MobileAccess™ 1000/1200

Installation and Configuration Guide

Version 1.0

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TRADEMARK ACKNOWLEDGEMENT

POLICY FOR WARRANTEE AND REPAIR

MobileAccess tests and inspects all its products to verify their quality and reliability. MobileAccess uses every reasonable precaution to ensure that each unit meets their declared specifications before shipment. Customers should advise their incoming inspection, assembly, and test personnel about the precautions required in handling and testing our products. Many of these precautions can be found in this manual.

The products are covered by the following warranties:

General Warranty

MobileAccess warrants to the original purchaser all standard products sold by MobileAccess to be free of defects in material and workmanship for one (1) year from date of shipment from MobileAccess. During the warranty period, MobileAccess will repair or replace any product that MobileAccess proves to be defective. This warranty does not apply to any product that has been subject to alteration, abuse, improper installation or application, accident, electrical or environmental over-stress, negligence in use, storage, transportation or handling.

Specific Product Warranty Instructions

All MobileAccess products are warranted against defects in workmanship, materials and construction, and to no further extent. Any claim for repair or replacement of units found to be defective on incoming inspection by a customer must be made within 30 days of receipt of shipment, or within 30 days of discovery of a defect within the warranty period.

This warranty is the only warranty made by MobileAccess and is in lieu of all other warranties, expressed or implied. MobileAccess sales agents or representatives are not authorized to make commitments on warranty returns.

RETURNS

In the event that it is necessary to return any product against above warranty, the following procedure shall be followed:

1. Return authorization is to be received from MobileAccess prior to returning any unit. Advise MobileAccess of the model, serial number, and discrepancy. The unit may then be forwarded to MobileAccess, transportation prepaid. Devices returned collect or without authorization may not be accepted.
2. Prior to repair, MobileAccess will advise the customer of our test results and any charges for repairing customer-caused problems or out-of-warranty conditions etc.
3. Repaired products are warranted for the balance of the original warranty period, or at least 90 days from date of shipment.

LIMITATIONS OF LIABILITIES

MobileAccess's liability on any claim, of any kind, including negligence for any loss or damage arising from, connected with, or resulting from the purchase order, contract, quotation, or from the performance or breach thereof, or from the design, manufacture, sale, delivery, installation, inspection, operation or use of any equipment covered by or furnished under this contact, shall in no case exceed the purchase price of the device which gives rise to the claim.

EXCEPT AS EXPRESSLY PROVIDED HEREIN, MOBILEACCESS MAKES NO WARRANTY, EXPRESSED OR IMPLIED, WITH RESPECT TO ANY GOODS, PARTS AND SERVICES PROVIDED IN CONNECTION WITH THIS AGREEMENT INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. MOBILEACCESS SHALL NOT BE LIABLE FOR ANY OTHER DAMAGE INCLUDING, BUT NOT LIMITED TO, INDIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF OR IN CONNECTION WITH FURNISHING OF GOODS, PARTS AND SERVICE HEREUNDER, OR THE PERFORMANCE, USE OF, OR INABILITY TO USE THE GOODS, PARTS AND SERVICE.

REPORTING DEFECTS

The units were inspected before shipment and found to be free of mechanical and electrical defects.

Examine the units for any damage that may have been caused in transit. If damage is discovered, file a claim with the freight carrier immediately. Notify MobileAccess as soon as possible.

NOTE: Keep all packing material until you have completed the inspection

WARNING: To comply with FCC RF exposure compliance requirements, antennas used for this product must be fixed mounted on indoor permanent structures, providing a separation distance of at least 20 cm from all persons during normal operation.

WARNING: Antenna gain should not exceed 10dB.

WARNING: Each individual antenna used for this transmitter must be installed to provide a minimum separation distance of 20 cm or more from all persons and must not be co-located with any other antenna for meeting RF exposure requirements.

WARNING: The MobileAccess™ system uses an optical laser for transmitting voice and data. The laser unit has the following output characteristics:

- Optical output power (mW): ≤3.0

- Wavelength (nM): 1310 ± 10

WARNING: Applying power to the MobileAccess™ creates a laser energy source operating in class I as defined by IEC 60825-1, 21 CFR 1040.10 and 1040.11 except for deviations pursuant to laser notice no. 50 (July 26, 2001). Use either an infrared viewer, optical power meter or fluorescent screen for optical output verification.

WARNING: The use of controls or adjustments or performance procedures other than those specified herein may result in hazardous radiation exposure.

WARNING:

Compliance with RF safety requirements:

MobileAccess™ products have no inherent significant rf radiation.

The Rf level on the down link is very low at the remote hub unit downlink ports. Therefore, there is no dangerous rf radiation when the antenna is not connected.

The design of the antenna installation needs to be implemented in such a way so as to ensure rf radiation safety levels and non- environmental pollution during operation.

ATTENTION: To avoid damaging your product, please observe the following:

- Always keep the optical connector covered. Use the fiber optic cable or a protective cover. Do not allow any dirt and/or foreign material to get on the optical connector bulkheads.
- The optical fiber jumper cable bend radius is 3 cm. Smaller radii can cause excessive optical loss and/or fiber breakage.
- For proper system performance only use cables equipped with SC/APC connectors to connect to the MobileAccess MobileAccess™ system.

CERTIFICATION

MobileAccess products have met the approvals of the following certifying organizations:

ISO-9001 REGISTERED FIRM **ISO 9001**

For Europe

CE 0681

For US

FCC 47 CFT part 15,22,24,90
FDA-CDRH
UL

For Canada

RSS-118, RSS-119, RSS-133« .

SPECIFICATIONS

Maximum ambient operating temperature:	50° C
Maximum ambient temperature in a rack:	50° C

Preface

This user guide provides all the information necessary to…

User Guide Organization

Chapter 1. Introduction. About MobileAccess 1000/1200 .

Chapter 2.

Chapter 3.

Chapter 4.

Appendix A.

Revision History

The revision history for this document is shown in Table 1-1.

Table 1-1: Revision history

Version	Date	Description
1.0	April 2003	Initial version.

Terms and definitions

Table 1-2: Terms and Definitions

Term	Definition
BSC	Base Station Controller
BTS	Base Station Transceiver Subsystem

Table of Contents

Chapter 1. Introduction

1.1 About MobileAccess 1000/1200™

MobileAccess™ 1000/1200 family of products provides seamless coverage for voice and data wireless services in difficult indoor environments such as those found in large corporate business buildings, airports, convention centers, hospitals and university campuses. In these types of locations materials such as steel, concrete and earth block RF signals; in high-rise buildings the opposite phenomena often occurs – reception of multiple signals that cause interference.

MobileAccess™ is a hybrid fiber coax modular DAS solution designed to serve multiple wireless services using a single common cabling infrastructure. Homogeneous coverage is provided by antennas connected to Remote Hub Units (RHUs) distributed throughout the coverage area.

The MobileAccess™ infrastructure is protocol-independent and can simultaneously serve various frequency bands and protocols for voice and data wireless services. The MobileAccess™ includes built-in alarm and control capabilities that enable remote monitoring and control of the system elements (including antennas).

Features

- Single cabling and antenna system for all services and frequency bands
- Support for all current and future voice and data wireless services such as PCS/CELLULAR, TDMA, CDMA, GSM, future 3G protocols, Paging, iDEN and 802.11 (a,b,g) Wireless LAN
- Upgradeable to include additional services
- Eliminates RF interferences occurring where multiple antenna systems are used to serve multiple services
- Enables fast deployment for corporate enterprises, property owners and WSP's of new services
- Reduces tenant disruption
- Minimal input power to MobileAccess™ (~0dBm) - No need for high power BTS/RBS, less expenses for the operators.
- Provides both local and remote monitoring and control capabilities
- Software programmable parameters including output power, AGC (on/off and levels), and system gain
- Real time component setting capabilities for optimal performance (aging, temperature, optical connectors, etc.,)
- Modular design architecture

1.2 Applications

MobileAccess™ products are designed to provide coverage for both public and private types of structures.

Typical public markets include malls, airports, convention centers and hospitals; typical private markets include office buildings, business centers and campuses. (to send to JEFF)

Three types of applications are very common for both markets: single-building and multi-buildings or campus type. With **MobileAccess™**, there are no limitations for building height or structure spread.

1.3 Base Unit to Remote Unit Configuration Options

The MobileAccess™ 1000/1200 system includes three basic configuration options:

A) Basic configuration

In the basic configuration, depicted below, the Base Unit drives a single or dual band, MobileAccess™ 1000 RHU. The dual band RHU consists of a low band service (cellular 800, iDEN, Paging, or GSM 900) and a high band service (PCS 1900 or DCS 1800).

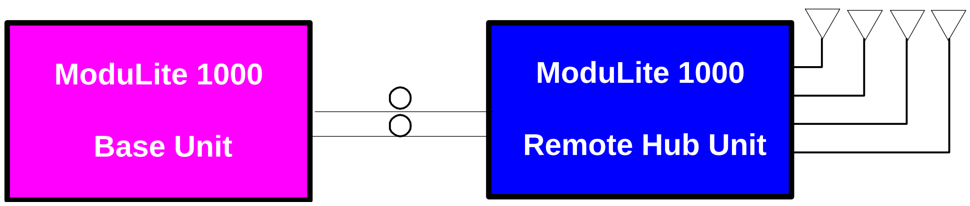


Figure 3: MobileAccess 1000 Basic BU – RHU Configuration

B) Using the MobileAccess 1200 add-on unit to provide an additional service

In the second option, a MobileAccess™ 1200 add-on unit can be added in order to provide an additional service. The add-on unit can be Cellular, PCS, UMTS, 3G, or any future service.

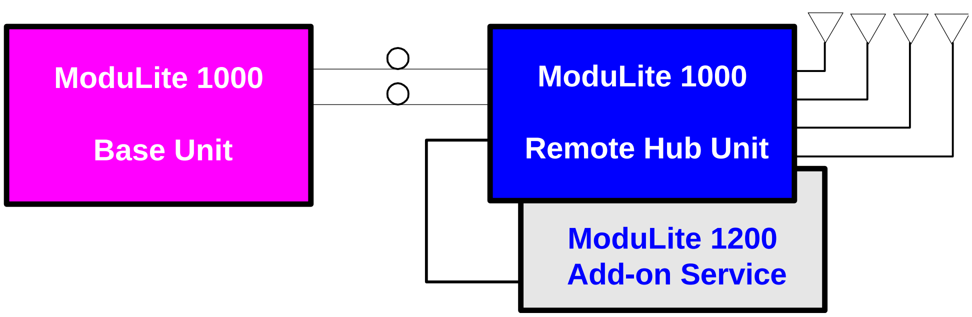


Figure 4: MobileAccess 1000/1200 BU – RHU Plus Add-On

C) Using the MobileAccess 800 WLAN module to provide access to high data-rate service

In the third configuration, depicted below, the WLAN module (MobileAccess™ 800) is added. The WLAN module may also be added without the MobileAccess™ 1200 unit.

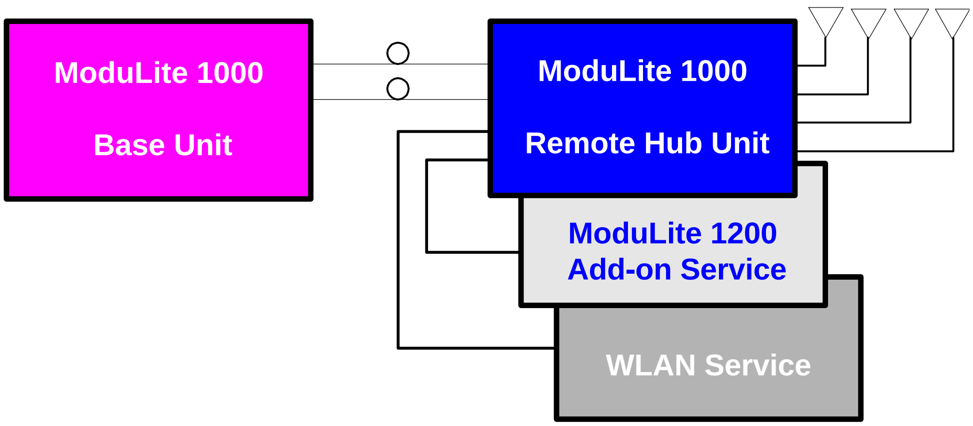


Figure 5: MobileAccess 1000/1200 BU – RHU Plus Add-on Plus WLAN Configuration

1.4 MobileAccess Models

Note: Your MobileAccess DAS site can support an additional service to adding a MobileAccess 1200 unit (either standalone or add-on).

Table 1-1: MobileAccess™ RIU Models

RIU	
Description	Catalog No.
Radio Interface Unit - Interface Module	RIU-IM
Base Station Conditioner supporting Cellular 800MHz	RIU-BTSC-CELL800
Base Station Conditioner supporting iDEN 800MHz	RIU-BTSC-IDEN800
Base Station Conditioner supporting PCS 1900MHz	RIU-BTSC-PCS1900
Base Station Conditioner supporting DCS 1800MHz	RIU-BTSC-DCS1800
Base Station Conditioner supporting Paging 900MHz	RIU-BTSC-PAGE900
Base Station Conditioner supporting GSM 900MHz	RIU-BTSC-GSM900

Table 1-2: MobileAccess™ 1000 Base Unit Models

MobileAccess 1000/1200/2000 Base Unit	
Catalog No.	Description

ML-B8U	Base 8
ML-B4U	Base 4

Table 1-3: MobileAccess™ 1000 RHU Models

MobileAccess 1000	
Catalog No. (RHU)	Band (MHz)
1000-DB - CELL800 - DCS1800 - R4U	Cellular 800/DCS 1800
1000-DB - GSM900 - DCS1800 - R4U	GSM 900/DCS 1800
1000-DB - EGSM900 - DCS1800 - R4U	E-GSM 900/DCS 1800
1000-DB - IDEN800 - PCS1900 - R4U	iDEN 800/PCS 1900
1000-DB - PAGE900 - PCS1900 - R4U	Paging 900/PCS 1900
1000-DB - CELL800 - PCS1900 - R4U	Cellular 800/PCS 1900
1000-SB - CELL800 - R4U	Cellular 800
1000-SB - IDEN800 - R4U	iDEN
1000-SB - SMR900 - R4U	SMR 900
1000-SB - GSM900 - R4U	GSM 900
1000-SB - DCS1800 - R4U	DCS 1800
1000-SB - PCS1900 - R4U	PCS 1900

1.5 System Description

The MobileAccess™ system can interface to up to three Base Stations (BTS) or repeaters. Connections to the **Base Units (BUs)** can be implemented either via passive interface or via active interface using the **Radio Interface Unit (RIU**). The RIU significantly simplifies the process of performing the adjustments required between the Base Station and BUs and in addition, provides enhanced monitoring and control capabilities.

The RIU supports up to three modular adapters referred to as **BTS Conditioners.** Each BTS Conditioner enables the support of a different service.

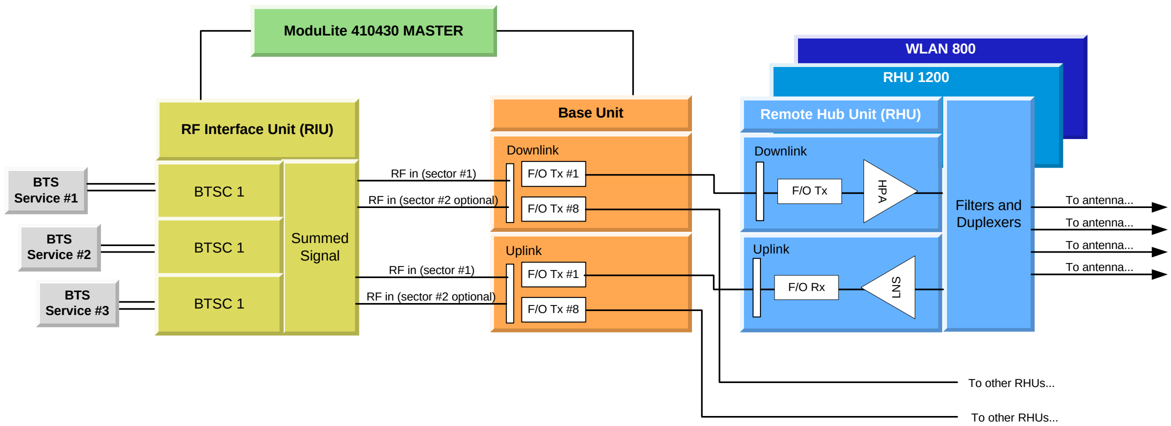


Figure 1-1. MobileAccess™ System Block Diagram

The downlink RF signal is converted at the Base Units to a robust optic signal that is driven over a single mode fiber to the **Remote Hub Units (RHU) –** where each BU can support up to eight RHUs. At the RHU end, the optic signal is converted to RF and distributed to the corresponding antennas – where each RHU can support up to four antennas.

In the uplink path, the signal is received at the RHUs antennas, converted to an optical signal at the RHU, and transmitted to the Base Unit where it is converted back to RF.

Each MobileAccess 1000 RHU can support up to two frequency bands (according to the specific model). A third band may be added using the **MobileAccess 1200 add-on** unit that is assembled onto the MobileAccess 1000 RHU.

MobileAccess 1200 is also available as a **standalone** unit that includes its own optical converters. **MobileAccess 1200 standalone** supports a single service power levels *twice to four times* that of the MobileAccess 1000.

Wireless LAN services can also be added to the MobileAccess 1000 RHU by connecting the **MobileAccess 840** add-on module. This provides wireless LAN signals to the antennas connected to the MobileAccess 1000 RHU.

Monitoring and control functionality for all system elements are provided by the **MobileAccess 410/430** controller.

The Base Units and controller (along with the power supplies and other elements required for interface) are usually installed in the same rack in the communication room, while the RHUs are distributed throughout the locations to be covered. In the communication room located next to the BTS or repeater, the RIU is also installed in the rack.

Chapter 2. Module Description

The MobileAccess™ 1000/1200 system consists of four major components:

- Radio Interface Unit (RIU)
- Base Units (BU)
- Remote Hub Units (RHU) 1000/1200
- Controller 410/430

The number and type of modules vary in each system according to the configuration:

2.1 Radio Interface Unit (RIU)

2.1.1 General

The Radio Interface Unit ensures optimal signal level between the RF source and MobileAccess 1000 Base Units.

The RIU includes the following features:

- Support for both Simplex and Duplex connectivity to BDA/BTS
- Each RIU can simultaneously support up to three RF sources
- Programmable parameter for reduction of Noise Level injected to macro network in a BDA (or BTS) configuration
- RF source - Automatic gain setting in a BDA configuration to compensate for changes in the macro network topology

Each RIU includes up to three BTS Conditioner (BTSC) units, each providing interface to a BTS unit. The model of the BTSC unit corresponds to the BTS carrier. Automatic Gain Control (AGC) maintains a stable power level and invokes event traps when the defined limits are exceeded.

In the downlink, the BTS conditioner attenuates the signals to the level required by the Base Units for optimal Fiber Optic conversion. The output signals are summed (note the front panel wiring) to a single output that is allocated to each of the connected Base Units.

In the uplink, the BTSC provides the attenuation of the signal that is fed to the BTS, minimizing the noise level of the signal.

The RIU may be monitored and controlled by direct connection to the RS232 front-panel connector or via the MobileAccess 410/430 controller (along with all other system elements).

LED indicators on the RIU front panel show the status of each input RF signal on each and of the RIU power. All connections on the BTS side and on the BU side are implemented on the rear-panel.

The RIU front and rear panels are described in the following section.

2.1.2 Front and Rear Panel Descriptions

RIU Front Panel

The RIU front panel provides all the indicators and LEDs. The unit is supplied with the front-panel connections that summarize the signals of all conditioners into a single signal that is applied to all BUs.

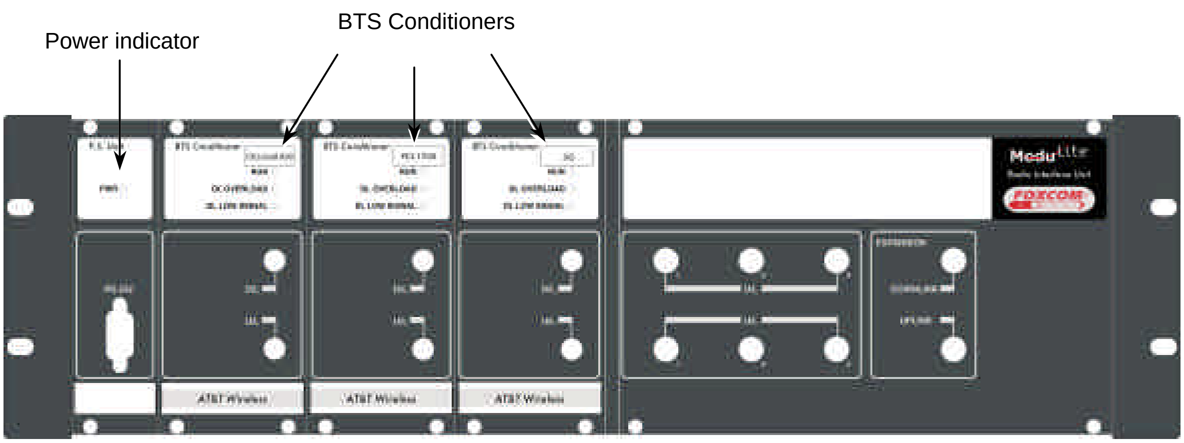


Figure 2-1. RIU Front Panel

Table 2-1. RIU Front Panel Indicators

LED	**Description**
P.S UNIT **PWR**	ON – input signal is at the required level.
BTS CONDITIONER **RUN**	Flashing -- CPU is running and software loaded
BTS CONDITIONER **DL OVERLOAD**	Continuous Red – RF switch is disconnected to protect the system. This may be due to one of the following reasons: • Unpredicted power rise for which the attenuation response was insufficient to compensate and reduce the power to the required level. • Software problem detected. Flashing: When the BTSC DL output power is more than 3dB of the calibrated value.
BTS CONDITIONER **DL LOW**	Continuous Red – if the BTSC DL power is at least 15dB lower than the calibrated BTSC max power level. This condition also triggers an event.

RIU Rear Panel

The rear-panel provides all the connections on the BTS side and on the BU side as well as connections to the MobileAccess 410/430 controller and the power connection. Two types of BTS side connections are available for each BTS conditioner: non-duplexed and duplexed.

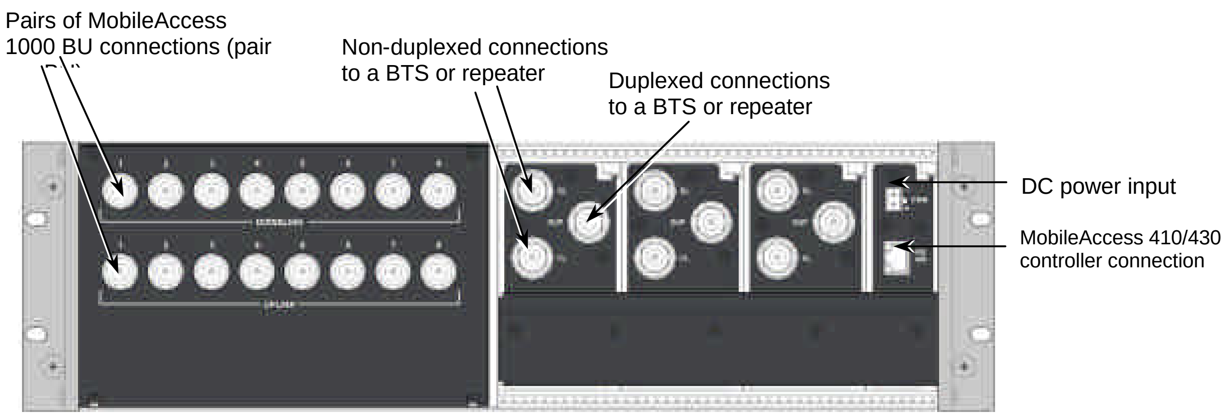


Figure 2-2. RIU Rear Panel showing the RF Connection

2.2 Base Unit

2.2.1 General

The Base Unit converts the downlink signal from the BTS or repeater from RF to Fiber Optic and transmits it to the Remote Hub Units via a composite or F/O cable. On the uplink, the BU converts the signal from Fiber Optic to RF.

Depending on the Base Unit model, each Base Unit drives up to four or eight remotes via duplex F/O connection, where each remote can be as far as 2 kilometers (1¼ miles) from the BU. Eight port BU consist of two four port BU that are integrated.

Each Base Hub Unit may be monitored and controlled via either a direct RS232 connection to a laptop on which the MobileAccess Configuration application (MCT) has been installed, or via the MobileAccess 410/430 controller.

During power-up, the Base Unit identifies the active connected RHUs that are connected to that Base Unit and each of the corresponding link LEDs is lit according.

2.2.2 Base Unit Front and Rear Panels

The front panel contains all the optical connections while the rear panel contains all the RF connections.

Front Panel

The following figures shows the front panel of an eight port BU and a four port Bu.

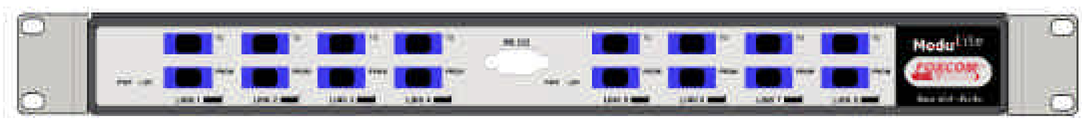


Figure 2-3. Eight Port MobileAccess 1000 Base Unit Front Panel

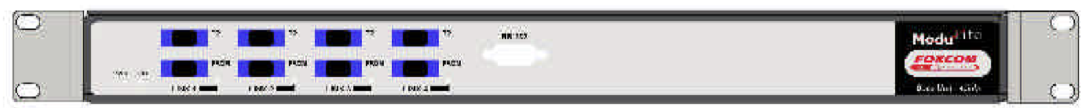


Figure 2-4. Eight Port MobileAccess 1000 Base Unit Front Panel

Table 2-2. MobileAccess 1000 Front Panel Indicators

LED	Description
PWR	Internal voltages OK. Two LEDs – one for each four-port module.
LSR	Laser signal transmission is OK. Two LEDs – one for each four-port module.
Link	Detected optical signal received on that link.

Rear Panel

The Base Unit rear panel on which the BTS side (RF) connections are located is displayed by the following figure.

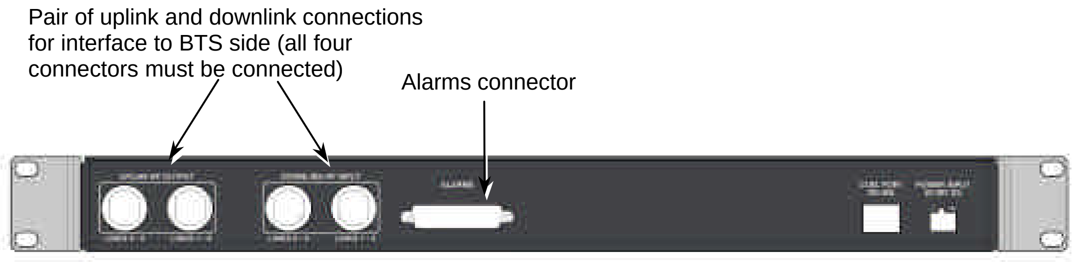


Figure 2-5. Base Hub Unit Rear Panel (RF Connections)

Table 2-3. MobileAccess 1000 Front Panel Indicators

Connector	Description
Uplink output	Uplink connectors to be connected on BTS side.
Downlink input	Downlink connectors to be connected on the BTS side.
Com Port RS485	Connection to MobileAccess 410/430 controller.
PWR	Power connection

2.2.3 Remote Hub Unit (RHU)

On the downlink, the RHU converts the optical energy received from the BU back to RF energy which is then delivered to the connected indoor antennas. On the uplink, the RHU converts the RF energy from the antennas to optical energy which is then delivered to the Base Units.

In order to make your system as flexible as possible and maximize the resources, MobileAccess product line includes three models of RHUs:

- MobileAccess 1000 RHU
- MobileAccess 1200 RHU standalone
- MobileAccess 1200 RHU add-on

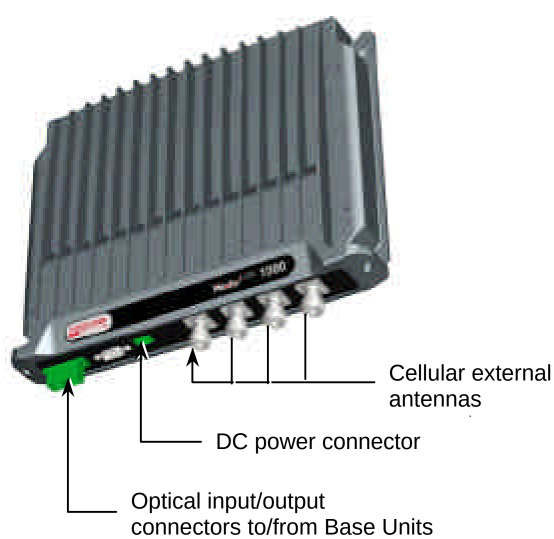
2.2.3.1 MobileAccess 1000

Each MobileAccess 1000 RHU unit can support two different frequency bands depending on the RHU 1000 model. Output composite power per antenna port is in the range of 14 to 20 dBm (depending on the served protocol).

MobileAccess 1000 can be purchase in one of the following models:

- Two-band RHU
- Two-band plus support for a third band (implemented using MobileAccess 1200 add-on unit)

Note: A third band may be added using the RHU 1200 add-on unit or RHU 1200 standalone unit (see section xx for more details).



2.2.3.2 MobileAccess 1200

RHU 1200 is supplied in two configurations:

- **MobileAccess 1200 add-on**. This unit is installed on the MobileAccess™ 1000 unit (supporting this option) . RHU 1200 add-on unit enables expanding the RHU 1000 unit capabilities by an additional service. The supported band varies depending on the model of the RHU 1200 add-on unit. RHU 1200 is simply connected to the existing RHU 1000 unit.
- **MobileAccess 1200 standalone unit.** RHU 1200 standalone is a single-band high power RHU. It consists of two sub-modules: an optical module that provides the optics to RF conversion and the RF module that provides amplification and power to the antennas.

Table 2-4: MobileAccess™ 1200 RHU Models

MobileAccess 1200	
Catalog No. (RHU)	Band (MHz)
1200 - UMTS - SA - R1U	UMTS
1200 - UMTS - AO	UMTS
1200 - PCS1900 - SA - R1U	1900
1200 - PCS1900 - AO	1900
1200 - DCS1800 - SA - R1U	1800
1200 - DCS1800 - AO	1800
1200 - CELL800 - SA - R1U	800
1200 - CELL800 - AO	800

Note: Detailed specifications for all models appear in the MobileAccessTM data sheet (421300220).

Figure 2-6. 1200 add-on unit

Figure 2-7. 1200 standalone unit (TD)

2.2.4 MobileAccess 410/430 Controller

NOTE: This section provides general information on the *MobileAccess 410/430 Controller. For detailed information onf the controller, configuration and connections refer to xxxx.*

The MobileAccess controller enable managing and controlling the MobileAccess system elements. Each controller provides connection to up to four Legacy Base Units, or a total of up to eight MobileAccess Base Units and Radio Interface Units in any combination. The RHUs (and antennas) are monitored via the Base Units.

Where support of more than four Legacy Bus or more than eight MobileAccess BU and RIU elements is required, additional MobileAccess controllers, defined as a “slaves” controller, can be added.

Slave controllers can also be used in a campus configuration where up to eight Slaves can be connected to a single Master. All the monitoring and control operations can be performed from the Master’s location.

Two MobileAccess controller configurations are provided: MobileAccess 410 and MobileAccess 430. The models differ in their remote access capabilities:

- MobileAccess 410 provides point-to-point connectivity implemented via either direct RS232 connection or via connection to a DSPN phone line
- MobileAccess 430 provides client/server management capability over TCP/IP network with enhanced monitoring and control capabilities (in addition to the connectivity options provided by MobileAccess 410).

NOTE: The MobileAccess 430 front panel is differentiated from the MobileAccess 410 front panel by the SNMP Agent Card that provides TCP/IP management capabilities.

The controller front panel provides:

- LED indicators and an LCD display
- Local PC connections for monitoring
- For MobileAccess 430 only – TCP/IP connection and corresponding status indicators

The controller rear panel provides connections to:

- Base Units – up to four Litenna and up to 8 MobileAccess
- Up to eight slave controllers
- Alarm outputs and inputs
- Modem connections for management connections
- Power

Note: The rear panels for the MobileAccess 410 and MobileAccess 430 are the same.

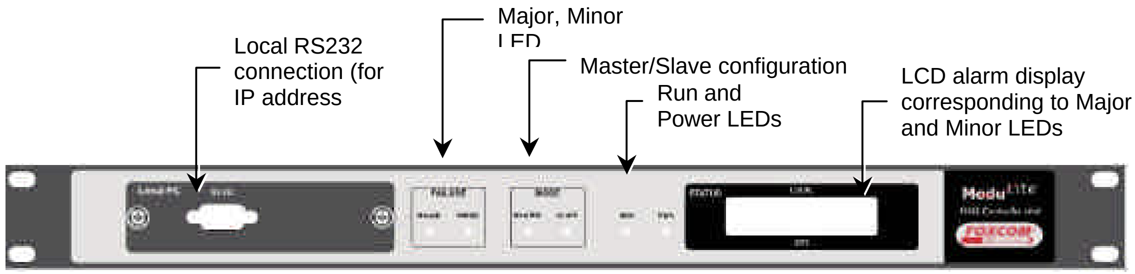


Figure 2-8. MobileAccess 410 Front Panel

Figure 2-9. MobileAccess 430 Front Panel

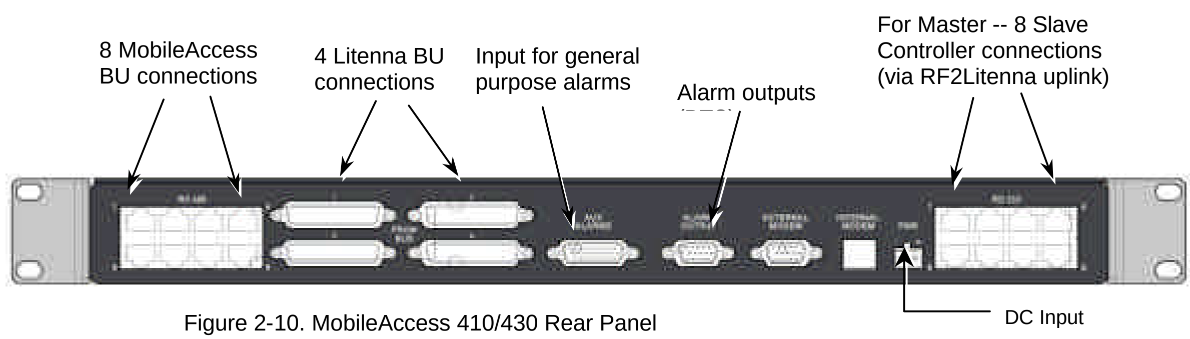


Figure 2-10. MobileAccess 410/430 Rear Panel

Chapter 3. Installation Procedure

This following installation procedure is based on the assumption that site survey and installation planning (*including power requirements*) have been completed:

- Infrastructure preparation according to site analysis and planning: Fiber Optic, coax cable and DC cable installation, Splice the fiber optic cable according to the fiber optic infrastructure design plan.
- Individual floor installation: Install antennas and connect to coax, Install Remote Hub Unit installation on each floor (mounting and connections).
- Communication room installation: RF interface (passive or RIU), Base Units and MobileAccess 410/430 controller (mounting and connections).

3.1 General

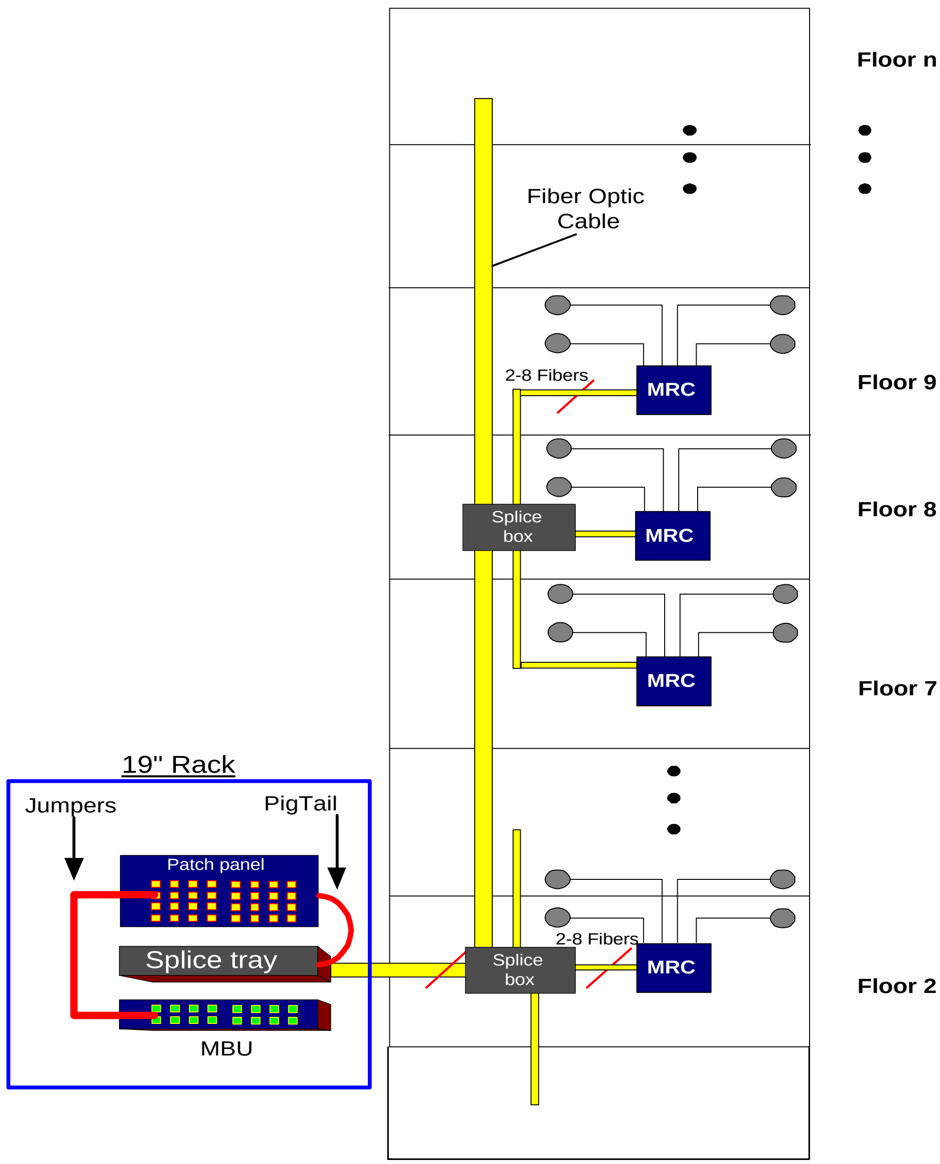
There are two types of installations: single-building and multi-building (campus) configuration. This section describes the recommended Fiber Optics and system location for both configurations. It is recommend to perform the following steps for all MobileAccess installations (both single- and multi-building).

Single-building Installation

In this installation, all Base Units are placed in the same location (usually in the communication room). The Base Units are connected to the BTS/RBS (or repeater) via passive interface or via the RIU (Radio Interface Unit). RHUs are located in various zones in the building according to the RF design. In a multiple story building, a single RHU can typically cover a floor of up to 30,000 sq ft.

As illustrated in figure xx, the fiber optic cable runs from the communication room (Base Units) through the building shaft. Usually every three floors, a fiber optic cable is tapped to a splice box where it is distributed to the floor on which the splice box is located, to the floor above and to the one below.

On each floor, the fiber is connected to the corresponding RHU where it is converted to RF and distributed to the connected antenna(s) via coax cable.


Floor n
Fiber Optic Cable
2-8 Fibers
MRC
Floor 9
Splice box
MRC
Floor 8
MRC
Floor 7
19" Rack
Jumpers
PigTail
Patch panel
Splice tray
MBU
2-8 Fibers
Splice box
MRC
Floor 2

Example 2: Horizontal Structure

In a horizontal layout installation, a separate fiber optic cable is connected to every site location, where a site may include more than one RHU. The connection may be to a splice box or directly to the RHU (depending on the site confiugraiton).

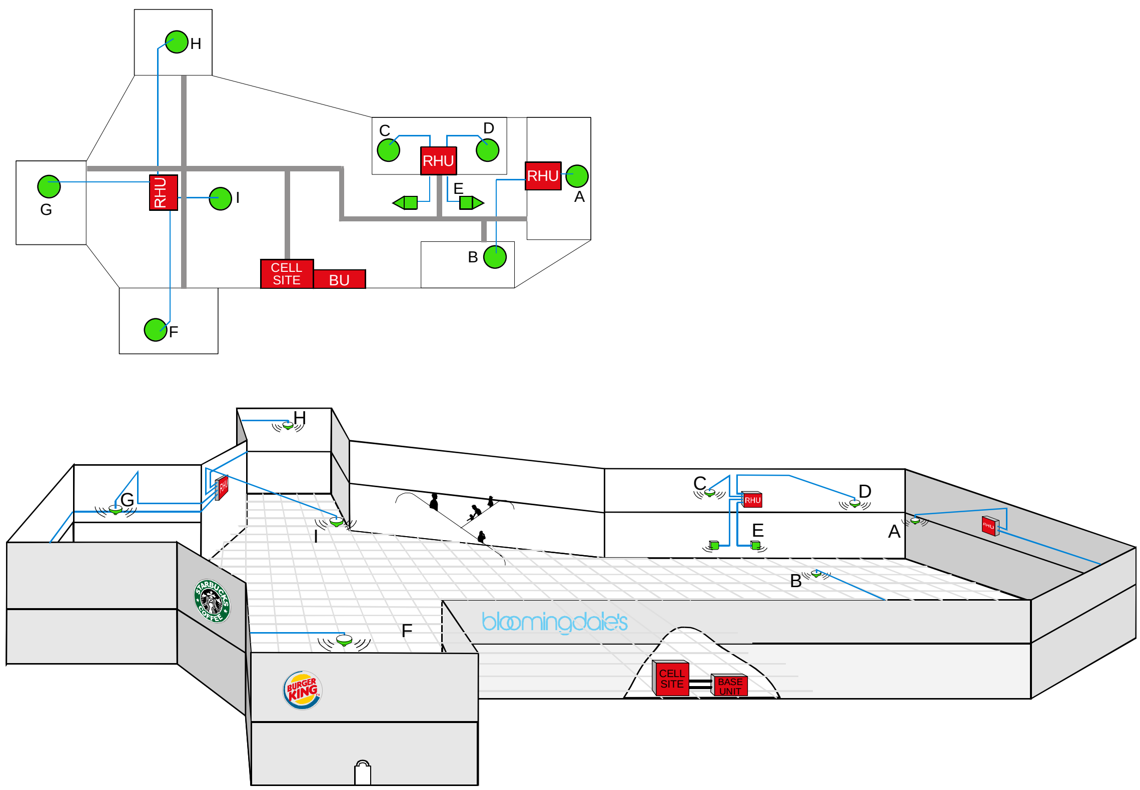


Figure 3-1: Horizontal Layout Installation

3.2 About Infrastructure Installation

Note: When working with fiber optics, it is crucial to maintain a clean working environment. However, if the working environment has been tainted or if the optics connectors has not been covered, refer to appendix x for information on cleaning the fiber optic cable.

ATTENTION: MobileAccess™ requires singlemode fibers with SC/APC connectors. Be sure to use only these types of fibers.

Install all the insfratusture equipment according to the site plan. This procedure includes:

- **Installing the antennas**. The antenna(s) are mounted to the ceiling, or are embedded inside the ceiling tile, depending on the building construction.
- **Routing the coax cables**. These cables are routed between the antennas and the location of the corresponding RHUs.
- Assembling coax connectors to either side of the coax cables.
- Routing Fiber optic cable backbone.
- Splicing the main routed fiber optic in the appropriate locations and installing or placing the corresponding equipment (splice box, splice tray, patch panel, etc.) in the appropriate locations.

  Note: if these devices are installed in the 19" rack, be sure to place them as high as possible so they will not interfere with the rest of the components that will be installed.

- Routing DC cables (see section xx for more info)

3.3 Power Supply for the MobileAccess™

Note: Power to the MobileAccess™ modules may be supplied by any configuration of power supplies that provide the necessary voltage and power.

It is recommended to calculate the required power according to the requirements of the specific installation and then determine the configuration of the power supplies. The required DC cables will then be determined by the selected PS configuration.

Following are the Power Supply configurations usually in use:

- Local configuration in which each PS unit is located adjacent to the BU or RHU units (PS provide AC to DC conversion)
- Single source configuration in which all BU and RHUs are supplied from a single location (i.e. high-rise)
- Mixed configuration in which a number of BU and RHUs are supplied from each power supply (i.e. campus application where each building has a single source)

The power required by each MobileAccess™ type unit is listed in the following table:

Table 3-1. MobileAccess™ Power Requirements

Unit Type	Voltage Input	Power Consumption
RIU	*20 to 48VDC*	10W
Base Unit	*20 to 48VDC*	10W
Remote Hub Unit 1000	*20 to 48VDC*	25W
Remote Hub Unit 1200	*20 to 48VDC*	30W

Various types of power supplies meeting these requirements may be purchased from MobileAccess. The power supplies can be installed in a rack or mounted on a wall, depending on your configuration. Four power supply options are available.

- **Option One.** In this option, the BU is connected to the power supply via electrical cables. In order to power the RHU from the power supply, two copper electrical wires running through the building (separately from the fiber optic cables) supply power to each RHU in parallel. For this configuration, electrical power calculations are needed. The option is shown in Figure 3-2.
- **Option Two.** In this option, the power supply is located near the BU. The power supply will drive the BU and RHU's. To provide power, the BU is connected to the power supply via electrical cables. To supply power to the RHU, a composite cable is used (composite cable contains two fiber cables and copper electrical wires in the same jacket). For this configuration, electrical power calculations need to be made.
- **Option Three.** In this option the power supply type is a standalone configuration. Power for both the BU and RHU's will be supplied separately. In this configuration each unit will be co-located with a power supply. This will not require long electrical cable runs.

Table 3-2: Power Supply Options

Materials	Model
Local power supply	LPS-24-1A
Remote power supply (no redundancy)	RPS-200-N-48
Remote power supply (fully redundant)	RPS-150-R-48
Remote power supply (fully redundant)	RPS-500-R-48
Remote power supply (fully redundant)	RPS-1000-R-48

The example in Figure 3-2 depicts a MobileAccess™ GSM Dual Band installation with 500W/ 48VDC AC/DC converters providing a total of 0.5A power.

Between the AC/DC converters and the units, a circuit breaker (maximum 10A) must be installed, either in the AC/DC converter or nearby.

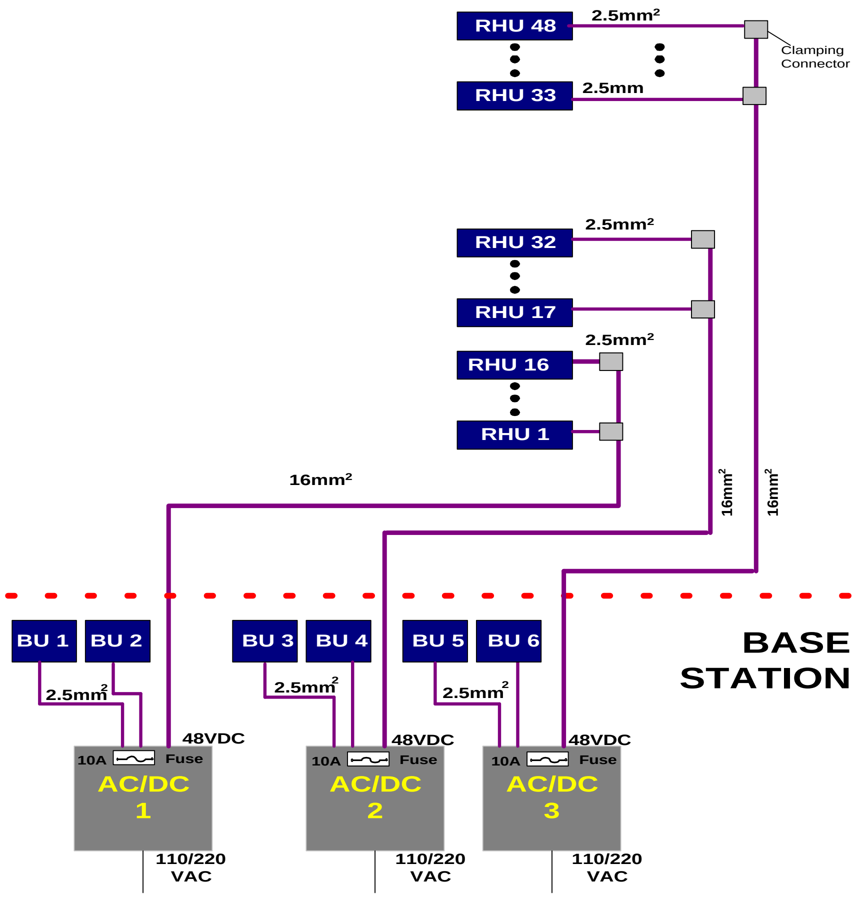


Figure 3-2: EXAMPLE: DC Power Supply in High Rise Installation

3.4 Rack Installation

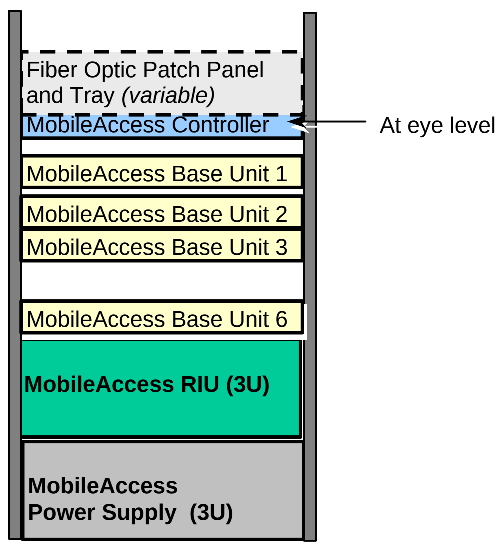
It is recommended to install the following MobileAccess system modules in a 19" rack (usually in the communication room):

- RIU 3U
- BU 1U
- MobileAccess 410/430 controller 1U
- Fiber Optic patch panel and splice tray– (previously installed – see section xx)
- Power supply/supplies (MobileAccess – 3U for each unit, other manufacuters may vary in size)

Verify that the rack height can support all the units to be installed, where you may also want to consider future expansions.

The following image describes shows the recommended locations of the MobileAccess elements in the rack in order to facilitate and simplify the cabling connections.

Note that the MobileAccess 410/430 controller is at eye level to provide an easy view of the LED indicators and LCD display and easy access to the local and remote monitoring connections.



3.5 Connecting Each of the MobileAccess Elements

3.5.1 Base Unit Connections

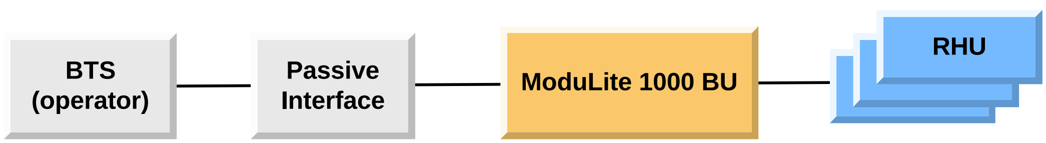
The Base Unit converts the RF signal from the BTS side to optic signals to be transmitted via optic fiber to the RHUs. Therefore, there are two types of connections to each base unit:

- Base Unit to BTS side RF connections
- Base unit to RHU side optic connections

The BU may be connected in the following three configurations:

A) MobileAccess 1000 full configuration:

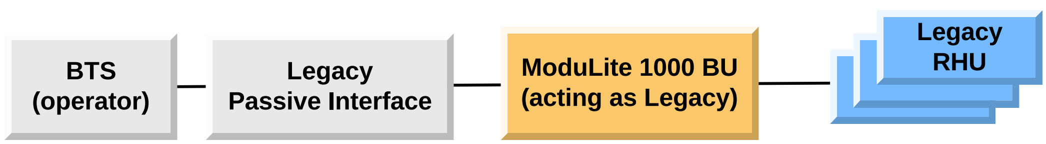
This is a typical MobileAccess 1000 configuration.



B) MobileAccess / Litenna configuration for backwards compatibility:

In this configuration the BU replaces an old BU in the old MobileAccess / Litenna products.

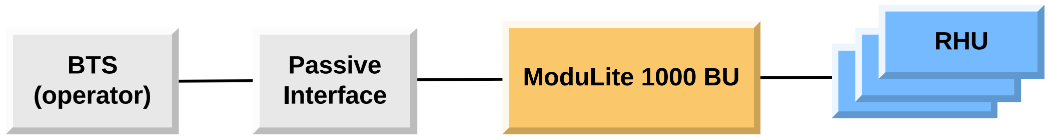
The BU is connected to the BTS through a passive interface without a BTSC, and has to perform exactly like the old BU. The issue here is that the passive interface is previously calibrated to input powers that the old BU needed. The new BU has to be able to adapt itself to these input powers.



C) MobileAccess 1000 partial configuration:

In this configuration the BU is driven by a passive interface instead of a BTSC.

Unlike the previous configuration, the passive interface is supplied at the same time as the BU, so the passive interface is calibrated to supply the input power normally expected by the BU (as if a BTSC was connected).



3.5.2 Base Unit to BTS Side Connections

Base Units may be connected to the BTS/RBS/BDA either via passive RF interface or via the Radio Interface Unit.

The Base Unit rear panel on which the BTS side (RF) connections are located is displayed by the following figure.

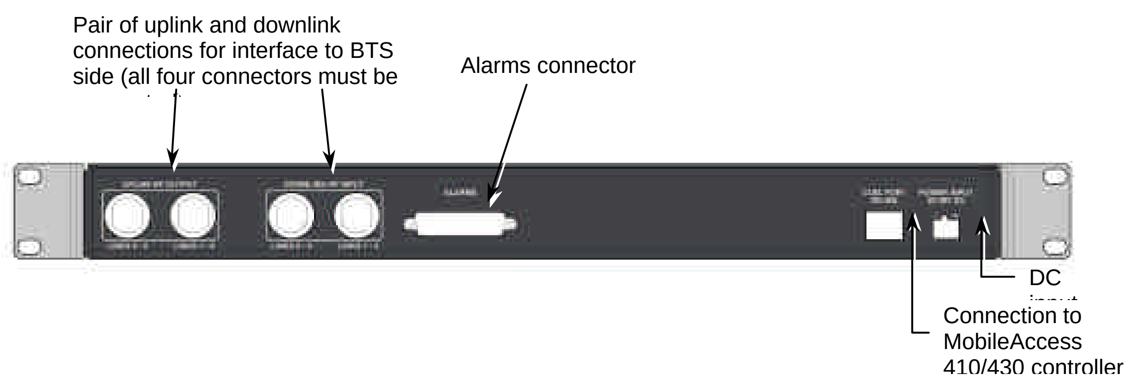


Figure 3-3. Base Hub Unit Rear Panel (RF Connections)

3.5.2.1 Connections via *Passive* RF Interface

BTS/RBS/BDA Duplexed Configuration

4. Verify that the BTS/RBS/BDA is connected to a standard duplexer via a 50Ω (RG223) coax cable.
5. Connect the downlink port through attenuators to the input on the Base Unit rear panel, according to the required input power.
6. When more than one Base Unit is used, splitters are required to connect to the other Base Unit inputs.

7. On the uplink side, combine the ports and connect them to the duplexer uplink port via a 50Ω (RF 223) coax cable.

Note: All other cables are male to male 50Ω.

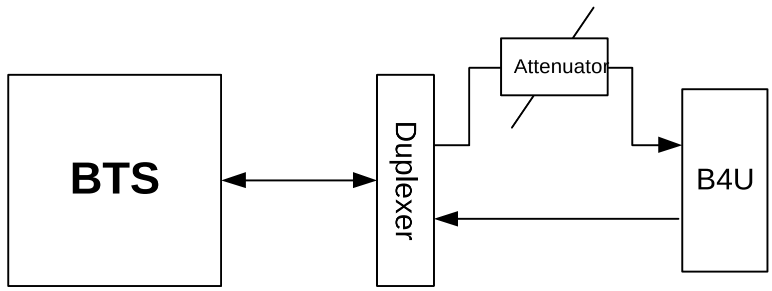


Figure 3-4: Example: One port BTS/RBS connected to 1BFU

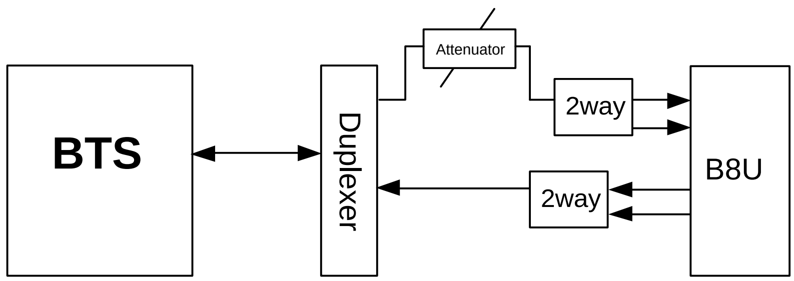


Figure 3-5:Example: One port BTS/RBS connected to 1 B8U .

BTS/RBS/BDA Simplex Configuratoin

1. The BTS/RBS downlink port should be connected via 50Ω (RG223) coax cable to the Base Unit input via an attenuator.
2. The downlink coax cable coming from the BTS/RBS should be split using splitters to all Base Unit input ports (split according to need).
3. The input power for the Base Unit should be calculated to meet the product specifications.
4. For the uplink only the necessary ports will be combined and connected to the BTS/RBS uplink port with suitable splitter.

Note: All cables are coax jumpers (male to male 50Ω).

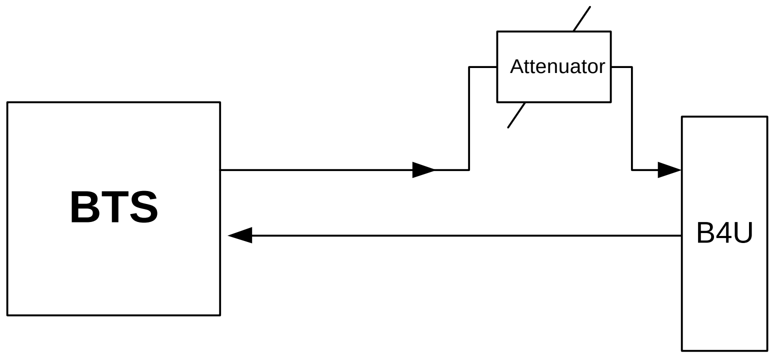


Figure 3-6: Example: Two port BTS/RBS connected to B4U.

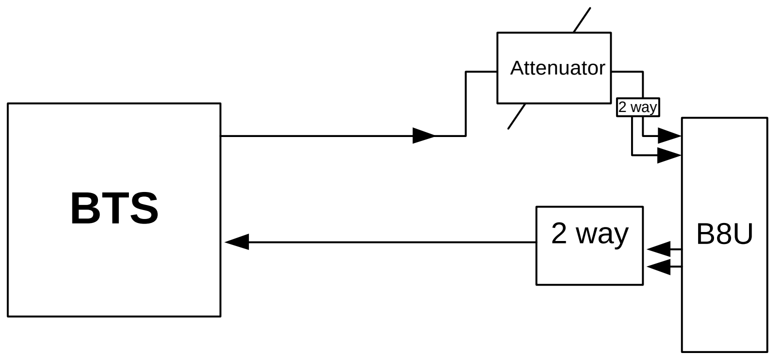


Figure 3-7: Example: Two port BTS/RBS connected to B8U with six optic links

3.5.2.2 Connections via Radio Interface Unit (RIU)

Each RIU can support up to four 8-port Base Units. The RIU can be expanded to support additional BU via the front panel connectors. Figure 3-8 shows the RIU rear panel connections.

Note: All connections are via RG223 coax cables with 1/2" N-type male connectors

RIU to BTS/RBA/BDU connections

Note: Be sure to connect each service from the BTS side to the corresponding BTS conditioner module.

The RIU can be interfaced to up to three BTS/RBA/BDU connections. Two types of BTS connections are supported:

- Simplex BTS connection via an external duplexer.
- Duplex BTS connection via an internal duplexer.

RIU to Base Unit connections

Connect each Base Unit to the corresponding pair of RF outputs on the RIU rear panel.

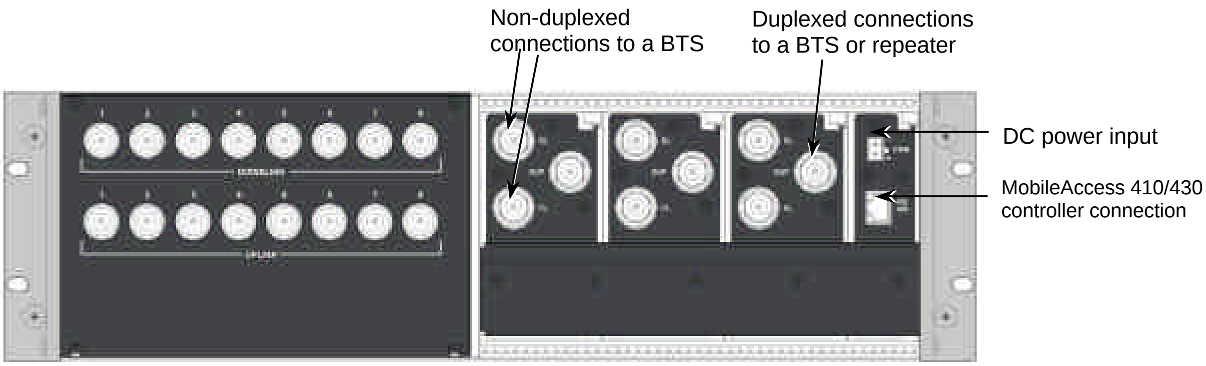
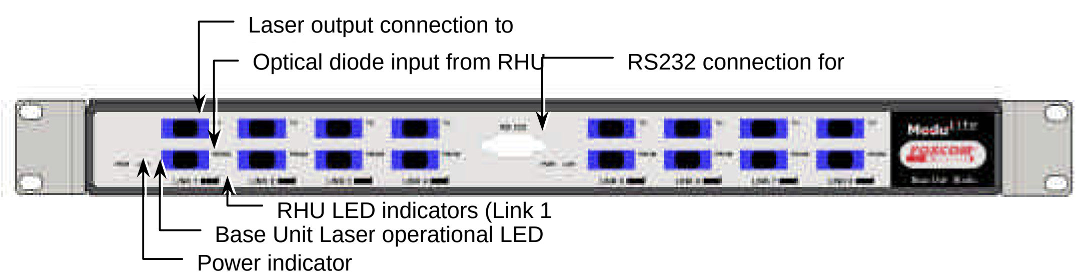


Figure 3-8. RIU Rear Panel showing the RF Connection

3.5.3 Base Unit to RHU connections

1. It is assumed that the patch panel cabinet (SC/APC adaptors) for fiber optic cable connections is installed in the rack near the Base Units.
2. Connect (3/125/900) pigtail with SC/APC connectors between splice tray and patch panel cabinet.
3. Connect (3/125/3000) SC/APC jumpers between the corresponding Base Unit and patch panel.
4. Connect the fiber optic cables from the Base Unit to the RHU's through the patch panel cabinet.



3.6 Remote Hub Units (RHUs) 1000

1. Install splice box near RHU (refer to optic planning).
2. Connect fiber optic cable to splice box and (3/125/3000) pigtails to RHU
3. For the downlink, connect the fiber optic cable pigtails from splice box coming from the Base Unit port to the corresponding Remote Hub Unit port.
4. Connect the Remote Hub Unit to antennas according to the RF engineers design. (up to 4 antennas per RHU).
5. For the uplink, connect the fiber optic cable pigtails from splice box from the Remote Hub Unit to the uplink port that connects to the Base Unit.
6. Connect the power supply to each RHU according to power design planning.

3.7 RHU 1200

3.7.1 Remote Hub Unit 1200 Add-on Unit

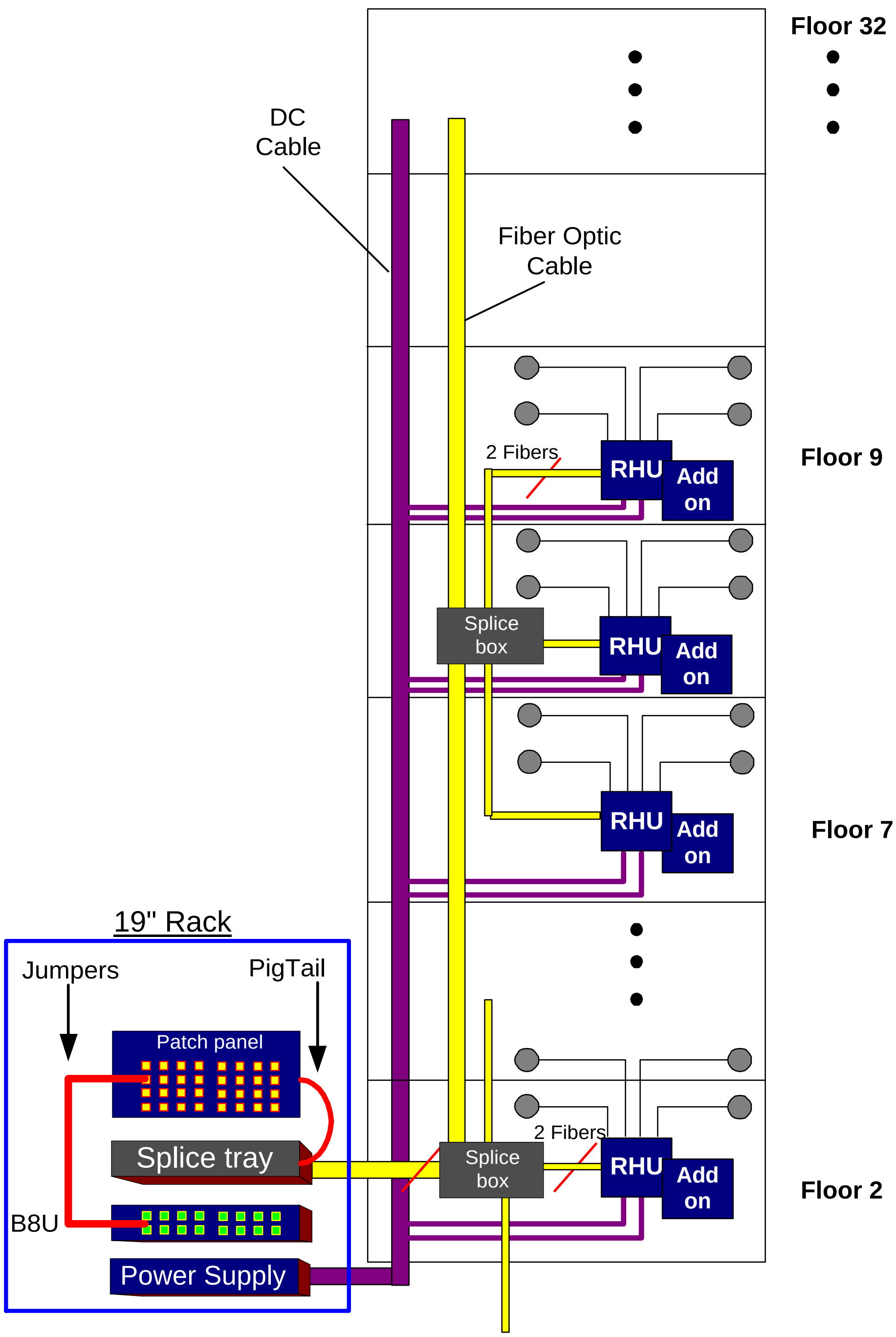
RHU 1200 does not require additional installation of either coax or fiber since the optical to RF conversion and antenna connections are provided by the RHU 1000 unit.

The add-on RHU is connected to the corresponding RHU 1000 unit using SMA coax jumpers at the rear of the units.

Figure 3-9. RHU 1000 with RHU 1200 add-on unit

To install the 1200 add-on unit

1. Remove all three SMA connectors.
2. Connect the Add–On unit with four screws to the installed RHU 1000.
3. Connect coax jumpers between units correspondently.
4. Connect power to the Add-On unit.



3.7.2 Remote Hub Unit 1200 Standalone

RHU 1200 standalone unit provides high power support for a single band. The supported band varies depending on the model of the RHU 1200 standalone unit.

The standalone RHU 1200 is connected to the communication center's base unit by two fiber optic strands

Figure 3-10. RHU 1000 with RHU 1200 add-on unit – wrong picture

To install the 1200 standalone

1. Connect BTS/RBS to Base Units via ½" coax cable RG223 or similar with 50Ω impedance according the RF design.
2. In the remote end, install the RHU 1200 standalone in a shaft or wall mount.
3. Connect two pigtail/jumpers fibers from the splice box to each unit. One splice box can support several RHU's according to the optical design (normally three RHU's).
4. Connect antennas to the Remote Hub Unit UMTS Ready via ½" or 3/8" or similar coax cable with 50Ω impedance and N-type male to male.
5. Terminate all unused antenna ports (N-type for antennas) on the Remote Hub Unit UMTS Ready with 50Ω load

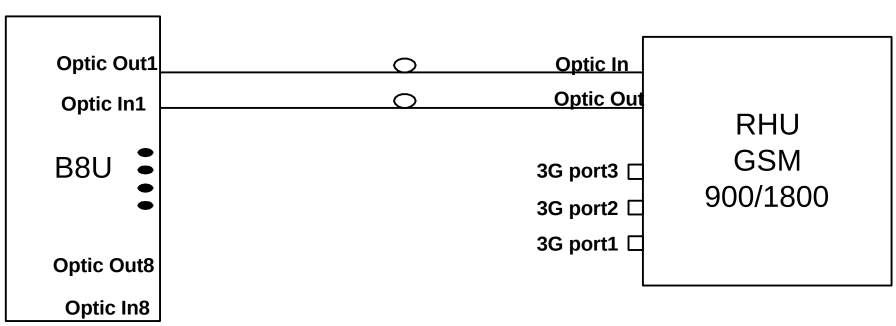


Figure 3-11:UMTS Ready -System Configuration

The following diagram depicts the upgraded remote site design:

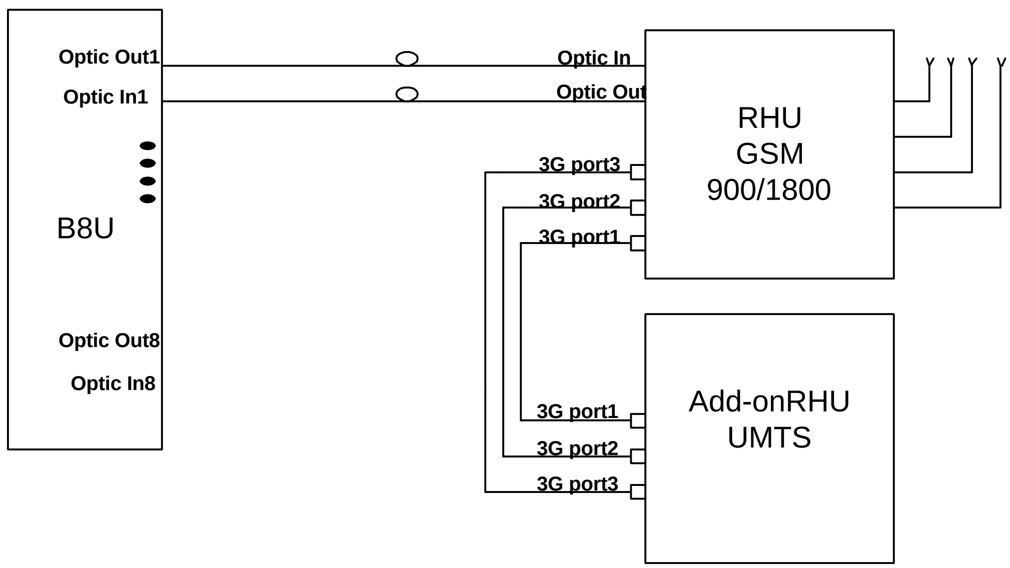


Figure 3-12: Example - MobileAccess™ UMTS Ready Full Installation

3.8 Controller Connections

The MobileAccess controller connections vary depending on the configuration of the site and the required monitoring capabilities. The MobileAccess 410/430 controller configuration is described in section xx .

3.9 Power Supply Connections

Connect the power supply to the units, according to power design planning.

Chapter 4. Adjustments Procedure

This procedure is used to adjust the system to provide optimal performance. The system will be operational without this adjustment procedure; however, the system performance will be better.

Adjustments can be made only after the system is fully installed. The adjustments procedures differ depending on the system topology:

- With RIU
- Without RIU
- Main building adjustments
- Remote building adjustments

The adjustment procedure consists of three phases:

1. Performing auto-discovery and verifying that all system elements are detected.
2. Downlink adjustments
3. Uplink adjustments

4.1.1 Auto-detect

Before beginning the adjustment procedure, verify that all the system elements are detected by doing the following:

1. If your Master controller is MobileAccess 430 (with a TCP/IP) slide-in board, replace the TCP/IP slide-in board with an RS-232 board without TCP/IP.
2. Connect a laptop on which the MCT application is installed to the Master controller RS232 front panel connector.
3. Launch the MCT application. The application will perform auto-discovery and a Browser tree with all the system elements will be displayed.
4. Verify that all the installed system elements are displayed in the list. You may now begin to perform the downlink adjustment procedure.

4.1.2 Downlink Adjustments

The adjustment procedure is performed after the system installation is completed. The procedure requires injecting a signal equivalent to that provided by the BTS. This can be done by either using a signal generator or simply connecting the BTS.

If using a signal generator, set it up as follows:

- Frequency – mid-band frequency of the Operator's range
- Amplitude – equal to the maximal expected composite RF transmitted by the BTS

4.1.3 Main or Independent Building with RIU Adjustment

The DL path can be calibrated using either an injected signal that physically represents the maximum input power expected from the BTS or using an estimation of the same power level.

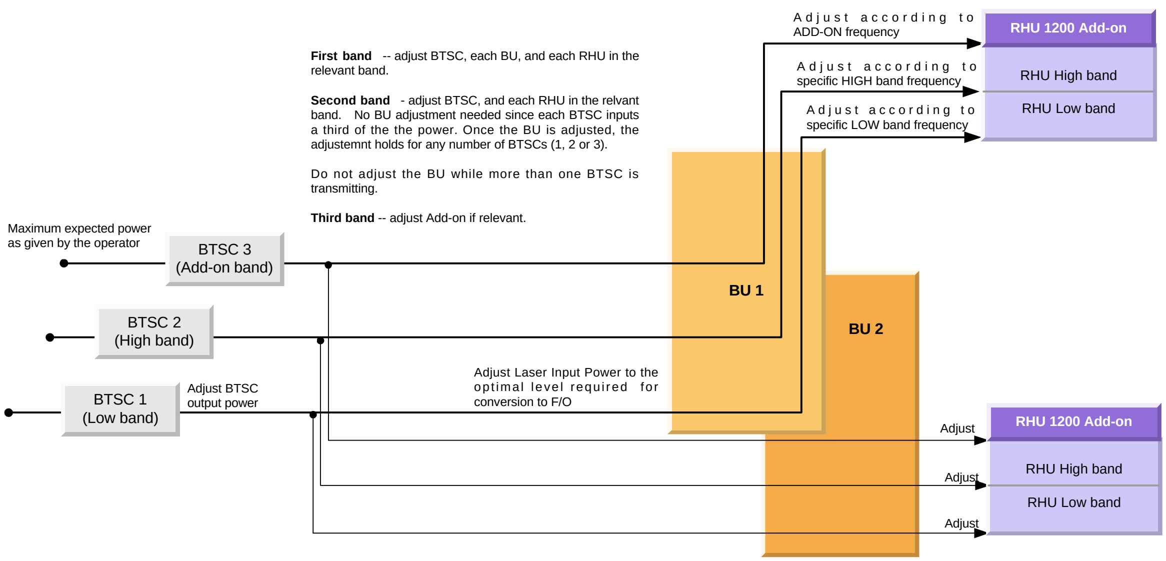


Figure 4-1. Main or Independent Building with RIU

4.1.4 First Band Adjustment

4.1.4.1 First Band (any of the bands)

For the first band, adjustments are made end-to-end from the BTSC, through to each of the connected BU and to each of the corresponding RHUs.

1. Connect either the signal generator or the BTS to either the duplex or non-duplex connectors of one of the BTSC units (i.e. BTSC #1).

   NOTE: The signal generator must be set to mid range frequency and maximum power, while BTS must be set to test mode with all carriers on.

2. Verify that the MobileAccess RS232 slide-in panel is inserted in the MobileAccess 410/430 controller and connect the laptop to on which the MCT application is installed to the RS232 front panel connector.
3. Launch the MCT application, double-click on the first BTSC element (i.e. BTSC 1) in the Topology tree, and access the **Adjustments** pane.
4. Select the type of adjustment (Live or Emulated signal source) and click **Adjust.** A message will appear indicating if the procedure was successful or failed.

   If the procedure was successful the parameters will be stored.

5. If the procedure failed, the cause will be indicated. In addition, if the procedure failed, the BTSC will retain the parameters of the last successful adjustment procedure.

.

Second Band (any of the other bands)

1. Connect either the signal generator or the BTS to either the duplex or non-duplex connectors of one of the BTSC units (i.e. BTSC #1).

   NOTE: The signal generator must be set to mid range frequency and maximum power, while BTS must be set to test mode with all carriers on.

2. Launch the MCT application, double-click on the next BTSC element (i.e. BTSC 2) in the Topology tree, and access the **Adjustments** pane.
3. Select the type of adjustment (Live or Emulated signal source) and click **Adjust.** A message will appear indicating if the procedure was successful or failed.

   If the procedure was successful, the parameters will be stored.

4. If the procedure failed, the cause will be indicated. In addition, if the procedure failed, the BTSC will retain the parameters of the last successful adjustment procedure.

.

The BTSC embedded SW will carry out the following scenario. Note: The DCA value is set in the factory to 31 (– max attenuation).

The leds DL OVERLOAD and DL LOW SIGNAL will serve as indications during the adjustment as described in the block diagram. Upon success the sw will calculate Pin (see the method in DL 'dry' adjustment section) and store it.

4.1.4.2 First band downlink adjustment

Appendix A. Frequently Asked Questions

1. What are the BU and the RHU, and for what are they used for?
The MobileAccess™ system consists of two modules: Base Unit and Remote Hub Unit. The Base Unit interfaces between the microcell or base station and the Remote Hub Unit (RHU). The interface is via either a composite cable or fiber optic cable. In this description, on the downlink path, the Base Unit converts incoming RF signals to optical signals, transmitting these signals over fiber optic cable to the RHU. The RHU converts the optical signal back to RF. The RHU drives the four connected antennas. On the uplink path, the RHU combines and converts incoming RF signals from the four antennas into optical signals, transmitting these signals back to the Base Unit. The Base Unit converts the signals back into RF signals.

2. How does the BU connect to the RHU, and which fibers and connectors are required?
The BU connects to the RHU via fiber optic cable. The system uses 2 fibers for each RHU connection, one fiber for the uplink and one fiber for the downlink. The MobileAccess™ system requires singlemode fibers and SC/APC connectors.

3. How many RHU's and antennas are required for each floor in a building?
Determine the number of RHU's and antennas per floor depends on the building size and configuration. Each RHU can support up to four antennas. It is possible to connect several BUs together in one installation, increasing the amount of available RHU's. With one BU able to support up to eight RHU's, this translates to up to 32 antennas.

4. Is the RHU and BU power supply AC or DC? and what is the voltage level?
The power needs of the BU and RHU are supplied by DC power. The voltage level is 18V-48V. MobileAccess offers a power supply for the BU as well as the RHU. The power supply options are a Remote-located power supply, or a Local power supply.
The Remote-located power supply is located near the BU. This power supply drives the BU and the RHU's. To provide power, the BU is connected to the power supply via electrical cables. For power to the RHU, a composite cable can be used. [A composite cable contains two fiber cables and two copper electrical wires in the same jacket]
The Local power supply provides power to the BU and to the RHU separately. A Local power supply is co-located with each BU and RHU, not requiring long electrical cable runs.

5. Can the RHU be used in outdoor applications?
Currently, the RHU can be used only for indoor applications. The RHU can be upgraded for outdoor applications.

6. What type of antennas can be used?
All antennas types (appropriate to the cellular standard used) can be used for the MobileAccess™ system, including leaky coax.

7. Does the RHU require a dedicated power supply or can it be powered by remote?
The RHU can be supplied with a local power supply, or by a remote powering DC cable over fiber optic cables (composite cable).

8. Can the MobileAccess™ Base Unit be connected to the BTS/Microcell/BDA/off-air repeater?
The MobileAccess™ BU can be connected to the following: BTS, Microcell, Off-air Repeater (with virtually no modifications).

9. Does the MobileAccess™ require any special tuning or adjustments during the installation?
The MobileAccess™ doesn't required any special tuning or adjustments during the installation.

10. Does the MobileAccess™ support multi services, like GSM Dual band?
The MobileAccess™ system is upgradable to support multi services over the same fiber cable, like GSM Dual-Band (900/1800). The system will also be available as a field modular system for UMTS (3G).

11. What are advantages of the MobileAccess™ compared to a coax solution?
The MobileAccess™ advantages over coax are: Low cost per antenna, easy to install and maintain, flexible placement, easy to configuration, and future proof.

12. What is the RF input power required at the Base Unit?

The required composite RF input power at the Base Unit is between 0dBm to 7dBm, depending on the operating standard.

13. What alarms are in the system, and how can they be transmitted to a central monitoring system?

The MobileAccess™ system can support 3 alarm options: Dry Contact alarms (Normally Closed), Dry Contact alarms (Normally Open) and open collector alarms. The alarms can be applied to every link or as a major alarm.

Appendix B. : Link Measurements Form

To smoothly carry out link measurements, refer to table *Table 4-2: Fiber optic Cable Test Results*. This table aids system evaluation and provides necessary feedback to MobileAccess.

The following issues should be taken into account:

- Measure the optical power for every link with an optical meter and light source, according to the number of links or RHU's.
- Measure the typical signal strength (RSSI) for every installed antenna.
- Check coax cable connection between RHU and every installed antenna.

Table 4-1: Link Measurement Table

System Link	Power Meter (mW)	RSSI (dBm)				Coax Cable (OK/Fail)			
		Ant1	Ant2	Ant3	Ant4	Ant1	Ant2	Ant3	Ant4
RHU1									
RHU2									
RHU3									
RHU4									
.									
.									
.									
.									
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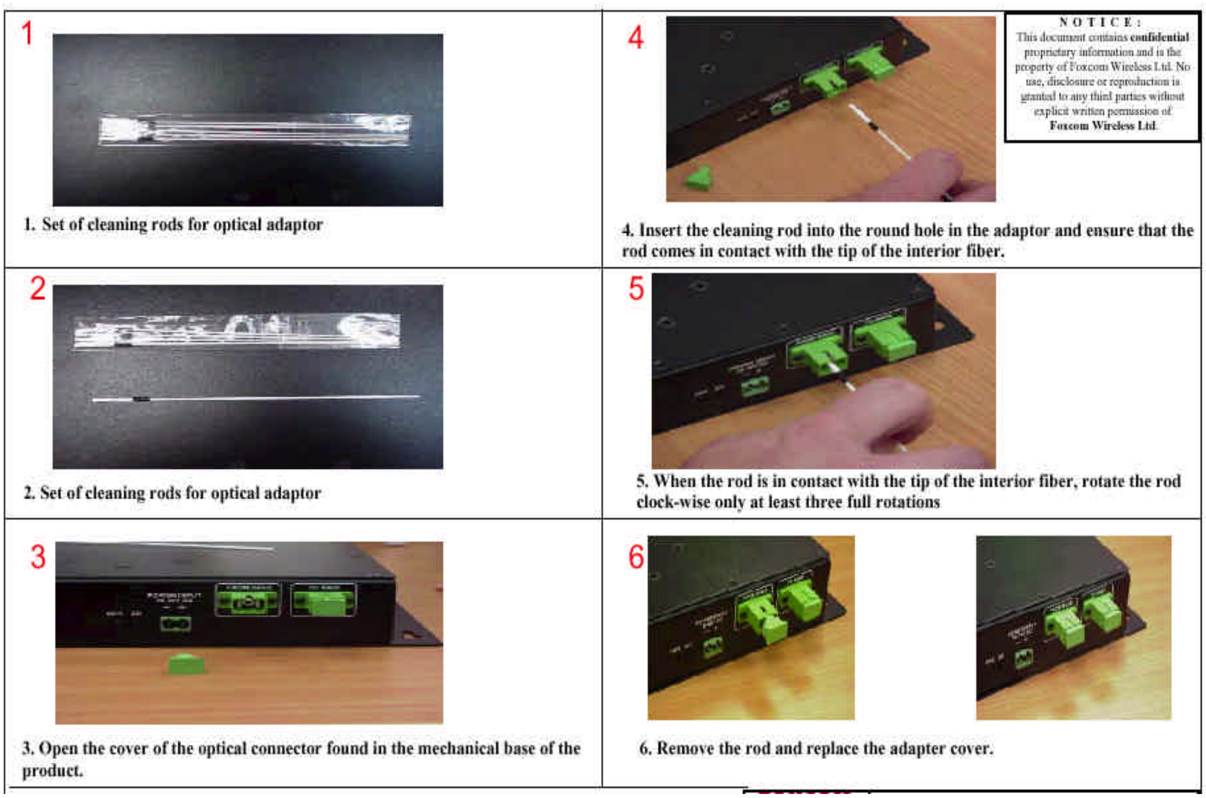
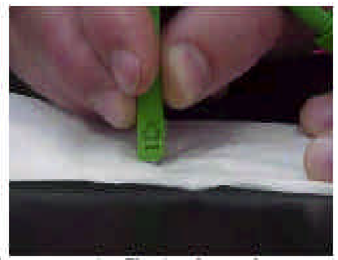
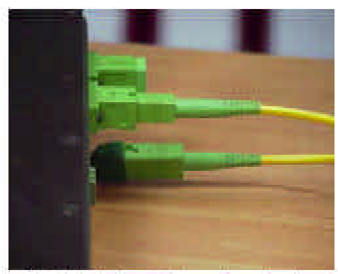
.									

Appendix C. Fiber Optic Cable Instructions

Fiber Optic Cable

Before connecting the cable, clean the inside adaptor of the MobileAccess™ according to the following instructions:



1  Open the cover of the optical connector cleaning pads.	4  Hold a connector (see Figur) and move the connector so that the fiber head rubs against the cleaning pad. Repeat three or four times.
2  Fold a single cleaning pad. (See Figure). Place the pad on a flat surface.	5  Return the connector to a cleaned optical adaptor .
3  Remove the cover from the optical connector.	6  If the optical adaptor has not been cleaned, replace the protective cover on the optical connector.

NOTE: In order to explain the testing procedures, the terms related to these tests need to be explained.

Appendix D. Fiber Optic Cable – Terms

Fiber optic cable is produced in a variety of formats with different characteristics. The following terms define the various aspects of fiber optic cable:

- Fiber optic cable
  - Jacket
  - Buffer
  - Fiber
- Optical fiber
  - Core
  - Clad
  - Singlemode
  - Multimode
- Fiber optic connection
  - Splice
  - Fusion
  - Mechanical
  - Connector
- Bending Loss -- Minimum bending radius
- Coupler

Optical Fiber

Fiber optic cable is described by the amount of fibers contained within. The cable described by the following terms:

- **Glass.** Glass is the middle fiber in the cable. The data sent over the cable travels through the glass.
- **Buffer.** The buffer is the plastic coating that covers the fiber optic cable. The buffer protects the glass from moisture and other damage.

- **Jacket.** The jacket covers the buffer, providing greater protection to the glass.

The fiber consists of Core and Clad. The central part of a fiber is known as the core, and the material surrounding the core is known as the clad. The clad has a lower index of refraction than the core, allowing light to be completely reflected off the surface between the core and the clad. As a result, propagated light remains entirely within the core. The cross-section of the cable is expressed as the core diameter followed by the clad diameter. For example, a 9/125 fiber has a core diameter of 9µm and a clad diameter of 125µm.

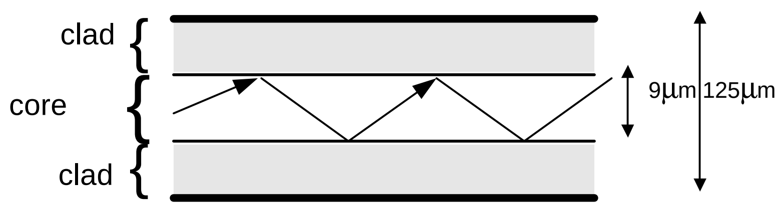
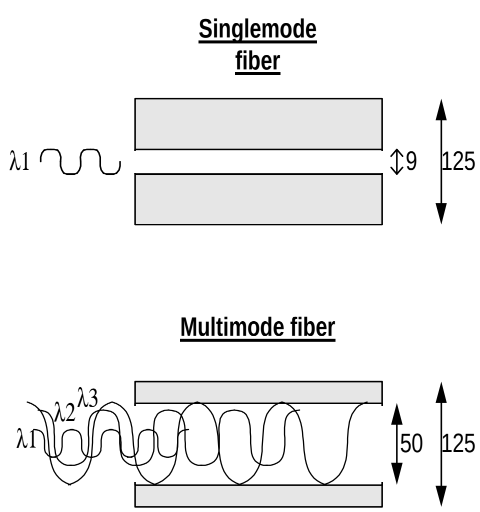


Figure 4-2: Fiber Optic Cable Structure

The cables are available in two different modes, each with different propagation properties:

Property	**Core**	**Clad**	**Attenuation**
Singlemode	9 µm	125 µm	.38 dB/Km
Multimode	50 µm	125 µm	1 dB/Km
Multimode	62.5 µm	125 µm	

@1310nm



(For illustration only)

Figure 4-3: Singlemode - Multimode Fibers

Connecting Fiber Optic Cable

In order to carry out a fiber optic connection a Splice and a Connector are required.

- **Splice.** A splice consists of cutting the fiber optic cable across the cable's diameter and combining the opening with another fiber optic cable. A splice can be carried out in the following methods:
  - **Fusion** – following the splice, the cables are warmed and the two fiber optic cables are melted together.
  - **Mechanical** – following the splice, a hard connection is made between the two fiber optic cables.
- **Connector.** In order to add or connect additional fiber optic cable, a connector is used to make the connection. There are several types of connectors:
  - FC/PC
  - SC/PC
  - SC/APC (used by MobileAccess™)

Fiber Optic Cable Bending Loss

When the cable has bends or interior irregularities, then the optical signal becomes weaker, known as Bending Loss. The sharper the bend – the greater the loss. Such losses increase the cable's attenuation.

Note: When installing fiber optic cable, the minimum bending radius needs to be noted in order to prevent excessive bending of the cable, causing additional loss.

Coupler

Light from the cable can be split or combined, using a **Coupler**. Couplers split light with minimal loss, from one to two fibers or combine light from two fibers into a single fiber.

Appendix E. Optical Test Procedure

This section describes the methods applied to test fiber optic cable's optical insertion loss and return loss.

Fiber Optic Cable Test

Due to the extended distances that analog signal transmissions travel on cable, the major challenge is to determine the status of the cable.

In order to determine that the cables are functioning, technical personnel need to perform optical power tests.

The optical power tests covered in this document are:

- Optical insertion loss measurement test
- Optical return loss measurement test

MobileAccess System Characteristics

The MobileAccess™ system consists of the following characteristics:

- Singlemode fiber
- Wavelength 1310nm
- Fiber Optic Cable Measurement Tests

Cable can be measured through several procedures. This document describes the following tests:

- Optical insertion loss measurement test
- Optical return loss measurement test

These tests are intended to be performed by technical personnel that deal with MobileAccess systems. Other equipment can be used to perform these tests, however the results have to be the same as will appear in the fiber optic cable test results table (Table 4-2), at the end of this document.

The insertion loss measurement determines whether the optical signal power traveling the cable length is strong enough to be received by the photo diode, in the receiver.

Following the completion of the insertion loss test, the return loss test determines the optical signal power that returns to the laser. The return power affects the laser, changing the laser's base current.

Test Equipment

In order to perform these tests, the following equipment is necessary:

- Light source (for wavelength 1310nm , 0dbm)
- Optical power meter
- Optical coupler (hosed and connectorized)
- Fiber optic jumper
- Adapter parts for the cable connectors

For information about equipment suppliers, contact MobileAccess.

Optical Insertion Loss Measurement Test

The optical insertion loss measurement tests the attenuation of the cable. The insertion loss' value should be minimal and remain in scale to 0.4dB/Km.

The insertion loss measurement can be performed in two methods:

- Two point test
- Single point test

Method #1: Two Point Test

Connection description: Light source connected at one end of the cable and an optical power meter at the other end.

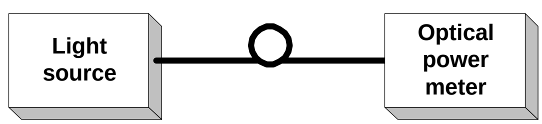


Figure 4-4: Two Point Test

1. Connect light source directly to the optical power meter.
2. Measure light source signal power, verifying power of 0dBm.
3. Connect light source to cable end.
4. Connect optical power meter to cable at other end.
5. Measure light source signal power using the optical power meter.
6. Calculate the difference between two signals (dB):

(Insertion loss)dB = (Light source signal at one end)dBm – (Measured signal at other end)dBm

Method #2: Single Point Test

Connection description: This method assumes that there are two parallel fibers on the path to be tested. Connect fiber jumper at end of the cable being tested to another parallel cable. Connect the light source, optical power meter and optical jumper as shown in Figure 4-5. This measurement can test two cables simultaneously.

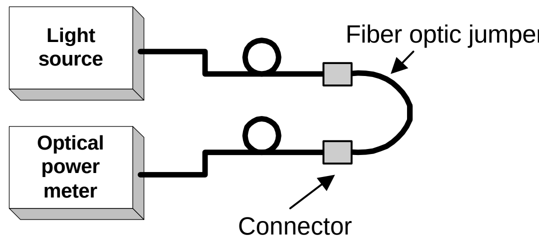


Figure 4-5: Single Point Test

1. Use optic jumper to connect the two cables.
2. Connect light source directly to the optical power meter.
3. Measure the power of light source signal , verify power of 0dBm.
4. Connect a light source and optical power meter to one end of each cable.
5. Measure the power of the signal.
6. Calculate the difference between the two signals in dB

(Insertion loss)dB =(Light source signal)dBm– (Measure signal)dBm

Other Test Equipment

The optical insertion loss measurement test can be performed with more sophisticated measurement equipment.

For information on other types of test equipment contact MobileAccess.

Optical Return Loss Measurement Test

Connection description: Connect a light source and optical power to the inputs. If the coupler has one output, connect the tested cable to this output. If the coupler has two outputs make a pigtail at the second output.

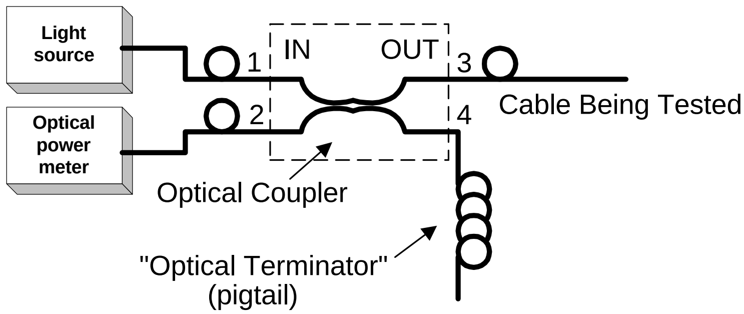


Figure 4-6: Optical Return Loss Measurement

Measurement Procedure

Measuring Power Input To Cable Being Tested

- Verify that light source power is at 0dBm.
- Connect a light source to connector #1.
- Connect optical power meter to connector #3.
- Measure signal power (P3), power should be approximately –4dBm.

Measuring Coupler Power Loss

- Move power meter from connector #3 to connector #2.
- Move light source from connector #1 to connector #3.
- Measure power loss of coupler (Lc).

Measuring Return Power

To measure return power:

- Move light source from connector #3 to connector #1.
- Connect cable being tested to output connector #3.
- If coupler has two outputs, then make a pigtail at second output.
- If cable is longer than 100 meter, then cable needs to be isolated.

***To isolate cable*:**

Find place near test point where winding the cable into a pigtail is possible.

Make pigtail.
If cable is shorter than 100 meter, then verify that cable is disconnected at end.
Measure the return light power (P2), connector #2.

Calculating Return Loss

Calculate the difference between the signals in dB.

(Return loss)dB = (P2)dBm – (P3)dBm + (Lc)dB

Results

The following table is to be filled in by technical personnel testing the fiber optic cables.

Table 4-2: Fiber optic Cable Test Results

Test	Measurement	Pass Range	Pass/Fail
Optical insertion loss		<0.5 dB/Km	
Optical return loss		< -50 dB	

Summary

If the fiber fails in the optical insertion loss or optical return loss tests, then the connector needs to be cleaned. Connector cleaning is carried out according to a standard cleaning procedure. Following cleaning, the fiber needs to be tested again. If the failure continues in the fiber following cleaning, then the technical personnel need to refer to the fiber optic cable manufacturer's troubleshooting guide.If the fiber passes the optical insertion loss and optical return loss tests, then the tested fiber optic cable is considered suitable for use with MobileAccess equipment