDM allocates channel resources, and sends the baseband signals over the optical Gbit Ethernet interface to the BTRM.
4) The BTRM performs demultiplexing, up-conversion and wave filtering on the received baseband signals, and sends them to the BHPA.
5) The BHPA amplifies the signals and forwards them to the DDU, from where the signals are transmitted by the antenna.

II. Reverse

In the reverse direction the signals are handled in the reverse order.

1) Through the main and diversity antennae, the DDU receives two CDMA signals transmitted from the MS. After being divided and amplified by the RLDU, the signals are sent to the BTRM.
2) The BTRM performs wave filtering, down-conversion and multiplexing on the main and diversity signals, and sends them to BRDM over the optical Gbit Ethernet.
3) The BRDM allocates channel resources, and sends the baseband signals over the electrical Gbit Ethernet interface to the BCPM.
4) The BCPM completes channel processing. The baseband signals carrying the Abis traffic (received over the ACH) from the BRDM are demultiplexed, demodulated, de-interleaved and decoded by the BCPM. Then under the control of BCKM, the obtained signals are sent to the BCIM over the Cell Bus in form of ATM cell.
5) The ATM cells are processed by the BCIM through IMA, and then sent to the BSC over the E1/T1 link.

7.4 O&M Signal Flow

The operations and maintenance over the BTS, originated either from the remote BAM or from the local maintenance terminal, are implemented by the OMU on the BCKM.

The blue continuous lines in Figure 7-1 represent the O&M signal flows between the OMU and various boards in the BTS, while the blue dotted lines represent the flows between the OMU and the MC and CLK units on the BCKM.

7.5 Clock Signal Flow

The BCKM receives satellite signals through the GPS/GLONASS synchronization antenna. The CLK unit processes the received signal and outputs 2S signal, 25MHz signal and 16×1.228MHz signal to the clock bus. The boards in the BTS obtain the required clock signals from the clock bus.

- The BCIM gets the 25MHz clock signal from the clock bus, which will be processed by the clock unit of the BCIM to produce other desired clock signals.
- The BRDM gets the 2S signal, 25MHz signal and 16×1.228MHz signal from the clock bus, which will be processed by the clock unit of the BRDM to produce other desired clock signals.
- The BCPM gets the 2S signal, 25MHz signal and 16×1.228MHz signal from the clock bus, which will be processed by the clock unit of the BCPM to produce other desired clock signals.
- The BTRM gets 100×1.228MHz signal from the Gbit Ethernet bus (optical interface), which will be processed by the clock unit of the BTRM to produce other desired clock signals such as 48×1.228MHz, 50×1.228MHz and 2S signals.

Chapter 8 BTS Configuration

This chapter details the configuration of each part of BTS based on the brief introduction to main cabinet, auxiliary cabinet, and cabinet door in Chapter 1.

8.1 Configuration Principle

BTS3612A applies outdoors It is highly integrated and is equipped with the excellent protection function.

To configure BTS3612A, observe the following rules that are listed in the order of precedence.

- Use the trunk cables as few as possible.
- Use the antennae as few as possible.
- Use the cabinets as few as possible.

The conformance to the above rules can facilitate the installation and expansion of BTS.

8.2 Configuration of Main Equipment

8.2.1 Configuration of Baseband Boards

The baseband boards include BCIM, BCPM, BRDM and BCKM. The baseband subrack in full configuration is shown in Figure 8-1. The slots are numbered uniformly. However, the boards are numbered according to the board type.

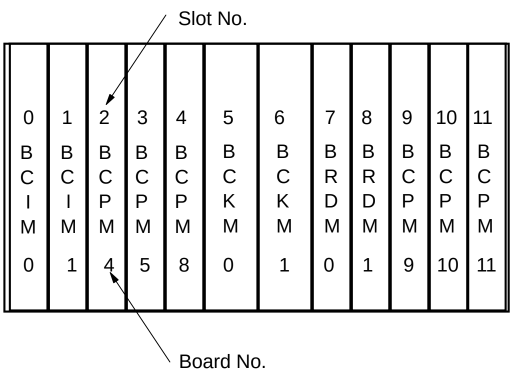


Figure 8-1 Baseband subrack in full configuration

I. BCIM

BCIM has two versions: QC51BCIM and QC52BCIM. QC51BCIMsupports eight E1 links. Compared with QC51BCIM, QC52BCIM has more functions as follows: timeslot cross-connection, fractional ATM transmission, and T1 transmission functions.

For the configuration of BCIM links, refer to the following typical data:

- For S(1/1/1) BTS, configure one E1/T1 link.
- For S(2/2/2) BTS, configure two E1/T1 links.

The above data is based on CDMA2000 1X system. For IS95 system, the above quantity can be reduced by half.

When the transmission resource is limited, the fractional ATM network function of QC52BCIM can be deployed to configure specific timeslot in a specific E1/T1 link to the BTS.

II. BCPM

At most 6 BCPMs can be configured in the baseband subrack. There are two types of BCPMs.

- The processing capability of type-A BCPM is 64 reverse channels and 128 forward channels.
- The processing capability of type-B BCPM is 128 reverse channels and 256 forward channels

BCPMs are configured based on the channel processing capability required by the system, with consideration of BTRM quantity and board types. Typical configurations are listed in Table 8-1.

The board Nos. of BCPMs are not successive. The left three are numbered as No.4, No.5, and No.8, while the right three are numbered as No.9, No.10, and No.11.

Table 8-1 Configuration of BCPMs

BTS configuration	Number of type-A BCPM	Number of type-B BCPM
O(1)	1	Not recommended
O(2)	2	Not recommended
S(1/1/1)	2	1
S(2/2/2)	4	2

The above configurations are for CDMA2000 1X system. For 3-sector configuration, type-B BCPMs are recommended. For IS95 configuration, the quantity should be reduced by half.

Normally, redundancy is not required. If one board fails, the system will automatically shield the faulty board. In this case, the system capacity decreases, but the service is normal.

III. BRDM

There are two types of BRDM, namely multi-mode BRDM and single-mode BRDM. The multi-mode BRDM is used to connect the BTRM in the cabinet, while the single-mode BRDM is used to cascade the ODU3601C.

Providing 6 pairs of ports for leading out optical fibers, the multi-mode BRDM can be connected with 6 BTRMs.

Providing 3 pairs of ports for leading out optical fibers, the single-mode BRDM can be connected with three ODU3601Cs in star networking.

Table 8-2 Configuration of BRDM

Cabinet configuration	Connected with ODU3601C	Configuration of BRDM
Single-cabinet configuration	Yes	One multi-mode BRDM and one single-mode BRDM
	No	One multi-mode BRDM
Combined-cabinet configuration	Yes	One multi-mode BRDM and one single-mode BRDM. The number of carrier configured for a combined cabinet does not exceed 6.
	No	Two multi-mode BRDMs

IV. BCKM

Normally, one BCKM is enough. For reliability purpose, two BCKMs can be used (active/standby mode).

The BCKM receives GPS/GLONASS signal as clock source. When two BCKMs are configured, two sets of independent satellite synchronization antenna & feeder systems are required.

8.2.2 Configuration of RF Modules

The radio modules include BTRM, BHPA, RLDU and CDU/DDU/DFU. The carrier subrack and the duplexer subrack in full configuration is shown in Figure 8-2.

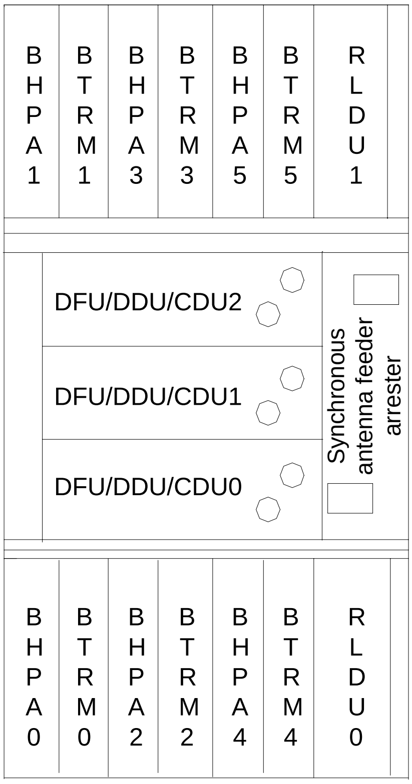


Figure 8-2 RF modules in full configuration

I. BTRM/BHPA configuration

BTRM and BHPA are configured in pairs. That is, one carrier unit consists of one BTRM and one BHPA. In Figure 8-2, totally three carrier units can be configured for the upper and lower carrier subracks to provide maximum 6 sector carriers with maximum 3 sectors. The modules are numbered as shown in Figure 8-2.

II. RLDU configuration

RLDU is configured in the carrier subrack. In the case of full configuration, two RLDUs are present.

When two sectors are configured per cabinet, that is, in the case of S(1/1) or S(2/2) configuration, one RLDU will suffice. When three sectors are configured per cabinet, that is, in the case of S(1/1/1) or S(2/2/2) configuration, two RLDUs should be configured.

III. CDU/DDU/DFU configuration

Either CDU, DDU or DFU all can be configured as a duplexer, For the difference between the three, see Chapter 3. In practice, one to three CDUs, DFUs, or DDUs, should be configured in a duplexer subrack.

One DFU supports one sector carrier. That is, only the configuration of S(1/1) or S(1/1/1) is allowed.

One DDU supports two sector carriers. That is, the configuration of S(2/2) or S(2/2/2) is allowed and there is no requirement about the carrier space.

One CDU supports two sector carriers. That is, the configuration of S(2/2) or S(2/2/2) is allowed, but the space between the two sector carriers must be equal or larger than 2 carrier spaces (for 450MHz band and 800MHz band) or 3 carrier spaces (for 1900MHz band).

For CDU and DDU, the corresponding BTRMs and BHPAs are configured from bottom to top and from left to right (as shown in Figure 8-2).

For DFU, the corresponding BTRMs and BHPAs are configured from left to right in the RF subrack under the DFU, and only in the bottom.

Based on the specific frequency of CDU, actual implementation conditions should also be considered when configuring the BTRMs and BHPAs.

8.2.3 Configuration of Power Modules

The BTS3612A supports the 110V AC and 220V AC power inputs. The $PSU_{AC/DC}$ completes the conversion from 110V AC or 220V AC to -48V DC, while the $PSU_{DC/DC}$ completes the conversion from -48V DC to +24V DC.

I. $PSU_{AC/DC}$

Two models of $PSU_{AC/DC}$ are available to respectively support 110V AC and 220V AC power inputs.

In the case of full configuration, there are 9 $PSU_{AC/DC}$ modules, one of which is used as standby module. The maximum output current can reach 200A (8×25).

II. $PSU_{DC/DC}$

In the case of full configuration, there are 3 $PSU_{DC/DC}$ modules, one of which is used as standby module. The maximum output current can reach 130A (2×65).

8.3 Configuration of Auxiliary Equipment

8.3.1 Batteries

To ensure the normal operation of the BTS3612A in the case of local mains failure, storage batteries can be configured either in the battery subrack or in an auxiliary cabinet.

I. Configuration of battery subrack

The battery subrack can be installed with the batteries or DC lightning protector / DC filter.

If batteries are installed, the subrack can hold a -48V/65Ah battery group containing four 12V/65Ah storage batteries connected in serial.

If the battery cabinet is installed, only the DC lightning protector and the DC filter are configured in the built-in battery subrack.

II. Configuration of battery cabinet

The battery cabinet can hold a –48V/650Ah battery group containing twenty-four 2V/65Ah storage batteries connected in serial.

If an air conditioner is used to control the temperature, a -48V/650Ah battery group can maintain the normal operation of the BTS in S(2/2/2) configuration (with nine $PSU_{AC/DC}$ modules and three $PSU_{DC/DC}$ modules) for four hours.

8.3.2 Temperature Control Device

Either an air conditioner or a heat exchanger can be used for the temperature control, and the configuration principle is as below.

When an air conditioner is adopted, the operational environment temperature can be -40 ~ +55^{o}C, and when a heat exchanger is adopted, the operational environment temperature can be -40 ~ +45 ^{o}C

I. Air conditioner

Two models are available, respectively supporting the local mains of 110V AC and 220V AC.

II. Heat exchanger

Two models are available, respectively supporting the local mains of 110V AC and 220V AC.

8.3.3 Monitoring Devices

Monitoring devices include the sensors, TMU and PMU.

One PMU is configured in the BTS3612A, while the TMU is optional. Sensors include the temperature sensor, door status sensor, water sensor and smoke sensor.

8.3.4 Transmission Equipment

The transmission equipment is optional. The BTS3612A is connected to the transmission equipment through standard E1/T1 interface. Within the BTS3612A, standard space is reserved for installing microwave, HDSL or SDH transmission equipment.

8.4 Configuration of Antenna and Feeder

I. RF antennaand feeder

Two omni antennae should be used for omni cell.

For 3-sectors and 6-sectors configuration, each sector needs one bi-polarization antenna or two uni-polarization antennae.

When the BTS works in the 1900MHz band, tower-top amplifier may be applied. Because the power of tower-top amplifier is provided through the feeder, lightening arrester shall be configured for the RF antenna and feeder.

When the BTS works in 450MHz band or 800MHz band, the tower-top amplifier and lightening arrester need not to be configured.

II. GPS/GLONASS synchronization antenna and feeder

Normally, one set of GPS/GLONASS synchronization antenna and feeder is configured for one BTS3612A.

However, when two BCKMs are configured for BTS3612A for the purpose of higher system reliability, each of the two BCKMs requires one set of GPS/GLONASS synchronization antenna and feeder. If one set of the two fails, the BCKMs will be switched over and the synchronization signals will be received through the other synchronization antenna and feeder.

8.5 Networking Configuration

The BTS3612A supports star networking, chain networking and tree networking, In practice, these networking modes are usually used together.

The proper utilization of different networking modes can save a lot of transmission equipment with the guaranty of Quality of Service (QoS).

8.5.1 Star Networking

I. Application scope

Star networking is widely used, especially in the densely populated urban area. Start networking is shown in the following figure.

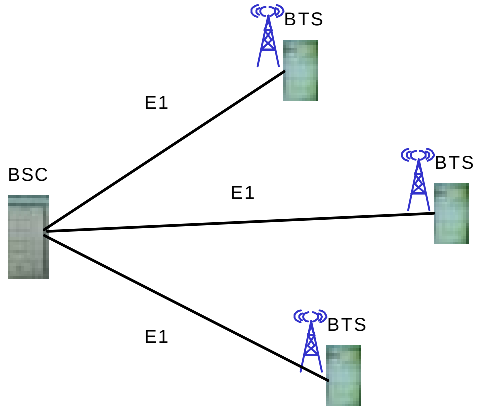


Figure 8-3 BTS star networking

II. Advantage

In the star networking mode, each BTS is directly connected with BSC via E1/T1 trunk line. The star networking is simple and allows convenient maintenance and engineering.

Because the signals go through a few sections of links, the line is more reliable and future expansion is easier.

III. Disavantage

Compared with other networking modes, star networking requires the largest number of transmission lines.

IV. Implementation

The internal network of Huawei CDMA BSS is built on ATM platform. The logic links of Abis interface, such as traffic link and signaling link, are carried by ATM links, which is carried by E1/T1 links in IMA mode or UNI mode.

8.5.2 Chain Networking

I. Application scope

Chain networking of the BTS is shown in Figure 8-4. It is applicable to sparsely populated stripe areas, e.g. along the highways and railways.

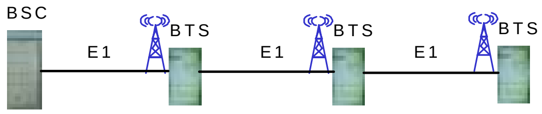


Figure 8-4 BTS chain networking

II. Advantage

The adoption of the chain networking mode can scale down the expenditure on transmission equipment, engineering construction, and lease of transmission links.

III. Disavantage

The signals go through more nodes in the chain networking mode, the line reliability is poor.

The failure of upper-level BTS may affect the normal operation of lower-level BTS.

Maximum three-level cascading is allowed. That is, the nodes cascaded should not exceed 3.

IV. Implementation

Chain networking is realized through the transmission trunk function of the BTS. The transmission trunk is essentially Virtual Path (VP) switching. One BTS can be configured with maximum 10 trunk links.

Note:

ATM switching is divided into two types: VP switching and Virtual Channel (VC) switching. In the VP switching process, only the value of VPI is changed, while the value of VCI is transmitted transparently. In the VC switching process, values of both VPI and VCI remain unchanged. The VP is equivalent to a large channel, while the VC a small one.

To configure a BTS trunk link, the forward/reverse BCIM No., forward/reverse link set No., and forward/reverse VP No. should be properly configured.

8.5.3 Tree Networking

I. Application scope

Tree networking mode applies to the area where network structure, site and subscriber distribution are complicated, such as the area where different types of subscribers are not evenly distributed.

Tree networking is shown in Figure 8-5.

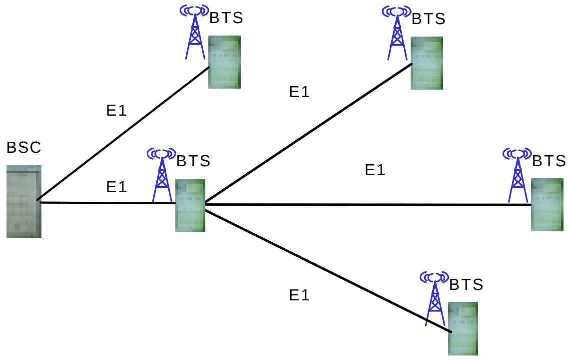


Figure 8-5 BTS tree networking

II. Advantage

In the tree networking mode, less transmission lines are needed than in the star networking mode.

III. Disavantage

In this mode, because signals go through many sections of links, the line reliability is low, and engineering and maintenance are difficult.

The failure of upper-level BTS may affect the normal operation of lower-level BTS.

Expansion is not easy and may cause substantial network reconstruction.

The cascaded BTSs should not exceed 3 levels, i.e. the depth of the tree should not exceed 3 layers.

IV. Implementation

The tree networking is in fact one application of the chain networking. For example, the first-level BTS can be configured with multiple trunk links. These trunk links can be allocated to each of the lower-level BTSs. (Note that these BTSs do not share the same trunk lines.) The lower-level BTS can in turn allocate the trunk links to its own lower-level BTSs. In this way, a tree network comes into being.

8.5.4 Fractional ATM Networking

I. Application scope

When the transmission resource is rather limited and the BTS capacity is not large, BTS3612A supports the fractional ATM networking. That is, BTS only uses specific timeslots in one or more E1/T1 links.

Fractional ATM networking is similar with the tree networking, except that in the fractional ATM networking mode, only part of the timeslots of E1/T1 links are used.

II. Advantage

In this mode, transmission resource can be fully and flexibly utilized and thus related cost can be reduced.

III. Disavantage

The capacity of BTS cannot be too large due to the restriction of transmission resource. If the actual BTS capacity is more than what the transmission resource can support, the call connected ratio will be affected.

The failure of upper-level BTS may affect the normal operation of lower-level BTS.

Expansion is not easy and may cause substantial network reconstruction.

IV. Implementation

BTS3612A can use the timeslot cross-connection function of QC52BCIM board to implement the fractional ATM networking without the support of external equipment.

In practice, the timeslot cross-connection should be added to the upper-level BTS, while the E1/T1 timeslots should be specified for the lower-level BTS by adding the E1/T1 fractional ATM transmission link to this BTS.

8.5.5 Cascading with ODU3601Cs

I. Application scope

The ODU3601C is an outdoor soft BTS. By connecting ODU3601 to a master BTS3612A in cascading mode, flexible coverage can be realized, including the indoor coverage, underground coverage, and coverage of highways and railways.

II. Advantage

The satellite synchronization antenna & feeder is not required, which saves the investment. This networking mode is suitable in the areas like the metro where the satellite synchronization antenna & feeder cannot be easily installed.

Compared with repeater, ODU3601C supports the centralized management of the upper-level BTS, which facilitates the network planning.

III. Disavantage

The failure of upper-level BTS may affect the normal operation of lower-level BTS.

IV. Implementation

The single-mode BRDM can be used for the cascading of ODU3601C. ODU3601C can be configured as either in a certain sector of the master BTS, or as an independent cell.

8.6 Typical Configurations

8.6.1 Overview

The BTS3612A support 450MHz band, 800MHz band and 1900MHz band, the typical configurations for 450MHz band are listed as below (Without diversity transmission), and the configurations for 800MHz band and 1900MHz band is similar to the configurations for 450MHz band.

I. Single cabinet configuration

- Omni cell, 1~2 carriers (DFU or DDU adopted).
- 3 sectors, 1 carrier per sector (DFU adopted).
- 3 sectors, 1~2 carriers per sector (DDU adopted).

II. Combined configuration (with two cabinets)

- 3 sectors, 3~4 carriers per sector (CDU adopted).
- 6 sectors, 1~2 carriers per sector (DDU adopted).

Omni configuration is generally represented by O(X), where X indicates the number of carriers. For example, O(2) represents the omni configuration with two carriers. The three-sector directional configuration is represented by S(X/X/X), and the six-sector one is represented by S(X/X/X/X/X/X).

The following will detail the typical configurations including O(2), S(2/2/2), and S(4/4/4).

8.6.2 S(2/2/2) Configuration

The following is the configuration of BTS3612A for S(2/2/2) (i.e., 2 carriers × 3 sectors):

- Baseband boards: 1 BCIM, 1 BRDM, 1-2 BCKMs, and BCPM can be configured according to actual requirement.
- Power modules: 3 $PSU_{DC/DC}$ modules, 9 $PSU_{AC/DC}$ modules.
- RF antennas: 2 uni-polarization directional antennas or 1 bi-polarization directional antenna for each sector.
- RF modules: The configuration of the RF modules is shown in Figure 8-6, and the logic connection of RF modules of one-sector is shown in Figure 8-7.

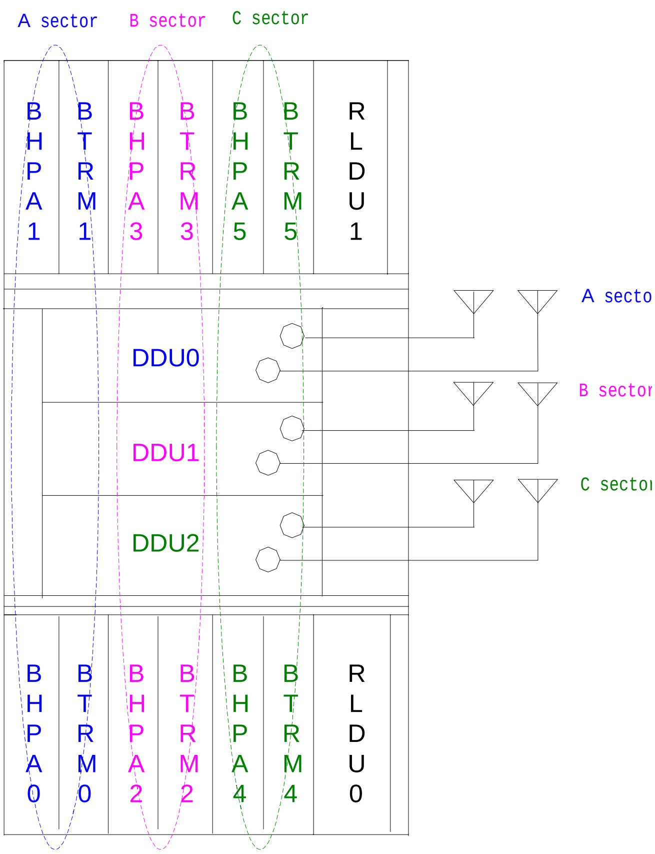


Figure 8-6 S(2/2/2) RF configuration

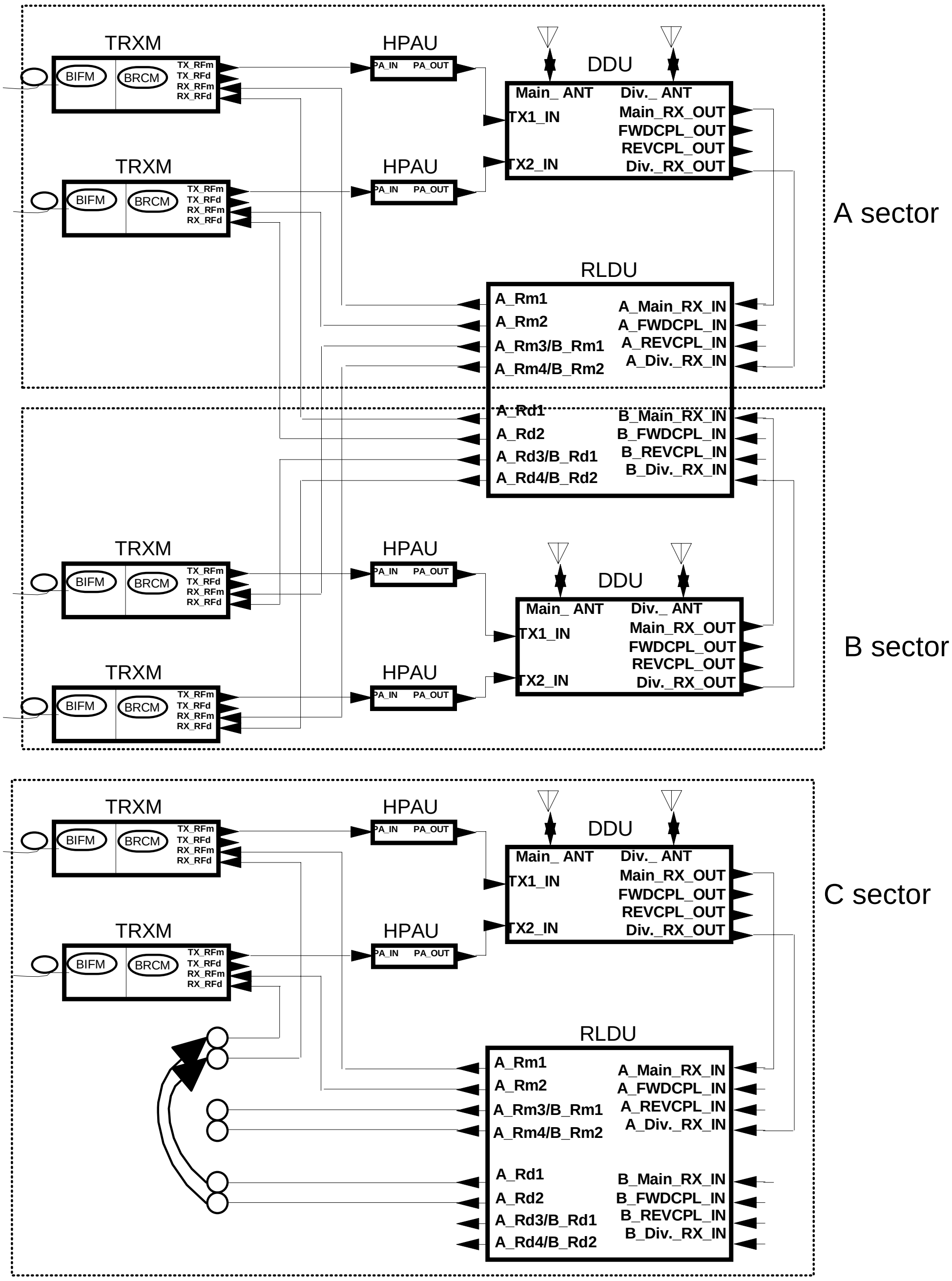


Figure 8-7 Logic connection of one-sector RF modules for S(2/2/2) configuration

8.6.3 S(4/4/4) Configuration

The S(4/4/4) (i.e., 4 carriers x 3 sectors) configuration requires two combined cabinets, and the RLDU should receive two signals and process each signal in 1-4 modes. The following shows the configuration of the boards or modules.

- Baseband boards: 1 BCIM, 2 BRDM, 1-2 BCKMs, and BCPM can be configured according to actual requirement.

- Power modules: 3 $PSU_{DC/DC}$ modules, 9 $PSU_{AC/DC}$ modules.
- RF antennas: 2 uni-polarization directional antennas or 1 bi-polarization directional antenna for each sector.
- RF modules: The configuration of the RF modules is shown in Figure 8-8, and the logic connection of RF modules of one-sector is shown in Figure 8-9 and Figure 8-10.

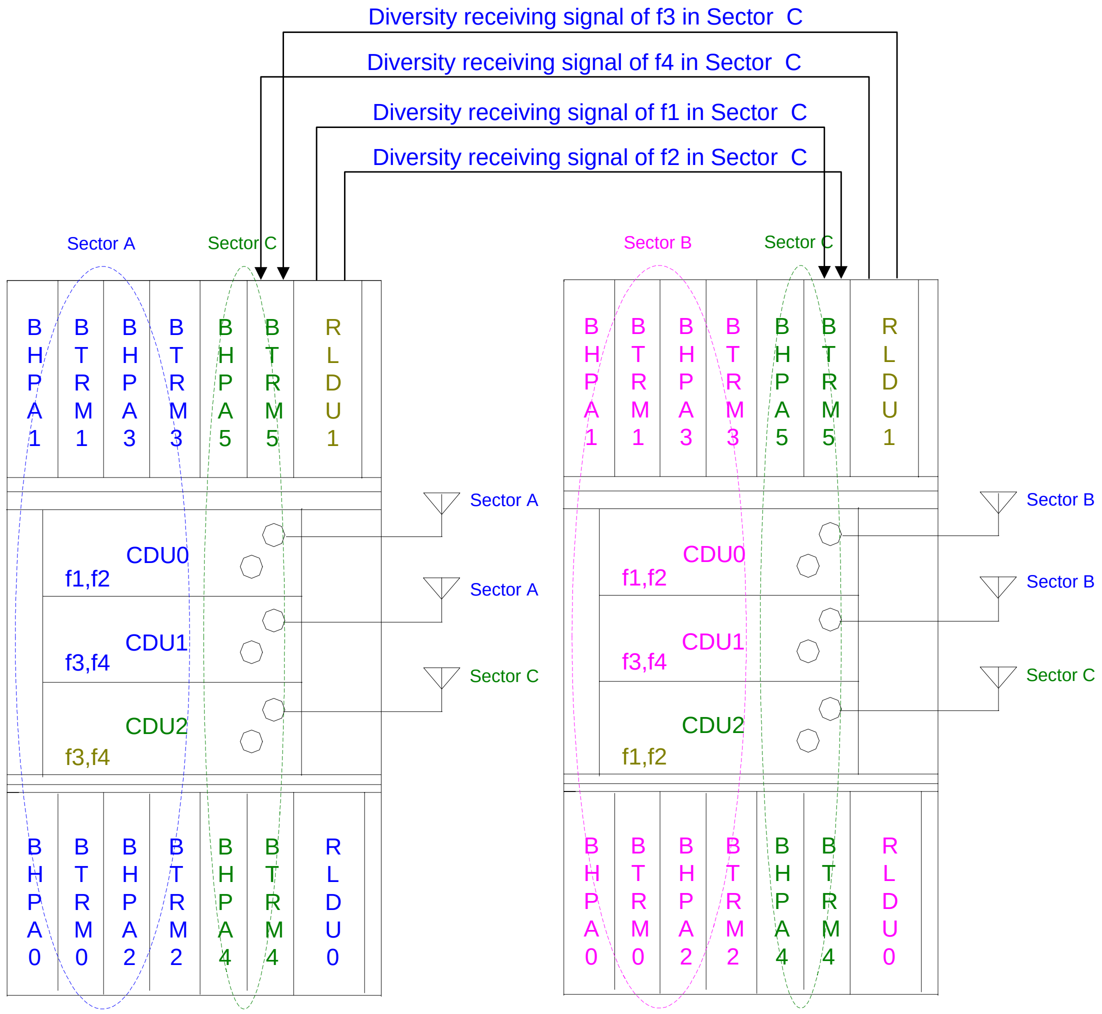


Figure 8-8 S(4/4/4) RF configuration

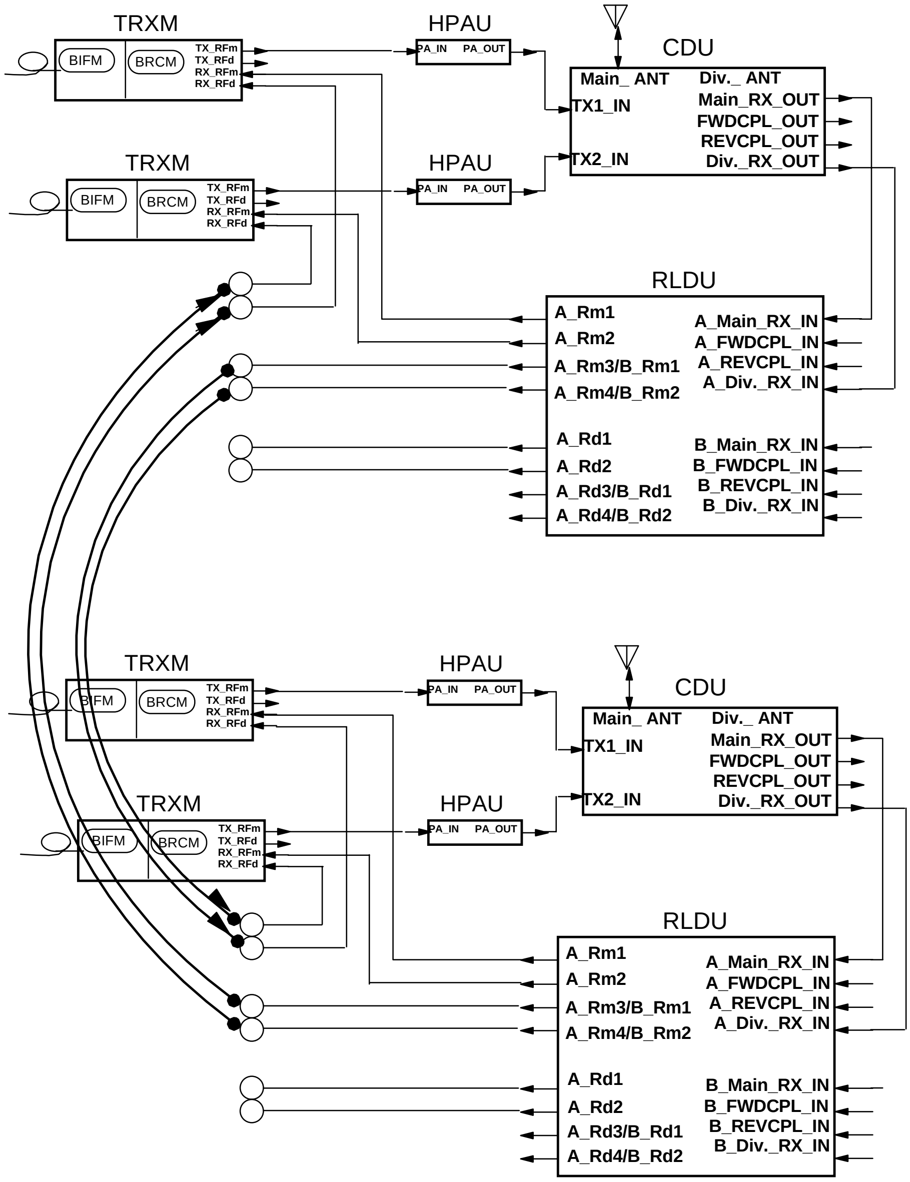


Figure 8-9 Logic connection of one-sector RF modules for S(4/4/4) configuration (The RF modules belong to different cabinets)

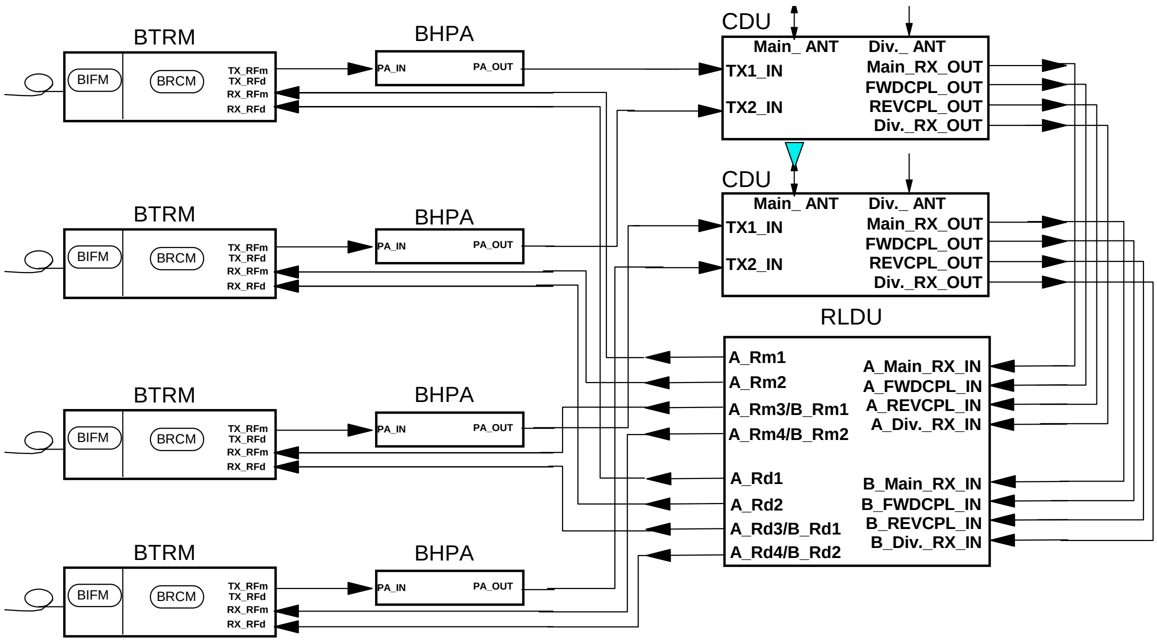


Figure 8-10 Logic connection of one-sector RF modules for S(4/4/4) configuration (The RF modules belong to the same cabinet)

Appendix A Performance of Receiver and Transmitter

The technical specifications of BTS receivers and transmitters comply with or surpass all the performance requirements defined in the IS-97-D Recommended Minimum Performance Standards for cdma2000 Spread Spectrum Base Stations.

A.1 Performance of Receiver

A.1.1 Frequency Coverage

- 450MHz band: 450 - 460MHz
- 800MHz band: 824 - 849MHz
- 1900MHz band: 1850 - 1910MHz

A.1.2 Access Probe Acquisition

The access probe failure ratio under the reliability of 90% is below the maximum values listed in Table A-1:

Table A-1 Access probe failure ratio

Eb/N0 Per RF input point (dB)	Maximum failure rate
5.5	50%
6.5	10%

A.1.3 R-TCH Demodulation Performance

I. Performance of R-TCH in Additive White Gaussian Noise (AWGN)

The demodulation performance of the Reverse Traffic Channel in AWGN (no fading or multipath) environment is determined by the frame error rate (FER) at specified Eb/N0 value.

FER of 4 possible data rates should be calculated respectively. With 95% confidence, the FER for each data rate does not exceed the two given FERs in Table A-2 to Table A-9, which adopt the linear interpolation in the form of Log_{10}(FER).

Eb/N0 measurement value is decided by whichever is bigger of the Eb/N0 values in two RF input ports.

Table A-2 Maximum FER of F-FCH or R-DCCH receiver in demodulation performance test under RC1

Data rate (bit/s)	FER limits (%)	
	Lower limit Eb/N0	Upper limit Eb/N0
9600	3.0 @ 4.1dB	0.2 @ 4.7dB
4800	8.0 @ 4.1dB	1.0 @ 4.7dB
2400	23.0 @ 4.1dB	5.0 @ 4.7dB
1200	22.0 @ 4.1dB	6.0 @ 4.7dB

Table A-3 Maximum FER of F-FCH or R-DCCH receiver in demodulation performance test under RC2

Data rate (bit/s)	FER limits (%)	
	Lower limit Eb/N0	Upper limit Eb/N0
14400	5.0 @ 3.2dB	0.2 @ 3.8dB
7200	6.3 @ 3.2dB	0.7 @ 3.2dB
3600	5.8 @ 3.2dB	1.0 @ 3.2dB
1800	3.5 @ 3.2dB	1.0 @ 3.2dB

Table A-4 Maximum FER of F-FCH or R-DCCH receiver in demodulation performance test under RC3

Data rate (bit/s)	FER limit (%)	
	Lower limit Eb/N0	Upper limit Eb/N0
9600	2.3% @ 2.4 dB	0.3% @ 3.0 dB
4800	2.3% @ 3.8 dB	0.4% @ 4.4 dB
2700	2.5% @ 5.0 dB	0.5% @ 5.6 dB
1500	1.7% @ 7.0 dB	0.4% @ 7.6 dB

Table A-5 Maximum FER of R-SCH receiver in demodulation performance test under RC3

Data rate (bit/s)	FER limit (%)	
	Lower limit Eb/N0	Upper limit Eb/N0
19200	9% @ 1.7 dB	1.7% @ 2.3 dB
38400	13% @ 1.4 dB	2.1% @ 2.0 dB

Data rate (bit/s)	FER limit (%)	
	Lower limit Eb/N0	Upper limit Eb/N0
76800	14% @ 1.3 dB	2.4% @ 1.9 dB
153600	14% @ 1.3 dB	2.4% @ 1.9 dB
307200	14% @ 1.8 dB	2.0% @ 2.4 dB

Table A-6 Maximum FER of R-SCH (Turbo Code) receiver in demodulation performance test under RC3

Data rate (bit/s)	FER limit (%)	
	Lower limit Eb/N0	Upper limit Eb/N0
19200	20% @ 0.6 dB	0.9% @ 1.2 dB
38400	24% @ -0.1 dB	0.3% @ 0.5 dB
76800	30% @ -0.5 dB	0.2% @ 0.1 dB
153600	60% @ -0.9 dB	0.1% @ -0.3 dB
307200	90% @ -0.3 dB	0.1% @ 0.3 dB

Table A-7 Maximum FER of F-FCH or R-DCCH receiver in demodulation performance test under RC4

Data rate (bit/s)	FER limit (%)	
	Lower limit Eb/N0	Upper limit Eb/N0
14400	2.4% @ 0.8 dB	0.3% @ 1.4 dB
7200	2.4% @ 3.1 dB	0.4% @ 3.7 dB
3600	1.7% @ 4.6 dB	0.3% @ 5.2 dB
1800	1.6% @ 6.6 dB	0.5% @ 7.2 dB

Table A-8 Maximum FER of R-SCH receiver of demodulation performance test under RC4

Data rate (bit/s)	FER limit (%)	
	Lower limit Eb/N0	Upper limit Eb/N0
28800	10% @ 1.7 dB	1.9% @ 2.3 dB
57600	12% @ 1.6 dB	1.7% @ 2.2 dB
115200	14% @ 1.6 dB	2.0% @ 2.2 dB
230400	12% @ 1.7 dB	1.7% @ 2.3 dB

Table A-9 Maximum FER of R-SCH (Turbo Code) receiver of demodulation performance test under RC4

Data rate (bit/s)	FER limit (%)	
	Lower limit Eb/N0	Upper limit Eb/N0
28800	27% @ 0.7 dB	0.5% @ 1.3 dB
57600	28% @ 0.2 dB	0.2% @ 0.8 dB
115200	60% @ -0.2 dB	0.1% @ 0.4 dB
230400	33% @ -0.5 dB	0.1% @ 0.1 dB

II. R-TCH performance in multipath fading without Closed-Loop power control

The performance of the demodulation of the Reverse Traffic Channel in a multipath fading environment is determined by the frame error rate (FER) at specified Eb/N0 value.

FER of 4 possible data rates should be calculated respectively. With 95% confidence, the FER for each data rate shall not exceed that given by linear interpolation on a log10 (FER) scale between the two values given in Table A-13 and Table A-14.

The test value of Eb/N0 assumes the average value of Eb/N0 in two RF input ports.

During the test, the reverse service channel Eb/N0 of each RF input port adopted is within the limits specified in Table A-12.

The configurations of standard channel simulator are given in Table A-10; and the channel models of the R-TCH receiving performance test in multipath environment are listed in Table A-11.

Table A-10 Standard channel simulator configuration

Standard channel Simulator configuration	Speed	Number of Paths	Path 2 power (corresponds to path 1)	Path 3 power (corresponds to path 1)	Deferring path 1 input	Deferring path 2 input	Deferring path 3 input
B	8km/h	2	0dB	N/A	0μs	2.0 μs	N/A
C	25km/h	1	N/A	N/A	0μs	N/A	N/A
D	100km/h	3	0dB	-3dB	0μs	2.0 μs	14.5 μs

Table A-11 Channel models for the R-TCH receiving performance test

Case	Channel Simulator configurations
B	2 (8 km/h, 2 paths)
C	3 (30 km/h, 1 path)
D	4 (100 km/h, 3 paths)
D2	4 (100 km/h, 3 paths)

Table A-12 Eb/N0 limits of R-TCH without closed-loop power control

Rate aggregation	Condition	Eb/N0 Limits (dB)	
		Lower limit	Upper limit
RC1	B	11.1	11.7
	C	11.2	11.8
	D	8.8	9.4
	D2	9.2	9.8
RC2	B	10.7	11.3
	D	8.5	9.1
	D2	8.9	9.5

Table A-13 Maximum FER of demodulation performance test of R-FCH or R-DCCH receiver under RC1

Case	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
B	9600	1.3	0.8
	4800	1.4	0.9
	2400	1.6	1.2
	1200	1.3	0.9
C	9600	1.2	0.7
	4800	1.4	0.9
	2400	2.5	1.7
	1200	2.0	1.4
D	9600	1.6	0.6
	4800	2.6	1.2

Case	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
D	2400	6.4	3.4
	1200	5.6	3.5
D2	9600	0.9	0.3
	4800	1.6	0.7
	2400	4.2	2.3
	1200	4.1	2.6

Table A-14 Maximum FER of demodulation performance test of R-FCH or R-DCCH receiver under RC2

Case	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
B	14400	1.3	0.8
	7200	1.0	0.5
	3600	0.7	0.4
	1800	0.6	0.5
D	14400	1.7	0.6
	7200	1.6	0.6
	3600	1.5	0.9
	1800	2.2	1.2
D2	14400	0.9	0.3
	7200	0.9	0.4
	3600	1.1	0.6
	1800	1.5	0.9

III. Performance in multipath fading with Closed-Loop power control

The performance of the demodulation of the Reverse Traffic Channel in a multipath fading environment is determined by the frame error rate (FER) at specified Eb/N0 value.

FER of 4 possible data rates needs to be calculated respectively. With 95% confidence, the FER for each data rate shall not exceed that given by linear interpolation on a log10 scale between the two values given in Table A-16 and Table A-23.

The test value of Eb/N0 assumes the average value of Eb/N0 tested on the two RF input ports.

Table A-15 Channel models for the R-TCH receiving performance test

Condition	Number of Channel Simulator configurations
A	1 (3 km/h, 1 path)
B	2 (8 km/h, 2 paths)
C	3 (30 km/h, 1 path)
D	4 (100 km/h, 3 path)

Table A-16 Maximum FER of demodulation performance test of R-FCH receiver under RC1

Condition	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
B	9600	2.8% @ 5.9 dB	0.3 @ 6.5 dB
	4800	7.6 @ 5.9 dB	2.2 @ 6.5 dB
	2400	23.0 @ 5.9 dB	12.0 @ 6.5 dB
	1200	22.0 @ 5.9 dB	14.0 @ 6.5 dB
C	9600	1.5 @ 7.1 dB	0.7 @ 7.7 dB
	4800	8.0 @ 7.1 dB	4.8 @ 7.7 dB
	2400	18.0 @ 7.1 dB	13.0 @ 7.7 dB
	1200	16.0 @ 7.1 dB	12.0 @ 7.7 dB

Table A-17 Maximum FER of demodulation performance test of R-FCH receiver under RC2

Case	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
B	14400	2.8 @ 5.2 dB	0.4 @ 5.8 dB
	7200	4.7 @ 5.2 dB	1.3 @ 5.8 dB
	3600	8.7 @ 5.2 dB	4.6 @ 5.8 dB
	1800	15.0 @ 5.2 dB	9.8 @ 5.8 dB
C	14400	1.3 @ 7.7 dB	0.7 @ 8.3 dB
	7200	3.2 @ 7.7 dB	1.8 @ 8.3 dB
	3600	4.7 @ 7.7 dB	3.5 @ 8.3 dB
	1800	5.2 @ 7.7 dB	3.9 @ 8.3 dB

Table A-18 Maximum FER of demodulation performance test of R-FCH or R-DCCH receiver under RC3

Case	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
A	9600 (20 ms)	2.4% @ 3.4 dB	0.5% @ 4.0 dB
	4800	2.0% @ 4.4 dB	0.5% @ 5.0 dB
	2700	1.8% @ 5.6 dB	0.5% @ 6.2 dB
	1500	1.8% @ 7.2 dB	0.6% @ 7.8 dB
B	9600 (20 ms)	2.0% @ 3.9 dB	0.5% @ 4.5 dB
	4800	2.0% @ 4.9 dB	0.5% @ 5.5 dB
	2700	1.8% @ 6.1 dB	0.5% @ 6.7 dB
	1500	1.7% @ 7.8 dB	0.5% @ 8.4 dB
C	9600 (20 ms)	1.5% @ 5.2 dB	0.6% @ 5.8 dB
	4800	1.5% @ 6.1 dB	0.6% @ 6.7 dB
	2700	1.4% @ 7.2 dB	0.6% @ 7.8 dB
	1500	1.4% @ 8.8 dB	0.6% @ 9.4 dB
D	9600 (20 ms)	2.0% @ 4.7 dB	0.5% @ 5.3 dB
	4800	2.0% @ 5.7 dB	0.5% @ 6.3 dB
	2700	1.8% @ 6.9 dB	0.5% @ 7.5 dB
	1500	1.7% @ 8.5 dB	0.5% @ 9.1 dB

Table A-19 Maximum FER of demodulation performance test of R-SCH (Turbo Code) receiver under RC3

Case	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
B	307200	10% @ 2.6 dB	2.0% @ 3.2 dB
	153600	10% @ 2.6 dB	2.0% @ 3.2 dB
	76800	10% @ 2.1 dB	2.4% @ 2.7 dB
	38400	9.0% @ 2.4 dB	2.4% @ 3.0 dB
	19200	9.0% @ 2.8 dB	2.5% @ 3.4 dB

Table A-20 Maximum FER of demodulation performance test of R-SCH (Turbo Code) receiver under RC3

Case	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
B	307200	15% @ 0.8 dB	1.8% @ 1.4 dB
	153600	12% @ 0.2 dB	2.0% @ 0.8 dB
	76800	10% @ 0.7 dB	2.0% @ 1.3 dB
	38400	10% @ 1.3 dB	2.0% @ 1.9 dB
	19200	10% @ 2.1 dB	2.5% @ 2.7 dB

Table A-21 Maximum FER of demodulation performance test of R-FCH or R-DCCH receiver under RC4

Case	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
A	14400	2.2% @ 3.2 dB	0.4% @ 3.8 dB
	7200	1.9% @ 3.9 dB	0.4% @ 4.5 dB
	3600	1.9% @ 5.1 dB	0.5% @ 5.7 dB
	1800	1.8% @ 7.0 dB	0.5% @ 7.6 dB
B	14400	2.0% @ 3.8 dB	0.4% @ 4.4 dB
	7200	2.0% @ 4.3 dB	0.5% @ 4.9 dB
	3600	1.8% @ 5.6 dB	0.5% @ 6.2 dB
	1800	1.8% @ 7.5 dB	0.5% @ 8.1 dB
C	14400	1.6% @ 5.1 dB	0.6% @ 5.7 dB
	7200	1.7% @ 5.6 dB	0.7% @ 6.2 dB
	3600	1.5% @ 6.7 dB	0.6% @ 7.3 dB
	1800	1.6% @ 8.4 dB	0.7% @ 9 dB
D	14400	2.0% @ 4.6 dB	0.5% @ 5.2 dB
	7200	2.0% @ 5.1 dB	0.5% @ 5.7 dB
	3600	1.9% @ 6.3 dB	0.5% @ 6.9 dB
	1800	1.8% @ 8.1 dB	0.6% @ 8.7 dB

Table A-22 Maximum FER of demodulation performance test of R-SCH(Turbo Code) receiver under RC4

Case	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
B	230400	10% @ 2.4 dB	1.4% @ 3.0 dB
	115200	9.0% @ 2.5 dB	2.3% @ 3.1 dB
	57600	9.0% @ 2.6 dB	2.2% @ 3.2 dB
	28800	7.5% @ 2.8 dB	2.5% @ 3.4 dB

Table A-23 Maximum FER of demodulation performance test of R-SCH (Turbo Code) receiver under RC4

Case	Data rate (bit/s)	FER limits (%)	
		Lower limit Eb/N0	Upper limit Eb/N0
B	230400	10% @ 1.1 dB	2.0% @ 1.7 dB
	115200	10% @ 1.0 dB	1.5% @ 1.7 dB
	57600	11% @ 1.5 dB	1.8% @ 2.1 dB
	28800	10% @ 2.1 dB	2.0% @ 2.7 dB

A.1.4 Receiving Performance

I. Sensitivity

- 450MHz band and 1900MHz band

The R-TCH FER shall be <1.0% with 95% confidence when -126dBm/1.23MHz CDMA RC3 signal level is inputted at BTS RF main and diversity input ports.

- 800MHz band

The R-TCH FER shall be <1.0% with 95% confidence when -127dBm/1.23MHz CDMA RC3 signal level is inputted at BTS RF main and diversity input ports.

II. Receiver dynamic range

- 450MHz band and 1900MHz band

The R-TCH FER shall be 1.0% or less with 95% confidence when -126dBm/1.23MHz~-65dBm/1.23MHz CDMA signal level is inputted at BTS RF main and diversity input ports.

- 800MHz band

The R-TCH FER shall be 1.0% or less with 95% confidence when -127dBm/1.23MHz~-65dBm/1.23MHz CDMA signal level is inputted at BTS RF main and diversity input ports.

III. Single-tone desensitization

- 450MHz band

Input the single-tone interference deviated from the center frequency at the BTS RF input port: when the single-tone interference deviates from the center frequency +900kHz and -900kHz, the input single-tone interference power is 87dB higher than the output power of the mobile station simulator.

When R-TCH FER maintains <1.5%, the output power of mobile station simulator changes less than 3dB whether there is single-tone interference or not.

- 800MHz band

Input the single-tone interference deviated from the center frequency at the BTS RF input port: when the single-tone interference deviates from the center frequency about +750kHz and -750kHz, the input single-tone interference power is 50dB higher than the output power of the mobile station simulator; when the single-tone interference deviates from the center frequency +900kHz and -900kHz, the input single-tone interference power is 87dB higher than the output power of the mobile station simulator.

When R-TCH FER maintains <1.5%, the output power of mobile station simulator changes less than 3dB whether there is single-tone interference or not.

- 1900MHz band

Input the single-tone interference deviated from the center frequency at the BTS RF input port: when the single-tone interference deviates from the center frequency +1.25MHz and -1.25MHz, the input single-tone interference power is 80dB higher than the output power of the mobile station simulator.

When R-TCH FER maintains <1.5%, the output power of mobile station simulator changes less than 3dB whether there is single-tone interference or not.

IV. Intermodulation spurious response attenuation

- 450MHz band and 800MHz band

Input two single-tone interference of center frequency at the BTS RF input port: both deviate from the center frequency +900kHz and +1700kHz respectively, and -900kHz and -1700kHz respectively, the input single-tone interference power is 72dB higher than the output power of the mobile station simulator.

When R-TCH FER keeps <1.5%, the output power of the mobile station simulator changes less than 3dB whether there are two single-tone interference or no interference.

- 1900MHz band

Input two single-tone interference of center frequency at the BTS RF input port: both deviate from the center frequency +1.25MHz and +2.05MHz respectively, and -1.25MHz and -2.05MHz respectively.

When R-TCH FER keeps <1.5%, the output power of the mobile station simulator changes less than 3dB whether there are two single-tone interference or no interference.

V. Adjacent channel selectivity

The output power of the mobile station simulator shall increase by no more than 3 dB and the FER shall be less than 1.5% with 95% confidence.

A.1.5 Limitations on Emissions

I. Conducted spurious emissions

At BTS RF input port, the conducted spurious emissions within the BTS receiving frequency range is <-80dBm/30kHz.

At BTS RF input port, the conducted spurious emissions within the transmitting frequency range is <-60dBm/30kHz.

At BTS RF input port, the conducted spurious emissions within other frequency range of 0~6GHz is <-47dBm/30kHz.

II. Radiated spurious emissions

The performance is in compliant with local radio specifications.

A.1.6 Received Signal Quality Indicator (RSQI)

RSQI is defined as the signal-to-noise ratio Eb/N0, where Eb is the energy per bit including the pilot and power control overhead and N0 is the total received noise-pulse-interference power in the CDMA bandwidth including the interference from other subscribers.

The RSQI report values of the BTS are list in Table A-24.

Table A-24 RSQI range

Eb/N0 (dB) per input port	Minimum Acceptable Report Value	Maximum Acceptable Report Value
4	10	18
5	12	20
6	14	22
7	16	24
8	18	26
9	20	28
10	22	30
11	24	32
12	26	34
13	28	36
14	30	38

A.2 Performance of Transmitter

A.2.1 Frequency Requirements

I. Frequency coverage

- 450MHz band: 460 - 470MHz
- 800MHz band: 869 - 894MHz
- 1900MHz band: 1930 - 1990MHz

II. Frequency tolerance

Within the working temperature range, the average difference between the actual carrier frequency of CDMA transmit sector and the carrier frequency of the dedicated transmit sector is less than $\pm 5\times 10^{-8}$($\pm$0.05ppm)of the designated frequency.

A.2.2 Modulation Requirements

I. Synchronization and timing

Time tolerance for pilot frequency: The pilot time alignment error should be less than 3 µs and shall be less than 10 µs. For BTSs supporting multiple simultaneous CDMA

Channels, the pilot time tolerance of all CDMA Channels radiated by a BTS shall be within ±1 µs of each other.

Time tolerance of pilot channel and other code-division channels: in the same CDMA channel, time error between the pilot channel and other forwarding code-division channels is <±50ns.

The phase differences between the Pilot Channel and all other code channels sharing the same Forward CDMA Channel should not exceed 0.05 radians and shall not exceed 0.15 radians.

II. Waveform quality

The normalized cross correlation coefficient, ρ, shall be greater than 0.912 (excess power < 0.4 dB)..

A.2.3 RF Output Power

I. Total power

Total power is the mean power delivered to a load with resistance equal to the nominal load impedance of the transmitter.. The total power of this system is +43dBm (20W), the deviation in all kinds of environmental conditions shall not exceed +2dB and -4dB.

II. Pilot power

The Pilot Channel power to total power ratio shall be within ±0.5 dB of the configured value.

III. Code domain power

For RC1and RC2, the code domain power in each inactive W_n^{64} channel shall be 27 dB or more below the total output power.

For RC3 and RC4, the code domain power in each inactive W_n^{128} channel shall be 30 dB or more below the total output power.

For RC1 and RC2, the code domain power in each inactive W_n^{256} channel shall be 33 dB or more below the total output power of each carrier.

A.2.4 Limitations on Emissions

I. Conducted spurious emissions

The requirements on Conducted Spurious Emissions vary with frequency bands, as shown in Table A-25 and Table A-26. Local radio requirements should also be observed.

Table A-25 Conducted Spurious Emissions Performance (450MHz band and 800MHz band)

Offset from carrier central frequency	Spurious requirement	
750 kHz~1.98 MHz	-45 dBc / 30 kHz	
1.98 MHz~4.00 MHz	-60 dBc / 30 kHz; Pout ≥ 33 dBm -27 dBm / 30 kHz; 28 dBm ≤ Pout < 33 dBm -55 dBc / 30 kHz; Pout < 28 dBm	
> 4.00 MHz (ITU Class A Requirement)	-13 dBm / 1 kHz; -13 dBm / 10 kHz; -13 dBm/100 kHz; -13 dBm / 1 MHz;	9 kHz < f < 150 kHz 150 kHz < f < 30 MHz 30 MHz < f < 1 GHz 1 GHz < f < 5 GHz
> 4.00 MHz (ITU Class B Requirement)	-36 dBm / 1 kHz; -36 dBm / 10 kHz; -36 dBm/100 kHz; -30 dBm / 1 MHz;	9 kHz < f < 150 kHz 150 kHz < f < 30 MHz 30 MHz < f < 1 GHz 1 GHz < f < 12.5 GHz

Table A-26 Conducted Spurious Emissions Performance (1900MHz band)

Offset from carrier central frequency	Spurious requirement	
885 kHz~1.25 MHz	-45 dBc / 30 kHz	
1.25 MHz~1.98 MHz	-60 dBc / 30 kHz; Pout ≥ 33 dBm -27 dBm / 30 kHz; 28 dBm ≤ Pout < 33 dBm -55 dBc / 30 kHz; Pout < 28 dBm	
1.98 MHz~2.25 MHz	-55dBc/30kHz， Pout⩾33dBm -22dBm/30kHz， 28dBm ≤ Pout < 33dBm -50dBc/30kHz， Pout < 28dBm	
2.25 MHz~4.00 MHz	-13dBm/1MHz	
> 4.00 MHz (ITU Class A Requirement)	-13 dBm / 1 kHz; -13 dBm / 10 kHz; -13 dBm/100 kHz; -13 dBm / 1 MHz;	9 kHz < f < 150 kHz 150 kHz < f < 30 MHz 30 MHz < f < 1 GHz 1 GHz < f < 5 GHz

II. Radiated spurious emissions

The performance is in compliant with local radio specifications.

Appendix B EMC Performance

ETSI EN 300 386 Electromagnetic Compatibility and Radio Spectrum Matters (ERM); Telecommunication network Equipment; ElectroMagnetic Compatibility (EMC) Requirements are the international EMC standards.

The EMC performance of BTS3612A complies with ETSI EN 300 386 V1.2.1 (2000-03). They are described in two aspects: ElectroMagnetic Interference (EMI) and ElectroMagnetic Sensitivity (EMS).

B.1 EMI Performance

I. Conductive Emission (CE) at DC input/output port

CE indices are listed in Table B-1.

Table B-1 CE indices at -48V port

Frequency range	Threshold (dB μV)	
	Average	Quasi-peak
0.15 ~ 0.5MHz	56~46	66~56
0.5 ~ 5MHz	46	56
5 ~ 30MHz	50	60

II. Radiated Emission (RE)

RE indices are listed in Table B-2.

Table B-2 RE indices

Band (MHz)	Threshold of quasi-peak (dB μV/m)
30 ~ 1000	61.5
1000 ~ 12700	67.5

Note:

Test field is arranged according to ITU-R 329-7 [1].

B.2 EMS Performance

I. RF EM field immunity (80~1000MHz)

RF EM field immunity indices are listed in Table B-3.

Table B-3 RF EM field immunity indices

Port	Level	Performance class
Whole cabinet	3V/m	A

Note:

Test method complies with IEC1000-4-3 [9].

II. Voltage dips and short interruptions immunity

Among all test items of EMS, the requirement for continuous interference immunity is class A and the requirement for transient interference immunity is class B. Requirements for voltage dips and short interruptions is shown in Table B-4.

Table B-4 Voltage dips and short interruptions indices

Port	Test level	Performance class
AC port	Dip 30% Duration: 10ms	A
	Dip: 60% Duration: 100ms	With backup power: A With no backup power: The communication link need not be maintained. It can be re-created and the subscriber data can be lost.
	Dip: over95% Duration: 5000ms	With backup power: A With no backup power: The communication link need not be maintained. It can be re-created and the subscriber data can be lost.

Note:

Test method complies with IEC61000-4-11 [13].

III. Electrostatic Discharge (ESD) immunity

ESD immunity indices are shown in Table B-5.

Table B-5 ESD immunity indices

Discharge mode	Level	Performance class
Contact	2kV, 4kV	B
Air	2kV, 4kV, 8kV	B

Note:

Test method complies with IEC 61000-4-2 [5].

In addition to the protection measures specified in the user's documents, ESD measures should be taken to all exposed surface of equipment to be tested.

IV. RF induced currents

In CDMA equipment, the port where a cable of more than 1 meter may be connected to, including control port, DC input/output port and the input/output port of the connection line when cabinets are combined, should satisfy the requirements for RF induced currents. The indices are shown in Table B-6.

Table B-6 Induced currents indices

Port	Voltage level	Performance class
DC line port	3V	A
AC line port		
Signal line port and control line port		

Note:

Test method complies with IEC61000-4-6 [9].

V. Surge immunity

For CDMA equipment, the DC power input port, indoor signal line of more than 3 m, control line (such as E1 trunk line, serial port line) and the cable that may be led out to the outdoor should all satisfy the requirements for surge immunity. The indices are shown in Table B-7.

Table B-7 Surge immunity indices

Port	Level	Performance class
AC port	Line~line, 2kV Line~ground, 4kV	B
Control line, signal line	Line~line, 0.5kV Line~ground, 1kV	B
Control line, signal line (outdoors)	Line~line, 1kV Line~ground, 2kV	B

Note:

The test method complies with IEC61000-4-5 [11].

VI. Common-mode fast transient pulse immunity

The signal & data line between CDMA cabinets and that connected with other systems (such as E1 trunk line), control line and cable connected to DC input/output port, should satisfy the requirements for fast transient pulse immunity. The indices are shown in Table B-8.

Table B-8 Common-mode fast transient pulse immunity indices

Port	Level	Performance class
Signal control line port	0.5kV	B
DC line input/output port	1kV	B
AC line input port	2kV	B

📖 **Note:**

Performance class A: BTS can withstand the test without any damage and it can run normally in the specified range. There is not any change in the software or data (all data in the storage or the data being processed) related to the tested switching equipment. Equipment performance is not lowered.

Performance class B: BTS can withstand the test without any damage. There is no change in the software or the data in storage. Communication performance is lowered a little, but in the tolerance (as defined for different products). The existing communication link is not interrupted. After the test, the equipment can recover to the normal status before the test automatically without any interference of the operator.

Performance class C: Some functions of BTS are lost temporarily during the test, but they will recover to normal performance in a specific period after the test (normally the shortest time needed for system reboot). There is no physical damage or system software deterioration.

Performance class R: After the test, there is no physical damage or fault (including software corruption) with BTS. Protection equipment damage caused by external interference signal is acceptable. When the protection equipment is replaced and the running parameters are re-configured, the equipment can operate normally.

Appendix C Environment Requirements

The environment requirements of BTS3612A involve storage, transportation, and operation environments. These requirements are specified based on the following standards:

- ETS 300019 Equipment Engineering (EE); Environmental conditions and environmental tests for telecommunications equipment
- IEC 60721 Classification of environmental conditions

C.1 Storage Environment

I. Climate environment

Table C-1 Requirements for climate environment

Item	Range
Altitude	≤5000m
Air pressure	70kPa~106kPa
Temperature	-40~+70 Celsius degree
Temperature change rate	≤1 Celsius degree/min
Relative humidity	10%~100%
Solar radiation	≤1120W/s²
Thermal radiation	≤600W/s²
Wind speed	≤30m/s
Rain	Drippings

II. Biotic environment

- No microorganism like fungal or mould multiplied around or inside.
- Free from the attack of rodential animals (such as rats).

III. Air cleanness

- No explosive, electrically/magnetically conductive, or corrosive particles around.
- The density of physically active substances shall meet the requirements listed in Table C-2.

Table C-2 Requirements for the density of physically active substances

Substance	Unit	Density
Suspending dust	mg/m^3	≤5.00
Falling dust	$mg/m^2 \cdot h$	≤20.0
Sands	mg/m^3	≤300
Note: Suspending dust: diameter ≤75μm Falling dust: 75μm≤diameter≤150μm Sands: 150μm≤diameter≤1,000μm		

- The density of chemically active substances shall meet the requirements listed in Table C-3.

Table C-3 Requirements for the density of chemically active substances

Substance	Unit	Density
SO_2	mg/m^3	≤0.30
H_2S	mg/m^3	≤0.10
NO_2	mg/m^3	≤0.50
NH_3	mg/m^3	≤1.00
Cl_2	mg/m^3	≤0.10
HCl	mg/m^3	≤0.10
HF	mg/m^3	≤0.01
O_3	mg/m^3	≤0.05

IV. Mechanical stress

Table C-4 Requirements for mechanical stress

Item	Sub-item	Range	
Sinusoidal vibration	Displacement	≤7.0mm	-
	Acceleration	-	≤20.0m/s²
	Frequency range	2~9Hz	9~200Hz
Unsteady impact	Impact response spectrum II	≤250m/s²	
	Static load capability	≤5kPa	

Item	Sub-item	Range
Note: Impact response spectrum: The max. acceleration response curve generated by the equipment under the specified impact excitation. Impact response spectrum II refers to the semi sinusoidal impact response spectrum whose duration is 6ms. Static load capability: The capability of the equipment in package to bear the pressure from the top in normal pile-up method.		

C.2 Transportation Environment

I. Climate environment

Table C-5 Requirements for climate environment

Item	Range
Altitude	⩽5,000m
Air pressure	70kPa~106kPa
Temperature	-40~+70 Celsius degree
Temperature change rate	⩽3 Celsius degree/min
Relative humidity	5%~100%
Solar radiation	⩽1,120W/s²
Thermal radiation	⩽600W/s²
Wind speed	⩽30m/s

II. Biotic environment

- No microorganism like fungal or mould multiplied around or inside.
- Free from the attack of rodential animals (such as rats).

III. Air cleanness

- No explosive, electrically/magnetically conductive, or corrosive particles around.
- The density of physically active substances shall meet the requirements listed in Table C-6.

Table C-6 Requirements for the density of physically active substances

Substance	Unit	Density
Suspending dust	mg/m³	No requirement

Substance	Unit	Density
Falling dust	$mg/m^2 \cdot h$	⩽3.0
Sands	mg/m^3	⩽100
Note: Suspending dust: diameter ⩽75μm Falling dust: 75μm⩽diameter⩽150μm Sands: 150μm⩽diameter⩽1,000μm		

- The density of chemically active substances shall meet the requirements listed in Table C-7.

Table C-7 Requirements for the density of chemically active substances

Substance	Unit	Density
SO_2	mg/m^3	⩽0.30
H_2S	mg/m^3	⩽0.10
NO_2	mg/m^3	⩽0.50
NH_3	mg/m^3	⩽1.00
Cl_2	mg/m^3	⩽0.10
HCl	mg/m^3	⩽0.10
HF	mg/m^3	⩽0.01
O_3	mg/m^3	⩽0.05

IV. Mechanical stress

Table C-8 Requirements for mechanical stress

Item	Sub-item	Range		
Sinusoidal vibration	Displacement	⩽7.5mm	-	-
	Acceleration	-	⩽20.0m/s²	⩽40.0m/s²
	Frequency range	2~9Hz	9~200Hz	200~500Hz
Random vibration	Acceleration spectrum density	10m²/s³	3m²/s³	1m²/s³
	Frequency range	2~9Hz	9~200Hz	200~500Hz
Unsteady impact	Impact response spectrum II	⩽300m/s²		
	Static load capability	⩽10kPa		

Item	Sub-item	Range
Note: Impact response spectrum: The max. acceleration response curve generated by the equipment under the specified impact excitation. Impact response spectrum II refers to the semi sinusoidal impact response spectrum whose duration is 6ms. Static load capability: The capability of the equipment in package to bear the pressure from the top in normal pile-up method.		

C.3 Operation Environment

I. Climate environment

Table C-9 Temperature and humidity requirements

Product	Temperature		Relative humidity
	Long-term	Short-term	
BTS3612A	-40~+55 Celsius degree	-40~+45 Celsius degree	5%~100%
Note: The measurement point of temperature and humidity is 2 m above the floor and 0.4 m in front of the equipment, when there are no protective panels in front of or behind the cabinet.			

Table C-10 Other climate environment requirements

Item	Range
Altitude	⩽4000m
Air pressure	70kPa~106kPa
Temperature change rate	⩽5 Celsius degree/min
Solar radiation	⩽1120W/m²
Rain	⩽12.5L/min±0.625 L/min (IPX5)
Wind speed	⩽50m/s

II. Biotic environment

- No microorganism like fungal or mould multiplied around or inside.
- Free from the attack of rodential animals (such as rats).

III. Air cleanness

- No explosive, electrically/magnetically conductive, or corrosive particles around.
- The density of physically active substances shall meet the requirements listed in Table C-11.

Table C-11 Requirements for the density of physically active substances

Substance	Unit	Density
Suspending dust	mg/m^3	⩽5
Falling dust	$mg/m^2 \cdot h$	⩽20
Sands	mg/m^3	⩽300
Note: Suspending dust: diameter ⩽75μm Falling dust: 75μm⩽diameter⩽150μm Sands: 150μm⩽diameter⩽1,000μm		

- The density of chemically active substances shall meet the requirements listed in Table C-12.

Table C-12 Requirements for the density of chemically active substances

Substance	Unit	Density
SO_2	mg/m^3	⩽0.30
H_2S	mg/m^3	⩽0.10
NH_3	mg/m^3	⩽1.00
Cl_2	mg/m^3	⩽0.10
HCl	mg/m^3	⩽0.10
HF	mg/m^3	⩽0.01
O_3	mg/m^3	⩽0.05
NO_2	mg/m^3	⩽0.5

IV. Mechanical stress

Table C-13 Requirements for mechanical stress

Item	Sub-item	Range	
Sinusoidal vibration	Displacement	⩽3.5mm	-
	Acceleration	-	⩽10.0m/s²
	Frequency range	2~9Hz	9~200Hz
Unsteady impact	Impact response spectrum II	⩽100m/s²	
	Static load capability	0	

Note:

Impact response spectrum: The max. acceleration response curve generated by the equipment under the specified impact excitation. Impact response spectrum II refers to the semi sinusoidal impact response spectrum whose duration is 6ms.

Static load capability: The capability of the equipment in package to bear the pressure from the top in normal pile-up method.

Appendix D Electromagnetic Radiation

D.1 Introduction

The BTS has RF radiation (Radiation Hazard). Although there is no scientific evidence of possible health risks to persons living near the BTSs, some recommendations are giving below for the installation and operation of BTS.

Maximum Permissible Exposure (MPE) limits are specified by the Federal Communications Commission (FCC). FCC CFR part 1, subpart I, section 1.1307 requires operator to perform a Enviromenta Assemessmet (EA).

Equipment listed in the table 1 of before mentioned part are subjected to routine environmental evaulation. For facilities and operations licensed under part 22, licensees and manufactuere are required tto ensure that their facility and equipment comply with IEEE C95.1-1991.

The objective of the Environmental Evaluation is to ensure that human exposure to RF energy does not go beyond the maximum permissible levels stated in the standard. Therefore certain sites do not require an evaluation by nature of its design. It could be that the antennas are placed high enough thereby resulting in extremely low RF fields by the time it reaches areas that would be accessible to people.

Environmental evaluations are required, for Paging and Cellular Radiotelephone Services, Part 22 Subpart E and H.

- Non-rooftop antennas: height of radiation center < 10m above ground level and total power of all channels > 1000 W ERP (1640 W EIRP)
- Rooftop antennae: total power of all channels > 1000 W ERP (1640 W EIRP)

D.2 Maximum Permissible Exposure

Maximum Permissible Exposure (MPE) refers to the RF energy that is acceptable for human exposure. It is broken down into two categories, Controlled and Uncontrolled.

Controlled limits are used for persons such as installers and designers that are in control of the hazard and exposed to energy for limited amounts of time per day.

Occupational/controlled limits apply in situations in which are persons are exposed as a consequence of their employment provided those persons are fully aware of the potential for exposure and can exercise control over their exposure. Limits for occupational/controlled exposure also apply in situations when an individual is transient through a location where occupational/controlled limits apply provided he or she is made aware of the potential for exposure.

Uncontrolled limits are used for general public. Uncontrolled exposure apply in situations is which the general public may be exposed, or in which persons that are exposed as a consequence of their employment may not be fully aware of the potential for exposure or can not exercise control over their exposure.

The exposure levels can be expressed in terms of power density, electric field strength, or magnetic field strength, as averaged over 30 minutes for the general public and 6 minutes for trained personnel.

The exposure criteria are frequency dependent, and a chart covering the range from 3 kHz to 100 GHz can be found in NCRP No.86 (references IEEE C95.1-1991). Below are the limits.

Limits for Occupational/Controlled Exposure			
Frequency Range (MHz)	**Electric Field Strength (E) (V/m)**	**Magnetic Field Strength (H) (A/m)**	**Power Density (S) (mW/cm^2)**
0.3-3.0	614	.63	(100)*
3.0-30	1842/f	4.89/f	$(900/f^2)$*
30-300	61.4	0.163	1.0
300-1500	--	--	f/300
1500-100,000	--	--	5

Limits for General Population/Uncontrolled Exposure			
Frequency Range (MHz)	**Electric Field Strength (E) (V/m)**	**Magnetic Field Strength (H) (A/m)**	**Power Density (S) (mW/cm^2)**
0.3-3.0	614	1.63	(100)*
3.0-30	842/f	2.19/f	$(180/f^2)$*
30-300	27.5	0.073	0.2
300-1500	--	--	f/1500
1500-100,000	--	--	1.0

Power density S [mW/cm^2] for controlled area at 880 MHz

$$S = \frac{f[MHz]}{300} = \frac{880}{300} = 2.9 mW/cm^2$$

Power density S [mW/cm^2] for uncontrolled area at 880 MHz

$$S = \frac{f[MHz]}{1500} = \frac{880}{1500} = 0.58 mW/cm^2$$

D.3 Estimation of Exposure to Electromagnetic Fields

The following method describes a theoretical approach to calculate possible exposure to electromagnetic radiation around a BTS antenna.

Precise statements are basically only possible either with measurements or complex calculations considering the complexity of the environment (e.g. soil conditions, near buildings and other obstacles) which causes reflections, scattering of electromagnetic fields.

The maximum output power (given in EIRP) of a BTS is usually limited by license conditions of the network operator.

A rough estimation of the expected exposure in power flux density on a given point can be made with the following equation. The calcualtions are based on FCC OET 65 Appendix B.

$$S = \frac{P(W) * G_{numeric}}{4 * r^2(m) * \pi}$$

Whereas:

P = Maximum output power in W of the site

$G_{numeric}$ = Numeric gain of the antenna relative to isotropic antenna

R = distance between the antenna and the point of exposure in meters

D.4 Calculation of Safe Distance

Calculation of safe distane can be made on a site by site basis to ensure the power density is below the specified limitse. Or guidelines can be done beforehand to ensure the minimum distances from the antenna is maintained through the site planning.

$$r = \sqrt{\frac{1.64 * G_d * Pt}{4\pi S}}$$

Whereas:

r = distance from the antenna [m]

G_d = Antenna gain relative to half wave dipole

Pt = Power at the antenna terminals [W]

S = power density [W/m^2] see also MPE Limits

Note: 1mW/cm^2 = 10W/m^2

D.5 Location of BTS Antennae

BTS antennas, the source of the radiation, are usually mounted on freestanding towers, with a height up to 30 m or on a tower on the top of buildings or, in some cases, to the side of the building.

Generally the height of the antenna position does not fall below 10 m.

The power usually is focused into a horizontal main beam and slightly downward tilted. The remaining power goes into the weaker beams on both side of the main beam. The main beam however does not reach ground level until the distance from the antenna position is around 50~200 m.

The highest level of emission would be expected in close vicinity of the antenna and in line of sight to the antenna.

D.5.1 Exclusion Zones

Antenna location should be designed so that the public cannot access areas where the RF radiation exceeds the levels as described above. .

If there are areas accessible to workers that exceed the RF radiation exceeds the levels as described above make sure that workers know where these areas are, and that they can (and do) power-down (or shut down) the transmitters when entering these areas. Such areas may not exist; but if they do, they will be confined to areas within 10 m of the antennas.

Each exclusion zone should be defined by a physical barrier and by a easy recognizable sign warning the public or workers that inside the exclusion zone the RF radiation might exceed national limits.

D.5.2 Guidelines on Arranging Antenna Locations

Observe the following guidelines when selecting the places for BTS antennas:

- For roof-mounted antennas, elevate the transmitting antennas above the height of people who may have to be on the roof.
- For roof-mounted antennas, keep the transmitting antennas away from the areas where people are most likely to be (e.g., roof access points, telephone service points, HVAC equipment).
- For roof-mounted directional antennas, place the antennas near the periphery and point them away from the building.
- Consider the trade off between large aperture antennas (lower maximum RF) and small aperture antennas (lower visual impact).
- Take special precautions to keep higher-power antennas away from accessible areas.
- Keep antennas at a site as for apart as possible; although this may run contrary to local zoning requirements.
- Take special precautions when designing "co-location" sites, where multiple antennas owned by different companies are on the same structure. This applies particularly to sites that include high-power broadcast (FM/TV) antennas. Local zoning often favors co-location, but co-location can provide "challenging" RF safety problems.
- For roof-mounted antennas, elevate the transmitting antennas above the height of people who may have to be on the roof.
- For roof-mounted antennas, keep the transmitting antennas away from the areas where people are most likely to be (e.g., roof access points, telephone service points, HVAC equipment).
- Take special precautions for antenna sites near hospital and schools.

Appendix E Abbreviations and Acronyms

A

A	Availability
A1/A2/A5	Interface between BSC and MSC
A3/A7	Interface between BSCs
A8/A9	Interface between BSC and PCF
A10/A11	Interface between PCF and PDSN
AAA	Authorization, Authentication and Accounting
AAL2	ATM Adaptation Layer 2
AAL5	ATM Adaptation Layer 5
Abis	Interface between BSC and BTS
AC	Authentication Center
AC	Alternating Current
A/D	Analog/Digital
ADC	Analog Digit Converter
AGC	Automatic Gain Control
ANSI	American National Standards Institute
ARQ	Automatic Repeat Request
ATM	Asynchronous Transfer Mode
AUC	Authentication

B

BAM	Back Administration Module
BASB	BTS3606 Baseband Backplane
BBFL	BTS BTRM FAN Lamp Module
BBFM	BTS BTRM FAN Monitor
BCIM	BTS Control Interface Module
BCKM	BTS Control & Clock Module
BCPM	BTS Channel Process Module
BDCS	BTS Direct Current Switchbox
BEOM	BTS Electric-Optical Module
BESP	BTS E1 Surge Protector

BFAN	BTS FAN Module
BFIB	BTS3606 Fan Block Interface Board
BFMM	BTS Fan Monitor Module
BHPA	BTS High Power Amplifier Unit
BICM	BTS Intermediate Frequency Control Module
BIFM	BTS Intermediate Frequency Module
BPLI	BTS Power & Lighting protection lamp Indicator board
BPSK	Binary Phase Shift Keying
BRCM	BTS Radio Up-Down Converter Module
BRDM	BTS Resource Distribution Module
BRFM	BTS RF Fan Module
BS	Base Station
BSC	Base Station Controller
BSS	Base Station Subsystem
BTEM	BTS Test Module
BTRM	BTS Transceiver Module
BTRB	BTS3606 TRx Backplane
BTS	Base Transceiver Station
C	
CCITT	International Telephone and Telegraph Consultative Committee
CDMA	Code Division Multiple Access
CDU	Combining Duplexer Unit
CE	Channel Element
CLI	Command Line Interpreter
CLK	Clock
CM	Connection Management
CMM	Capability Mature Mode
CN	Core Network
CPU	Central Processing Unit
CRC	Cyclic Redundancy Check
CTC	Common Transmit Clock
D	
D/A	Digit/Analog

DAC	Digit Analog Converter
DC	Direct Current
DAGC	Digit Automatic Gain Control
DCE	Data Communications Equipment
DDU	Dual Duplexer Unit
DFU	Duplexer and Filter Unit

E

EMC	Electro Magnetic Compatibility
EMI	Electro Magnetic Interference
EMS	Electro Magnetic Sensitivity
EIA	Electronics Industry Association
EIB	Erasure Indicator Bit
EIR	Equipment Identity Register
ESD	Electrostatic Discharge
ETS	European Telecommunication Standards
ETSI	European Telecommunication Standards Institute

F

FA	Foreign Agent
F-APICH	Forward Assistant Pilot Channel
F-ATDPICH	Forward Transmit Diversity Assistant Pilot Channel
F-BCH	Forward Broadcast Channel
FCACH	Forward Common Assignment Channel
FCC	Federal Communications Commission
F-CCCH	Forward Common Control Channel
FCH	Fundamental Channel
F-DCCH	Forward Dedicated Control Channel
F-DD	Frequency Division Duplex
FER	Frame Error Rate
F-FCH	Forward Fundamental Channel
F-PCH	Forward Paging Channel
F-PICH	Forward Pilot Channel
F-QPCH	Forward Quick Paging Channel
F-SCCH	Forward Supplemental Code Channel
F-SCH	Forward Supplemental Channel

F-SYNCH	Forward Sync Channel
F-TCH	Forward Traffic Channel
F-TDPICH	Forward Transmit Diversity Pilot Channel
FTP	File Transfer Protocol
G	
GLONASS	Global Navigation Satellite System
GPM	General Paging Message
GPS	Global Position System
GRIL	GPS/GLONASS Receiver Interface Language
GUI	Graphics User Interface
H	
HA	Home Agent
HDLC	High level Data Link Control
HLR	Home Location Register
HPAU	High Power Amplifier Unit
HPBW	Half Power Beam Width
HPCM	BTS High Precision Clock Module
HPSK	Hybrid Phase Shift Keying
I	
ICP	IMA Control Protocol
ID	IDentification
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
IF	Intermediate Frequency
IMA	Inverse Multiplexing for ATM
IP	Internet Protocol
IPOA	IP over ATM
ISDN	Integrated Services Digital Network
ITC	Independent Transmit Clock
ITU	International Telecommunications Union
ITU-R	International Telecommunications Union-Radiocommunication Sector
ITU-T	International Telecommunications Union-Telecommunication Standardization Sector

IWF	Interworking Function
J	
JTAG	Joint Test Action Group
L	
LAC	Link Access Control
LED	Light Emitting Diode
LMF	Local Maintenance Function
LNA	Low-Noise Amplifier
LPF	Low-Pass Filter
M	
MAC	Medium Access Control
MC	Message Center
MCPA	Multi-Carrier Power Amplifier
MCU	Main Control Unit
Mcps	Million chips per second
MM	Mobility Management
MMI	Man Machine Interface
MOC	Mobile Originated Call
Modem	Modulator-Demodulator
MPU	Micro Process Unit
MS	Mobile Station
MSC	Mobile Switching Center
MT	Mobile Terminal
MTC	Mobile Terminated Call
MT1	Mobile Terminal 1
MTBF	Mean Time Between Failures
MTRB	Micro-bts Transceiver Board
MTTR	Mean Time To Repair
O	
OAM	Operation & Maintenance
OEM	Original Equipment Manufacturer
OMC	Operation & Maintenance Center
OML	Operation & Maintenance Link

OMU	Operation & Maintenance Unit
OCXO	Oven voltage Control Oscillator
OQPSK	Offset Quadrature Phase Shift Keying
OTD	Orthogonal Transmit Diversity
P	
PCB	Printed Circuit Board
PCF	Packet Control Function
PCH	Paging Channel
PDSN	Packet Data Service Node
PGND	Protection Ground
PIB	Power Inspecting Board
PLL	Phase-Locked Loop
PLMN	Public Land Mobile Network
PMRM	Power Measurement Report Message
PN	Pseudo Noise
PP2S	Pulse Per 2 Seconds
PPP	Peer-Peer Protocol
PRM	Paging Response
PSPDN	Packet Switched Public Data Network
PSTN	Public Switched Telephone Network
PSU	Power Supply Unit
PVC	Permanent Virtual Channel
PVP	Permanent Virtual Path
PWM	Pulse-Width Modulation
Q	
QIB	Quality Identification Bit
QoS	Quality of Service
QPCH	Quick Paging Channel
QPSK	Quadrature Phase Shift Keying
R	
R-ACH	Reverse Access Channel
RC	Radio Configuration
R-CCCH	Reverse Common Control Channel

R-DCCH	Reverse Dedicated Control Channel
R-EACH	Reverse Enhanced Access Channel
RF	Radio Frequency
R-FCH	Reverse Fundamental Channel
RLDU	Receive LNA Distribution Unit
RLP	Radio Link Protocol
RM	Radio Management
RNC	Radio Network Controller
R-PC	Reverse Power Control subchannel
R-PICH	Reverse Pilot Channel
R-SCCH	Reverse Supplemental Code Channel
R-SCH	Reverse Supplemental Channel
RSQI	Receive Signal Quality Indicator
R-TCH	Reverse Traffic Channel
S	
SCH	Supplemental Channel
SDH	Synchronous Digital Hierarchy
SID	System Identification
SME	Signaling Message Encryption
SDU	Selection/Distribution Unit
SPU	Signaling Process Unit
SRBP	Signaling Radio Burst Protocol
SSSAR	Special Service Segmentation and Reassemble
STM-1	Synchronization Transfer Mode 1
STS	Space Time Spreading
T	
TA	Timing Advance
TA	Terminal Adapter
TAm	Mobile Terminal Adapter
TCP	Transport Control Protocol
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TE	Terminal Equipment 1
TIA	Telecommunications Industry Association

TMA	Tower Mounted Amplifier
TMSI	Temp Mobile Subscriber Identifier
TRX	Transceiver
U	
Um	Interface between BTS and MS
UNI	User Network Interface
UTC	Universal Coordinated Time
UART	Universal Asynchronous Receiver/Transmitter
V	
VCI	Virtual Channel Identifier
VLR	Visitor Location Register
VPI	Virtual Path Identifier
VSWR	Voltage Standing Wave Radio