



Litenna™
Installation and User's Guide

The Litenna logo features the word "Litenna" in a black serif font, with a red arc above it. The "i" in "Litenna" has a red dot. Below the logo, the text "Installation and User's Guide" is written in a bold, black, sans-serif font.

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Preliminary Document



Installation and User's Guide

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1. Front Chapter

1. 1. Warranty and Repair Policy

Foxcom Wireless tests and inspects all its products to verify their quality and reliability. Foxcom Wireless 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:

1) General Warranty

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

2) Specific Product Warranty Instructions

All Foxcom Wireless 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 Foxcom Wireless and is in lieu of all other warranties, expressed or implied. Foxcom Wireless sales agents or representatives are not authorized to make commitments on warranty returns.

3) Returns

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

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

4) Limitations of Liabilities

Foxcom Wireless'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 contract, shall in no case exceed the purchase price of the device which gives rise to the claim.

EXCEPT AS EXPRESSLY PROVIDED HEREIN, FOXCOM WIRELESS 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. FOXCOM WIRELESS 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.

1. 2. Reporting Defects

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

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

Refer to Warranty and Repair Policy for further details.

Note

Keep all packing material until you have completed the inspection.

1. 3. Conventions

In this manual the following special formats are used:

Note

Notes contain information detailing the current topic.

CAUTION

Cautions contain information regarding situations or materials which could damage your product.

WARNING

WARNINGS CONTAINS INFORMATION REGARDING DANGEROUS FUNCTIONS.

1. 4. Precautions

1. 4. 1. Personal Safety

WARNING

APPLYING POWER TO THE BASE UNIT AND REMOTE HUB UNIT WILL CREATE A LASER ENERGY SOURCE OPERATING IN CLASS I AS DEFINED BY IEC 825-1. USE EITHER AN INFRARED VIEWER, OPTICAL POWER METER OR FLUORESCENT SCREEN FOR OPTICAL OUTPUT VERIFICATION.

1. 4. 2. Equipment Safety

To avoid damaging your product, please observe the following:

1. Always keep the optical connector covered. Use the fiberoptic cable or a protective cover. Do not allow any dirt and/or foreign material to get on the optical connector bulkheads.
2. The optical fiber jumper cable bend radius is 3 cm. Smaller radii can cause excessive optical loss and/or fiber breakage.

2. Introduction to Litenna

The Litenna™, a high performance fiberoptic In-Building RF Distribution System, allows cellular & PCS services to be extended into *shadow* areas. With Litenna™ services can be cost-effectively broadened into micro & pico cell markets, such as airports, buildings, underground parking and shopping malls. The Litenna™ system means mobile communication that works everywhere, and satisfied customers getting the service that they demand.

The Litenna™ products can accommodate a plurality of services and transmission standards.

2. 1. Litenna™ Models

Litenna™ products come in various models, each model covering a different frequency spectrum and standard.

2. 2. Features

The Litenna™ series features the following:

1. Wide DC input range.
2. Slow start optical power control protects the laser from DC transients upon turn-on.
3. Alarm Interface with open collector and dry contact alarms - alarm loopback activates when there is a broken or faulty optical fiber, or no power in system.
4. LEDs that indicate status of individual optical links and sets of links.

2. 3. Product Drawings

The following drawings show sample front and rear panels of the Litenna™ units.

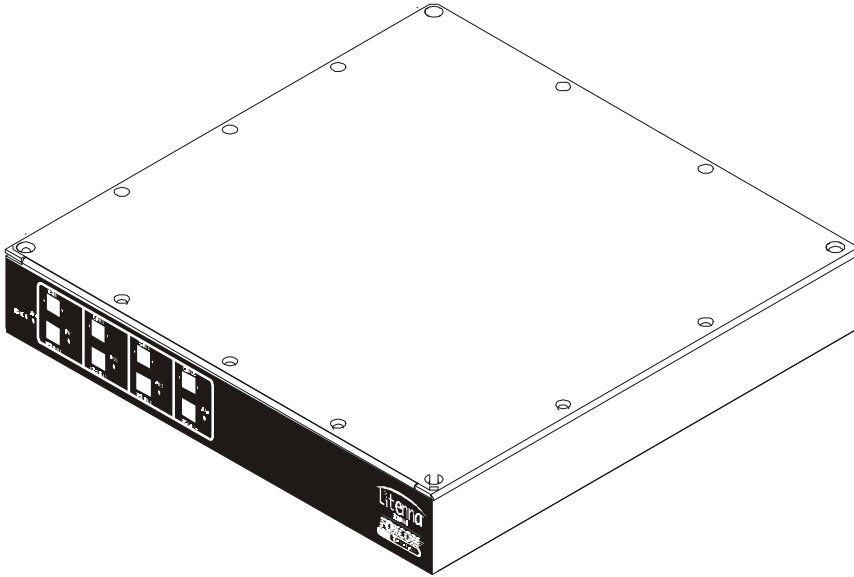


Figure 1 - Base Unit 4 ports

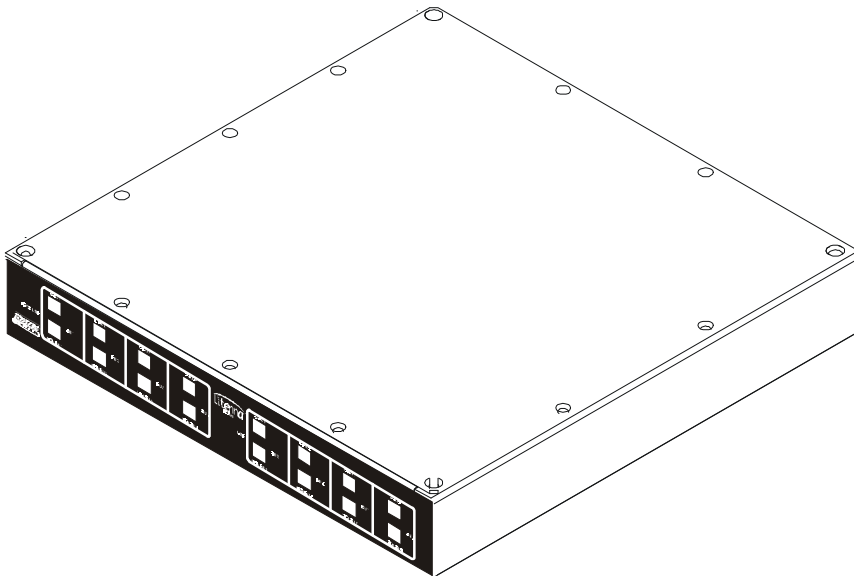


Figure 2 - Base Unit 8 ports

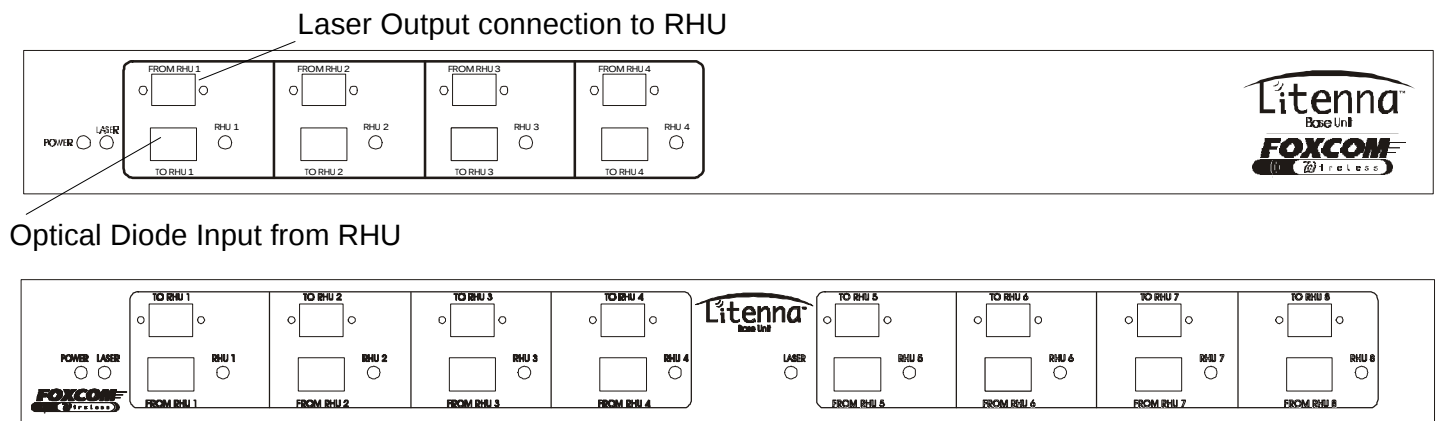


Figure 3 - Base Unit Front Panels

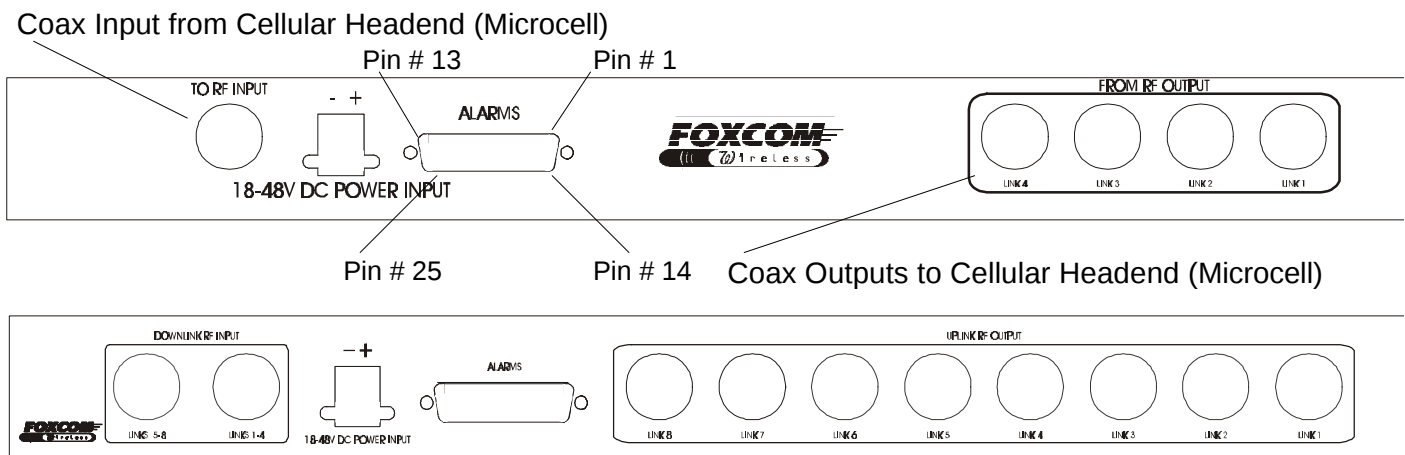
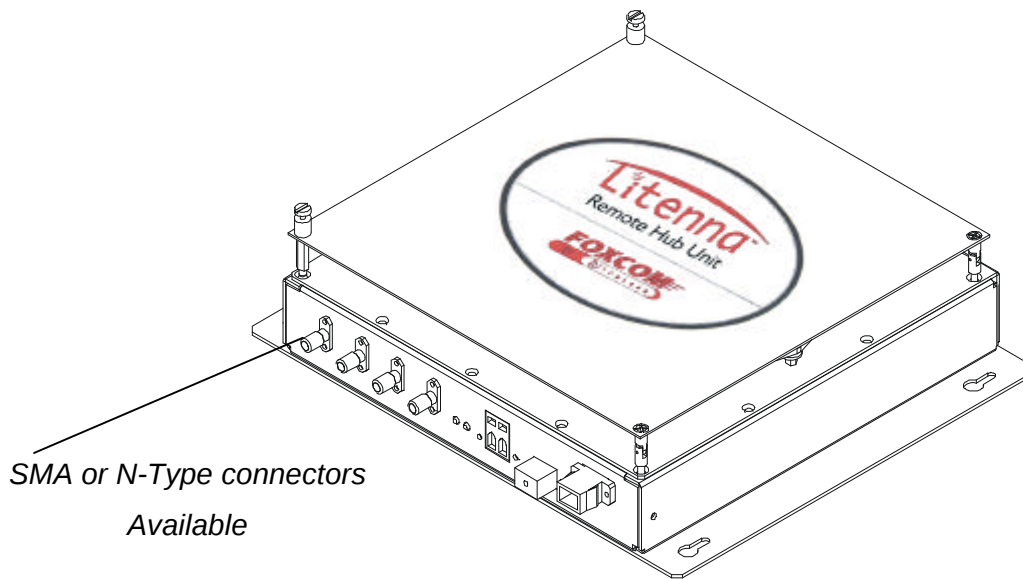
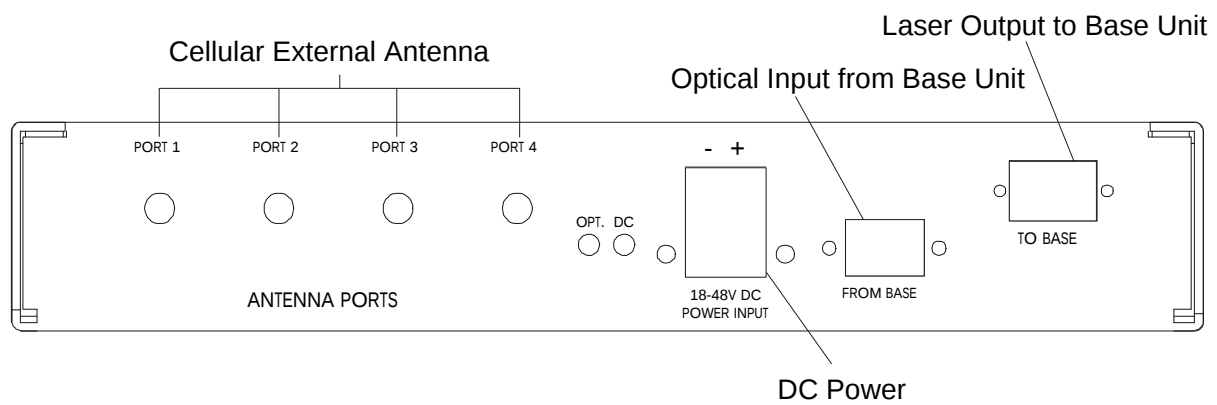


Figure 4 - Base Unit Back Panels

**Figure 5 - Remote Hub Unit****Figure 6 - Remote Hub Unit Front Panel**

2. 4. Block Diagram

The block diagram in Figure 7 shows a general description of the Litenna™ system operating with eight Remote Hub Unit links.

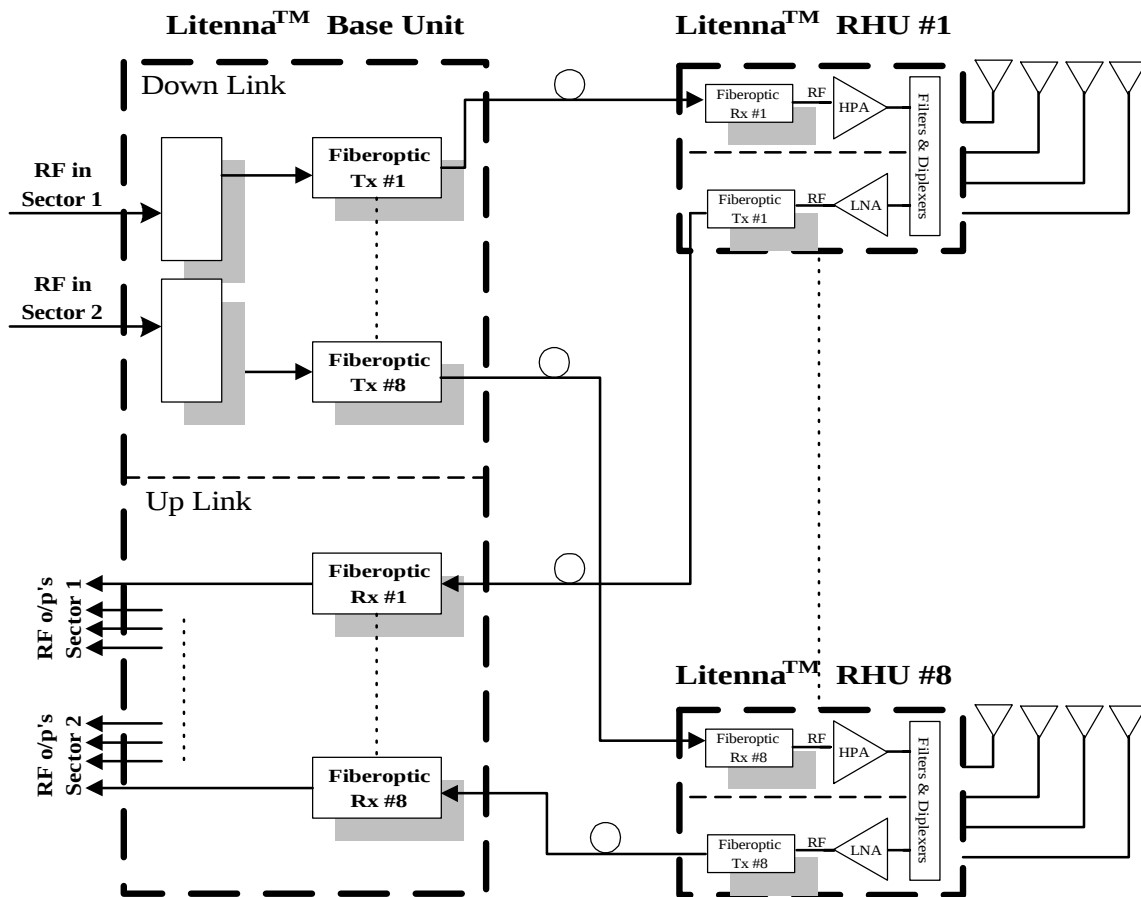


Figure 7 - Litenna™ Block Diagram for 8 Remote Hub Unit Set Up

The Litenna™ system consists of two major components.

- Base Unit
- Remote Hub Unit

Base Unit

The Base Unit is the interface to the microcell. Signals received from the microcell are converted to an optical signal. Concurrently optical signals received from the Remote Hub Units are converted to RF Outputs for the microcell.

The Base Unit is available in two options: Base Unit supporting four Remote Hub Units, Base Unit supporting eight Remote Hub Units.

The Base Unit consists of:

- Four or eight Fiberoptic Transmitters with common input.
- Four or eight Fiberoptic Receivers.

For a physical representation see Figure 1.

Remote Hub Unit

The Remote Hub Unit transmits the signal received from the Base Unit to the antennas. The Remote Hub Unit transmits the signal received at antenna port to the Base Unit. Up to 4 antennas are used to transmit to and receive from cellular telephones in the vicinity.

For a physical representation see Figure 5.

2. 4. 1. System Performance

The LitennaTM system performance is dependent on antenna placement. Correct antenna placement depends on:

- Transmit (downlink RF input) power/carrier.
- Receive sensitivity.
- Path loss.

Transmit Power/Carrier

The transmit power/carrier depends on:

- The total RF power transmitted from the antenna.
- The number of carriers used (determined by the user). As the carriers are added to the power/carrier needs to be reduced (See specifications on page 21).

Power output per carrier refers to power at port. Power from antenna depends on coaxial cable and effective radiated power. The loss of the coaxial cable to the antenna, and the directional gain of the antenna should also be taken into account.

Receive Sensitivity

The receive sensitivity is dependent on the noise figure and gain in the uplink (See specifications on page 21).

Path Loss

The path loss depends on many factors including the distances, number of walls and floors. (For more information regarding path loss estimates in buildings, refer to John Doble, *Introduction to Radio Propagation for Fixed and Mobile Communications*, Artech House, 1996). An example of a path loss calculation is shown in Appendix I.

3. Installation

The following sections describe the Litenna™ installation.

- Fiber Installation Parts List.
- Set Up.
- Panel Descriptions.
- Performance Verification.
- Alarm.

3. 1. Fiber Installation Parts List

The following parts are needed for setting up the Litenna™ Base and Remote Hub Units. A fiber contractor handles cable splicing for connecting the units. The fiber contractor needs to use the parts list from Table 1 to arrange all equipment necessary for setting up and installing the Litenna™.

Table 1 - Fiber Installation Parts List

Part -- Fiber Installation at Base	Quantity	
	4 RHU	8 RHU
3 mm duplex jumpers SC/APC	4	8
900 micron jumpers SC/APC	8	16
Splice Tray 19" width	1	1
Bulkheads SC/APC	8	16

3. 2. Set Up

The Litenna™ components need to be set up, followed by performance verification before installing the system. Foxcom Wireless suggests that a 19" rack-mountable Splice Tray be used at the Base Unit to facilitate optical fiber splicing. In the rack, the Splice Tray is mounted above or below the Base Unit (depending on direction of the incoming cables).

Setting up the Litenna™ Base and Remote units consists of the following steps:

1. Determine antenna placement by system engineer.
2. Pull composite cable or separate fiber and copper cables through building.
3. Install Splice Tray for Base Unit in 19" rack.
4. Fiber contractor splices fiber cable with SC/APC to connectorized pigtails.
5. Install Base Unit in 19" rack.
6. Connect Microcell to Base Unit.
7. Connect Remote Hub Unit.
8. Connect Antennas to Remote Hub Unit.

Refer to Product Specifications on page 21 for more details on power requirements.

3. 2. 1. Base Unit

The Base Unit has pre-attached 'L' brackets for installation in a 19" rack.

WARNING

THE LASERS FACE OUTWARD. DO NOT PLACE THE UNIT AT EYE LEVEL!

To install Base Unit into 19" rack:

1. Insert Base Unit into 19" rack directing back into rack, leaving front facing out from rack.
2. Tighten screws on rack to secure Base Unit in rack.
Where installation requirements demand, L-brackets can be moved in order to install the Base Unit with the front forward and the back directed away from rack.
3. Attach Base Unit to bulkheads in Splice Tray via 4/8 3mm double Jumper Cables.

Make certain that the RHU optical output connects to the Base Unit optical input and that the Base Unit optical output connects to the RHU optical input. **The connections run from lower connector (on RHU) to upper connector (on Base Unit) and from upper connector (on RHU) to lower connector (Base Unit).** When connections do not connect to proper output and input destinations, the unit fails to operate.

Note

Use an optical power meter with an SC adapter in order to be certain that light is emitted from the optical fiber. If connected properly, the optical power of light emitted from the optical fiber can be measured. When not working properly, light is not emitted from the optical fiber.

3. 2. 2. RF Interface to Base Unit

The Base Unit may require RF attenuators to meet input power requirements. The Base Unit RF outputs may be combined together, using external combiners, to connect to the Microcell receiver inputs.

3. 2. 3. Remote Hub Unit

The Remote Hub Unit has two power supply options.

The Remote Hub Unit can operate from:

- Central power supply connected to composite cable installed in the building.
- Power supply colocated with the Remote Hub Unit.

For voltage and power requirements, see Table 11.

The central power supply connection can be through either a composite cable or separate fiber and copper cables. The maximum length of the copper cable depends on the supply voltage, and the copper wire gauge.

On the back of the Remote Hub Unit there are wall-mounting attachments for mounting on a wall. For dimensions, see Table 11.

An Accessory Plate is hinge-attached to the top of the Remote Hub Unit, see Figure 8. The Accessory Plate has a Splice Chip and a Fiber Spool. The Splice Chip holds the connectorized pigtails for splicing from the optical fiber of the Remote Hub Unit. The Fiber Spool is used to wind excess optical fiber.

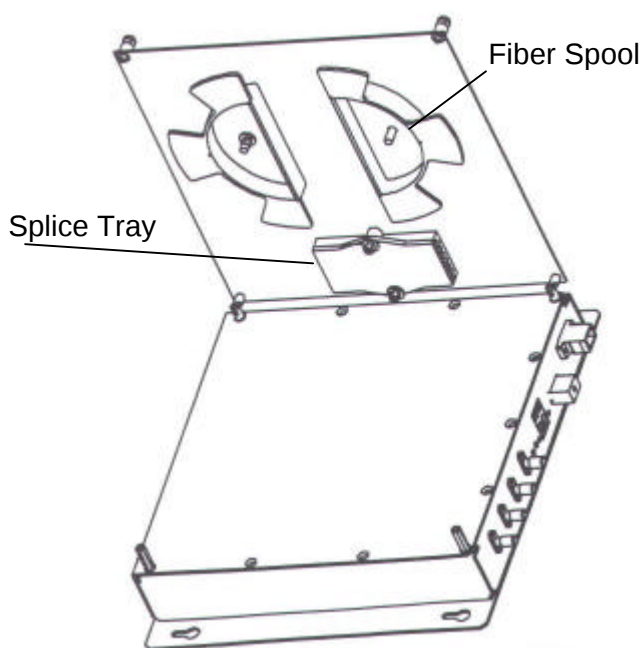


Figure 8 - Accessory Plate on Remote Hub Unit

3. 2. 4. Antennas

Antennas mounted in the building connect to the Remote Hub Unit.

CAUTION

A 50 ohm termination needs to be attached to non-active antenna ports on the Remote Hub Unit.

3. 3. Panel Descriptions

On the Front Panel of both the Litenna™ Base Unit and Remote Hub Unit, there are illuminated LEDs for indicating the performance states of the units, and the status of the link connections.

3. 3. 1. Base Unit LEDs

The Base Unit has three types of LEDs.

- Power status.
- Lasers status.
- Links between Base Unit and RHU (one LED per RHU) status.

All LEDs are lit when the unit is in proper operation. For LED locations see Figure 9.

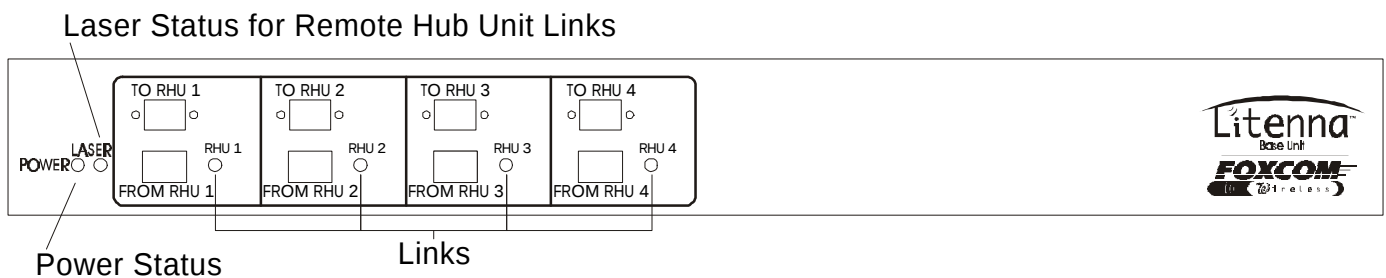


Figure 9 - Base Unit Front Panel

The following table describes the LEDs that appear on the Base Unit and their function states.

Table 2 - Base Unit

LED Name	LED Function
Links 1..8	When lit indicates that the two direction optical link between Base Unit and Remote Hub Unit is functioning - one LED for every RHU link.
Lasers 1..4	When lit indicates laser output power for RHU links 1-4. There is one LED for this set of four lasers.
Lasers 5..8	When lit indicates laser output power for RHU 5-8 links. There is one LED for this set of four lasers.
DC	When lit indicates that the Base Unit is receiving power.

3. 3. 2. Remote Hub Unit LEDs

On the Front Panel of the RHU there are two LEDs. Both LEDs should be on when the unit is in operation. For LED locations see Figure 6.

Table 3 - Remote Hub Unit

LED Name	LED Function
Optical	When not lit indicates that received optical power is low, causing the uplink to shut off. Optical failure is also indicated by the Link LED on the Base Unit.
DC	When lit shows that Remote Hub Unit is receiving power.

3. 4. Performance Verification

3. 4. 1. Base Unit and Remote Hub Unit Connections

When the Litenna™ is being installed the LEDs on the units can verify that the optical fibers are performing correctly, and that proper connections have been made. Foxcom Wireless recommends checking the status of all connections in the Litenna™ system in order to make sure that the installation was carried out correctly. Verification is done by checking the LEDs on the Base and Remote Hub Units. See Table 4 for an explanation of the possible optical LED performance states and how to deal with problems.

Note

RHU not receiving light signal from Base Unit, power to laser is disconnected.

Table 4 - Optical LED States

Optical Out	Optical In				
Base Unit Laser	Base Unit Link	RHU	State	Reasons	Troubleshooting
+	+	+	Both units performing.		
+	-	+	Base Unit sending light and Base Unit not receiving signal from RHU.	1. Defective fiber connection from RHU to Base Unit. 2. Failure in RHU.	1. Check connection from RHU to Base. Check fiber for break or crimp test. 2. Contact Customer Service at Foxcom Wireless.
+	-	-	RHU not receiving signal from Base Unit.	Defective fiber connection from Base Unit to RHU.	Check connections To RHU.
-	-	-	System not active.	Power not reaching any unit.	Check power connections. If LEDs on, then LEDS have failed at the Base Unit.

+ Optical connection performing correctly (Optical LED lit).

- Optical connection not performing correctly (Optical LED not lit).

3. 5. Alarm

The alarm occurs if the Base Unit receives optical power that falls below -10 dBm (0.1 mW). The alarm can occur as both of following types:

Open collectors - Can sink up to 30 mA., under alarm condition.

Dry Contacts - Open when the alarm is active. Dry Contact opens if receiver optical power drops.

For a description of the pinouts in the 25 pin alarm, see Table 12.

4. Product Specifications

The following section contains Litenna™ specifications.

Table 5 - Products Specifications TDMA(IS-136)/AMPS(IS-54)

Link Specifications	Uplink	Downlink
Frequency Range (MHz)	824-849	869-894
Typical Input Power per carrier (measured with 10 carriers) (dBm)	-	-4
Nominal Gain/Antenna	0 (or -17 option)	14
Typical Output Power of a single Antenna port (dBm)		
Output Power per Carrier (measured with 10 carriers)		10
Output Power per Carrier (measured with 2 carriers)		17
Typical Output IP3 (dBm)	-	33
Typical Input IP3 (dBm)	-2	-
Typical NF (dB)	23	-

Table 6 - Products Specifications GSM 900

Link Specifications	Uplink	Downlink
Frequency Range (MHz)	880-915	925-960
Typical Input Power per carrier (measured with 10 carriers) (dBm)	-	1
Nominal Gain/Antenna	5	7
Typical Output Power of a single Antenna port (dBm)		
Output Power per Carrier (measured with 2 carriers)		8
Typical Output IP3 (dBm)	-	30
Typical Input IP3 (dBm)	-2	-
Typical NF (dB)	22	-

Table 7 - Products Specifications LMR 800

Link Specifications	Uplink	Downlink
Frequency Range (MHz)	806-824	851-869
Typical Input Power per carrier (measured with 10 carriers) (dBm)	-	-4
Nominal Gain/Antenna	5	14
Typical Output Power of a single Antenna port (dBm)		
Output Power per Carrier (measured with 10 carriers)		10
Output Power per Carrier (measured with 2 carriers)		17
Typical Output IP3 (dBm)	-	33
Typical Input IP3 (dBm)	-2	-
Typical NF (dB)	23	-

Table 8 - Cable Specifications

Specifications		Number
Fiber Type	Single Mode Fiber 2.8 mm Tight Buffer Jacket	2
Copper Diameter (mm)	18AWG	2
Standard Compliance	UL Listed Cable	

Table 9 - General Technical Specifications

Optical Specifications	
Wavelength (nm)	1310+10
Optical budget (dB)	2dB
Fiber type	9/125 single mode
Optical loss per mated pair connectors	1 dB maximum
Optical output power (mW)	≥0.5
Other Specifications	
Distance between BU and RHU (m)	
DC power is supplied via composite cable	500
DC power is supplied directly to RHU	2000

Table 10 - Environmental Conditions

Parameter	Value
Operating temperature	0 to +50 °C
Storage temperature	-20 to +70 °C

Table 11 - Physical Specifications

Specifications	Base Unit	Remote Hub Unit
Power	18 VDC/48VDC 8W max. when driving 8 RHUs 4W max. when driving 4 RHUs	Fed through composite cable 27-48VDC or DC input: 18-48VDC 8W max.
Dimensions	19" x 1U	8"W x 8"L x 2"H
RF Connector	N Type Female	N Type Female
Optical Connector	SC/APC	SC/APC

Table 12 - 25 Pin Alarm Pinouts

Pin	Type of Alarm	Port
1	Dry Contact 4	1
2	Dry Contact 4	2
3	Open Collector	4
4	Dry Contact 1	1
5	Dry Contact 1	2
6	Open Collector	1
7	Dry Contact 2	1
8	Dry Contact 2	2
9	Open Collector	2
10	Dry Contact 3	1
11	Dry Contact 3	2
12	Open Collector	3
13	Dry Contact 8	1
14	Dry Contact 8	2
15	Open Collector	8
16	Dry Contact 5	1
17	Dry Contact 5	2
18	Open Collector	5
19	Dry Contact 6	1
20	Dry Contact 6	2
21	Open Collector	6
22	Dry Contact 7	1
23	Dry Contact 7	2
24	Open Collector	7
25	-	-

These units are for indoor use only. All specifications are subject to change without prior notice.

5. Appendix I Path Loss Estimate

The following table gives estimates of the path loss under various conditions.

Table 13 - Path Loss Estimates

Distance (m)	No of Floors traversed	No of interior walls traversed	Path Loss dB
30	0	0	89
30	1	1	99
30	0	2	99
40	0	0	94
40	1	1	104
40	0	2	104
50	0	0	98
50	1	1	108
50	0	2	108