

Document Name:

MBSC0700-040-RU

Revision:

001.01A

Effective Date:

4/15/2013



USER MANUAL

Fiber Optic DAS Platform

MBSC0700-040-RU

**High-Power In-Building
Coverage Solution**



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Document History

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Revision History

Revision Number	Revision Date	Summary of Changes
001.00A	2/28/2013	Initial Release for NA
001.01A	4/15/2013	Updated for new EMS

GENERAL SAFETY PRECAUTIONS

Warning: Wet conditions increase the potential for receiving an electrical shock when installing or using electrically-powered equipment. To prevent electrical shock, never install or use electrical equipment in a wet location or during a lightning storm.

Improper installation and operation of this equipment outside of the recommended installation procedures, and operation beyond the designed operating specifications, and/or not in compliance with regulatory requirements, will revoke any warranty and may:

- Prevent the equipment from performing properly
- Violate regulatory RF emissions requirements
- Require removal of the equipment from service.

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1 Introduction

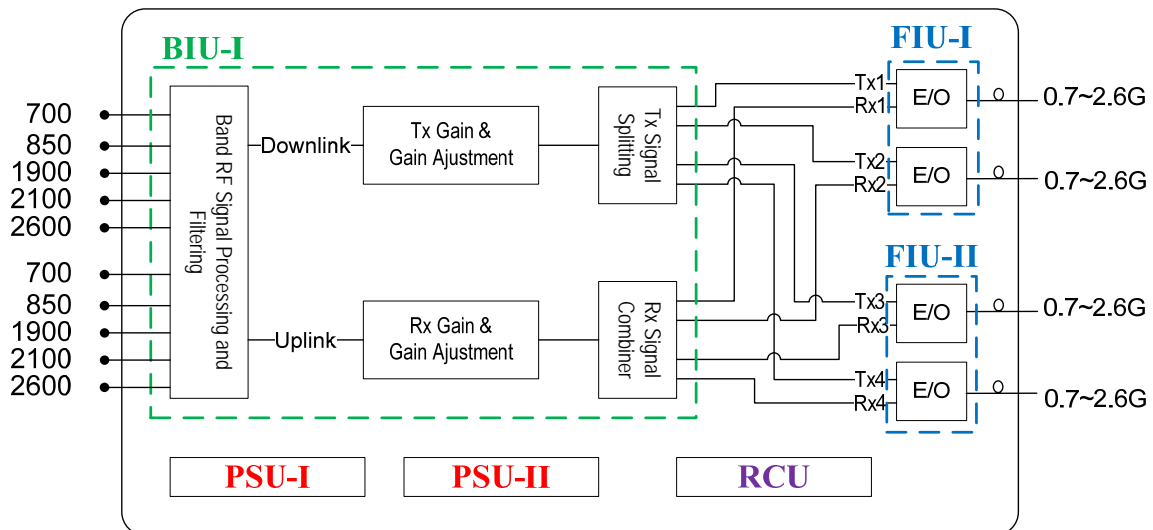
The MBSC0700-040-RU Fiber Optic Coverage System is used to extend wireless coverage to specific areas in building(s), or throughout a complex zone. The mBSC product family offers a flexible, scalable, modular platform to improve signal quality and enhance the services to meet the increasing demands.

The MBSC0700-040-RU system components include a Host Unit (HU) and a Remote Node. Each Host Unit can feed up to eight multi-band Remote Nodes, each utilizing a single fiber. A Remote Node can accommodate between one and five single-band bi-directional amplifiers (Remote Units) – install only the bands required at the time of deployment. As requirements change, additional single-band units can be easily installed in the field. This modular architecture provides optimum implementation flexibility, reduces initial cost, and defers further investment until required.

1.1 System Solution Block Diagram

The MBSC0700-040-RU platform allows flexible system deployment to support mixed mode 700~2700MHz services in SISO and/or MIMO configurations.

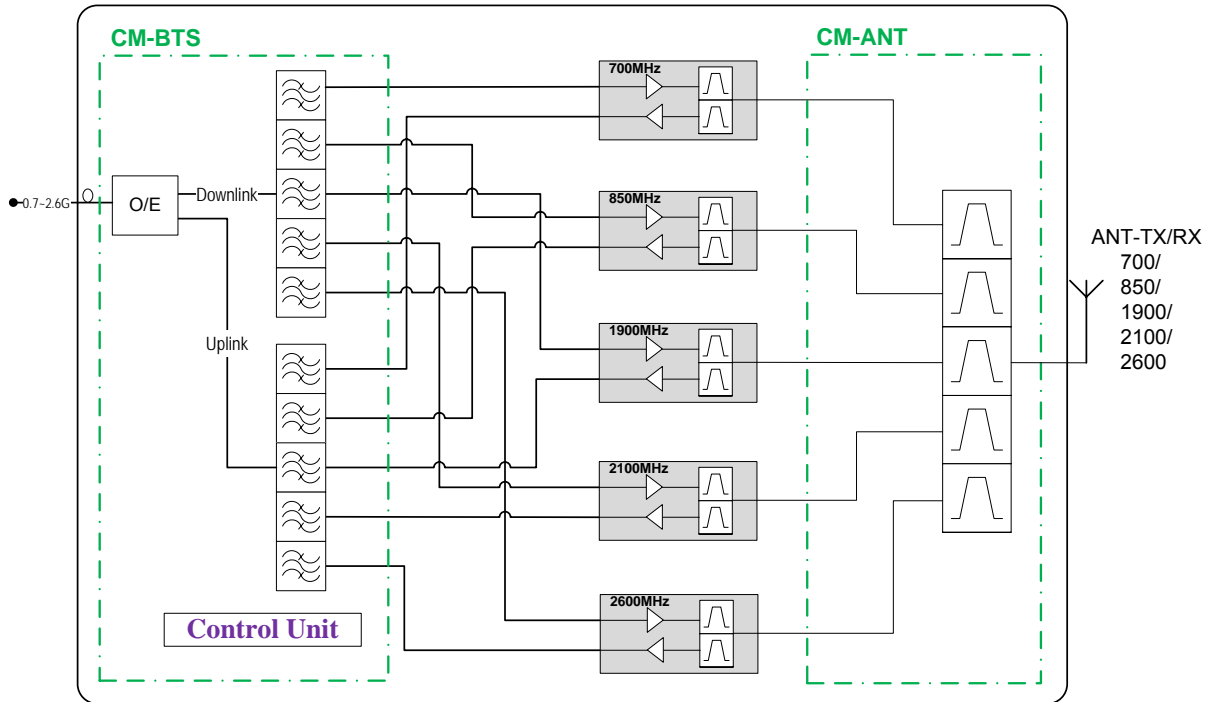
1.1.1 Host Unit



HOST UNIT (4:1 Simulcast)

Figure 1 Block Diagram of Host Unit

1.1.2 Remote Node



REMOTE NODE (5 Bands deployed)

Figure 2 Block Diagram of Remote Node

2 Safety

 **Caution**

All the following "Safety Precautions" must be observed during the entire installation and operation of the mBSC system.

1. The mBSC system is designed for maximum safety and reliability when installed, used, and maintained by trained and qualified technicians in accordance with the procedures and instructions contained in this manual. To assure the safe operation of your system, always follow the safety and operational recommendations in this manual.
2. Read and understand all instructions and warnings before handling the mBSC system.
3. **Warning:** Do not install or operate mBSC system in the presence of flammable gases or fumes.
4. **Warning:** mBSC system produces high level of RF radiation.
5. Do not operate exposed circuitry or radiating elements with personnel in close proximity to radiating source.
6. Persons with cardiac pacemakers should avoid exposure to RF radiating elements.
7. Exposing the human eye to high levels of radio-frequency radiation may result in the formation of cataracts.
8. **Warning:** To avoid injuries or damage, use care and obtain assistance before lifting the mBSC unit.
9. **Warning:** mBSC system should be installed only in restricted access areas (dedicated equipment room, equipment closet, or similarity designated areas) where access is controlled or where access can only be gained by service personnel with a key or tool. Access to this equipment is restricted to qualified service personnel only.

3 System Overview and Unit Description

3.1 System Overview

The MBSC0700-040-RU system is a multi-operator, multi-band and multi-technology coverage system that provides in-building / venue coverage for up to five operating bands. Large buildings typically interfere with the transmission or reception of cellular phone system signals by imposing high attenuation losses on the RF signal. The mBSC system is designed to overcome these losses which otherwise make cellular communications within buildings or structures difficult or impossible. With the mBSC system, cellular phone RF signals can be distributed to the interior areas of any building or structure to eliminate dead spots and improve reception.

The MBSC0700-040-RU coverage solution interconnects to, and extends, the wireless service provider base station equipment(BTS) and service antennas. A functional overview is illustrated below.

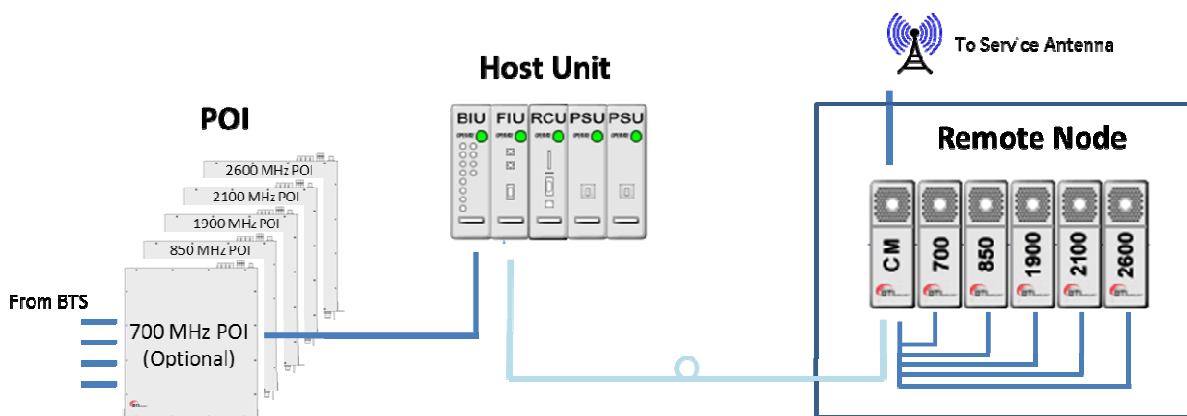


Figure 3mBSC System Functional Overview

The mBSC system provides downlink signal amplification and uplink sensitivity improvement for multi-band RF signals, which may be comprised of multiple carriers and multiple standards.

The Host Unit provides the input interface for RF signals from a base transceiver station (BTS). The Host Unit converts the RF signals into a digital format and distributes the digitized signal over fiber to multiple output ports. An optional Multi-operator Point-of-Interface (POI) combines multiband BTS inputs from several operators into a single TXin / RXout interface to the Host Unit. Refer to “SP-MBSC-C-POI” for additional details.

The Remote Node receives the optical signals from the Host Unit, converts the signals back into RF and interfaces with the service antennas to amplify the RF signals throughout the building. The Remote Node is typically wall-mounted within an equipment room.

3.1.1 Interface with BTS

The Host Unit is typically installed close to the wireless service provider BTS equipment. In the downlink path the Host Unit combines RF signals from up to 5bands and feeds the combined signal to a fiber-optic

transceiver for transmission to the interconnected Remote Node(s). In the uplink path the Host Unit converts a composite multi-band optical signal into independent RF signals for interconnection with the BTS receive elements.

3.1.2 Interface with Cellular Phones

The mBSC Remote Node interfaces with the cellular phones through the service antennas. In the reverse path, the Remote Node receives RF signals from cellular phones. In the forward path, the Remote Unit transmits the RF signals to the cellular phones. A bi-directional antenna is connected to the mBSC Remote Node to transmit and receive RF signals from the cellular phones.

3.1.3 Fiber Optic Transport

The Host Unit is connected to each Remote Node over a single optical fiber. The optical fibers must be terminated with E2000/APC connectors for connection with the Host Unit and the Remote Node. For MIMO operation a duplicate set of BTS interface, fiber transmission, and remote node equipment is required, along with an additional optical fiber.

3.1.4 Powering

The Host Unit is powered by -48V DC which is supplied by either the equipment room power distribution cabinet or an AC/DC converter. The Remote Node is powered by 110/220VAC, 50/60Hz power which is supplied through a power supply distribution junction box.

3.1.5 Cooling

The Host Unit is cooled through cross-convection without fans.

The Remote Node contains multiple single-band Remote Units, which are cooled through continuous air flow fans mounted on the top of each single-band unit. A minimum of 200mm (7.87 inches) of clearance space must be provided on both the top and the bottom sides of the Remote Node for air flow.

An alarm is provided that indicates if a high temperature condition occurs.

3.1.6 Fault Detection and Alarm Reporting

LED indicators are provided on the front panel of the Host Unit to indicate if the mBSC system is operating as expected (normal) or if a fault is detected. In addition, normally open and closed alarm contacts (for both major and minor alarms) are provided at the Host Unit for connection to a customer provided external alarm system.

The mBSC system also includes a standalone (optional) Element Management System server, which interconnects with each Host Unit in a multi-system deployment, and is used for system configuration, status monitoring, and SNMP alarm reporting / management.

3.2 Host Unit Description

As shown in Figure 4, the Host Unit is a standard 19"4U rack-mounted shelf, which serves as the BTS servicing unit for the mBSC system. The Host Unit provides the following basic functions:

- RF interface with BTS (Simplex TXin, RXout)
- Optical interface to Remote Nodes
- Conversion of the forward path(downlink) RF signals into up to four simulcast optical signals
- Conversion of up to four reserve(uplink) optical signals to RF signals
- Manages and monitors the system alarms and configurations
- Provides alarm information to a local alarm or remote system

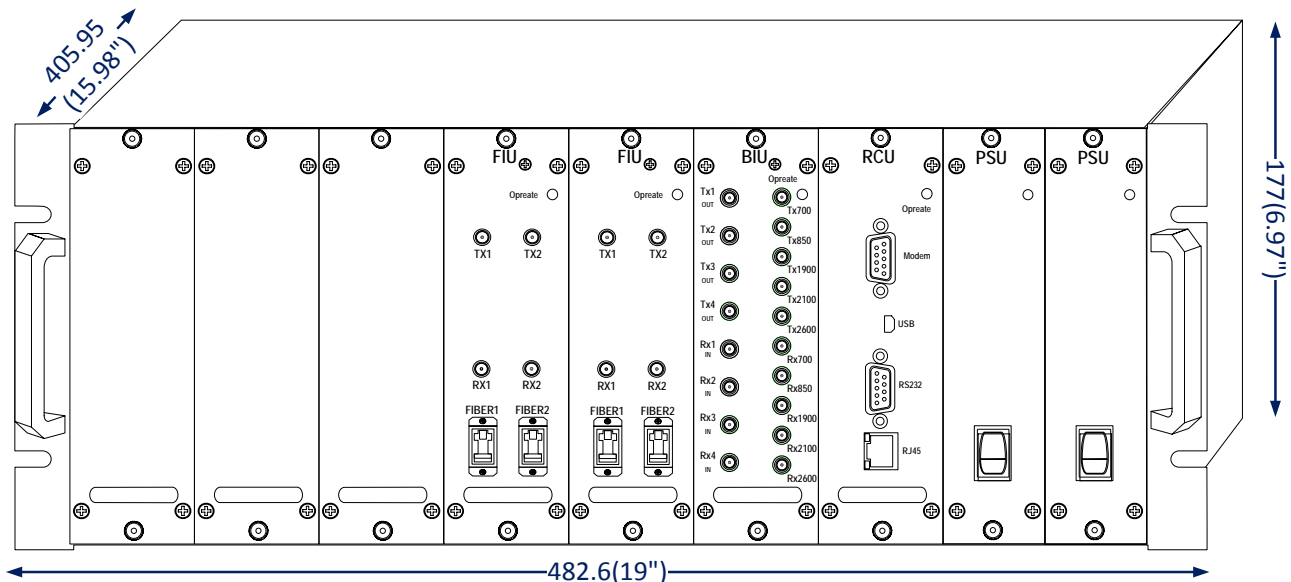


Figure 4 Host Unit

3.2.1 Host Unit Components

The Host Unit is a multi-slot chassis, consisting of 9 slots numbered from left to right: 1 through 9. Slots 7 through 9 are dedicated and specifically keyed for the Remote Control Unit (RCU) and two redundant Power Supply Units (PSUs). The Host Unit also houses the Base Station Interface Units (BIU) and Fiber Interface Units (FIU). The Host Unit allows any combination of BIU and FIU modules, up to six in total.

3.2.1.1 BIU (BTS Interface Unit)

The BIU is a frequency agnostic RF interface card that provides simplex TX input and RX output connections to the BTS equipment. The BIU combines up to 5 bands of RF downlink signal into a composite signal, which is then split across four TX out connectors for interconnection to up to four fiber modules (simulcast). In the uplink path the BIU combines up to four separate multi-band uplink signals for distribution

to the BTS receivers. Internal splitters, combiners, and software controlled attenuators enable customized designs to support various RF inputs scenarios.

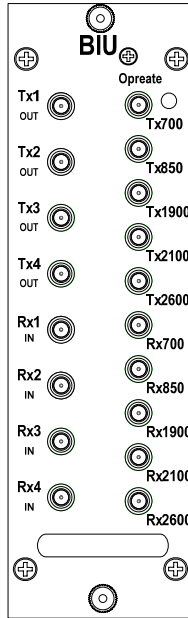


Figure 5BIU

3.2.1.2 FIU (Fiber Interface Unit)

The FIU provides the interface between the combined RF signals (BIU) and the optical fiber connections. Each FIU is equipped for 2 independent bi-directional fiber connections.

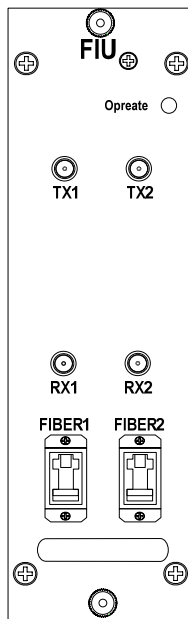


Figure 6FIU

3.2.1.3 PSU (Power Supply Unit)

The Host Unit is powered by -48V DC. The PSU takes the -48 VDC input source power and provides voltage conversion and distribution for the line cards installed within the host unit shelf. The host unit is equipped with 2 independent PSU's in parallel redundancy. Each PSU is hot swappable (one unit at a time only).

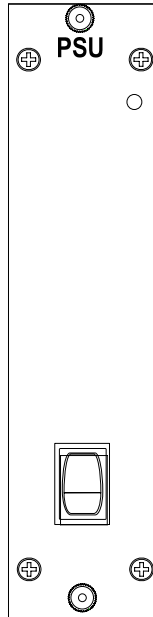


Figure 7 PSU

3.2.1.4 RCU (Remote Control Unit)

The RCU provides the control and interface for a local Operations and Maintenance Console (OMC) GUI, and a remote Element Management System (EMS) server through Ethernet or modem connection (optional).

The RCU is a hot swappable card and will not affect operation of the RF path if removed.

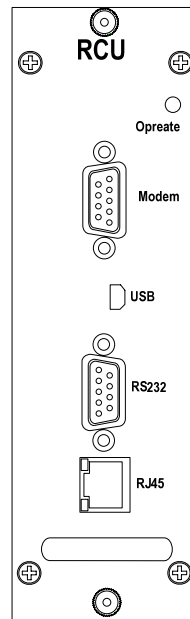


Figure 8RCU

3.2.2 Mounting

The Host Unit is intended for use in indoor, rack-mounted applications. For rack mounting, a pair of mounting brackets is provided that allows the Host Unit to be mounted in a 19" equipment rack. When rack-mounted, the front panel of the Host Unit is flush with the front of the rack.

3.2.3 Fault Detection and Alarm Reporting

The Host Unit detects internal circuitry faults and optical port faults. Various front panel LED indicators turn from green to red if a fault is detected or an optical input is lost. A set of dry-contact alarm points (normally open and normally closed) are also provided for interfacing with an external alarm system.

3.2.4 RF Signal Connections

RF signal connections with the BTS are supported through two QMA female connectors per RF Band (5 bands supported). One QMA connector per band is used for coaxial cable connection of the combined downlink path (TXin) RF signal. The other QMA connector is used for coaxial cable connection of the combined uplink path (RXout) RF signal.

Notes: The input RF signal level range to Host Unit is -10dBm - +10dBm, normally it is between -5~0dBm.

3.2.5 Optical Connections

The Host Unit optical connections to the Remote Unit are supported on the Fiber Interface Unit (FIU). Each FIU supports two independent optical paths, each consisting of a status LED, two QMA RF connectors, and an E2000/APC optical transceiver using single-mode fiber. Up to five bands of non-overlapping RF signal can be transported across a single fiber. A second fiber connection is required for MIMO transmission.

3.2.6 Powering

The Host Unit is powered by -48V DC through a DC power terminal block on the rear. An ON/OFF switch is provided at the PSU front panel. The switch applies power to the Host Unit internal power supply, which distributes the operating voltages to lines cards installed in the Host Unit shelf.

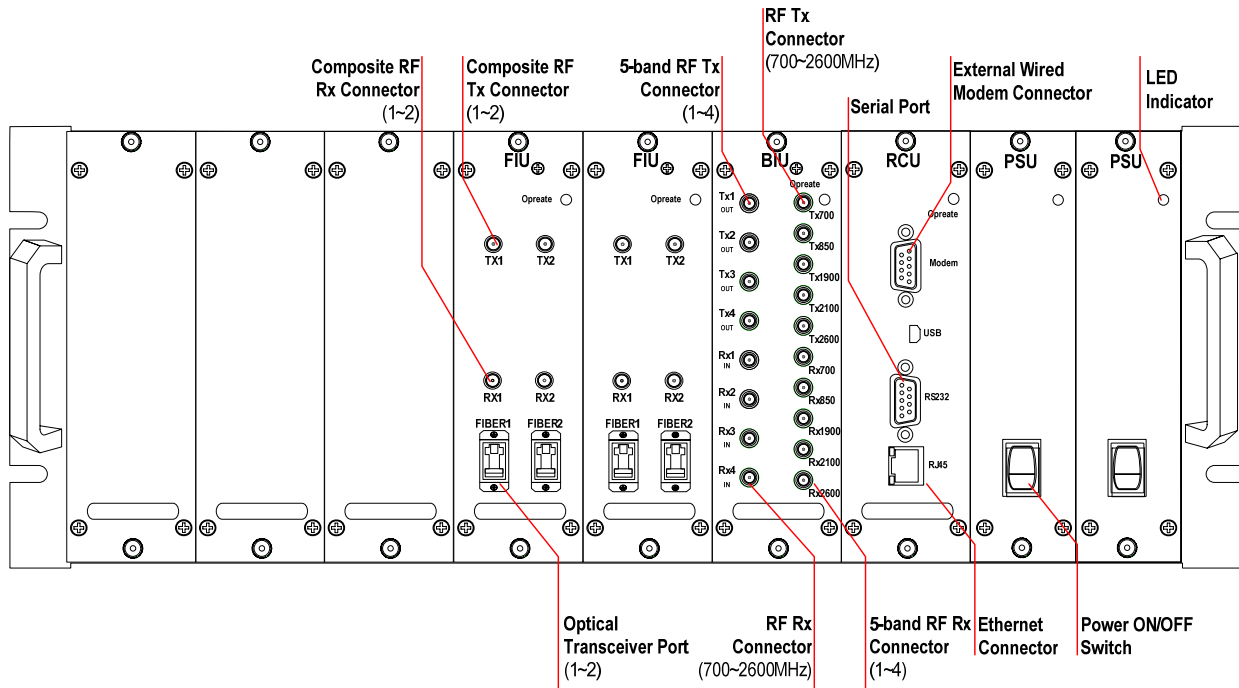
3.2.7 Host Unit Interface

The Host Unit interface consists of the various connectors, switches, terminals and LED indicators that are provided on the front and rear panel. The Host Unit user interfaces are described in Table 1 and indicated in Figure 9.

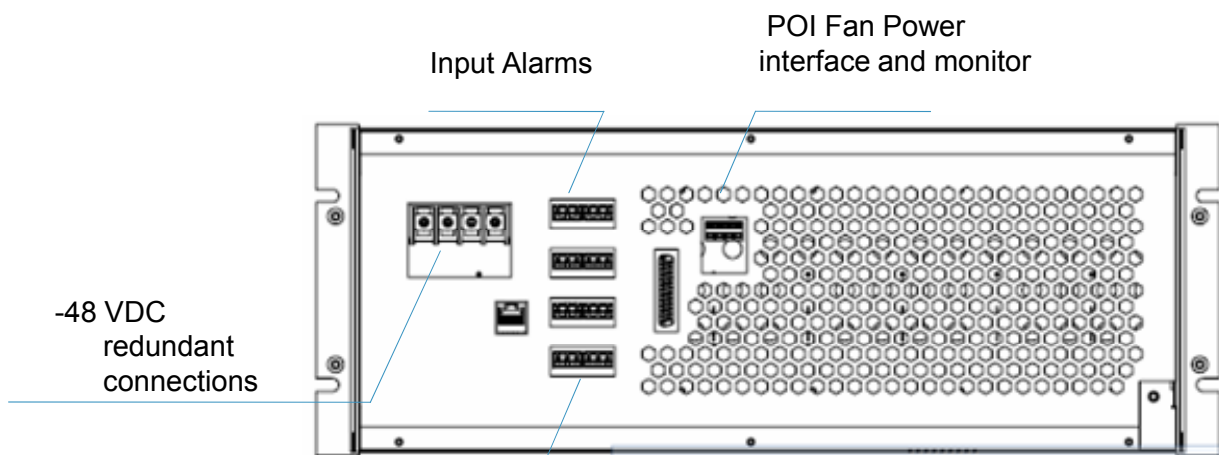
Table 1 Host Unit User Interface

#	User Interface Designation	Device	Functional Description
PSU			
1	ON/OFF	Power switch	Enable/disable Host Unit internal power supply
2	Power	LED(Green/Off)	Indicates if the PSU is powered on or off.
Note: The power input port is provided according to the power in type.			
RCU			
1	Modem (optional)	DB9(male)	Used for external wired modem connection
2	RS232 (optional)	DB9(female)	Local connection from PC/Laptop through serial cable
3	RJ45	RJ45 jack (female)	Ethernet connection interface for NMS
4	USB	Mini USB (female)	Used for USB connection for local GUI
5	Operate	LED(Green/Red)	Indicates if the RCU is normal or faulty
BIU			
1	Tx (700~2600)	QMA female connector	Band-specific Downlink input from BTS (one QMA per band, up to 5 bands)
2	Rx (700~2600)	QMA female connector	Band-specific Uplink output to BTS (one QMA per band, up to 5 bands)
3	Tx1~Tx4	QMA female connector	Combined multi-band Downlink signal output to up to four independent fiber paths (on FIUs)
4	Rx1~Rx4	QMA female connector	Combines multi-band Uplink signal inputs from up to four independent fiber paths (on FIUs)
5	Operate	LED(Green/Red)	Indicates if the BIU is normal or faulty
FIU			
1	Tx (1~2)	QMA female connector	Composite Downlink RF input from BIU
2	Rx (1~2)	QMA female connector	Composite Uplink RF output to BIU
3	Fiber (1~2)	E2000/APC WDM optical transceiver	Fiber connection to Remote Node (2 per FIU)
4	Operate	LED(Green/Red)	Indicates if the FIU is normal or faulty
Enclosure Rear Panel			
1	Alarm In	Screw-type terminal block	Alarm contacts - inputs from an external alarm system
2	Alarm Out	Screw-type terminal block	Alarm contacts – outputs to an external alarm system
3	DEBUG	DB19 male connector	Local serial connection for debug by BTI staff only

#	User Interface Designation	Device	Functional Description
4	Power Input	Screw-type terminal block	-48VDC power input
5	POI FAN (optional)	Screw type terminal	+12VDC for external power connection
6	NETWORK	RJ45 jack (female)	Optional Ethernet connection



Front Panel



Rear Panel

Figure 9 Host Unit User Interface

Table 2 Host Unit Indicator Description

#	Indicator	Status	Description
1	RUN	Green(Flashing)	Normal system operation
		Red(Flashing)	System fault detected

3.3 Remote Node Description

The Remote Node serves as the remote interface unit for the fiber optic mBSC system. It is comprised of a mounting bracket and enclosure for up to five single-band Remote Units (RUs) and a Fiber/Antenna combiner unit. The Remote Node provides the following basic functions:

- RF interface to the mobile end-systems via an external service antenna
- Optical interface to the Host Unit FIU
- Conversion of the forward path(downlink) optical signal to original RF signal
- Conversion of the reverse path(uplink) RF signal to an optical signal
- Transports alarm status over the optical fiber
- Supplies in-band messaging between the Host Unit and the Remote Node for Remote Node alarms and configuration

3.3.1 CM-BTS/ANT Enclosure

The CM-BTS/ANT module provides two key functions:

1. Electrical-optical/optical-electrical signal conversion and separates the combined multi-band RF signals into simplex connections for delivery to the respective single-band RU Enclosures
2. Combines the RF signals from each single-band RU Enclosure for duplex interconnection with the service antenna

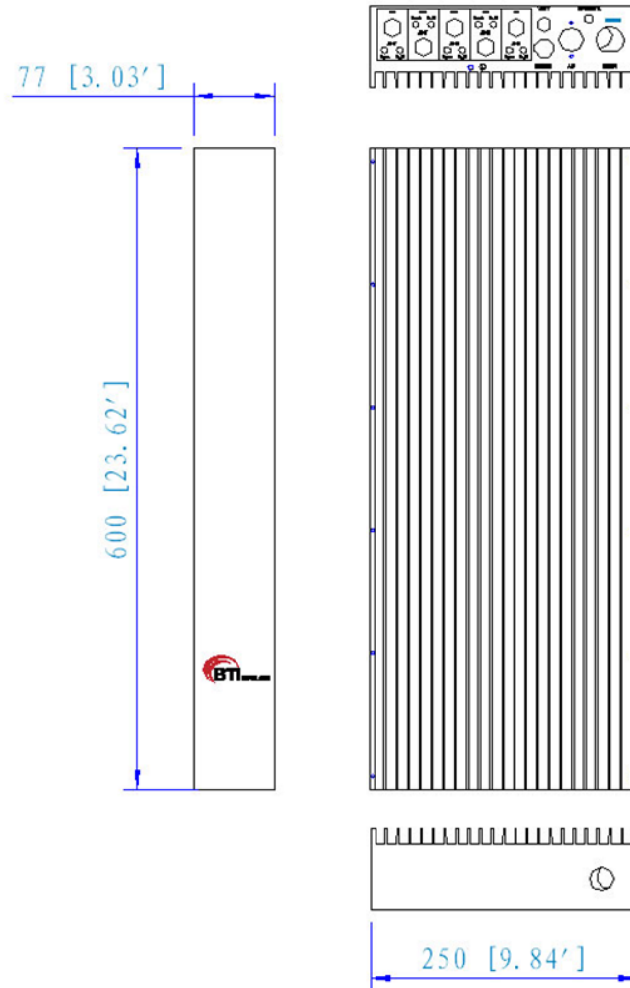


Figure 10 Fiber CM-BTS/ANT Enclosure Outline

3.3.1.1 Primary Components

The fiber CM-BTS enclosure interior layout, shown in Figure 11, is equipped to interface up to five bands (700MHz, 850MHz, 1900MHz, 2100MHz and 2600MHz). The enclosure includes weatherproof housing, mounting brackets, and internal multiplexer, duplexer, RF-optic transceiver, control unit and power supply unit elements.

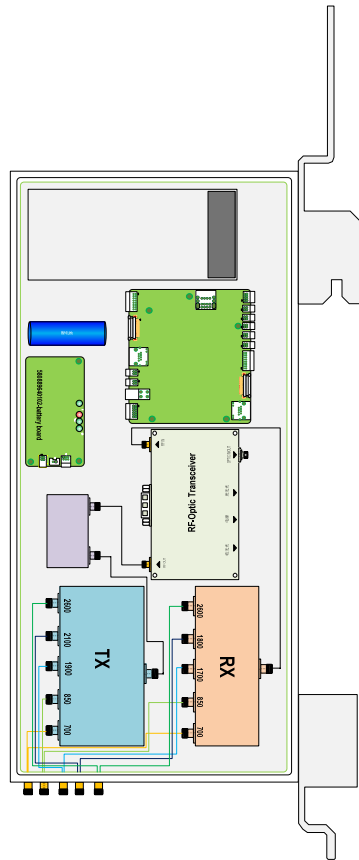


Figure 11 Fiber CM-BTS/ANT Interior Layout

3.3.1.1.1 Power Supply Module

Power Supply Module provides stable power to fiber CM-BTS unit. Power Supply Module is supplied with 110/220V AC.

3.3.1.1.2 Multiplexer & Duplexer

The multiplexer separates the various band frequencies respectively. The duplexer is used to make the bi-directional signals into simplex signals and provides sufficient isolation.

3.3.1.1.3 RF-Optic Transceiver

The RF-Optic Transceiver is an optical module providing conversion between RF signals and optical signals over a single fiber. The optical module converts the downlink optical signal from the FIU module in the host unit, and it also converts the uplink RF signal to an optical signal and simultaneously sends it back to FIU module in the host unit for distribution to the BIU modules. A laser and received optical power monitor and alarm are provided.

Table 3 RF-Optic Transceiver Interface

#	Port	Device	Description
1	RF OUT	SMA female coaxial connector	RF output
2	RF IN	SMA female coaxial connector	RF input
3	OPTIC IN/OUT	E2000/APC	Fiber interface (HU & RN)
4	---	DB9 female	Power supply & monitoring

Table 4 DB9 PINOUTS

#	PIN	Definition	Description
1	PIN1	NC	
2	PIN2	GND	
3	PIN3	VCC	+12V DC
4	PIN4	TXD1/B1	Channel1: RS485-B1
5	PIN5	RXD1/A1	Channel1: RS485-A1
6	PIN6	RXD0/A0	Channel0: RS485-A0
7	PIN7	LD ALM	Laser Device error
8	PIN8	TXD0/B0	Channel0: RS485-B0
9	PIN9	PD ALM	Photo-detector error

Table 5 RF-Optic Transceiver Indicators

#	Indicator	Status	Description
1	POWER	Green	Normal
		Off	No power supply
2	PD ALARM	Off	Photo-detector works
		Red	Photo-detector error
3	LD ALARM	Off	Laser Device works
		Red	Laser Device error

Notes: If the fiber is not connected properly, both of the HU and RN's PD ALARM indicator will alarm (red LED). Otherwise the indicator is off.

3.3.1.2 Mounting

The fiber CM-BTS/ANT enclosure is hanging-mounted on the mounting bracket.

3.3.1.3 RF Connection

Optical Module: The RF signal connections with the optical fiber module are supported through 5 groups of SMA female connectors. These five connector groups are used for coaxial cable inter-connection of the simplex Tx and Rx RF signals to the single-band RU enclosures.

Antenna Combiner: The RF signal connections with the antenna combiner are supported through 5 N-type female connectors. These five N-type connectors are used for coaxial cable connection to the Antenna ports of the single-band RU enclosures. A single 7/16 DIN connector is used to interface the combined multi-band

RF signal to the service antenna.

3.3.1.4 Optical Port

The fiber CM-BTS enclosure uses anE2000/APC type optical transceiver for inter-connecting the optical fiber. The transceiver supports single-mode (yellow) fiber.


3.3.1.5 Powering

The fiber CM-BTS/ANT enclosure is equipped with a 4-wire AC power connector that provides a connection point for the AC power cable distributed from the power distribution junction box. The CM-BTS/ANT module is powered by 110/220V AC.

3.3.1.6 User Interface

The fiber CM-BTS/ANT enclosure interface consists of the various connectors, terminals and LED indicators that are provided on the chassis panel. The fiber CM-BTS enclosure user interface is described in Table 6 and indicated in Figure 12.

Table 6 Fiber CM-BTS/ANT Enclosure User Interface

#	User Interface Designation	Device	Functional Description
Model FCM-CN-C			
1	Fiber	E2000/APC optical connector	Used for fiber connecting to host unit
2	Operation	LED (Green/Red/Off)	Indicates if Fiber/RF link is normal or faulty.
3	TX(700~2600)	SMA female RF coaxial connector	RF inter-connection to TX_IN of single-band unit
4	RX(700~2600)	SMA female RF coaxial connector	RF inter-connection to RX_OUT of single-band unit
5	ANT	N female RF coaxial connector	RF duplex Tx/Rx connection to antenna
6	700~2600 TxRx	N female RF coaxial connector	RF duplex Tx/Rx inter-connection from ANT of single-band RU
7	DEBUG	8-PIN circular plug	Used for local serial RS232 connection
8	AC	4-wire circular push-plug power connector	Used for connecting AC 110/220V power input.
9		Grounding stud	Used for connecting a grounding cable to the enclosure

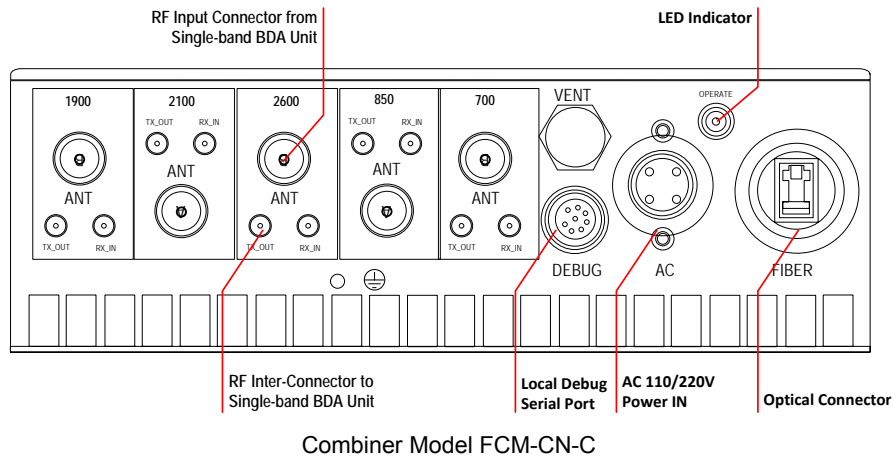


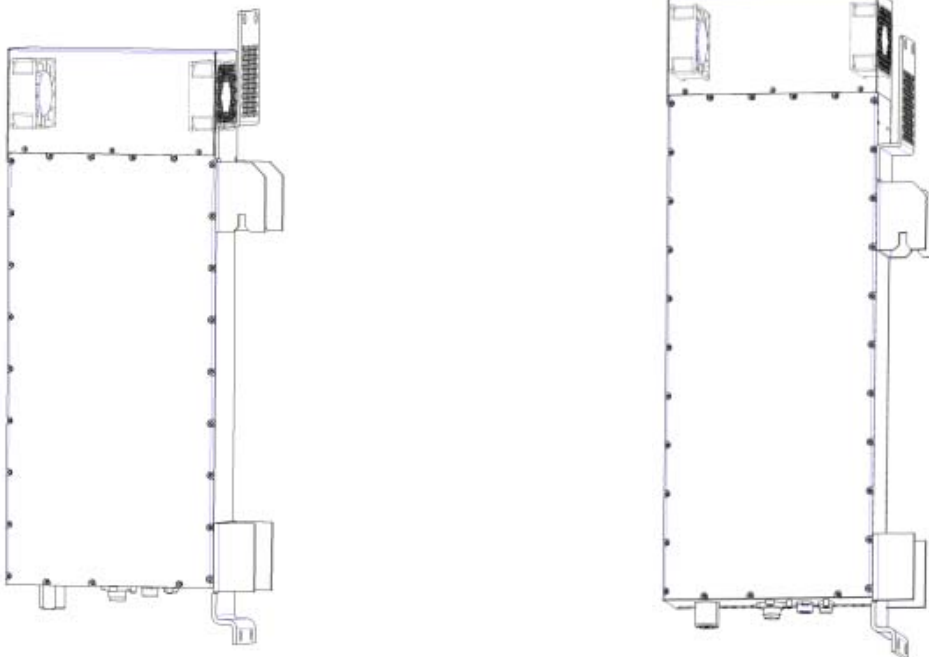
Figure 12 Fiber CM-BTS/ANT Enclosure User Interface

3.3.2 Single-band RU Enclosure

The Single-band Remote Unit (RU) enclosure provides forward and reverse amplification of the RF signals within the specified band. Its enclosure accommodates the remote single-band modules and protects them from the environment. The enclosure consists of the housing, mounting brackets, and enclosed MCPA (Multi-Carrier Power Amplifier), power supply, controller unit, duplexer modules. Figure 13 shows the single-band enclosure dimensions.

700MHz, 850MHz, 1900MHz and 2600MHz

2100MHz



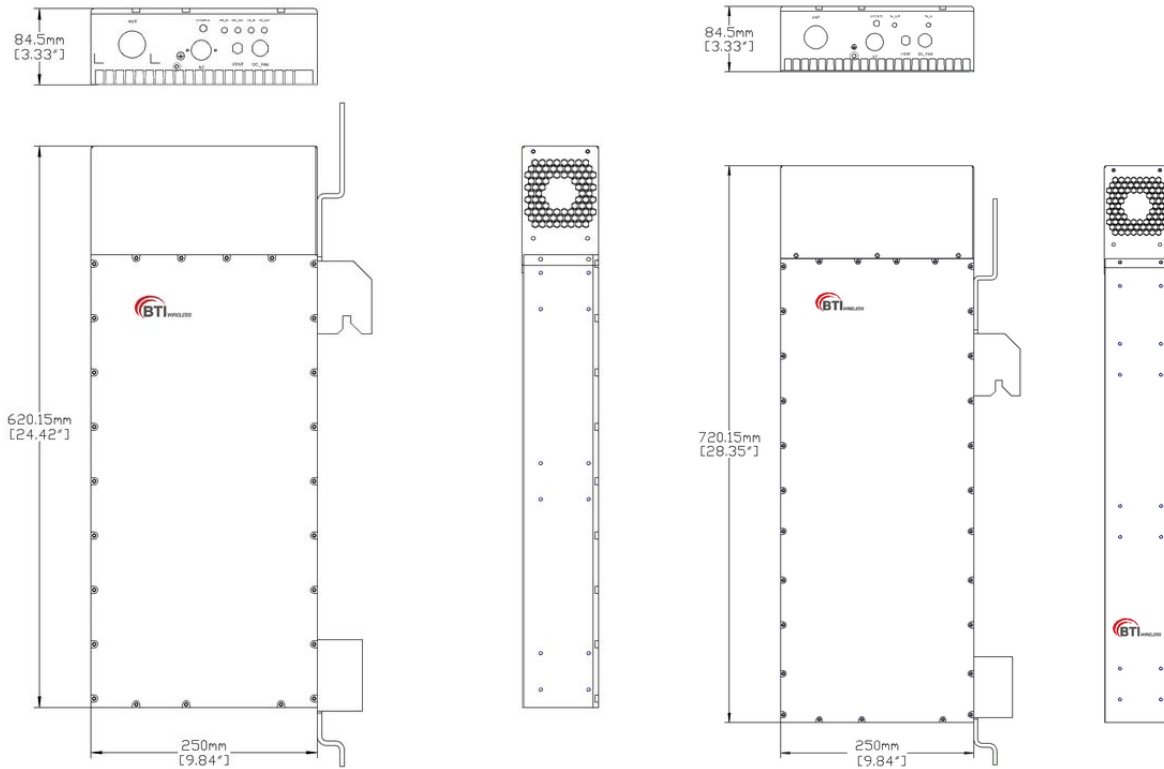


Figure 13 Single-band RU Enclosure

3.3.2.1 Primary Components

3.3.2.1.1 Multi-Carrier Power Amplifier (MCPA) Modules

The MCPA Module is the heart of the mBSC RU Enclosure. The MCPA Module boosts the BTS forward link transmission signal. Operating on 28VDC input, the MCPA Module produces 10W or 20 W composite RF power for each band (measured at output of the antenna combiner).

The mBSC system provides linear amplification of multi-carrier, mixed-mode signals in the 700MHz, 850MHz, 1900MHz, 2100MHz and 2600MHz frequency bands with the respective RU's.

3.3.2.1.2 LNA (Low Noise Amplifier)

The LNA amplifies the reverse link signal with a low-noise amplifier and then sends it to the input duplexer assembly.

3.3.2.1.3 MCU (Micro Controller Unit)

The MCU provides communications with power amplifier module and CM-BTS. The MCU also monitors and adjusts the rotational speed of the cooling fans to maintain nominal system operating temperature.

3.3.2.2 Mounting

The single-band RU enclosure is hanging-mounted on the mounting bracket.

3.3.2.3 RF Connection

The RF signal connections with the single-band enclosure are supported through two SMA female coaxial connectors and one 7/16" DIN female connector. The two SMA female connectors are used for coaxial cable connection (RF jumper) of the Tx and Rx RF signals between the CM-BTS/ANT enclosure and the single-band RU enclosure. The 7/16" DIN female connector is used for coaxial cable connection of the amplified duplex Tx/Rx RF signal to the CM-BTS/ANT enclosure.

3.3.2.4 Cooling

The single-band RU enclosure is cooled by continuous air flow fans mounted on the top of the casing. A minimum of 200mm (7.87 inches) of clearance space must be provided on both the top and the bottom sides of the Remote Node for air convection.

An alarm is provided that indicates if a high temperature condition occurs.

3.3.2.5 Powering

The single-band RU enclosure is equipped with a 4-wire AC power connector that provides a connection point for the AC power cable distributed from the power distribution junction box. The single-band RU enclosure is powered by 110/220V AC.

3.3.2.6 User Interface

The single-band RU enclosure user interface includes the various connectors that are provided on the exterior enclosure. The user interface is described in Table 7, and indicated in Figure 14.

Table 7 Single-band BDA Enclosure User Interface

#	User Interface Designation	Device	Functional Description
1	AC	4-wire power cord with circular push-plug connector	Used for connecting AC110/220VAC power input.
2	ANT	N type female RF coaxial connector	RF (Tx/Rx) inter-connection to CM-ANT/BTS enclosure
3	Tx-IN	SMA female coaxial connector	RF inter-connection to CM-BTS/ANT Tx In
4	Rx-OUT	SMA female coaxial connector	RF inter-connection to CM-BTS RxOut
5	FAN	8-pin circular push-plug connector	DC power to fans
6	RUN	LED (Green/Red/Off)	Indicates if unit operation is normal or faulty.

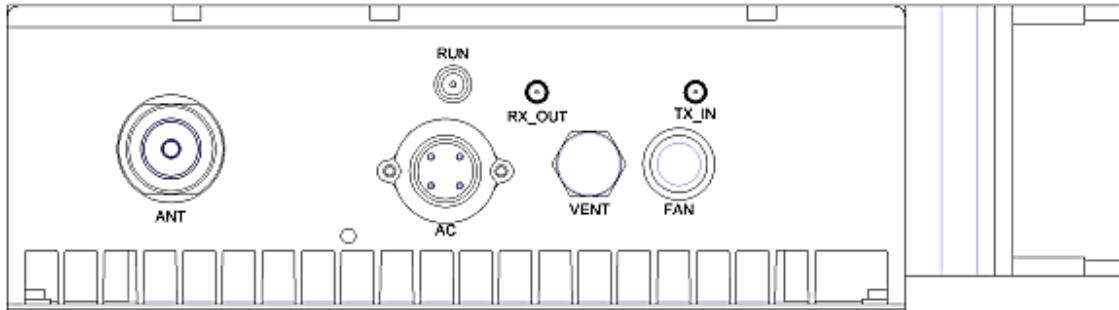


Figure 14 Single-band RU Enclosure User Interface

Table 8 Indicator Description

#	Indicator	Status	Description
1	RUN	Green(Flashing)	System operating normally
		Red(Flashing)	System alarm

3.3.3 Power Supply Junction Box

The power supply junction box provides power connection and distribution to each enclosure. The Junction Box provides a single 3-wire AC power cord for direct termination to the AC input power source (110/220 VAC), and four or six supply cords (depending on shroud size) with 4-pin Amphenol power connectors for powering the RUs and the CM-BTS/ANT Combiner,

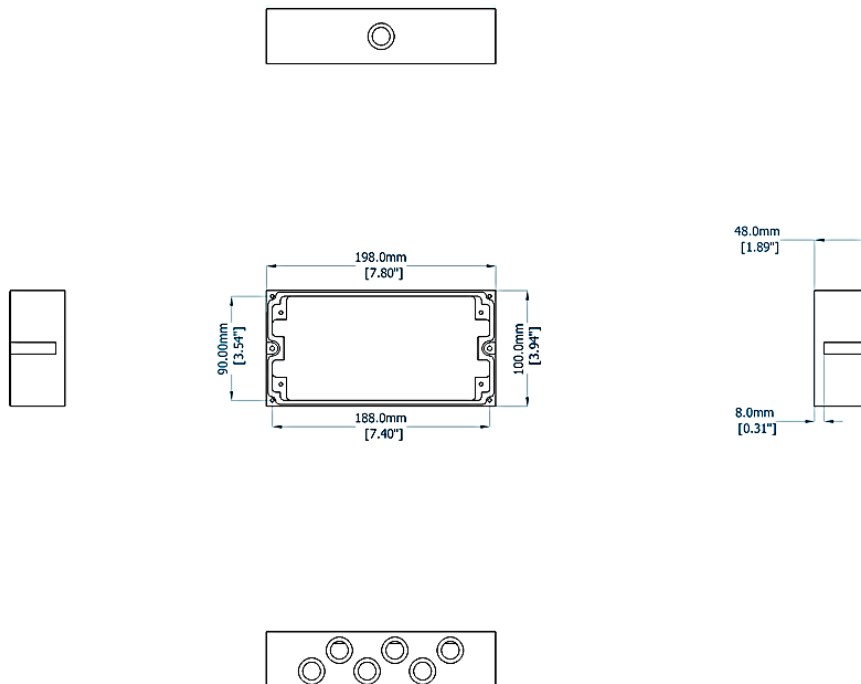


Figure 15 Power Box Outline

3.3.4 Shroud & Bracket

The Remote Node has a shroud cover for thermal protection. The shroud features are as below:

- Construction
 - ◆ All in aluminum
 - ◆ Corrosion protection to the entire cabinet
- Cabinet ingress protection to be IP53
- Powder coat neutral beige

Table 9 Shroud Specification

Mechanical Specification	Description
Material construction	Aluminum
Shroud & bracket weight	3-band unit: 16 kg (35.3 lbs) 5-band unit: 26 kg (57.3 lbs)
Dimension (H x W x D) With panel bracket	3-band unit: 1006 x 460 x 380 mm (39.6" x 18.1" x 15.0") 5-band unit: 1006 x 640 x 380 mm (39.6" x 25.2" x 15.0")

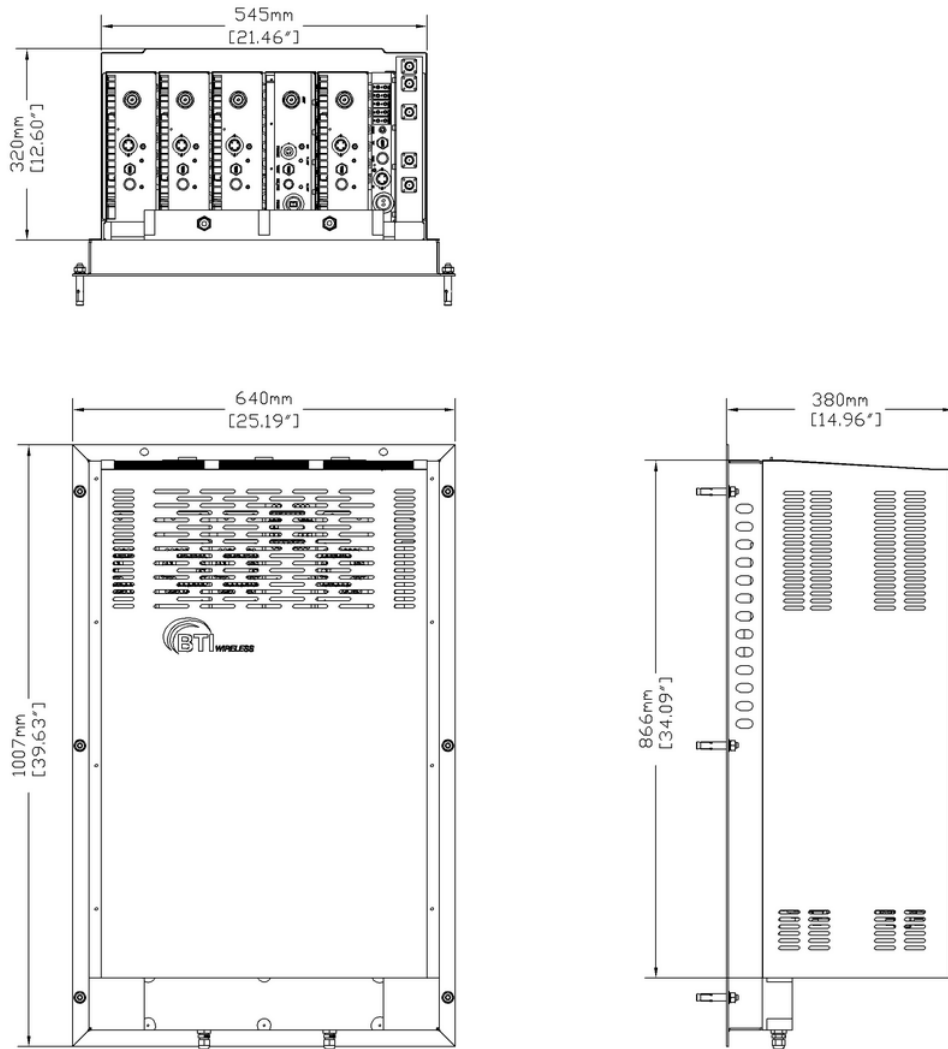


Figure 16 Remote Unit Shroud

4 System Installation

4.1 Unpacking and Inspection

Every mBSC-C component has been tested and calibrated at the factory. Unpack the mBSC-C components carefully after they arrive at the installation site. Open the wooden container and remove the foam padding.

If the equipment is damaged:

- Immediately contact the transportation and notify them of the damage.
- A claim should be filed with the carrier once the extent of any damage is assessed.
- If possible, always inspect the equipment in the presence of the delivery person.

If the equipment is damaged and must be returned to BTI's nearest RMA facility:

- Log on the BTI website, or call 714-230-8333 for a return authorization.
- BTI will not accept returns without a RMA number.

Claims for loss or damage may not be withheld from BTI, nor may any payment due be withheld pending the outcome thereof.

BTI CANNOT be held responsible for the freight carrier's performance.

4.2 Installation Preparation

4.2.1 Required Tools

The following equipment and tools may be required for a successful installation:

- Multi-meter
- Phillips screwdrivers
- Flat blade screwdrivers
- Wrenches
- Drill
- VSWR testing device
- N adapters
- RF testing cables
- RF Power meter (part of hand-held tester)

4.2.2 Installation Location

The mBSC Host unit is typically installed within a 19" rack:

- The rack should be selected with adequate shelf space to accommodate the Host Unit equipment with adequate space for ventilation around each component
- The rack must be able to support the weight of the equipment to be installed

The mBSC Remote unit is typically installed on the wall:

- The wall should be water-resistant, dry, non-caustic and without high-voltage power leaking.
- The wall's bearing capacity is more than 136kg.
- Concrete wall and brick walls are recommended, because those walls can accept expansion screws. Masonry walls or sandy-dust walls are not suitable.

4.2.3 Anti-corrosion and Shock-protection

To safeguard products and operators, the installation location must be kept away from caustic or poisonous pollutants. If the site can't meet seismic standards, it must be properly reinforced.

4.2.4 Lighting, Ventilation and Fire Protection

The installation site should have enough illumination for installation and maintenance needs. Flammable and explosive material should not be near the site.

4.2.5 Power Requirements

Nominal voltage:

- Remote Unit: 110/220VAC +/- 20%, 50/60 Hz +/-5%.
- Host Unit: -48VDC. Variable range: -36 ~ -72 V DC.

The power consumption of the mBSC Remote Node is approximately 220W per band. Make sure to select a fuse or breaker with the proper capacity. A 10A breaker is recommended @ 220VAC.

4.2.6 Lightning Protecting and Grounding

The cross section of grounding cable should be no smaller than 25mm². The grounding cable should be connected to earth ground directly without any splices. Keep the grounding cable as short as possible.

MBSC0700-040-RU system design complies with the criteria of IEC61000-4-5 and ETS 300 342-2/3.

4.3 Host Unit Installation

4.3.1 Rack Mounting

The Host Unit is a 19" 4U equipment shelf. When loading the Host Unit in a rack, make sure the mechanical loading of the rack is even to avoid a hazardous condition. The rack should safely support the combined

weight of all the equipment and be securely anchored. Installing the Host Unit in a room with sufficient air circulation is recommended as the maximum ambient temperature for Host Unit is 60°C.

Use the following steps to install the Host Unit in the equipment rack:

1. The Host Unit is built with mounting bracket installed for 19" rack installation.

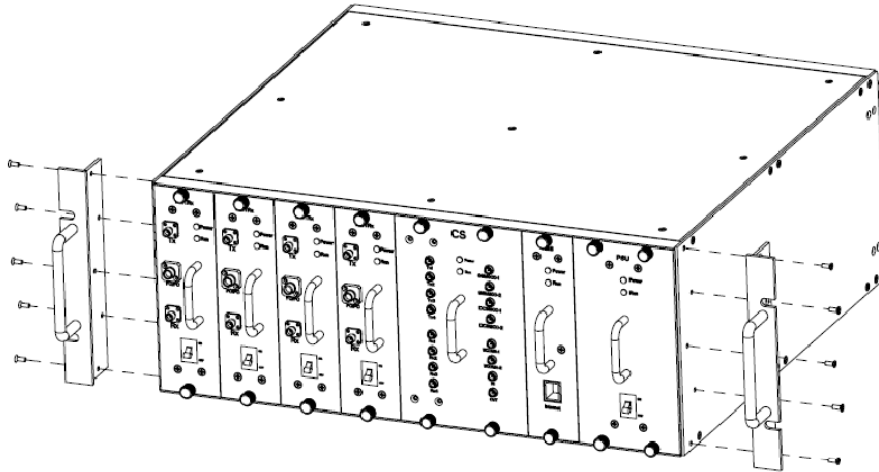


Figure 17 Mounting Brackets for 19" Rack Installation

2. Position the host unit in the designated mounting space in the rack as shown below.
3. Secure the mounting bracket to the rack using the four mounting screws provided.

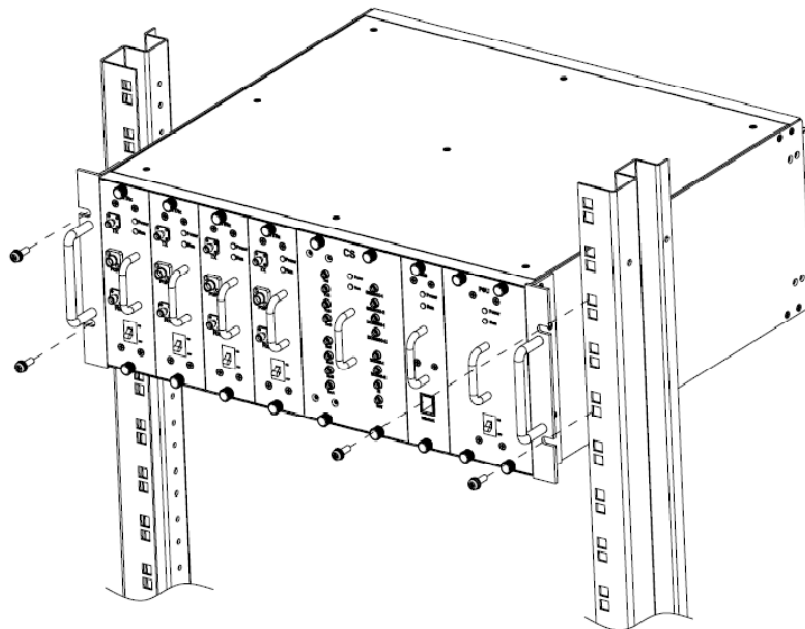


Figure 18 Host Unit-19" Rack Mounting View

4.3.2 Cable Connections

Note

The NEC(National Electrical Code) does not allow signal wires to share the same conduit with power wires unless the signal cable's voltage range is equal to the power wire's voltage range.

- Avoid bundling signal cable and grounding cable/power cable, keep them separate.
- The power cable and RF inter-connection cables are supplied.
- Check open and short circuits before installing the power cable.

4.3.2.1 Grounding

The host unit must be grounded. Do not connect external devices to the grounding connection.

Verify the host unit is securely grounded. If it is not securely grounded, use the following procedure to ground the host unit:

1. Find the screw at the bottom right corner of the Host Unit as shown in Figure 19.
2. Loosen the screw located on the grounding connection.
3. Connect the cabinet mounted earth-bonding cable between the two lock and flat washers as shown in Figure 20. Ensure the grounding surface is clean and free of paint, insulating material or contaminants.



Figure 19 Host Unit Grounding Stud

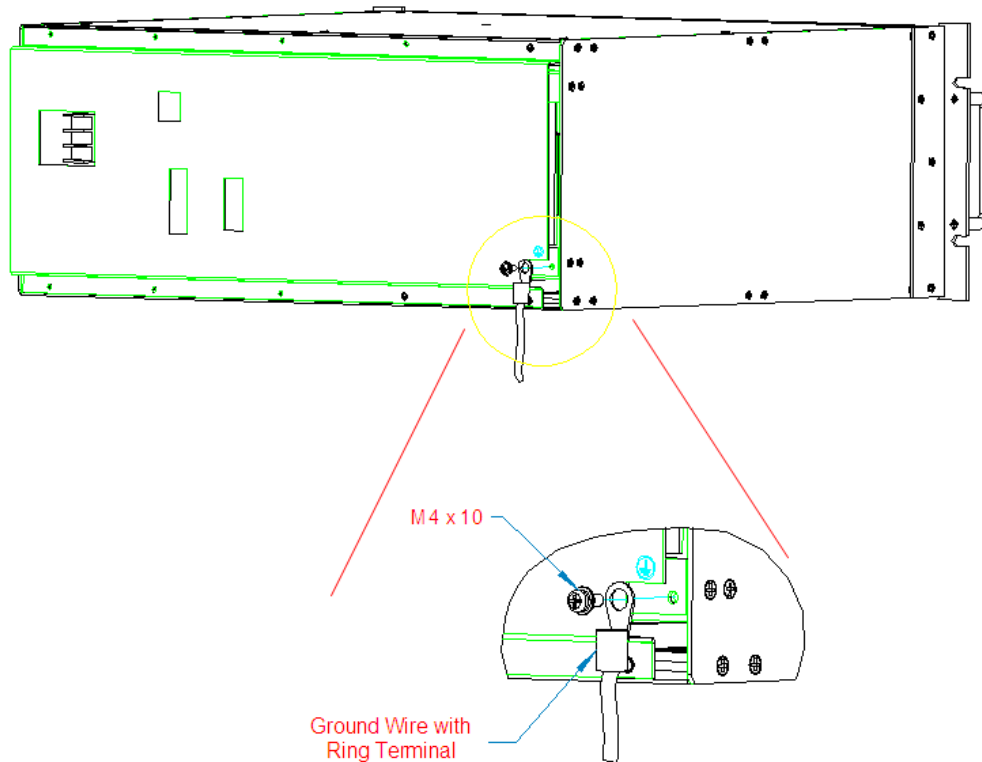


Figure 20 Grounded Host Unit

4. Tighten the screw, making sure the cable is securely connected before moving to the next phase of the installation.

4.3.2.2 Coaxial Cable Connections

The RF interface between the Host Unit and the BTS (or POI) is supported through Tx/Rx QMA female connectors mounted on the Host Unit front panel.

The Host Unit should be mounted as close as possible to the BTS to minimize RF cable losses. Use the following steps to route and connect the simplex path coaxial cables to the Host Unit:

1. Obtain the required lengths of high performance, flexible, low loss 50Ω coaxial communication cable for all coaxial connections.
2. Route the RF Tx and Rx path coaxial cables between the Host Unit and BTS interface and cut to the required length.
3. Terminate the cable with a QMA male connector.
4. Connect the Tx and Rx cables from the BTS to the Tx and Rx connectors on the BIU front panel corresponding to the frequency band (e.g. Tx 700, Tx 850, Tx1900, Tx 2100 or Tx2600).



Figure 21 BTS QMA Coaxial Cable Connection

5. Dress and secure cable at the Host Unit.
6. The RF inter-connection between the BIU and the FIU uses QMA to QMA jumper cables supplied with the mBSC-C equipment.

4.3.2.3 Optical Connections

The optical interface between the Host Unit and the Remote Node is supported by an E2000/APC optical adapter which is mounted on the FIU front panel. A single mode, E2000/APC patch cord may be used to connect the Host Unit with Remote Node.

Use the following steps to connect the optical fibers:

1. Obtain one patch cord which is sufficient length to reach from Host Unit to the Remote Node.
2. Clean each patch cord connector following the patch cord supplier’s recommendation.
3. Push and secure the patch cord connector into the desired optical port on the Host Unit FIU



Figure 22 Single Mode Patch Cord (E2000/APC)



Figure 23 E2000 Fiber Optic Port on Host Unit FIU

4. Route the patch cords from the Host Unit to the Remote Node.

5. Connect optical fiber to the Remote Node CM-BTS fiber port.

4.3.2.4 DC Power Connection

The DC power interface of the Host Unit is provided by a 2-wire termination located on the HU rear panel. The DC termination provides a connection point for the power cord which is provided separately with the HU. Use the following procedure to install the DC power:

1. Locate the 48 VDC power cord which is provided separately with the HU.
2. Place both HU PS module power ON/OFF switches in the OFF position.
3. Connect one end of the power cord to the DC termination on the HU.
4. Connect the other end of the power cord to the 48VDC source.
5. Dress and secure cable per standard industry practice.

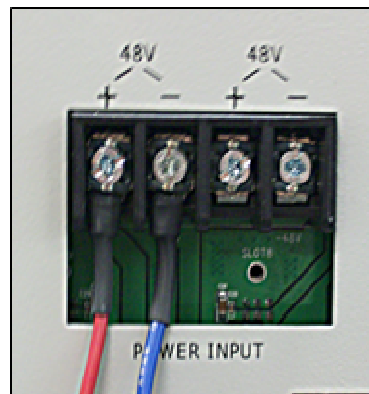


Figure 2448VDC Host Power Connection

4.3.2.5 Local OMC Computer Connection

The primary communication interface between the mBSC system OMC and a local computer is provided by a single RJ45 jack on the front panel of Host Unit (note: the USB port of the RCU card can also be used to access the local OMC port). All the connected Remote Nodes can be monitored at the Host Unit side through the fiber connection. The communication connector supports an IP interface. A CAT5 cable is used for connecting the local computer to the mBSC Host Unit OMC interface.

To connect the OMC computer with the Host Unit:

1. Obtain the required length of CAT5 twisted pair cable with RJ45 connectors.
2. Route the cable between the OMC computer (or local switch/router) and Host Unit.
3. Connect the cable to the RJ45jack on the front panel of Host Unit RCU.
4. Connect the other end of the cable to the RJ45 jack on the OMC computer or local switch/router.

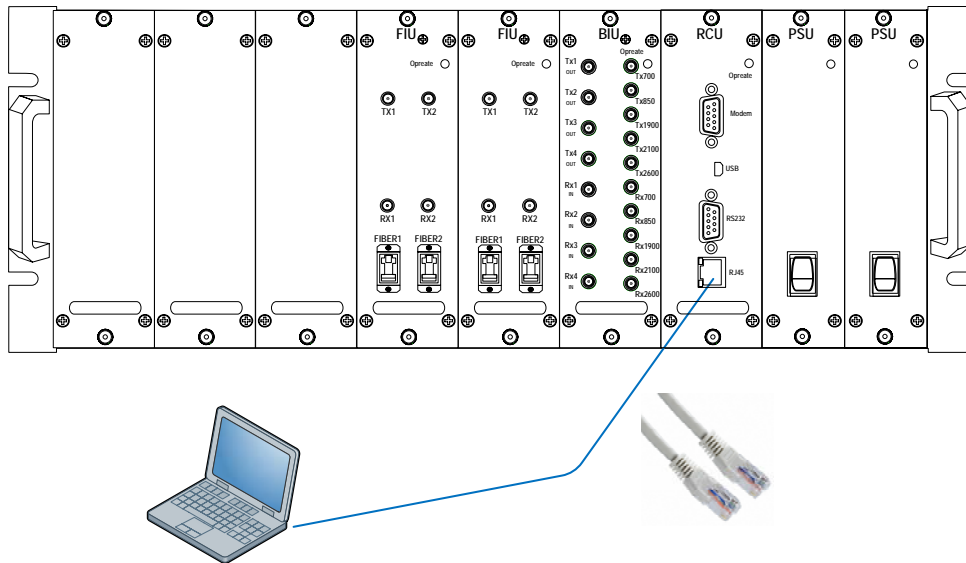


Figure 25IP Connection for local GUI Control

4.3.2.6 Modem Connection (optional)

For remote operation, the mBSC-C system provides a serial modem connector for external modem connection.

To connect a modem with the host unit:

1. Route the modem cable between the modem and host unit.
2. Connect the modem cable with a DB9 female plug to the modem socket on the host unit's RCU front panel.

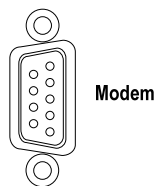


Figure 26Modem Port on RCU (DB9 male)

3. Connect the modem cable with DB9 male plug to the modem serial port.

4.4 Remote Node Installation

4.4.1 Bracket and Shroud Installation

Caution

The following high-altitude operation should be only performed by qualified personnel under well protection.

- 1) Follow the procedures provided by the manufacturer when installing the remote unit. Do not install the unit in a place or in a manner that does not meet the manufacturer's specifications.
- 2) Use the mounting hardware supplied by the manufacturer. If non-standard mounting hardware is used it must meet the requirements for mounting the unit as specified by the manufacturer.
- 3) Safety measures for lifting heavy materials should be followed to prevent injury.
NOTE: *It is important that specified load limits for the unit are not exceeded as this may void the warranty.*
- 4) High temperatures may occur due to power dissipation. Please follow the specifications for proper remote unit ventilation as indicated by the manufacturer.
- 5) Check that the mains supply is disconnected, before connecting or disconnecting the main power connector at the remote unit.
- 6) Do not block airflow ventilation outlets during installation or remote unit(s) may sustain critical damage.

4.4.1.1 Install the Mounting Panel

Follow the procedure below to install the mounting panel on the wall:

1. Mark the mounting panel fixing holes position on the wall.
2. Drill the holes ($\Phi 10$) on the wall.
3. Install the concrete anchors and tighten it firmly.
4. Hold the panel in the proper direction.
5. Secure the panel by using M8x70 (6pcs) expansion bolts

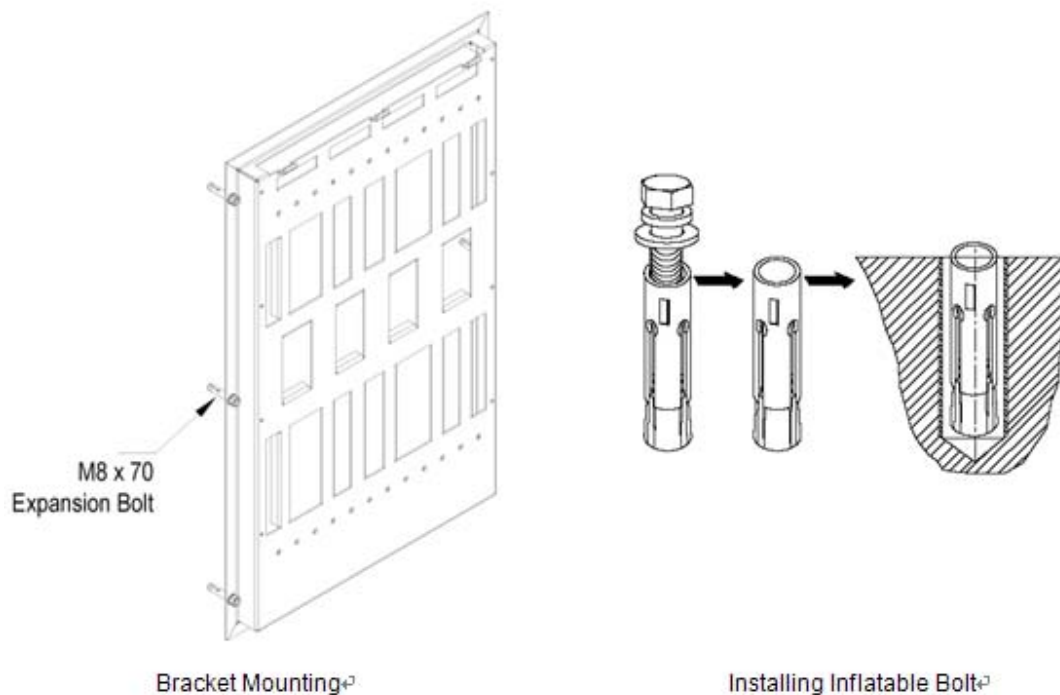


Figure 27 Mounting Panel Mounting

4.4.1.2 Mount the Remote Unit to the Mounting Panel

Use the following steps for a standard remote unit to mounting panel:

1. Grasp the CM-BTS/ANT or Single-band RU enclosure at the top and bottom of the casing and carefully slide the top two hooks onto the mounting panel, followed by the lower hooks and allow the enclosure to slide down into place.
2. After hanging the enclosure on the mounting panel, use the M8x16 screws, lock and flat washers to secure the rear mounting bracket (top and bottom) so the unit does not move.

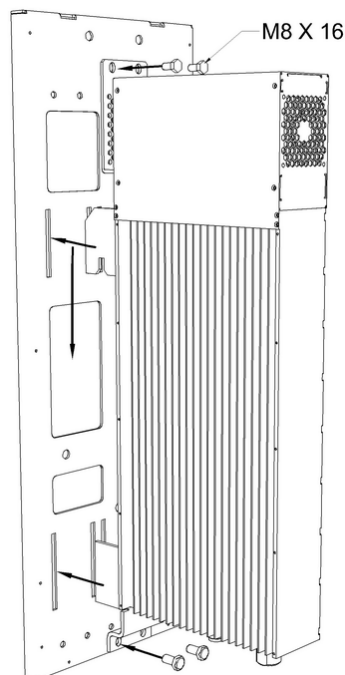


Figure 28 Mount the Remote Unit on the Mounting Panel

4.4.1.3 Attach the Shroud

Following is the procedure to install the shroud cover on the enclosures:

1. Line up the slots at the top of the shroud cover to the tabs at the top of the mounting panel.
2. Gently lower the slots over the tabs and slide the cover down. The cover will be at an angle.
3. Lay the cover flush against the mounting bracket, and then carefully place the M4 x 10 screw through the middle hole, aligning it to the hole on the bracket. Loosely fasten the screw. Working on the opposite side, again place an M4 x 10 screw through the middle hole and loosely fasten the screw.
4. Loosely fasten the remaining M4 x 10 screws to all four corners of the cover and then tighten all the screws securely.

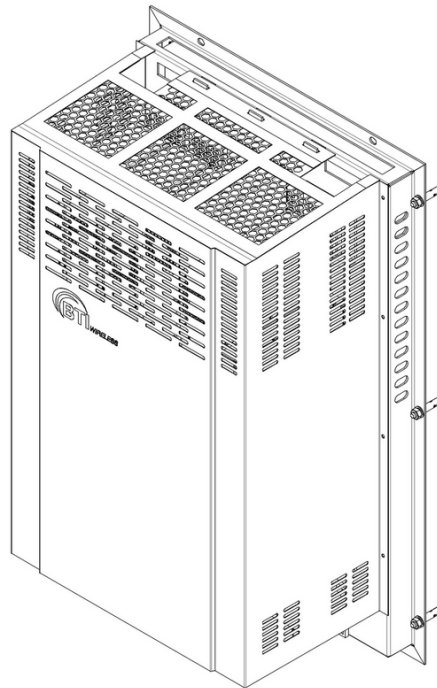


Figure 29 Attach the Shroud

4.4.2 Cable Connections

Attention

All the power switches must be switched off before cable installation.

- Avoid bundling signal cable and grounding cable/power cable, keep them separate.
- The power cable and RF inter-connection cables are supplied.
- Check open and short circuits before installing the power cable.

4.4.2.1 Grounding

A stud is provided on the bottom of the housing of fiber CM-BTS/ANT and each single-band RU enclosure for connecting a ground wire to the chassis, as shown in Figure 30.

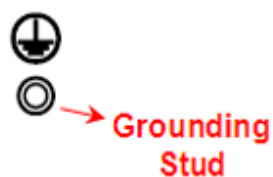


Figure 30 Grounding Stud

Use the following procedure to connect the grounding wire to the cabinet and route the ground wire to an approved earth ground source:

1. Obtain a length of #4 AWG(25mm²) and resistance lower than 0.5Ω insulated green or yellow-green colored copper wire as grounding wire.
2. Terminate one end of the wire with a ring terminal.



Figure 31 Grounding Wire the Ring Terminal

3. Secure the ring end of the wire to the ground stud.
4. Route the free end of the grounding wire to an approved earth ground source.
5. Cut the chassis grounding wire to length and connect it to the approved ground source.

4.4.2.2 Coaxial Cable Connections

The simplex low-power RF interface between the fiber CM-BTS/ANT enclosure and the single-band RU enclosures is supported through RF SMA female connectors mounted on the enclosure chassis. The duplex high-power RF interface between the single-band RU enclosures and the CM-BTS/ANT enclosure, and to the service antennas, is supported through type-Nor 7/16 DIN female connectors mounted on the enclosure chassis.

4.4.2.2.1 Fiber CM-BTS to Single-band RU

To connect the coaxial cable between fiber CM-BTS enclosure and single-band RU enclosure:

1. Obtain the required lengths of high performance, flexible, low loss 50Ω coaxial communication cable for all coaxial connections.
2. Route the RF Tx path and Rx path coaxial cable between the fiber CM-BTS enclosure and single-band enclosure interface and cut to the required length.
3. Connect the Tx and Rx cable to the designated Tx and Rx connector on the chassis of fiber CM-BTS enclosure and the chassis of the single-band enclosure.
4. Dress and secure cable.



SMA Coaxial Cable Inter-connection on Fiber CM-BTS/ANT Enclosure



SMA Coaxial Cable Inter-connection on Single-band Enclosure

Figure 32RF Inter-Connect between Fiber CM-BTS and Single-band RU

4.4.2.2.2 Single-band RU to CM-ANT

To connect the coaxial cable between CM-ANT enclosure and single-band enclosure:

1. Obtain the required lengths of high performance, flexible, low loss 50Ω coaxial communication cable for all coaxial connections.
2. Route the RF Tx/Rx path coaxial cable between the CM-ANT enclosure and single-band enclosure interface and cut to the required length.
3. Connect the Tx/Rx cable to the designated Tx/Rx connector on the chassis of CM-BTS/ANT enclosure and the chassis of the single-band enclosure.
4. Dress and secure cable in the Remote Unit indoor cabinet.



DIN(7/16) Coaxial Cable Inter-connection on Single-band RU Enclosure



N Type Coaxial Cable Inter-connection on CM-ANT Enclosure

Figure 33RF Inter-Connect between CM-ANT and Single-band RU

4.4.2.3 Antenna Cable Connection

Route a coaxial antenna cable from the antenna to the equipment enclosure. The cable must be terminated with the proper connector for connecting to the antenna port on the chassis of CM-BTS/ANT enclosure.

Below is the procedure to install the antenna cable:

1. Remove the dust cap from the N type female connector located on the chassis of the CM-BTS/ANT enclosure.
2. Route the coaxial antenna cable to the chassis of the CM-BTS/ANT enclosure chassis.
3. Cut the antenna cable to the required length and terminate with the proper connector.
4. Connect the antenna cable to the CM-BTS/ANT port.

4.4.2.4 Optical Connections

The optical interface between the fiber CM-BTS enclosure and the Host Unit is supported by duplex Tx/Rx optical port(s). Each optical port consists of aE2000/APC optical adapter which is mounted on the fiber CM-BTS enclosure chassis. A single mode, E2000/APC patch cord may be used.

Use the following steps to connect the optical fibers:

1. Obtain one patch cord which is sufficient length to reach from fiber optic distribution box to fiber CM-BTS chassis.
2. Remove the dust caps the optical ports and from the patch cord connectors that will be connected.
3. Clean each patch cord connector following the patch cord supplier's recommendation.
4. Screw-thread secures the patch cord connector into the optical port on the fiber optic distribution box.



Figure 34 Fiber Optic Cable Connection to Fiber CM-BTS Enclosure

5. Route the patch cords from the fiber optic distribution box to the designated optical port on the chassis of the fiber CM-BTS enclosure.
6. Identify each optical fiber.

4.4.2.5 AC Power Connection

Danger

Use extreme caution when working with high voltage AC power. Ensure all power is disconnected before working on power circuit.

Warning

Verify that the unit has been grounded with an earth-bonding cable to the grounding connector.

A connectorized 4-wire power cable is provided with the unit enclosures for the AC power connection, as shown in Figure 36. The connectorized end of the power cable connects to the AC power port located on the bottom of the enclosure.

The AC power source must supply 110/220V AC(+/-20% @50/60Hz) through a 15 Amp circuit breaker. The AC power cable provides the wire leads for line, neutral and ground connections. The power cable must be routed from the cabinet to an electrical junction box for connection to the AC power source. The power cable is rated for indoor or outdoor use. Refer to the following procedure to install the AC power wiring:

1. Locate the AC power junction box which is located at the bottom of the Remote Node mounting bracket as shown in Figure 35.



Figure 35 AC Power Junction Box

2. Terminate the AC power supply wires that are required between the AC junction box and the local source of AC power.
3. For each enclosure (CM-BTS and RU) connect the short AC power cable from the AC Junction Box to the enclosure AC power port labeled “AC”
4. Tighten the coupling nut.



Figure 364-Pin AC Power Connector

4.5 Installation Final Inspection

The following section provides a set of review procedures once the physical installation and connections are complete. Leave the source AC power at the Host Unit and Remote Node in the OFF position (breaker open) to prevent accidental power-up.

4.5.1 Host Unit Connection Overview

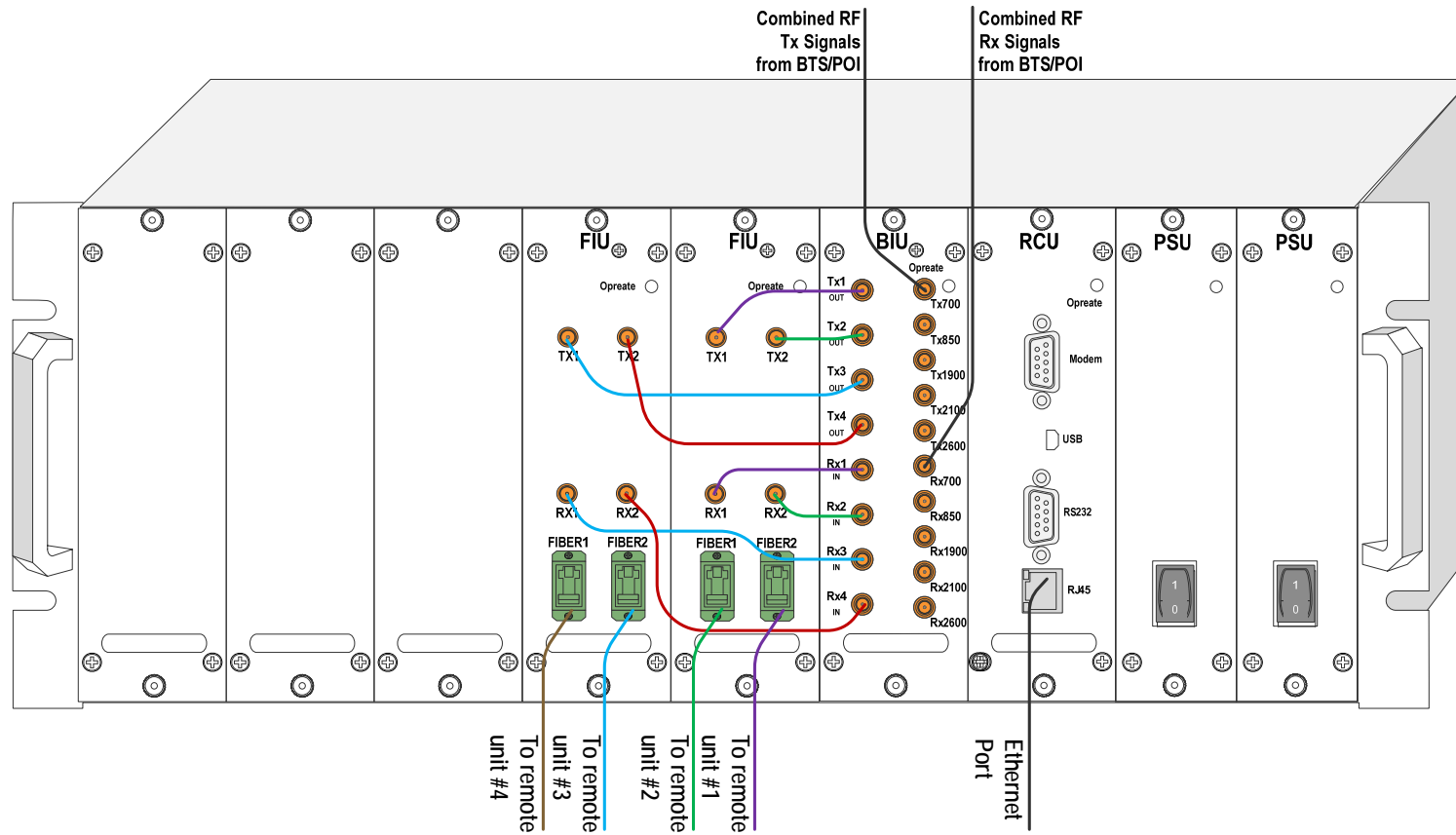
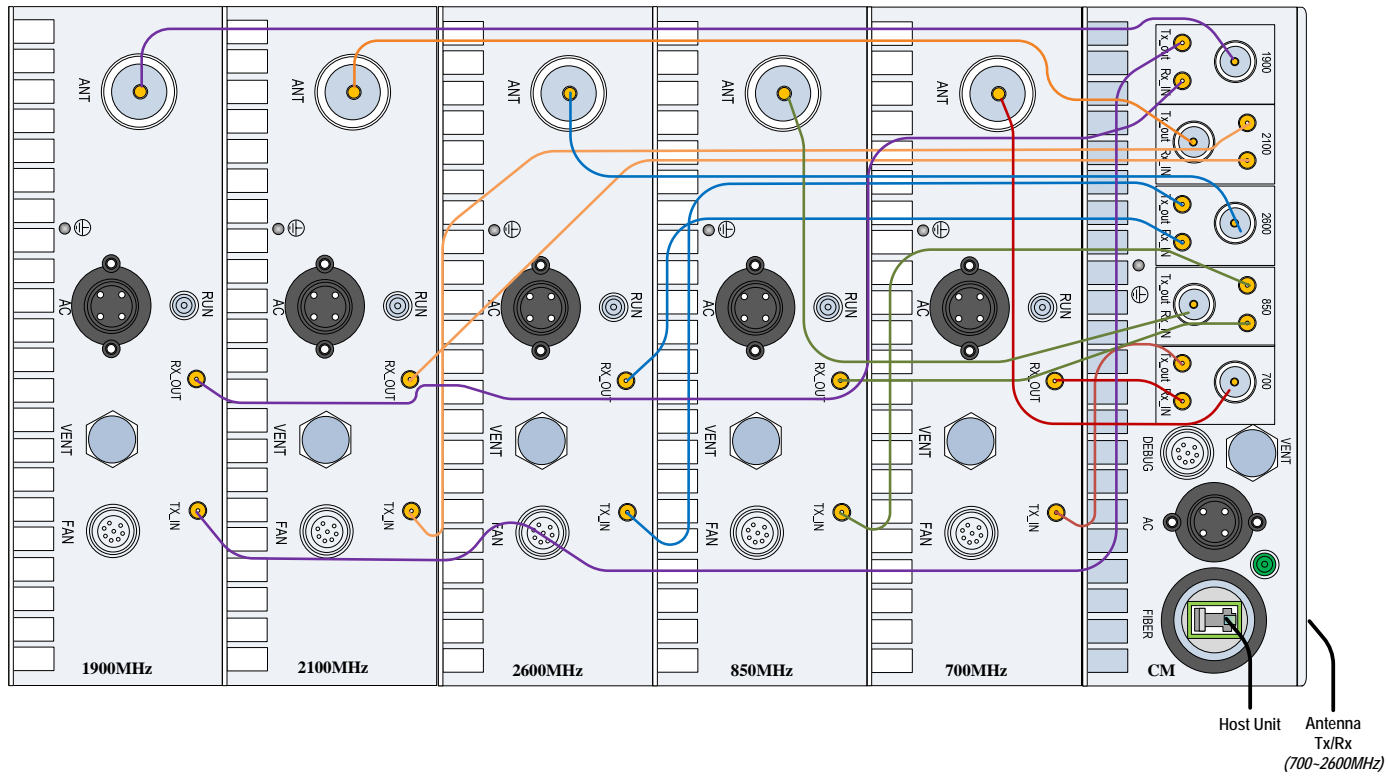


Figure 37 Host Unit Connection Overview

4.5.2 Remote Node Connection Overview



Interconnection with Combiner Model FCM-CN-C

Figure 38 5-band Remote Node Inter-Connection Diagram

4.5.3 mBSC-C Inspection Checklist

Table 10 mBSC Unit Inspection

Item	Description
1	Stable and normal.
2	Properly fastened
3	Screws and nuts screwed tightly, without missing flat washers and spring washers. Spring washers must be on the top of flat washers.
4	No cable damage.
5	Clean, no smudges or dust.
6	Connections between metallic parts must be reliable, to assure reliable electric connectivity.

4.5.4 Cabling Inspection

Table 11 Cable Inspection

Item	Description
1	The connection of the cable is tight, not loose or damaged.
2	The cable shell not damaged.
3	Grounding cable is connected properly.
4	Cables are dressed neatly, power kept separate from signal.
5	The minimum bending radius of the cable is proper. (Shouldn't be less than twenty times of the cable's diameter.)

4.6 System Test

It is recommended to perform a system test after the physical installation and cabling has been inspected and verified.

Use the following procedure to perform the system test:

- Configure the attenuation both of the forward path and reverse path
- Configure the parameters of Host Unit
- VSWR testing: sweep test of cables and antenna
- Configure the parameters of Remote Unit
- Signal testing: indoor signal level testing
- Effect testing: CQT/DT testing
- Coverage Optimize: based on the signal & effect testing result, adjust the mBSC parameters to optimize the coverage

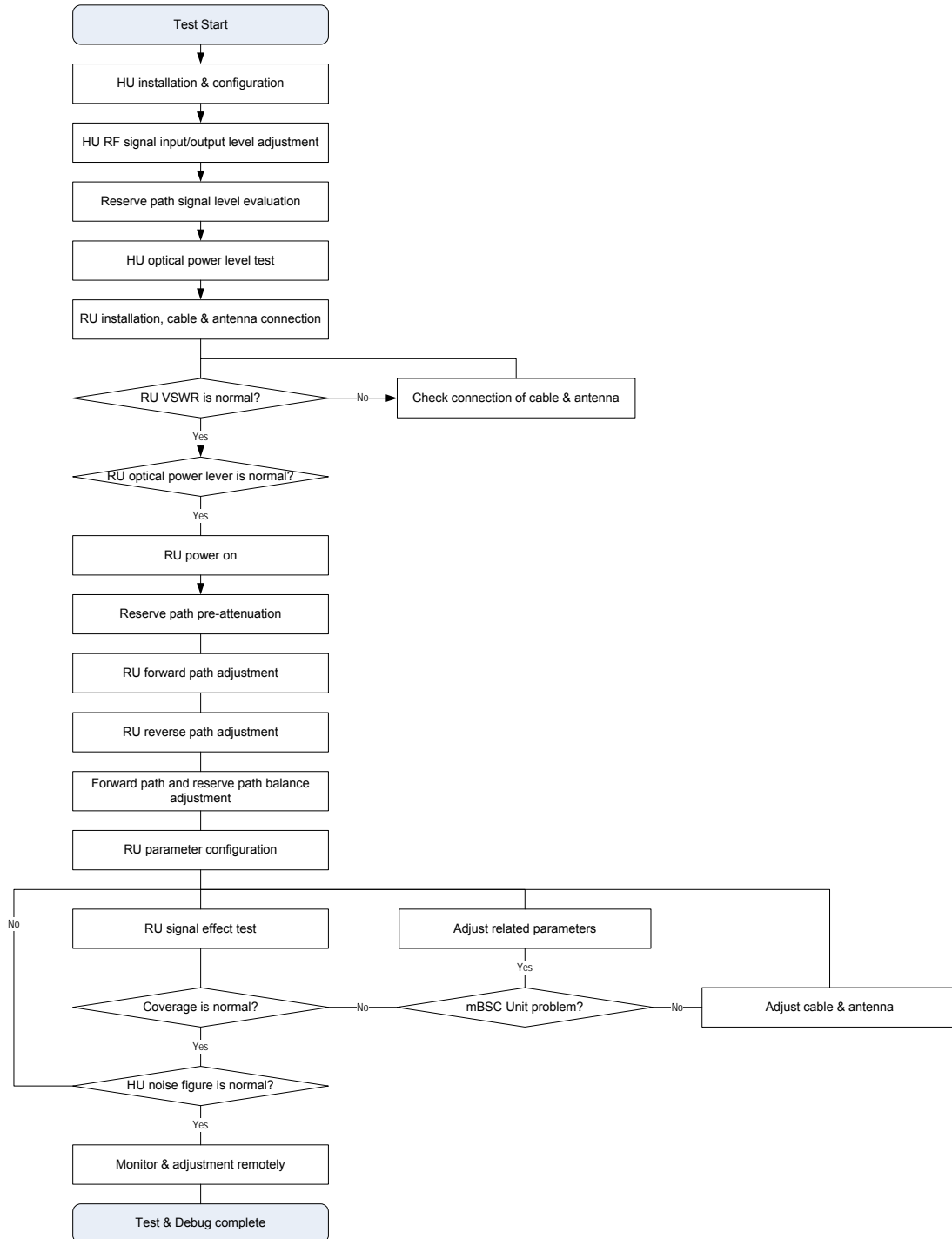


Figure 39 Flow Chart of System Debugging

5 System Monitoring & Configuration

5.1 Accessing EMS Local GUI

The MBSC0700-040-RU system supports local configuration through a web-based Element Management System (EMS) graphical user interface (GUI) accessed through the RJ-45 and USB ports of the Host Unit RCU card. The EMS local GUI is a web-based application supported by standard web-browsers. Microsoft Internet Explorer® is recommended.

System configuration and monitoring can also be performed from a remote EMS Server. The EMS Server is a multi-user platform that includes enhanced management capabilities for configuration, monitoring and alarming. The EMS Server is required to generate SNMP alarms.

Note: It may take up to 3 minutes for the mBSC system to initialize, therefore it is recommended to only attempt to login to the GUI after the mBSC system has completely started, otherwise the GUI may incorrectly display a message indicating that the username and/or password are wrong (when in fact they may be correct).

5.1.1 Using Ethernet Port

Access to the EMS Local GUI through an RJ-45 Ethernet connection is provided on the RCU card in the Host Unit shelf. The Ethernet port is the primary point of connection for the remote EMS Server. The EMS Local GUI accessed through the Ethernet port is assigned the IP address 172.18.60.60 at the factory. However, this IP address can be modified to suit the networking requirements of the installation (e.g. to allow access across a Local Area Network).

Steps:

1. Obtain a CAT5 cable and connect it to the RJ45 port on the host unit RCU card, and connect the other end into the RJ45 port on the laptop/computer. Depending on the model year of your computer, a crossover cable may be required.
2. Start an Internet Explorer browser session on the laptop/computer, and enter the following URL to connect to the Local GUI—"http://172.18.60.60".

Note: The mBSC system does not provide DHCP service. To access the GUI you will need to configure the local computer with a static IP address the same subnet as the local GUI.

Note: The EMS Local GUI is a single-user interface, and supports only a single user at a time. If the Ethernet interface is connected to a Local Area Network, and more than one user is accessing the EMS Local GUI at the same time, inconsistent operation may occur. Please use the EMS Server for multi-user applications.

5.1.2 Using USB Port

Access to the EMS Local GUI through a standard USB connection is also available at both the Host Unit RCU card, and the CM-BTS enclosure of the Remote Node. The EMS Local GUI has a fixed IP address assignment when accessed through the USB port – it is set at the factory and cannot be changed.

Steps:

1. Install the USB-Ethernet driver on the laptop/computer. **The laptop/computer must be connected to the internet in order for the drivers to be automatically installed.**
2. Obtain a USB cable and connect it to the USB port on the host unit and the laptop/computer.
3. Start an Internet Explorer browser session on the laptop/computer, and enter the following URL–“http://192.168.5.220”.

<p>Note: The mBSC system does not provide DHCP service. To access the GUI you may need to configure the local computer with a static IP address the same subnet as the local GUI.</p>
--

5.1.3 Login to EMS Local GUI

Access the EMS Local GUI as follows:

1. Type the appropriate URL into the browser (e.g. <http://192.168.5.220> for USB port). The dialog box shown in Figure 40– EMS Local GUI Login will appear.
2. User name: Type in the user name provided for you to access the system (default = “admin”)
3. Password: Type in the password provided for you to access the system (default = “”)
4. Click **Login**



Figure 40– EMS Local GUI Login

The default user account for the EMS Local GUI is set at the factory as follows:

Table 12 Local GUI Default User Accounts

Username	Admin
Password	(null)
Access Control Level	Equipment properties view Gain setting

The mBSC system administrator may have created different usernames and passwords for you to use.

5.2 Navigating the EMS Local GUI

When logged in to the EMS Local GUI, it displays the main page as shown in Figure 41. On the left side of the main page the topology of the mBSC-C system you are connected to is automatically displayed. This includes the Host Unit and the fiber attached Remote Nodes. On the right side is a floating window for displaying system component properties.

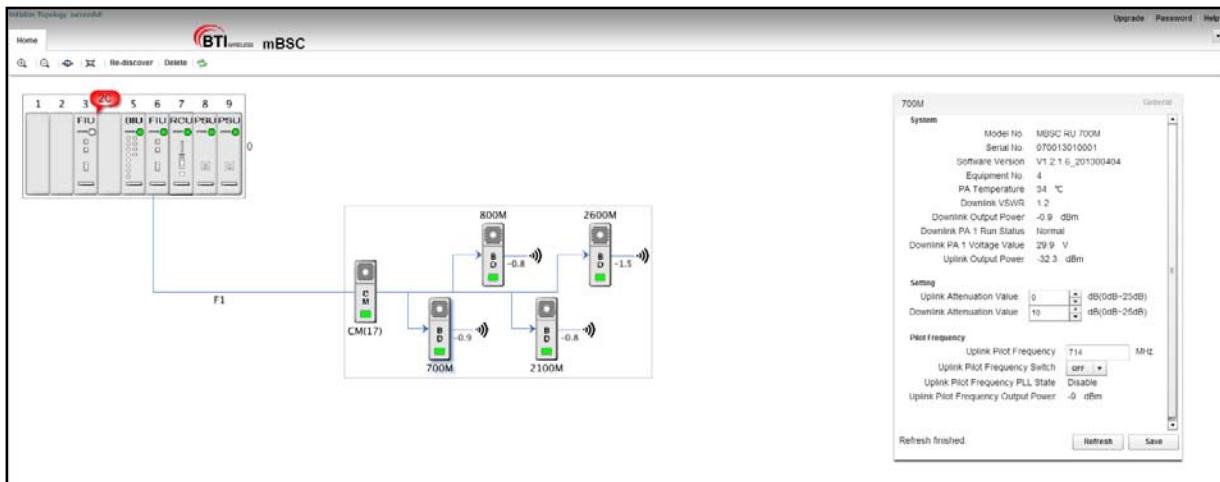


Figure 41- Main Page Expanded Topology

Note: The EMS Local GUI will only display the nodes that are connected to the specific Host Unit shelf that you are connected to. If the site has multiple Host Unit shelves (to support many Remote Nodes) then you will need to separately connect to each shelf to perform configuration. The EMS Server, if provided, will enable connections to multiple connected Host Unit Shelves and multiple installation sites.

In the topology window the system can be placed into a summary view by double-clicking on the Host Unit shelf, or the Remote Node components.

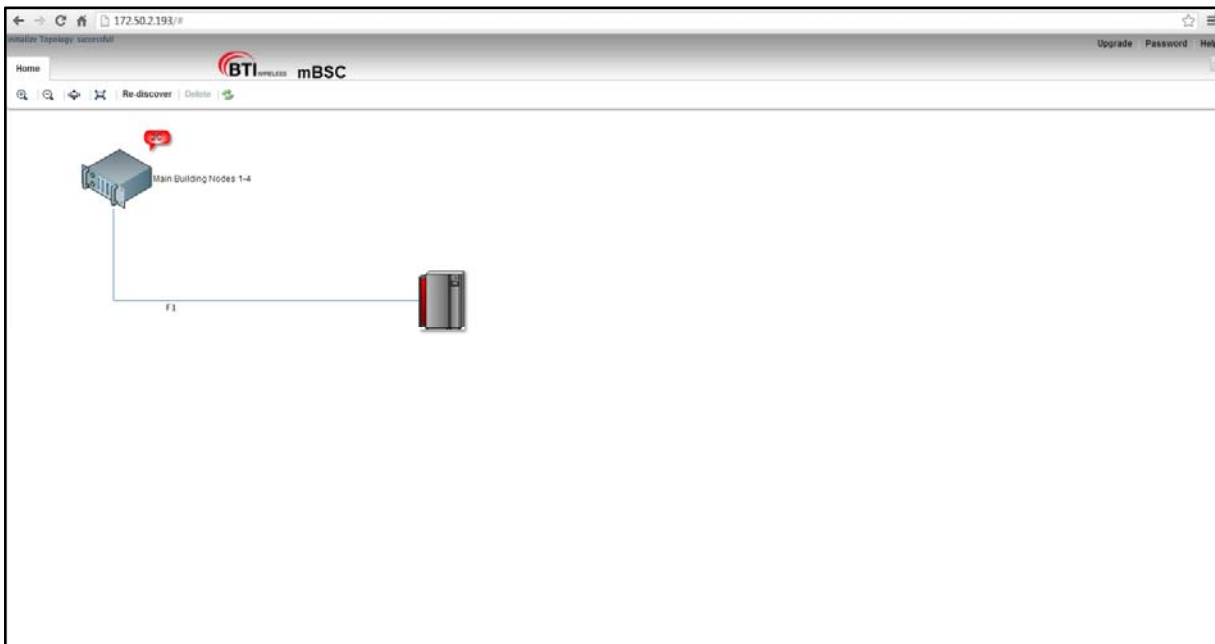






Figure 42- Main Page Summary View

5.2.1 Topology Tool Bar

Various functions can be performed by clicking on the following icons.

Table 13 Tool Bar Functions

Tool	Function
	Zoom in – Zooms in the topology diagram
	Zoom out – Zooms out the topology diagram
	Reset – Resets the topology view to default
	Overview – Resizes topology diagram to full screen
Re-discover	Re-Discovery – Constructs the topology upon initial local GUI login or changes in system configuration. This function is crucial to make sure topology structure is correct.
Delete	Delete – Deletes a component from the Topology view
Refresh	Refresh – Refreshes “real time” system topology

5.2.2 Upgrade/Password Functions

The links in the upper right corner contain the **Upgrade**, **Password**, and **Help** functions.

Table 14 General GUI Tools

Function	Description
Upgrade	Perform a component software upgrade
Password	Change the login password for current User
Help	System information and Help

5.3 Installation & Configuration

5.3.1 Network & Communications

5.3.1.1 Change IP Address of RCU Ethernet port

In order to connect the RCU to a Local Area Network (for example, to allow remote access to the mBSC from outside the Site) the user will need to change the IP address to the address required in their existing network.

To change the IP address of the RCU Ethernet Port:

1. Click on the RCU in the topology diagram and the component window will pop up on the right as shown in Figure 43- RCU Component View.
2. Locate the required fields and set the appropriate values.
 - a. Mode of Communication: must be set to Ethernet
 - b. Equipment IP Address: enter the value assigned to this HU shelf
 - c. Equipment Subnet Mask: enter appropriate subnet mask
 - d. Equipment Default gateway: enter assigned gateway
3. Click **Save**

RCU(0)		General
Model No.	mBSC-c-rcu-us-inte	
Serial No.	12141604610113010001	
Software Version	V3.0.1.9_1304041122	
Equipment No.	0	
System Temperature	45 °C	
Site Name/Number Info	Main Building Nodes 1-4	
Setting		
Mode of Communication	Ethernet ▼	
Site No.	96	
Query/Set Phone Number 1	0000000000000	
Report Phone Number		
NMS IP Address(IPv4)	172.50.2.192	
NMS IP Port	8008	
Query/Set IP Address 1	172.16.7.135	
Query/Set IP Address 2	172.16.7.136	
Equipment IP Address	172.50.2.193	
Equipment MAC Address	000000000000	
Equipment Port No.	7001	
Equipment Subnet Mask	255.255.0.0	
Equipment Default Gateway	172.50.1.1	
Refresh finished.		
		Refresh Save

Figure 43- RCU Component View

5.3.1.2 Assign IP Address for Remote EMS Server

The mBSC-C system can also be managed from a remote EMS Server. To communicate with the remote server the IP address must be reachable from the local network, and must be configured within the RCU.

To assign the IP address of the remote EMS Server:

1. Click on the RCU in the topology diagram and the component window will pop up on the right as shown in Figure 43- RCU Component View.

2. Locate the required fields and set the appropriate values.
 - a. NMS IP Address(IP4): enter the value assigned to the remote EMS Server
 - b. NMS IP Port: enter port (default value is 8008)
 - c. Equipment Default gateway: enter assigned gateway
3. Click **Save**

5.3.1.3 Assign HU Site Name/Number

Users can create a name or a site number for the Host Unit. This information is displayed in the Summary View (Figure 42- Main Page Summary View), or is used in the EMS Server to distinguish between multiple Host Shelves and/or multiple mBSC systems.

To assign the HU Site name/Number:

1. Click on the RCU in the topology diagram and the component window will pop up on the right as shown in Figure 43- RCU Component View.
2. Locate the required fields and set the appropriate values:
 - a. Site Name/Number Info: enter the desired identifier
3. Click **Save**

5.3.2 System Installation

5.3.2.1 Verify Component Status

Once the system has been properly installed, check the status of each component in the Home tab, as shown in Figure 44- Main Page Equipment Status.

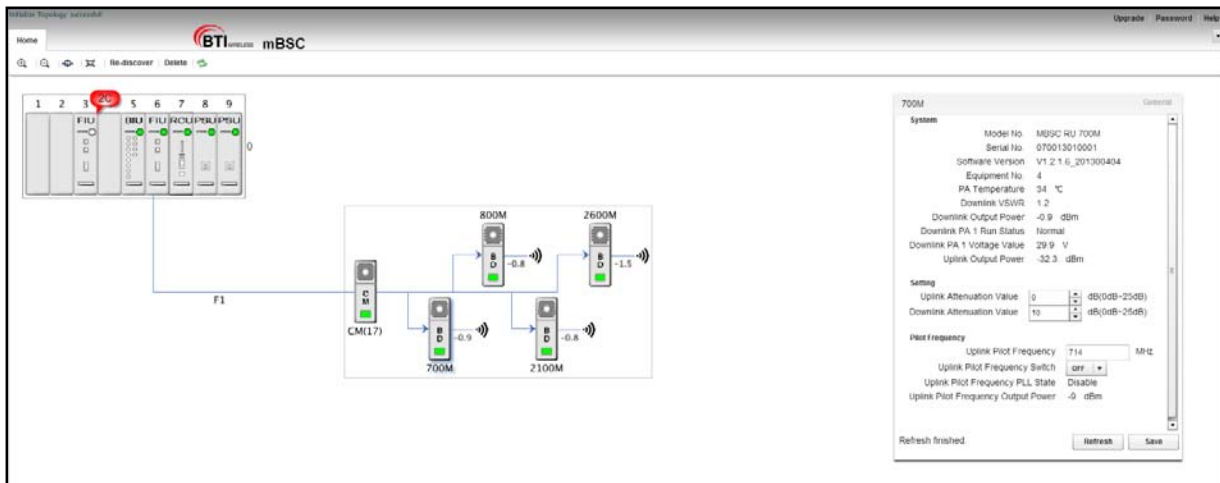


Figure 44- Main Page Equipment Status

Check the current status of each component as follows:

1. Update Topology view:
 - a. Click Re-Discover: If new equipment (eg. Remote Node) has been added but does not yet show up in the topology view
 - b. Click Refresh: If all components appear and to ensure current status is reflected
2. Review HU status indicators:
 - a. All OK: Component LEDs in the HU shelf indicate green state
 - b. Error/alarm: Component LEDs are flashing red, and a red “balloon” is present
3. Review Remote Node status indicators:
 - a. All OK: Component LEDs in the Remote Node indicate green state
 - b. Error/alarm: Component LEDs are flashing red, and a red “balloon” is present

If components appear with error conditions please see sections 5.3.3.1 Optical Link Alarms and 5.5 Monitoring for details on error conditions.

5.3.2.2 Verify Optical Power Levels

The optical power levels at both ends of the fiber link (at the FIU of the Host Unit, and the CM of the Remote Node) can be observed and verified through the EMS Local GUI.

Check optical power levels at the Host Unit as follows:

1. Click on the FIU in the topology diagram and the component window will pop up on the right as shown in Figure 45- FIU Optical Power Levels.
2. Optical Transceiver 1 Tx Power: the output power of the FIU 1 to the fiber.

- a. Nominal value is: +4.0 dBm +/-1.5 dB (impacted by temperature)
- 3. Optical Transceiver 1 Rx Power: the input power of the FIU 1 from the fiber.
 - a. Acceptable range is:-15 dBm ~ +6dBm (impacted by fiber loss)
- 4. Optical Transceiver 2Tx Power: the output power of the FIU 2 to the fiber.
 - a. Nominal value is: +4.0 dBm +/-1.5 dB (impacted by temperature)
- 5. Optical Transceiver 2 Rx Power: the input power of the FIU 2 from the fiber.
 - a. Acceptable range is: -15 dBm ~ +6dBm (impacted by fiber loss)

FIU(11)		General
System		
Model No.	mBSC-c-fiu	
Serial No.	12142204810113010002	
Software Version	V3.0.1.9_1304021907	
Equipment No.	11	
Optical Transceiver		
Optical Transceiver 1 Tx Power	4.3	
Optical Transceiver 1 Rx Power	1.2	
Optical Transceiver 2 Tx Power	4	
Optical Transceiver 2 Rx Power	-24	
Uplink Output Power 1	-40	dBm
Uplink Output Power 2	-40	dBm
Optical Transceiver 1 Alarm Enabled	<input checked="" type="checkbox"/>	
Optical Transceiver 2 Alarm Enabled	<input type="checkbox"/>	
Refresh finished.		
		<input type="button" value="Refresh"/> <input type="button" value="Save"/>

Figure 45- FIU Optical Power Levels

Check optical power levels at the Remote Node as follows:

1. Click on the CM in the topology diagram and the component window will pop up on the right as shown in Figure 46- CM Optical Power Levels.
2. Optical Transceiver 1 Tx Power: the output power of the CM 1 to the fiber.
 - a. Nominal value is: +4.0 dBm +/-1.5 dB (impacted by temperature)
3. Optical Transceiver 1 Rx Power: the input power of the CM from the fiber.
 - a. Acceptable range is: -15 dBm ~ +6dBm (impacted by fiber loss)

The screenshot shows a configuration window for CM(17) with the following data:

System	
Model No.	mBSC-c-cm
Serial No.	10142203930113010001
Software Version	V3.0.1.9_1304021907
Equipment No.	17
System Temperature	35 °C

Optical Transceiver	
Optical Transceiver 1 Tx Power	4
Optical Transceiver 1 Rx Power	1.1
Optical Transceiver 1 Alarm Enabled	<input checked="" type="checkbox"/>

Network	
Site No.	96
NMS IP Address(IPv4)	172.16.7.134
NMS IP Port	8008
Query/Set IP Address 1	172.16.7.134
Query/Set IP Address 2	192.168.5.225
Equipment IP Address	172.16.60.60
Equipment MAC Address	000000000000
Equipment Port No.	0
Equipment Subnet Mask	255.255.0.0

Refresh finished. [Refresh] [Save]

Figure 46- CM Optical Power Levels

5.3.2.3 Verify Software Versions

Click on **Help** in the upper right corner to verify the software version of the EMS Local GUI.

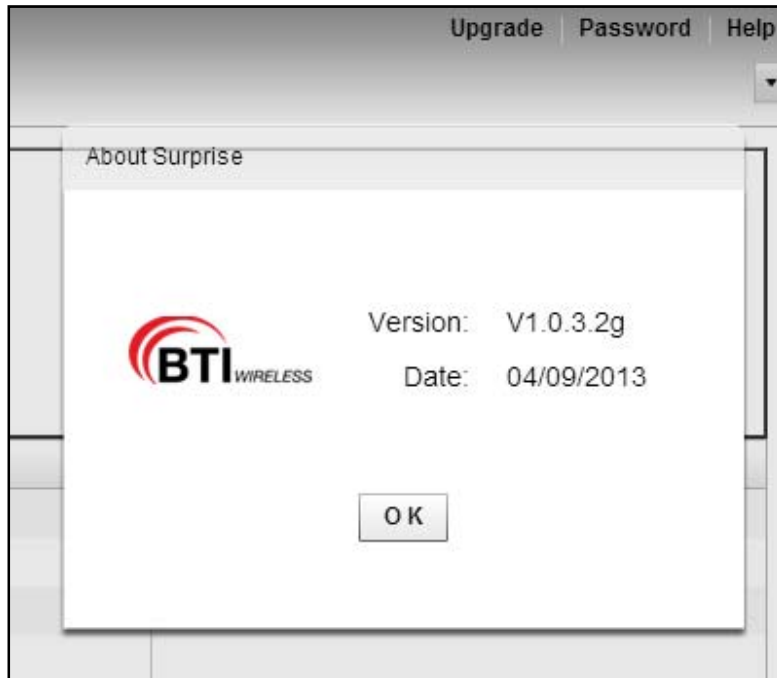


Figure 47 - EMS Local GUI Software Version

To verify the software version installed on each component click on the **Upgrade** button in the top right:

Equipment	Old version	Received packages	Total packages	Progress	Upgraded version
RCU(0)	V3.0.1.9_1304041122	0	0		
BIU(1)	BIU_1.0.0.7_20130404	0	0		
FIU(3)	V3.0.1.9_1304021907	0	0		
FIU(11)	V3.0.1.9_1304021907	0	0		
CM(17)	V3.0.1.9_1304021907	0	0		
700M	V1.2.1.6_201300404	0	0		
800M	V1.2.1.6_201300404	0	0		
2100M	V1.2.1.6_201300404	0	0		
2800M	V1.2.1.6_201300404	0	0		

Figure 48 - Component Software Versions

5.3.3 Alarms

5.3.3.1 Optical Link Alarms

Optical Link alarms at the FIU will occur for various reasons:

1. Remote Node not in service: The Remote Node connected to the specific FIU link is not yet powered up
2. Remote Node malfunctioning: connected to the specific FIU link is in an error state
3. Fiber issue: The fiber link between the specific FIU and the Remote Node has excessive loss (possibly due to breakage or to dirty optical connectors)
4. No Remote Node: there is no plan to connect a Remote Node to the FIU (an FIU card supports two links and one link is not used in this system).

In Figure 41- Main Page Expanded Topology the FIU in slot 3 is indicating an alarm state. Note the following in Figure 49 – Optical Link Alarms:

1. The LED indicator for the FIU in slot 3 is not solid Green
 - a. A flashing red state indicates an alarm
2. There is a red “balloon” extending from the FIU in slot 3

- a. The FIU supports two fiber connections: 1C indicates 1 alarm condition exists, 2C indicates 2 alarm conditions exist
- 3. There are no remote Nodes connected to the FIU in slot 3, and no fiber are extending from the FIU
 - a. In this case the HU recognizes there are no Remote Nodes connected
- 4. The FIU in Slot 6 is showing green operational status
 - a. No alarms are being reported, yet there is only one fiber extending from the FIU in connection F1
 - b. Normally this FIU would report an alarm state for F2 ("1C" showing in the red alarm balloon)
 - c. No alarm state is shown because the user disabled Optical Transceiver 2 Alarms

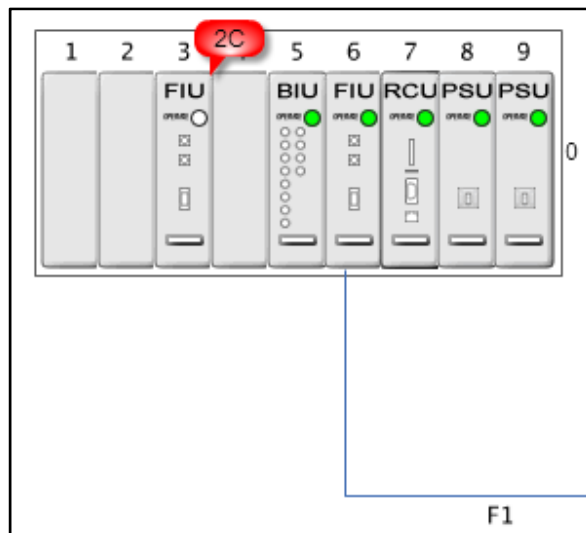


Figure 49 – Optical Link Alarms

To disable optical transceiver alarms:

1. Click on the desired FIU in the topology window. The FIU component dialog box will appear as in Figure 45- FIU Optical Power Levels
2. Optical transceiver 1 Alarm Enabled:
 - a. To enable alarms place a “check” in the box
 - b. To disable alarms clear the box
3. Optical transceiver 2 Alarm Enabled:
 - a. To enable alarms place a “check” in the box

- b. To disable alarms clear the box
4. Click **Save**

5.3.3.2 Enable SNMP alarms

Support for SNMP in the mBSC-C system is provided through the remote EMS Server. For more information about support for SNMP please refer to UM-MBSC-C-EMS.

5.4 System Tuning

5.4.1 BTS Signal Conditioning

The interface from the operator BTS equipment to the MBSC0700-040-RU is via simplex RF connections to the BIU. The nominal downlink input to the BIU (TXin) is 0 dBm±1dB (range: -10dBm to +10dBm). If the BTS signal downlink exceeds +10 dBm, or the signal is a composite duplex RF signal, then RF signal conditioning will be required.

BTI provides a high-power Point of Interface to perform RF signal conditioning (mBSC-C-POI) The use and operation of this component is outside the scope of this document.

5.4.2 Set Downlink Gain

It may be necessary to adjust the Downlink gain of the mBSC-C system in order to achieve a balanced forward and reverse link, or to adjust for other conditions (input levels from the BTS, propagation characteristics at different gain bands, specific RF design). The MBSC0700-040-RU provides two points of adjustment for downlink gain:

1. Software controlled attenuator for each band in the BIU
2. Software controlled attenuator in each band-specific Remote Unit

The determination of appropriate values for these parameters is outside the scope of this document.

5.4.2.1 Adjust BIU Downlink Attenuator

Adjust the BIU downlink value for each frequency band as follows:

1. Click on the BIU in the topology diagram and the component window will pop up on the right as shown in Figure 50 - BIU Attenuator.
2. Downlink Attenuation Value (XXX MHz): Input the appropriate value for each frequency band (0dB – 25dB range)
3. Click **Save**

Note that the system will report an error message if the input value is out of range.

BIU3(1)
General

basic

Model No. bti-mbasc-c-biu-001
 Serial No. 12142204510113010001
 Software Version BIU_1.0.0.7_20130404
 Equipment No. 1

Uplink

Attenuation Value(700M)	30	▲ ▼	
Attenuation Value(800M)	2	▲ ▼	dB(0dB~25dB)
Attenuation Value(1900M)	3	▲ ▼	dB(0dB~25dB)
Attenuation Value(2100M)	4	▲ ▼	dB(0dB~25dB)
Attenuation Value(2600M)	5	▲ ▼	dB(0dB~25dB)

Downlink

Attenuation Value(700M)	6	▲ ▼	dB(0dB~25dB)
Attenuation Value(800M)	7	▲ ▼	dB(0dB~25dB)
Attenuation Value(1900M)	8	▲ ▼	dB(0dB~25dB)
Attenuation Value(2100M)	7	▲ ▼	dB(0dB~25dB)
Attenuation Value(2600M)	10	▲ ▼	dB(0dB~25dB)

Refresh finished.

Refresh
Save

The value entered is out of range, please enter a value within the specified range!

Figure 50 - BIU Attenuator

5.4.2.2 Adjust RU Downlink Attenuator

Adjust the RU downlink value for the specific RU / frequency band as follows:

1. Click on the RU in the topology diagram and the component window will pop up on the right as shown in Figure 51 - RU Attenuator.
2. Downlink Attenuation Value: Input the appropriate values (0dB – 25dB range)
3. Click **Save**

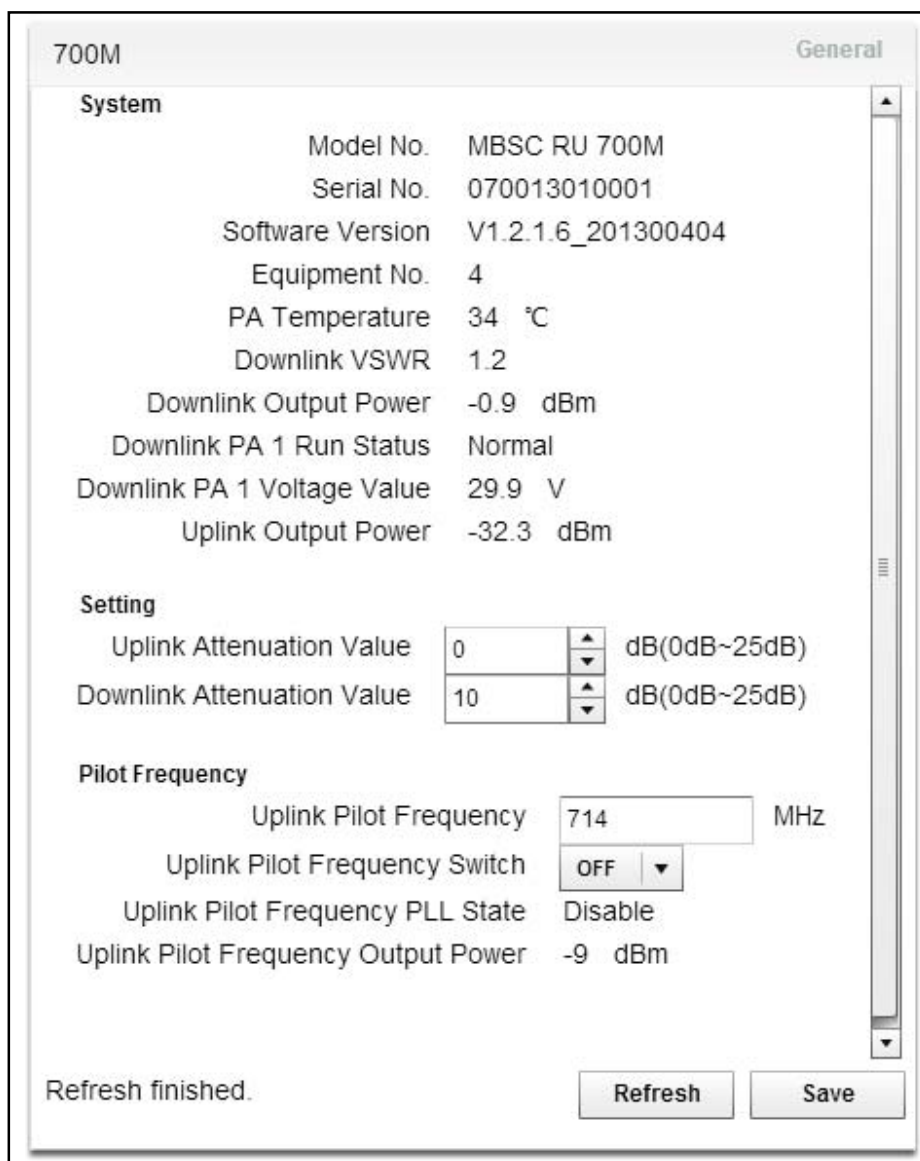


Figure 51 - RU Attenuator

5.4.3 Set Uplink Gain

It may be necessary to adjust the Uplink gain of the mBSC-C system in order to achieve a balanced forward and reverse link, or to adjust for other conditions (antenna placement, dynamic range requirements, propagation characteristics at different bands, specific RF design). The MBSC0700-040-RU provides two points of adjustment for uplink gain:

1. Software controlled attenuator for each band in the BIU
2. Software controlled attenuator in each band-specific Remote Unit

The determination of appropriate values for these parameters is outside the scope of this document.

5.4.3.1 Adjust BIU Uplink Attenuator

Adjust the BIU uplink attenuation value for each frequency band as follows:

1. Click on the BIU in the topology diagram and the component window will pop up on the right as shown in Figure 50 - BIU Attenuator.
2. Uplink Attenuation Value (XXX MHz): Input the appropriate value for each frequency band (0dB – 25dB range)
3. Click **Save**

5.4.3.2 Adjust RU Uplink Attenuator

Adjust the RU uplink attenuation value for the specific RU / frequency band as follows:

1. Click on the RU in the topology diagram and the component window will pop up on the right as shown in Figure 51 - RU Attenuator.
2. Uplink Attenuation Value: Input the appropriate values (0dB – 25dB range)
3. Click **Save**

5.4.4 Link Verification

The MBSC0700-040-RU system is equipped with features that enable the downlink and uplink link to be fine-tuned from the head-end location using common test equipment (RF signal generator and RF power detector).

5.4.4.1 Verify End-to-End Downlink Gain

Each RU in the remote node is equipped with a calibrated Downlink Power Detector which will display the average power at the output of the RU. By injecting an RF CW signal at each TXin port of the BIU the end-to-end downlink system gain can be verified without additional test equipment required at the Remote Node.

Verify the end-to-end Downlink Gain for each frequency band as follows:

1. Using an RF Signal generator inject a CW RF signal to the TXin port of the BIU
 - a. Set the frequency to the center of the spectrum to be used in the system (if the operator licensed bands are not known set the frequency to center of the band – e.g. 2132.5 MHz for AWS band)
 - b. Set the input RF power level to be 3 – 5 dB below the expected RF level to product maximum output power at the RU to avoid accidental overdrive (e.g. if the gain is set so that 0dBm input will produce +43 dBm at the output then start with -5dBm)
2. The resultant Downlink output power of the RU can be observed in two ways:
 - a. In the topology window the Downlink Output power is displayed next to the specific RU (e.g. 30.7 dBm indicated in the topology diagram by the 800MHz RU in Figure 52 – Up/Down Link Verification)
 - b. Downlink Output Power: In the component window
3. Variations in filtering, amplifiers, and optical loss may cause the actual system gain to vary +/- 6 dB. All paths can be normalized by adjusting downlink attenuation settings in the BIU.
4. This procedure should be repeated for each frequency band in the system

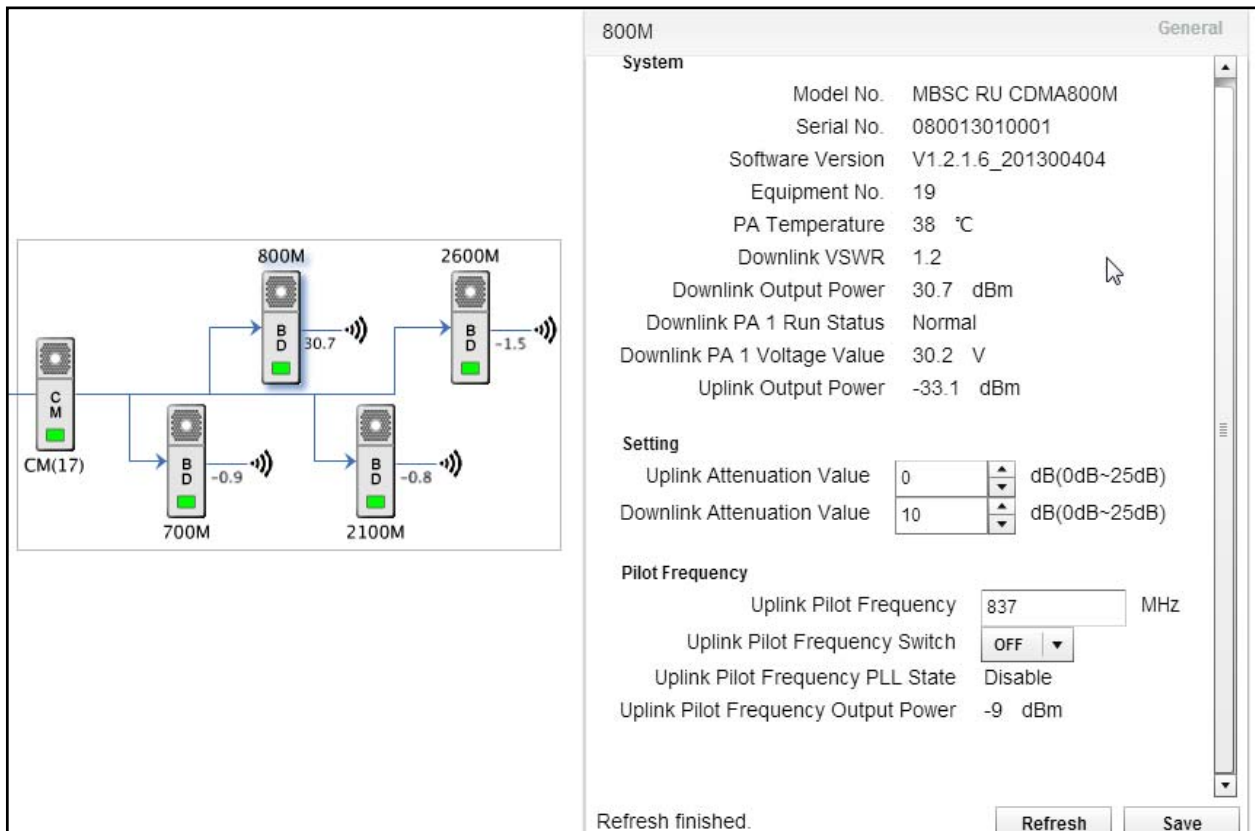


Figure 52 – Up/Down Link Verification

5.4.4.2 Using Uplink Pilot Tone Generator

Each RU in the remote node is equipped with an Uplink Pilot Tone Generator which will generate a CW RF tone out of the RU back towards the FIU and BIU.. By measuring the RF power at the RXout port of the BIU the end-to-end uplink system gain can be verified, and band-to-band / node-to-node, variations calibrated without additional test equipment required at the Remote Node.

Verify the end-to-end Uplink Gain for each frequency band as follows:

1. Click on the RU for the desired frequency band. The component window ;will pop up as shown in Figure 52 – Up/Down Link Verification
 - a. Uplink Pilot Frequency: Set the frequency to the center of the spectrum to be used in the system (if the operator licensed bands are not known set the frequency to center of the band – e.g. 1732.5 MHz for AWS band)
 - b. Uplink Pilot Frequency Switch: select ON from the drop-down box
 - c. Click **Save** to turn the Uplink Pilot generator ON
2. Connect an RF power meter to the corresponding RXout port of the BIU
 - a. A -6 dBm value in the Uplink Pilot Frequency Output Power field of the RU corresponds to an equivalent signal of -60 dBm at the input to the RU

- b. Variations in filtering, amplifiers, and optical loss may cause the actual system gain to vary +/- 6 dB. All paths can be normalized by adjusting uplink attenuation settings in the BIU.
- 3. This procedure should be repeated for each frequency band in the system

Note: Uplink Pilot Frequency Switch should be off during normal operations. This function is intended for testing, verifying, and adjusting uplink performance and will interfere with normal operation of the system.

5.5 Monitoring and Alarms

5.5.1 Operational Status

5.5.1.1 Host Unit

The EMS Local GUI graphical interface will notify users of an error or malfunction in the Host Unit with a red popup “alarm indicator”. The alarms will also be displayed in the lower section of the component window.

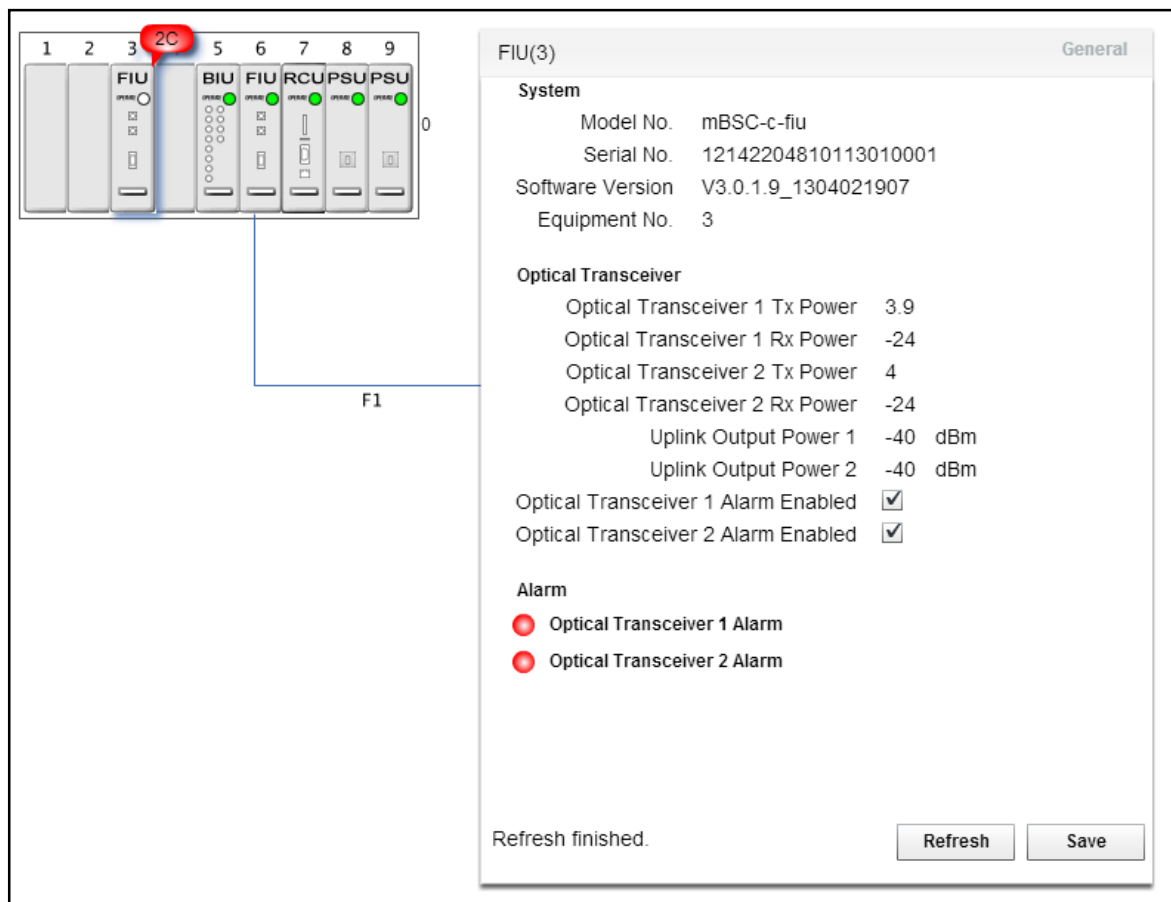


Figure 53 - Host Unit Alarm Status

5.5.1.2 Remote Node

In the case of a Remote Node malfunction, the affected unit will also be marked with a red popup “alarm indicator”. Figure 54 - Remote Node Alarm Status illustrates a condition where both fans of an RU are not working (power cable disconnected):

1. The alarm indicator beside the affected RU in the topology view displays “2C”
2. Additional alarm status is shown in the lower right section of the RU component window.

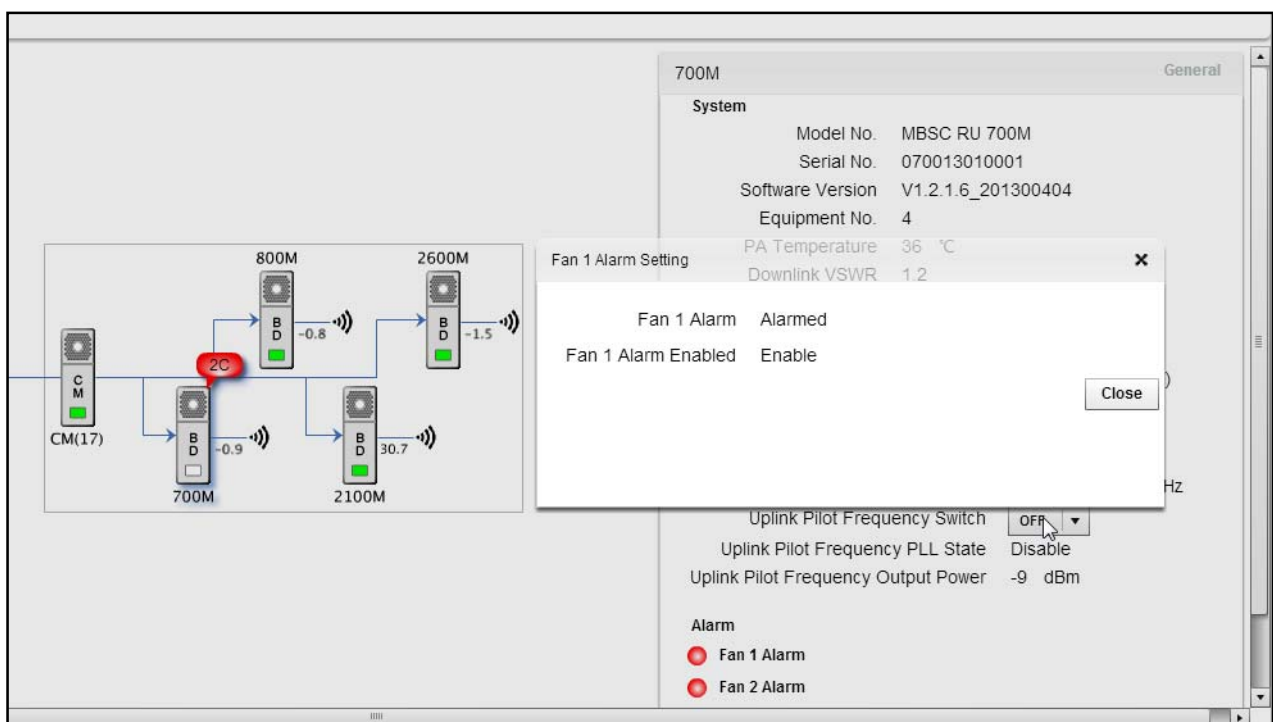


Figure 54 - Remote Node Alarm Status

5.5.2 System Alarms

The MBSC0700-040-RU provides alarm indications for equipment malfunctions or for conditions that place the out of standard operating range (such as over-power). A complete list of alarm events, and the originating product module, is provided in Table 15System Alarms.

These events are enabled by default factory settings, but can be disabled if desired.

These alarm events can be observed in multiples ways:

- In the EMS Local GUI in the network topology view and corresponding component parameter windows
- In the Monitor window of the remote EMS Server
- As SNMP traps issued by the remote EMS Server (if enabled)

Table 15System Alarms

Item	Equipment	Module	Alarm ID	Alarm Name	Description	
1	Host Unit	RCU	401500	Host/Remote Link	Optical RX signal is detected by the FIU but no logical connection exists to the Remote Node (CM)	
2			423000	System Temperature	A system over-temperature alarm has been reported	
3	Host Unit	FIU	401500	Host/Remote Link	Optical RX signal is detected by the FIU but no logical connection exists to the Remote Node (CM)	
4			422000	Optical Transceiver 1	Low/No optical signal is detected on Link 1	
5			422100	Optical Transceiver 2	Low/No optical signal is detected on Link 2	
6	Remote Node	CM	401500	Host/Remote Link	Optical RX signal is detected by the CM but no logical connection exists to the Host Unit (FIU)	
7			423000	System Temperature	A system over-temperature alarm has been reported	
8			400100	Power Down	Power has been lost at the Remote Node (internal battery backup enables alarm delivery)	
9	Remote Node	RU	PA	401920	PA Over VSWR	High VSWR detected at output of PA
10				427000	PA Over Output Power	PA output power exceed threshold
11				401620	PA Over Driver	PA overdrive condition exists
12				400600	PA Over Temperature Alarm	High temperature condition in final PA stage
13				427100	PA Lower Gain Alarm	Low gain condition (< 10dB) detected

14			415510	PA Loop Alarm	Error correction loop unlocked
15			400310	PA Voltage Alarm	PA voltage outside range
16			401300	PA Fault Alarm	Internal PA fault detected
17		SSM	401000	Uplink LNA Fault Alarm	Internal LNA fault detected
18		FAN	408301	Fan 1 Alarm	Fan 1 is non-functioning (low current)
19			408302	Fan 2 Alarm	Fan 2 is non-functioning (low current)

5.6 System Upgrade

To conduct a system upgrade, navigate to the upper right section and click on **“Upgrade”**.

5.6.1 Verify Software Versions

Verify component versions in the second column of the **Upgrade** tab.

5.6.2 Upgrade component software

Click on the **“Upgrade”** button and locate the firmware file to start the component upgrade. *Note: Each component upgrade time differs from one another ranging from 5 minutes to 120 minutes.*

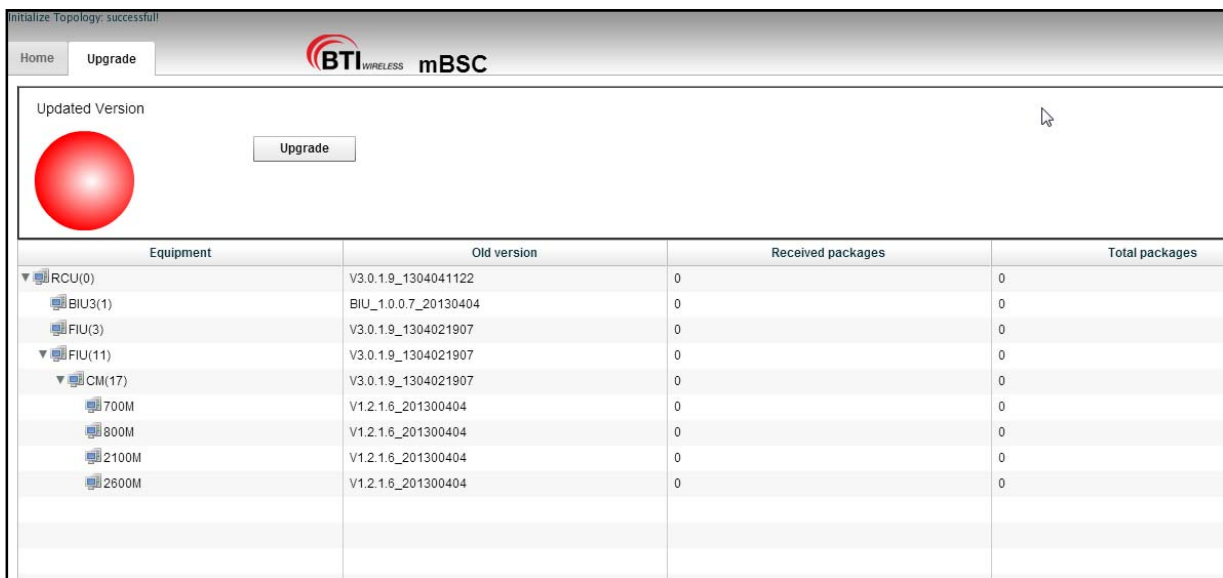


Figure 55 - Component Upgrade

6 Maintenance

Note: Check your sales order and equipment warranty before attempting to service or repair the mBSC-C system. Breaking the seals on equipment under warranty will void the warranty. Do not return equipment for warranty or repair until proper shipping instructions are received from the factory.

6.1 Electrostatic Discharge Precautions

The mBSC-C system modules contain assemblies and components which are sensitive to electrostatic discharge (ESD). Carefully observe the precautions and recommended procedures to verify that system reliability is not compromised due to component damage from static electricity.

The following precautions will significantly reduce the risk of system failure or malfunction due to ESD:

1. Always wear a grounded wrist strap while working around the system
2. Consider all assemblies, components and connections to be ESD sensitive
3. When unpacking circuit boards, interfaces and modules that are packaged separately from the system, keep them in their conductive wrapping until they are ready to be installed.
4. Before removing or replacing any components, select a work area where potential static sources are minimized
5. Handle circuit packs and boards by the grounded housings, avoiding contact with the connectors

6.2 Preventative Maintenance

The mBSC-C system requires minimal regular maintenance to ensure continuous and satisfactory operation. Maintenance includes diagnosing and correcting the service problems as they occur. When an alarm is reported, it is necessary to follow a troubleshooting procedure to identify the source of the problem.

The following are recommended routine maintenance procedures:

- Check the indicator status LEDs (normal or alarm).
- Prevent dust or grime from accumulating on the surface of heat sinks.
- Check power output.

6.3 Fault Detection and Alarm Reporting

The mBSC-C on-board embedded firmware detects unit and system faults and reports them as system alarms. The following methods may be used to report alarms:

- Dry-contact alarm points
- Status LEDs on system components
- NMS (Local GUI, remote NMS, and SNMP Alarms)

The mBSC-C Host Unit components are equipped with multiple LED indicators that show status and alarms by displaying Green, Red or Off. Detailed descriptions of the LED indicators are provided respectively in section 3.2.7 Host Unit Interface.

The NMS software provides detailed alarm information which includes module level faults, circuit faults and measured value faults such as door, RF power and temperature.

6.4 Troubleshooting Quick Guide

Use this section to quickly troubleshoot alarms and faults.

Table 16 Troubleshooting Quick Guide

Problem	Quick Troubleshooting Steps / Possible Cause
No RF output	1) Optical path is faulty; 2) Downlink path BTS input signal is low/not present 3) Remote Node RU is faulty.
RF output power level is low	Measure the downlink output power at the output of the RU, and at the input to the antenna 1) Passive components between the RU and the antenna port are faulty; 2) Host Unit RF input connections are faulty; 3) Optical path is faulty; 4) RU is faulty.
Loss of phone service, but the RF signal level is normal	1) Test calling in the coverage area of original BTS. It may be the BTS problem if the situation is the same; 2) Measure the gain both of the forward path and reserve path to see whether they are close; 3) RU LNA module is faulty.
Power supply is out of service	1) Measure the DC power input source. If the voltage is out of 48VDC +/- 20%, add a regulated power supply between the power in connector and the power source. 2) The interior power unit is faulty.

6.4.1 Host Unit Trouble Shooting

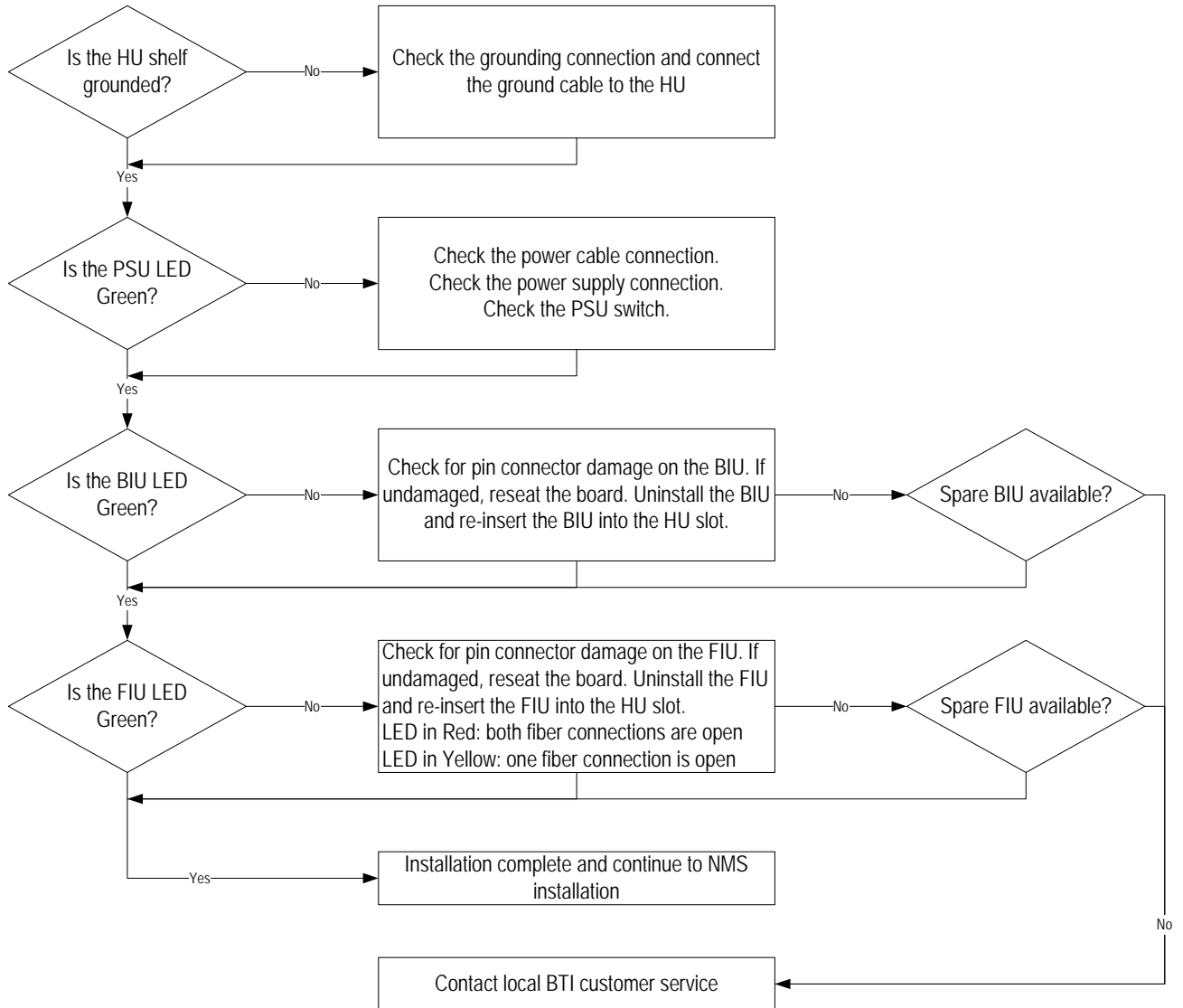


Figure 56 Host Unit Trouble Shooting

6.4.2 Remote Unit Trouble Shooting

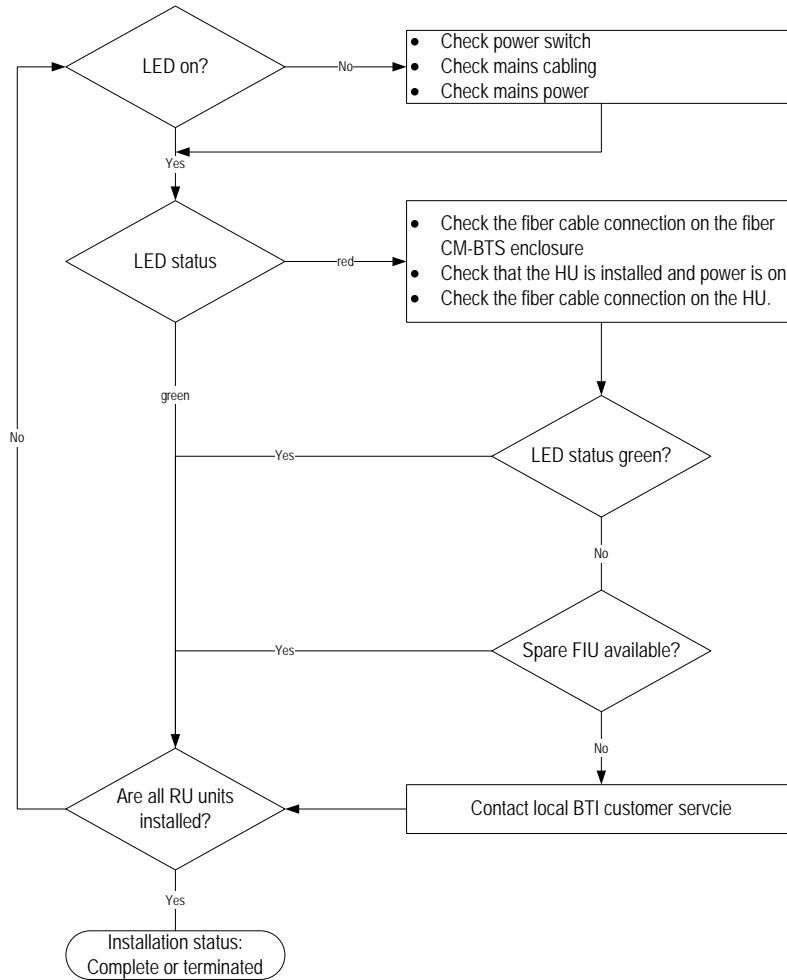


Figure 57 Remote Unit Trouble Shooting

7 Terms, Acronyms & Abbreviations

Table 17 Terms, Acronyms and Abbreviations

Terms/Acronyms/Abbreviation	Definition
ANT	Antenna
AWG	American Wire Gauge
BTS	Base Transceiver Station or Base Transceiver System
C°	Degree Celsius
COM	Serial Communication Port
CQT	Call Quality Test
dB	Decibels
dBm	Power measurement referenced to the specific power level of one milli watt
DCS	Digital Cellular System
DIN	Deutsches Insitut für Normung eV (German standardsinstitution)
7-16 DIN	German standards RF connector: 7mm OD of inner contact, 16mm ID of outer contact.
DL	Downlink
DT	Driver Test
EMC	Electromagnetic Compatibility
GSM	Global System for Mobile Communications
LED	Light Emitting Diode
LNA	Low Noise Amplifier
NMS	Network & Monitoring System
MCPA	Multi-carrier Power Amplifier
MHz	Megahertz
MTBF	Mean Time Between Failures
OMC	Operation Monitor Center
PA	Power Amplifier
RF	Radio Frequency
RX	Receive or Receiver
SMA	Subminiature Type A coaxial connector
TX	Transmit, Transmitter
UMTS	Universal Mobile Telecommunications System
VSWR	Voltage Standing Wave Ratio

Technical Parameter:		
LTE 700MHz	Downlink	728MHz~746MHz
	Uplink	698MHz~716MHz
Maximum Output Power		Downlink: 40W (46 dBm)
Max Gain		Downlink: 60dB
Type of modulation and Designator		G7D (LTE)
Antenna Type		External antenna
Antenna Gain		Downlink:16dBi
Remark		The EUT does not transmit over the air in the uplink direction.

To submit your comments by mail, use the response card behind the front cover of your document, or write to the following address:

Attn: Publications Manager
 BTI Wireless
 6185 Phyllis Drive
 Cypress, CA 90630

We appreciate your comments.

For US and Canadian installations: FCC RF exposure compliance requires the following antenna installation and device operation configurations be satisfied:

A separation distance of at least 5.5 meters must be maintained between the antenna of this device and all persons. RF exposure compliance may need to be addressed at the time of licensing, as required by the responsible FCC Bureau(s), including antenna co-location requirements of 1.1307(b)(3). § 2.1091

Maximum permissible antenna gain is 16 dBi.

IC STATEMENT Operation is subject to the following two conditions:

- (1) This device may not cause interference, and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence.

L'exploitation est autorisée aux deux conditions suivantes :

- (1) l'appareil ne doit pas produire de brouillage, et
- (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

IC Radiation Exposure Statement

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distances 5.5 m between the radiator include antenna & your body.

IC Déclaration sur la radio exposition

Cet équipement est conforme avec l'exposition aux radiations IC définies pour un environnement non contrôlé . Cet équipement doit être installé et utilisé avec une distance minimale de 5.5 m de entre le radiateur inclure l'antenne et votre corps.