



**Version 1.02**

**BreezeACCESS™ 900**

**System Manual**

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### **Electronic Emission Notices**

This device complies with Part 15 of the FCC rules.

Operation is subject to the following two conditions:

1. This device may not cause harmful interference.
2. This device must accept any interference received, including interference that may cause undesired operation.

## **FCC Radio Frequency Interference Statement**

The Cell Extender equipment has been tested and found to comply with the limits for a class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in commercial, business and industrial environments. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense.

The Subscriber Unit equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential environment notwithstanding use in commercial, business and industrial environments. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

## **FCC Radiation Hazard Warning**

To comply with FCC RF exposure requirement in section 1.1307, the antenna used for this transmitter (CX and the SU-I) must be fixed-mounted on an outdoor permanent structure with a separation distance of at least 2 meters (79 inches) from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

## **Safety Considerations**

For the following safety considerations, "Instrument" means the BreezeACCESS 900 units' components and their cables.

### **Caution**

To avoid electrical shock, do not open any of the instrument components and do not perform any servicing unless you are qualified to do so. Power connections should be made only by a licensed electrician.

## **Line Voltage**

Before connecting this instrument to the power line, make sure that the voltage of the power source matches the requirements of the instrument.

## **Installation Codes**

The system must be installed according to country national electrical codes. For North America, equipment must be installed in accordance to the US National Electrical Code (NEC) Articles 110-16, 110-17 and 110-18 and the Canadian Electrical Code (CEC), Sections 2□-202 and 2-308. Wiring methods are to be in accordance to NEC Article 300 and CEC Section 12.

## **Over-Current Protection**

A readily accessible external Listed branch circuit over-current protective device rated 15 A must be provided for the Cell Extender.

## **Radio**

The instrument transmits radio energy during normal operation. To avoid possible harmful exposure to this energy, do not stand or work for extended periods of time in front of its antenna. The long-term characteristics or the possible physiological effects of Radio Frequency Electromagnetic fields have not been yet fully investigated.

## **Outdoor Units and Antennas Installation and Grounding**

Be sure that the outdoor unit, the antennas and the supporting structures are properly installed to eliminate any physical hazard to either people or property. Verify that the outdoor units and the antenna masts are grounded so as to provide protection against voltage surges and static charges. Make sure that the installation of the outdoor units, antennas, supporting structures and cables is performed in accordance with all relevant national and local building and safety codes.

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# About this Guide



This manual describes the BreezeACCESS 900 Broadband Wireless Access System Release 4.3 and how to install, initialize and operate the system components.

This guide is intended for technicians responsible for installing, setting up and operating the BreezeACCESS 900 system.

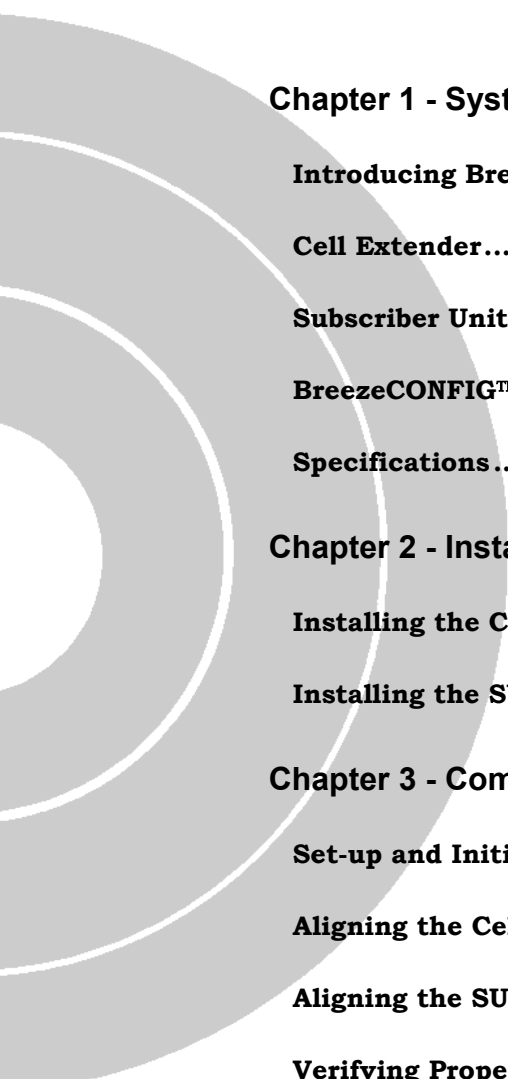
This guide contains the following chapters and appendices:

- **Chapter 1 – System description:** Describes the BreezeAccess 900 system and its components.
- **Chapter 2 – Installation:** Describes how to install the system components.
- **Chapter 3 – Commissioning:** Describes how to configure basic parameters, align the antennas and validate unit operation.
- **Appendix A – Wiring 10Base-T jacks:** Describes standard 10Base-T wiring schemes.
- **Appendix B – Mounting the Subscriber’s Antenna:** Describes how to install the Subscriber’s antenna.
- **Appendix C – Lightning and Grounding Kit Installation:** Describes how to install and connect the lightning protection and grounding for the Subscriber’s antenna.
- **Appendix D – Configuring Hopping Frequencies and Operational Sequences:** Describes how to use the Flexible Hopping Definition mode and the Hopping Shift parameter.





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# 1

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## Chapter 1 - System Description

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## Introducing BreezeACCESS 900

BreezeACCESS 900 system allows operators that provide IP services using BreezeACCESS II to extend the reach of their system and provide services to clusters of customers that cannot otherwise be reached due to being obstructed by heavy foliage or other obstacles. Operators can benefit from the advantage of operating locally in the 900 MHz band, being able to provide services to customers within a radius of half a mile in non line of sight environments with heavy foliage.

BreezeACCESS 900 system includes the following components:

- **Cell Extension Equipment (CX):** Provides the interface between the local system operating in the 900 MHz band and the primary system operating in the 2.4 GHz band.
- **Subscriber Units (CPE):** BreezeACCESS Subscriber Units operating in the 900 MHz band.

Alvarion also offers to its customers a special spectrum analysis tool to enable optimal selection of frequencies and antenna polarization in the heavily crowded 900 MHz band. For information on this tool, refer to the Breeze Access Spectrum Analyzer User's Guide.

# Cell Extender

The Cell Extender operates as an Access and Subscriber Unit that are connected back-to-back. The Subscriber Unit component operated in the 2.4 GHz band and provides connectivity to the primary BreezeACCESS II base station. The Access Unit component operates in the 900 MHz band and serves the Subscriber Units located in the area covered by the Cell Extender.

The CX-2.4-900 Cell Extender is comprised of an Interface Unit, a 2.4 GHz Radio Unit and a 900 MHz antenna.

The Interface Unit includes the interface (indoor) unit of a BreezeACCESS II Subscriber Unit and a BreezeACCESS 900 Access Unit. These two units are connected to each other via a hub module. It provides an interface for an optional local Ethernet connection and is powered from the mains (110/220VAC).

The SU-RA-2.4 radio unit of the Subscriber Unit component incorporates the radio module and an integrated flat antenna.

The Interface Unit is connected to the 2.4 GHz Radio Unit via a 50 $\Omega$  ohm coaxial Intermediate Frequency (IF) cable. This cable carries 440 MHz IF signals between the Interface Unit and the Radio Unit. In addition, this cable transfers power (12 VDC) and control signals from the Interface Unit to the Radio Unit.

The AU-900 Access Unit connects to an external antenna.

Both BreezeACCESS equipment in both the 2.4 GHz and 900 MHz bands operate in Time Division Duplex (TDD) mode. It employs wireless packet data switching technology, using Frequency Hopping Spread Spectrum (FHSS) radios.

## Subscriber Unit

The Subscriber Unit (SU) installed at the customer premises enables the customer data connection to the Access Unit of the Cell Extender.

The Subscriber Unit provides an efficient platform for high speed Internet and Intranet services. The use of packet switching technology provides the user with a connection to the network that is always on, enabling immediate access to services.

The SU-I-1D-A10-900 miniature Subscriber Unit is designed for desktop or wall-mount installation. It supports a single Ethernet device and connects to the customer's data equipment via a standard IEEE 802.3 10Base-T (RJ-45) interface. The unit is powered from the 110/220 VAC mains. It has one RF connector for an outdoor wall-mountable 10dBi antenna.

## **BreezeCONFIG™ ACCESS**

The BreezeCONFIG ACCESS utility is an SNMP-based application designed to manage BreezeACCESS system components and upgrade unit software versions. The system administrator can use the BreezeCONFIG ACCESS utility to control a large number of units from a single location. BreezeCONFIG ACCESS provides a single point of control for both BreezeACCESS II and BreezeACCESS 900 system components. In addition, BreezeCONFIG ACCESS enables you to load an updated configuration file to multiple units simultaneously, thus radically reducing the time spent on unit configuration maintenance.

# Specifications

## 2.4 GHz Radio specifications

| Table 1-1: 2.4 GHz Radio Specifications                  |  |                    |
|--|--|--------------------|
| Item   | Description  |                    |
| Frequency  | 2.4000 – 2.4835 GHz ISM band   |                    |
| Operation Mode   | Time Division Duplex (TDD)   |                    |
| Radio Access Method                                      | FH-CDMA  |                    |
| Standard Compliance                                      | FCC Part 15.247  |                    |
| Channel Bandwidth  | 1 MHz  |                    |
| Central Frequency Resolution                             | 1 MHz  |                    |
| SU-RA Integral Antenna                                   | 16dBi, 20° horizontal x 20° vertical, VPOL,<br>EN 301 525 Class TS 2 compliant |                    |
| Maximum Input Power<br>(at antenna port)                 | -20dBm   |                    |
| Output Power (at antenna port)                           | 26dBm typical<br>Control Range 20dB typical                                    |                    |
| Gross Bit Rate   | 1, 2, 3 Mbps   |                    |
| Sensitivity, typical<br>(dBm at antenna port, BER 10E-6) | <u>Gross Rate</u>  | <u>Sensitivity</u> |
|  | 1 Mbps   | -87dBm             |
|  | 2 Mbps   | -81dBm             |
|  | 3 Mbps   | -73dBm             |
| Modulation   | GFSK modulation, 2, 4 8 modulation states<br>(1, 2, 3 bits/symbol)             |                    |
| Symbol Rate  | 1 Msymbol/sec  |                    |



## 900 MHz Radio specifications

| Table 1-2: 900 MHz Radio Specifications                  |   |                    |
|--|---|--------------------|
| Item   | Description   |                    |
| Frequency  | 904 – 926 MHz ISM band  |                    |
| Operation Mode   | Time Division Duplex (TDD)  |                    |
| Radio Access Method                                      | FH-CDMA   |                    |
| Standard Compliance                                      | FCC Part 15.247   |                    |
| Channel Bandwidth  | 2 MHz   |                    |
| Central Frequency Resolution                             | 1 MHz   |                    |
| SU Antenna   | 10 dBi, 55° x 60° (VPOL), VPOL/HPOL   |                    |
| AU Antenna   | <ul style="list-style-type: none"> <li>• 14 dBi, 60° x 16°, Adj. Beam Width</li> <li>• 10 dBi, 65° x 65°, Flat Panel (H/V)</li> <li>• 9 dBi Omni, 360° x 10°, VPOL</li> </ul> |                    |
| Maximum Input Power<br>(at antenna port)                 | -20 dBm   |                    |
| Output Power (at antenna port)                           | 23 dBm typical<br>Control Range 21 dB in 1 dB steps   |                    |
| Gross Bit Rate   | 1, 2, 3 Mbps  |                    |
| Sensitivity, typical<br>(dBm at antenna port, BER 10E-6) | <u>Gross Rate</u>   | <u>Sensitivity</u> |
|  | 1 Mbps  | -90 dBm            |
|  | 2 Mbps  | -84 dBm            |
|  | 3 Mbps  | -77 dBm            |
| Modulation   | GFSK modulation, 2, 4 8 modulation states<br>(1, 2, 3 bits/symbol)  |                    |
| Symbol Rate  | 1 Msymbol/sec   |                    |

## Data Communication

| Table 1-3: Data Communication  |                            |
|--------------------------------|----------------------------|
| Item                           | Description                |
| Standard compliance            | IEEE 802.3 CSMA/CD         |
| VLAN Support                   | Based on IEEE 802.1Q       |
| Layer-2 Traffic Prioritization | Based on IEEE 802.1p       |
| Layer-3 Traffic Prioritization | IP ToS according to RFC791 |

## IF Communication Interface (CX)

| Table 1-4: IF Communication Interface |             |
|---------------------------------------|-------------|
| Item                                  | Description |
| IF Frequency                          | 440 MHz     |
| IF Cable Impedance                    | 50 ohm      |
| Maximum IF Cable Attenuation          | 15dB        |
| Maximum IF Cable DC Resistance        | 1.5 ohm     |

## Configuration and Management

| <b>Table 1-5: Configuration and Management</b> |   |
|--|---|
| <b>Type</b>                                    | <b>Standard</b>   |
| Management                                     | <ul style="list-style-type: none"> <li>■ Monitor program via Telnet</li> <li>■ SNMP</li> <li>■ Configuration upload/download using TFTP</li> </ul>  |
| Management Access                              | From Wired LAN, Wireless Link   |
| Management access protection                   | <ul style="list-style-type: none"> <li>■ Multilevel password</li> <li>■ Configuration of remote access direction (from Ethernet only, from wireless link only or from both sides)</li> <li>■ Configuration of IP addresses of authorized stations</li> </ul>  |
| SNMP Agents                                    | SNMP ver 1 client<br>MIB II, Bridge MIB, Private BreezeACCESS MIB   |
| Security                                       | <ul style="list-style-type: none"> <li>■ Association protocol – ESSID</li> <li>■ RC4 WEP option (encryption of the authentication process)</li> <li>■ VLAN according to IEEE 802.1Q</li> <li>■ d. IP level filtering for user addresses or protocols</li> <li>■ Access direction and IP address filtering for management</li> </ul> |
| Authentication and Accounting                  | RADIUS client in the SU according to RFC 2865 and 2866  |
| Allocation of IP parameters                    | Configurable or automatic (DHCP client)   |
| Software upgrade                               | TFTP  |

## Standards Compliance, General

| Type   | Standard                          |   |
|--|-----------------------------------|---|
| EMC  | FCC Parts 15.207, 15.209          |   |
| Safety   | IEC 60 950 US/C (TUV), FCC 1.1307 |   |
| Environmental                                    | Operation                         | ETS 300 019 part 2-3 class 3.2E for indoor units<br>ETS 300 019 part 2-4 class 4.1E for outdoor units |
|  | Storage                           | ETS 300 019-2-1 class 1.2E  |
|  | Transportation                    | ETS 300 019-2-2 class 2.3   |
| Lightning protection<br>(CX antenna connections) | EN 61000-4-5, Class 3 (2kV)       |   |
| Radio  | FCC part 15.247, 15.203           |   |

## Environmental

| Type                  | Unit             | Details                            |
|-----------------------|------------------|------------------------------------|
| Operating temperature | Interface Unit   | -10° C to 55° C (-14° F to 131° F) |
|                       | SU-RA            | -40° C to 55° C (-40° F to 131° F) |
|                       | SU-I             | 0° C to 40° C (32° F to 104° F)    |
| Operating humidity    | Outdoor units    | 100% RH Condensing                 |
|                       | Indoor equipment | 5%-95% non condensing              |

# Physical and Electrical

## Subscriber Unit

### Mechanical

| Unit         | Structure   | Dimensions (cm)   | Weight (kg/lb) |
|--------------|---|-------------------|----------------|
| General      | An indoor SU-I unit and an outdoor antenna  |                   |                |
| SU-I         | Metal box, desktop or wall mountable  | 15 x 8.7 x 3.7    | 0.35 / 0.77    |
| Power supply | Plugged directly into the mains socket (3 AC power pins), 1.5 meter DC cable with a right angle phone | 7.5 x 3.1 x 5     | 0.38 / 0.84    |
| Antenna      | Plastic radome with aluminum base plate, 1.5"-4" pole mountable                                       | 30.5 x 30.5 x 1.5 | 1.5 / 3.3      |

### Connectors

| Unit    | Connector        | Description  |
|---------|------------------|--|
| SU-I    | ETH              | 10BaseT Ethernet (RJ-45) with 2 embedded LEDs.<br>Cable connection to a PC: Straight |
|         | Port 2 (antenna) | Proprietary SMA jack, 50 ohm   |
|         | Monitor          | 3-pin low profile  |
|         | AC IN            | Standard DC 2.5 mm jack to external power supply                                     |
| Antenna | Antenna          | N-Type jack, 50 ohm  |

## Electrical

| <b>Table 1-10: Electrical Specifications, Subscriber Unit</b> |  |
|---|--|
| <b>Unit</b>   | <b>Details</b>   |
| General   | External power supply<br>AC input power: 100-240 Vr.m.s., 47-63 Hz<br>DC power output: 5.1V, 2A max. |

## Cell Extender

### Mechanical

| Unit   | Structure   | Dimensions (cm)      | Weight (kg/lb) |
|--|---|----------------------|----------------|
| Interface Unit                                 | Metal box, wall mountable                                       | 28 x 23 x 11         | 5.9 / 13       |
| SU-RA  | Metal box, 2"-3" pole mountable                                 | 30.6 x 30.6 x 7.2    | 2.5 / 5.5      |
| 900 MHz, 14 dBi, 60° x 16°, Adjustable Azimuth |   |                      |                |
| 900 MHz, 10 dBi, 65° x 65°, Flat Panel (H/V)   | Plastic radome with aluminum base plate, 1.5"-4" pole mountable | 30.5 x 30.5 x 1.5    | 1.5 / 3.3      |
| 900 MHz VPOL 9dBi Omni Antenna                 | Fiberglass, 2.38" pole mountable                                | 244 x 3.4 (diameter) | 1.8 / 4        |

### Connectors

| Unit          | Connector | Description  |
|---------------|-----------|--|
| Cell Extender | SU-IF     | TNC female jack, lightning protected   |
|               | AU-ANT    | N-Type female jack, lightning protected  |
|               | ETHERNET  | 10Base-T (RJ-45) in an sealed Physical Media ENSR 1FB5 receptacle that mates with ENSAM315 field attachable connector  |
|               | Power     | UL/CSA listed power cable through a Heyco-Flex Straight Connector 8402 that fits ½" conduit. 15 ft. cord, 3 wires, un-terminated. Requires fused 3 wire, single phase service. |
| SU-RA         | ANT       | TNC jack, lightning protected  |
|               | Power     | 12 VDC from the Interface Unit via the IF cables   |
| Antenna Port  | RF        | N-Type female jack   |

| <b>Table 1-12: Connectors, Cell Extender</b>       |                  |                    |
|--|------------------|--------------------|
| <b>Unit</b>  | <b>Connector</b> | <b>Description</b> |
| 900 MHz, 14 dBi,<br>60° x 16°, Adj. Azimuth        | RF               | N-Type jacks       |
| 900 MHz, 10 dBi,<br>65° x 65°,<br>Flat Panel (H/V) | RF               | N-Type jack        |
| 900 MHz VPOL 9dBi<br>Omni Antenna                  | RF               | N-Type jack        |

## Electrical

| <b>Table 1-13: Electrical Specifications, Cell Extender</b> |                                |
|---|--------------------------------|
| <b>Unit</b>   | <b>Details</b>                 |
| General   | 110-240 VAC, 50□60Hz, 1.4A max |
|   |                                |



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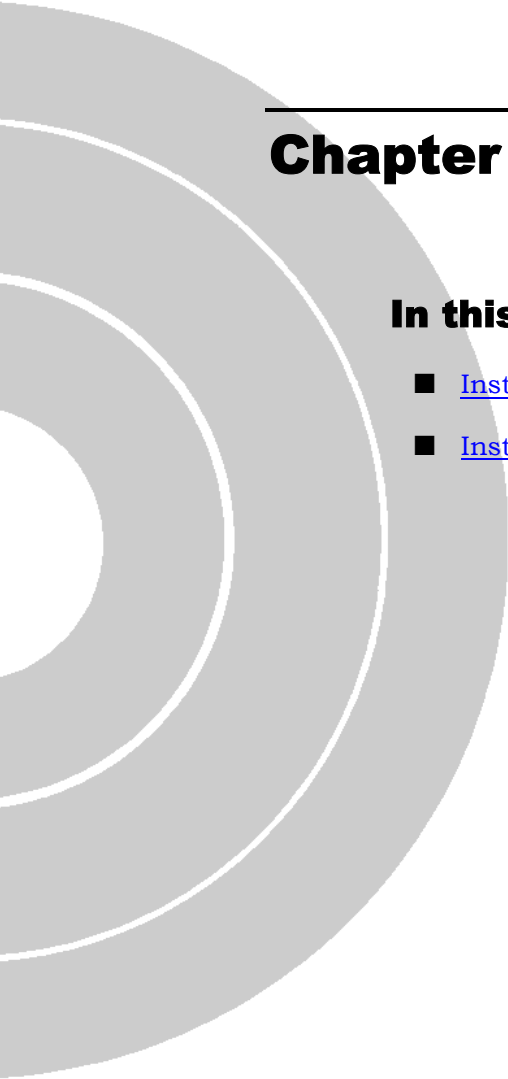


# 2

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## Chapter 2 - Installation

### In this Chapter

- [Installing the Cell Extender](#), on page 2-2
  - [Installing the SU-I](#), on page 2-17
- 

# Installing the Cell Extender

## Installation Requirements

This section describes all the supplies required to install the Cell Extender and the items included in each installation package.

### NOTE



Before proceeding beyond this point and installing the Cell Extender, the spectrum survey should already be complete using the spectrum analysis tool provided with this equipment (special firmware). The results of the survey will identify the specific clear channels and polarization required to configure and operate the 900 MHz equipment. Refer to the provided “Site Survey Procedure and Spectrum Analysis Utility Manual” for detailed instructions on performing the survey. This step is important to ensure the best performance from the product.

## Packing List for CX-2.4-900 Cell Extender

The Cell Extender installation kit includes the following components:

- Interface Unit with a 15 ft. (4.5 m) open- ended power cable
- SU-RA-2.4 Radio Unit with an integrated 16 dBi antenna
- 98 ft. (30 m) RG 58 IF cable with TNC connectors
- Sun guard for the Interface Unit
- RJ-45 Dual Monitor cable
- Outdoor type field-attachable Ethernet connector
- 50 ft. (15 m) LMR-400 Antenna cable with N connectors

## Additional Installation Requirements

The following items are also required to install the Cell Extender system components:

- Grounding cables and other lightning protection materials according to specific installation requirements
- ½ inch conduit for the power cable
- 3 wire fused single phase 100 -240 VAC service (consult a licensed electrician to install)
- Outdoor category 5 Ethernet cable (if a local Ethernet connection is required)

- For configuring basic parameters – a portable PC with Terminal Emulation software (connected using the Dual Monitor cable)  
OR  
A portable PC with Ethernet NIC, a straight Ethernet cable and Telnet software (or BreezeCONFIG ACCESS Configuration Utility)
- Installation tools and materials, including appropriate means (e.g. a pole) for installing the antennas.

## Equipment Location Guidelines

This section provides key guidelines for selecting the optimal installation locations for the various BreezeACCESS 900 system components.

### WARNING



**ONLY experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities should install outdoor units and antennas.**

**Failure to do so may void the BreezeACCESS product warranty and may expose the end user or Service Provider to legal and financial liabilities. Alvarion and its resellers or distributors are not liable for injury, damage or regulation violations associated with the installation of Outdoor Units or antennas.**

Select the optimal locations for the equipment using the following guidelines:

- Units should be installed in easily accessible locations to facilitate installation and testing.
- The higher the placement of the antennas, the better the achievable link quality. (Locate the antennas at least 20 cm (8 in.) away from each other or any other antenna.)
- The antenna of the AU component of the Cell Extender should be installed as close as possible to the Interface Unit to minimize loss in the RF cable. The antenna should be installed so as to provide coverage to all Subscriber Units within its service area.

### NOTE



**The Cell Extender equipment complies with the ETS 300 385 standard and is protected against secondary lightning strikes when the Radio Unit and antenna connected to it are properly grounded according to the relevant country specific industry standards for protection of structures against lightning. The system complies with EN 61000 4 5 test level 3 (2kV).**

## IF Cable

The SU-RA-2.4 Radio Unit is connected to the Interface Unit via an IF cable carrying both signals and power. The IF frequency is 440 MHz. The maximum permitted attenuation of the IF cable is 15dB at 440 MHz and the maximum permitted DC resistance (the sum of the DC resistance of the inner and outer conductors) is 1.5 ohms. This enables a cable length of up to 30m when using the standard RG 58 cable.

If longer cables are required, a cable with lower attenuation and/or DC resistance should be used.

Table 2-1 provides detailed information about common cables such as the RG 58 and RG 213. If the spectral environment is polluted with noise in the 440 MHz band, it is recommended that a higher quality double-shielded cable, such as the LMR 200, LMR 240 and LMR 400, be used. (These cables are manufactured by Times Communications).

| <b>Cable Type</b>        | <b>RG 58</b> | <b>RG 213</b> | <b>LMR 200</b> | <b>LMR 240</b> | <b>LMR 400</b> |
|--------------------------|--------------|---------------|----------------|----------------|----------------|
| Maximum Cable Length (m) | 30           | 100           | 45             | 65             | 150            |

If you are using coaxial cables other than those listed above, consult the cable manufacturers' specification to ensure that the cable's attenuation at 440 MHz does not exceed 15dB, and its DC loss (center conductor plus shield) does not exceed 1.5 ohms.

## Cell Extender's 900 MHz Antennas

| <b>Antenna Model</b>  | <b>Part Number</b> |
|---|--------------------|
| 902-928 MHz, 14 dBi, Adjustable Azimuth Antenna, N type connector | TBD                |
| 902-928 MHz, 9 dBi Vertical Polarized Omni, N type connector      | 990008             |
| 902-928 MHz, 10 dBi Panel Antenna, H/VPOL mount, N type connector | 990010             |

**WARNING**

It is the responsibility of the professional installer to ensure that when using the outdoor antenna kits, only these antenna configurations shown in the table above are used along with the minimum cable lengths provided with the product. The use of any antenna other than those listed is expressly forbidden in accordance to FCC rules CFR47 part 15.204.

## Installing the SU-RA-2.4 Radio Unit

The following sections describe how to install the SU-RA Radio Unit, including pole mounting the unit, and connecting the IF and grounding cables.

### Pole Mounting the SU-RA-2.4 Unit

The SU-RA Radio Unit can be mounted on a pole using one of the following options:

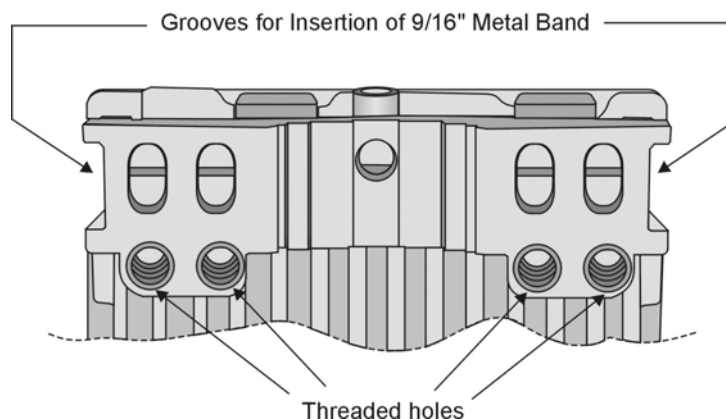
- Special brackets and open-ended bolts are supplied with each unit. There are two pairs of threaded holes on the back of the unit, enabling the special brackets to be mounted on diverse pole widths.
- Special grooves on the sides of the unit enable the use of metal bands to secure the unit to a pole. The bands must be 9/16 inches wide and at least 12 inches long. The metal bands are not included with the installation package.

Figure 2-1 shows the locations of the holes and band grooves on the back, top and bottom of the Outdoor Unit.

#### NOTE



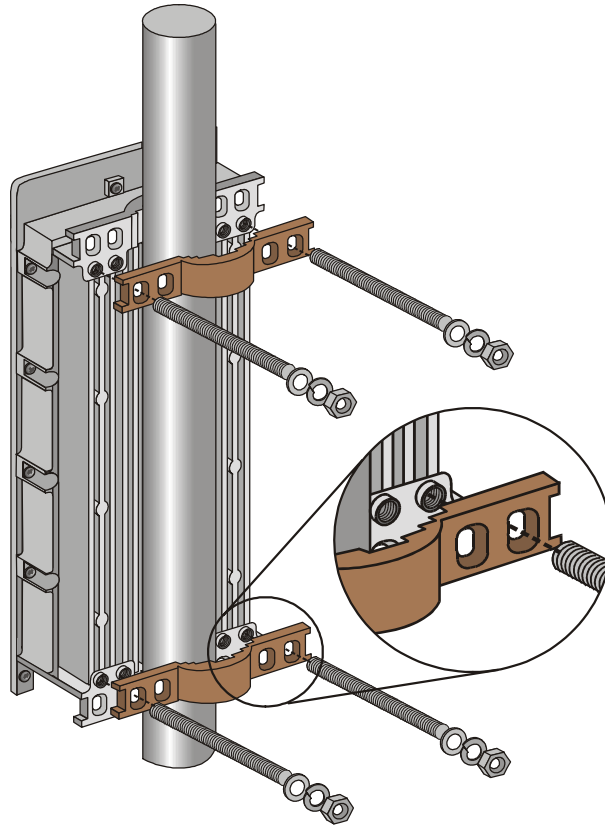
**Be sure to install the unit with the bottom panel, which includes the LED indicators, facing downward.**



**Figure 2-1: Threaded Holes/Grooves**



Figure 2-2 illustrates the method of installing an SU-RA unit on a pole, using the brackets and open-ended bolts.



**Figure 2-2: 3" Pole Installation Using Special Brackets**

#### NOTE



Be sure to insert the open ended bolts with the grooves pointing outward, since these grooves enable you to use a screwdriver to fasten the bolts to the unit.

## Connecting the Ground and IF Cables

The Ground terminal (marked  $\equiv$ ) and the IF cable connector (marked IF) are located on the bottom panel of the SU-RA Radio Unit, as shown in Figure 2-3



#### To connect the ground cable:

1. Connect one end of a grounding cable to the ground terminal and tighten the ground screw firmly.
2. Connect the other end of the ground cable to a ground connection.



### To connect the IF cable:

1. Connect one end of the coaxial IF cable to the IF connector on the bottom panel of the unit
2. Verify that the length of the IF cable is sufficient to reach the Interface Unit.
3. The IF cable connectors should be sealed properly to protect against rain and moisture

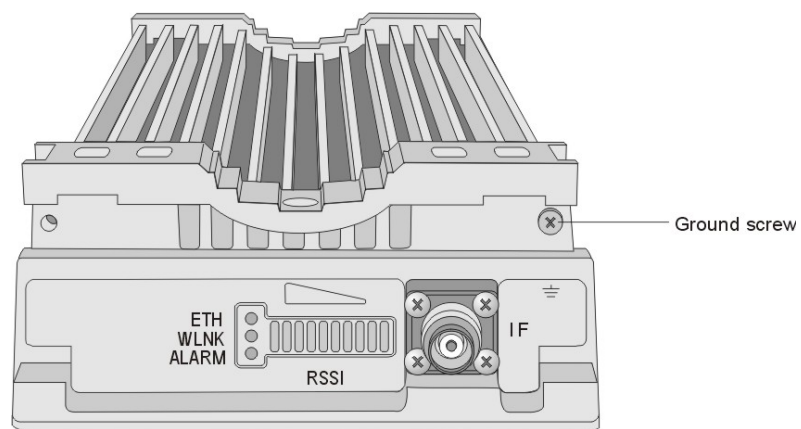


Figure 2-3: SU-RA-2.4 Bottom Panel

## Installing the 900 MHz Antenna

Locate the 900 MHz antenna at least 20 cm (8 in.) away from the 2.4 GHz SU antenna or any other antenna. Refer to the installation instructions included in the antenna kit for proper mounting guidelines. Use only the antennas stated in Table 2-2 of this manual.

### NOTE



Verify that you use the correct polarization according to the results of the spectrum analysis survey.

### WARNING



**ONLY** experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities should install outdoor units and antennas.

Failure to do so may void the BreezeACCESS product warranty and may expose the end user or Service Provider to legal and financial liabilities. Alvarion and its resellers or distributors are not liable for injury, damage or regulation violations associated with the installation of Outdoor Units or antennas.

## Installing the Interface Unit

The following sections describe how to install the Interface Unit, including wall mounting the unit, preparing the power cable and connecting the ground and IF cables. In addition, for those requiring a local Ethernet connection, a description of how to connect the Ethernet cable is provided.

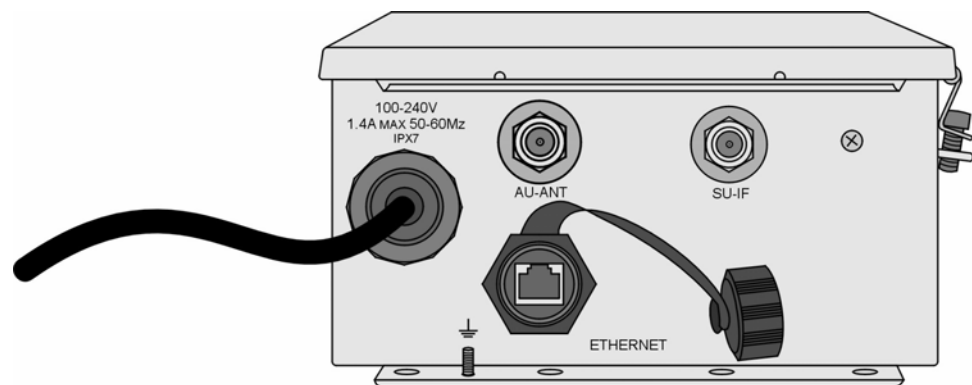


Figure 2-4: Interface Unit Bottom Panel

## Wall Mounting the Interface Unit

The Interface Unit must be installed on a wall with the bottom panel, which includes the connectors, facing downward.

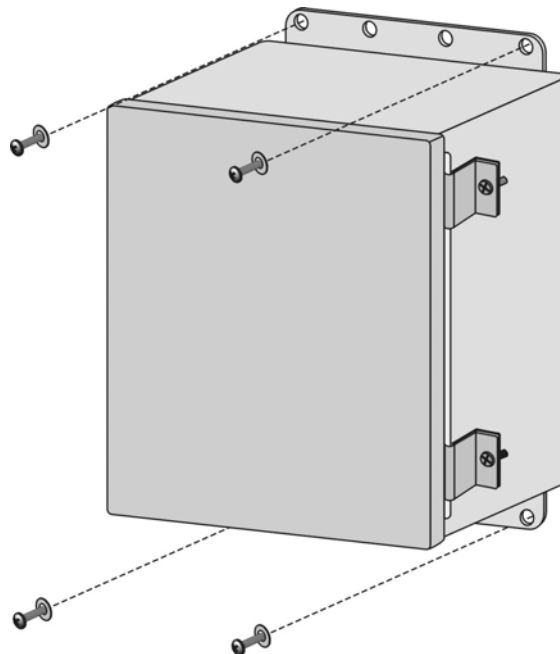


Figure 2-5: Wall Mounting the Interface Unit

The Interface Unit can be secured to a wooden wall using 4 screws or to a concrete wall using 4 masonry anchors and suitable bolts.

If the unit is exposed to direct sunlight, the Sun Guard must be installed to prevent overheating. Before the screws or bolts are firmly secured, place the Sun Guard so that it is properly secured between the unit and the wall.

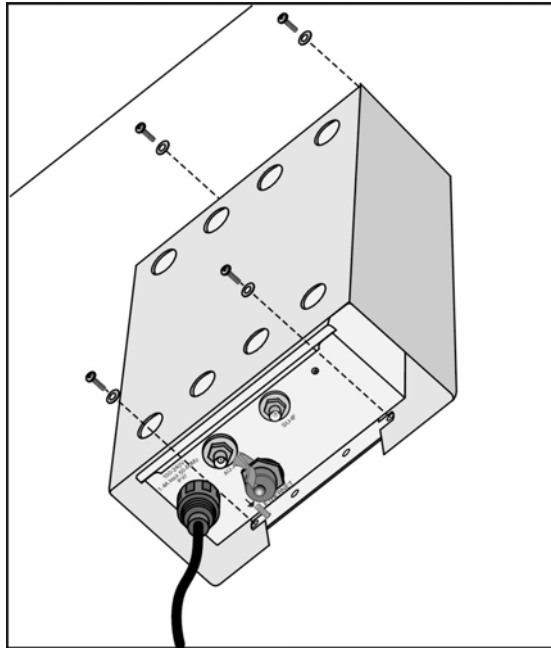


Figure 2-6: Interface Unit with Sun Guard

## Preparing the Power Cord

### CAUTION



**Electric Shock Hazard. The power plug should be connected only by a licensed electrician.**

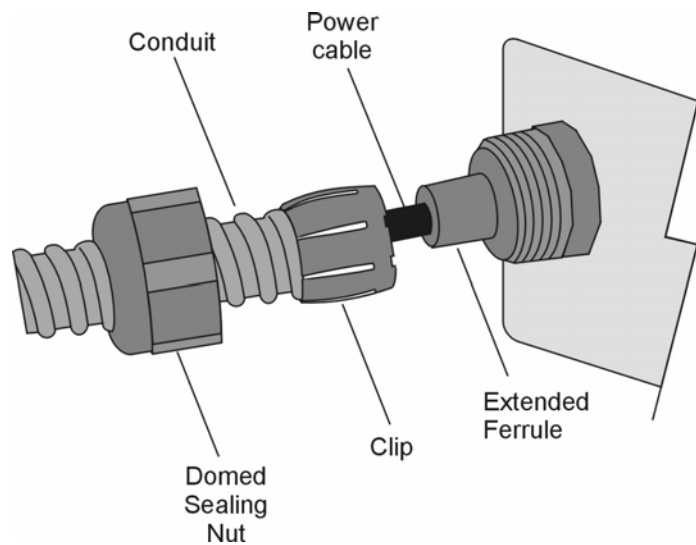
The power cord should be environmentally protected with a ½ inch conduit to the electrical junction box or breaker panel. If connecting to a standard AC receptacle is required, attach a power plug that meets local electrical regulations.

### NOTE

**The color codes of the power cable are as follows:**



|              |         |   |
|--------------|---------|---|
| Black        | Phase   | ~ |
| Grey/White   | Neutral | 0 |
| Yellow/Green | Ground  | ≡ |



**Figure 2-7: Preparing the Power Cord**

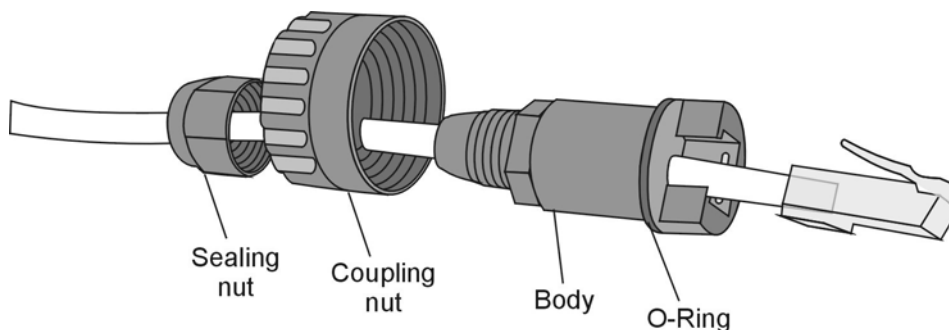


**To prepare the power cord:**

1. Release the domed sealing nut and the special clip of the power cord protective connector.
2. Push the ½ inch conduit over the power cable and through the domed sealing nut until it reaches the end of the special clip. Continue pushing it onto the ferrule, and then tighten the domed sealing nut.

## Preparing the Local Ethernet cable

This section is only for those requiring a local Ethernet connection.



**Figure 2-8: Preparing the Local Ethernet Cable**



**To prepare the local Ethernet cable:**

1. Push the O-Ring over the connector's body until it reaches the end, as shown in Figure 2-8. Push a category 5 shielded Ethernet cable (2.5-6.5mm diameter) through the connector body, the coupling nut and the sealing nut.
2. Crimp the cable to the RJ-45 Ethernet plug. Use the standard 10Base-T wiring sequence (pins 1, 2, 3 and 6). See [Appendix A](#) for more details on the wiring scheme.
3. Insert the RJ-45 plug into the connector body.
4. Push the coupling nut over the connector body and tighten the sealing nut to the connector body.
5. Connect an RJ-45 Ethernet connector to the other end of the cable, using the same 10Base-T wiring sequence.

**NOTE**

10Base-T standard connections use pins 1, 2, 3 and 6. Pins 4, 5, 7 and 8 are used for the special Dual Monitor cable connections. Do not connect any equipment that uses these pins, e.g. Gigabit Ethernet ports.



If the Ethernet port of a PC or any other device connected to the Interface Unit supports automatic rate negotiation, the Ethernet port must be configured to 10Mbps.

If the local Ethernet connection is not used, the Ethernet receptacle must be closed using the attached closure cap to ensure sealing integrity.

## Connecting the Ground, IF, RF and Power Cables



**To connect the ground, IF, RF and power cables:**

1. Connect one end of the ground cable to the ground stud. Connect the other end to a suitable ground connection.
2. Connect a coaxial IF cable between the SU-IF connector and the SU-RA Radio Unit.

**CAUTION**



**Do not connect or disconnect the IF cables while the Interface unit is powered.**

3. Connect a coaxial RF cable between the AU ANT connector and the antenna.

**NOTE**



All IF and RF cables connections must be adequately sealed against water.

4. Connect the power cable to the AC mains.
5. Seal the power cable conduit at the AC mains end to prevent the entry of insects.

# Installing the SU-I Subscriber Unit

## Installation Requirements

This section describes all the supplies required to install the SU-I Subscriber Units and the items included in each installation package.

### Packing List for SU-I-1D-A10-900 Subscriber Unit

The SU-I installation kit includes the following components:

- SU-I-1D Subscriber Unit with a wall mounting kit
- 5 VDC universal power adaptor
- Mounting bracket for wall or ceiling installation
- A torque key for the antenna connector
- Antenna cable kit (10ft and 20ft cables [LMR-240] and a DC grounding block)
- Antenna, including pole mounting hardware

### Additional Installation Requirements

The following items are also required to install the Subscriber Unit:

- Grounding cables and other lightning protection materials according to specific installation requirements
- Straight Ethernet cable for connecting the Subscriber Unit to a PC
- For configuring basic parameters - A portable PC, with Ethernet NIC and Telnet software (or BreezeCONFIG ACCESS Configuration Utility)  
OR  
A portable PC with Terminal Emulation software and a Monitor cable
- Installation tools and materials, including appropriate means (e.g. a pole) for installing the antennas. A Wall/Roof Mounting Arm (P/N 872442 is available from Alvarion.



## Installation Guidelines

This section describes the installation guidelines and the various considerations that must be taken into account when planning the installation.

### Location of the Unit

- The unit can be placed on a desktop or a shelf, or can be attached to a wall.
- The unit should be installed as near as possible to the antenna. The RF cable connecting the unit to the antenna should be as short as possible to guarantee minimum power loss.
- The location of the Subscriber Unit should take into account its connection to a power outlet and the user's data equipment.
- Keep the units well away from sources of heat, such as radiators, air-conditioners, etc.

### Location of the Antenna

- The antenna should be pole mounted on the roof-top or on a side wall. It should be installed where it can be directed towards the location of the Cell Extender. Any physical object in the path between the unit and the Cell Extender should be avoided. Any buildings or other physical structure such as hills or other natural geographic features higher than the antenna and situated in the path between the two sites can constitute obstructions.

#### WARNING



**It is the responsibility of the professional installer to ensure that when using the outdoor antenna kit, that only this antenna provided with the subscriber unit is used along with the minimum cable lengths provided. The use of any antenna other than those listed is expressly forbidden in accordance to FCC rules CFR47 part 15.204.**

### Antenna Polarization

Antenna polarization must be the same at both ends of the link. The antenna can be mounted to provide either vertical or horizontal polarization. To verify polarization of the antenna, refer to the mounting instructions in Appendix B.

## Antenna Seal

The antenna connectors as well as other outdoors RF connections must be sealed against rain.

## Lightning Protection

Lightning protection is designed to protect people, property and equipment by providing a path to ground for the lightning's energy. The lightning arrestor diverts the strike energy to the ground along a deliberate and controlled path instead of allowing it to choose a random path. Lightning protection for a building is more forgiving than protection of electronic devices. A building can withstand up to 100,000 volts, but electronic equipment may be damaged by just a few volts.

Lightning protection entails connecting an antenna discharge unit (also called an arrestor) to each cable as close as possible to the point where it enters the building. It also entails proper grounding of the arrestors and of the antenna mast (if the antenna is connected to one).

The lightning arrestor should be installed and grounded at the point where the cable enters the building. The arrestor is connected to the unit at one end and to the antenna at the other end.

The professional installer you choose must be knowledgeable about lightning protection. The installer must install the lightning protector in a way that maximizes lightning protection.

A Lightning and Grounding installation kit is available from Alvarion.

### WARNING



**ONLY experienced installation professionals who are familiar with local building and safety codes and, wherever applicable, are licensed by the appropriate government regulatory authorities should install outdoor units and antennas.**

**Failure to do so may void the BreezeACCESS product warranty and may expose the end user or Service Provider to legal and financial liabilities. Alvarion and its resellers or distributors are not liable for injury, damage or regulation violations associated with the installation of Outdoor Units or antennas.**





# Installing SU-I Units

## Connectors and LEDs

The unit provides the following interfaces:

- An Ethernet connector (marked ETH) on the rear panel for connecting the unit to a PC.
- A DC-IN 5V connector on the side panel for the power transformer.
- A Monitor connector on the side panel for connecting an ASCII terminal with terminal emulation software for configuration and maintenance purposes.
- An RF connector (marked 2) on the side panel for connecting to an antenna.

The unit provides the following LED indicators on its front panel:

| Table 2-3: Subscriber Unit's LEDs |                         |   |   |
|-----------------------------------|-------------------------|---|---|
| Name                              | Description             | Functionality   |   |
| POWER                             | Power Supply            | On - After successful power up<br>Off - Power off   |   |
| WLNK                              | Wireless Link Activity  | Blinking - Receiving packets from the wireless link<br>Off - no reception of packets from the wireless link |   |
| ETHERNET                          | Ethernet Activity       | Blinking - Reception of data from Ethernet LAN<br>Off - No reception of data from Ethernet LAN              |   |
| SIGNAL QUALITY                    | Received Signal Quality |                          | Very low quality reception or not synchronized with Access Unit |
|                                   |                         |                          | Low quality reception (usually enabling 1Mbps traffic)          |
|                                   |                         |                          | Medium quality reception (usually enabling 2 Mbps traffic)      |
|                                   |                         |                          | High quality reception (usually enabling 3 Mbps traffic)        |

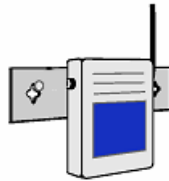
## Wall Mounting the Unit

Use the supplied brackets for wall mounting to install the unit on a wall or a ceiling.



### To mount the unit on a wall:

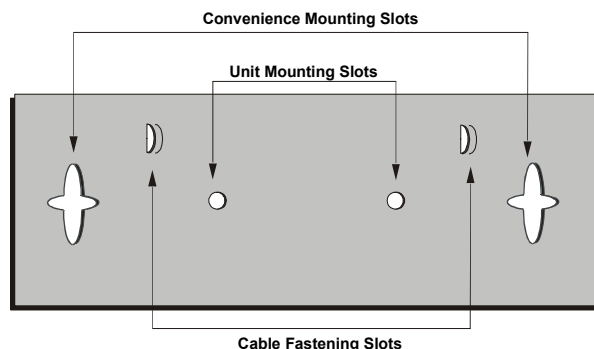
1. Turn the unit so the rear panel is facing you.
2. Unscrew the two screws located at the antennas end of the unit (the top screws).
3. Align the Unit Mounting Slots (see Figure 2-9) with the slots you have just unscrewed.



**Figure 2-9: Wall Mounting the SU-I**

4. Using the longer screws supplied with the wall mounts, screw the wall mount to the unit.
5. Align the Convenience Mounting Slots (see Figure 2-10) with the nails, push the wall mount against the wall and let it slide down until it rests on the nails.

Special slots have been added to the wall mounts to allow for unobtrusive cable installation. These slots should be used to fasten cables coming out of the unit to the wall mounts, eliminating loose or tangled cable installations.



**Figure 2-10: Wall Mounting Plate**

## Installing the Antenna and Lightning Protection



### To install the antenna and lightning protection:

1. The antenna can be mounted on a 1"-4" pole. The mounting on a 1"-2.5" pole differs from mounting on a 2.5"-4" pole. You may use the Wall/Roof Mount Arm available from Alvarion (P/N 872442). Refer to [Appendix B](#) for instructions on installing the antenna.

#### NOTE



Vertical polarization: The POLARIZATION arrow should point upward or downward.  
Horizontal polarization: The POLARIZATION arrow should be parallel to ground.

2. Install the DC grounding block or optional lightning arrestor near the point where the antenna cable enters the building and perform all the required RF and grounding connections according to the instructions provided in [Appendix C](#).

#### NOTE



All RF cables connections must be adequately sealed against water.

## Connecting the Antenna to the Unit



### To connect the antenna to the unit:

1. Connect the cable to the connector marked 2 on the side of the unit.

#### NOTE



Do not remove the runner cover of the connector marked 1, and do not attempt to connect the antenna to this connector.

2. Use the torque key included in the package to tighten the cable to the connector. The key is designed to prevent over tightening of the screws and protects the connectors from damage. If excessive pressure is applied to tighten the screws, the torque key will break.

#### NOTE



The use of improper tools for tightening antenna connection cables to BreezeACCESS units may result in damage to the cable connectors.

## Connecting the Unit to the CPE and Power Outlet

The unit operates on a power input of 5VDC, supplied by the power transformer included with the unit.



### To connect the unit to the CPE and Power Outlet:

1. Plug the output jack of the power transformer into the DC input jack (marked DC IN 5V) located on the side of the unit.
2. Connect the power transformer to a power outlet - 110/ 220VAC.
3. Use a straight Ethernet 10Base-T cable to connect a PC to the Ethernet port located on the rear panel of the unit.

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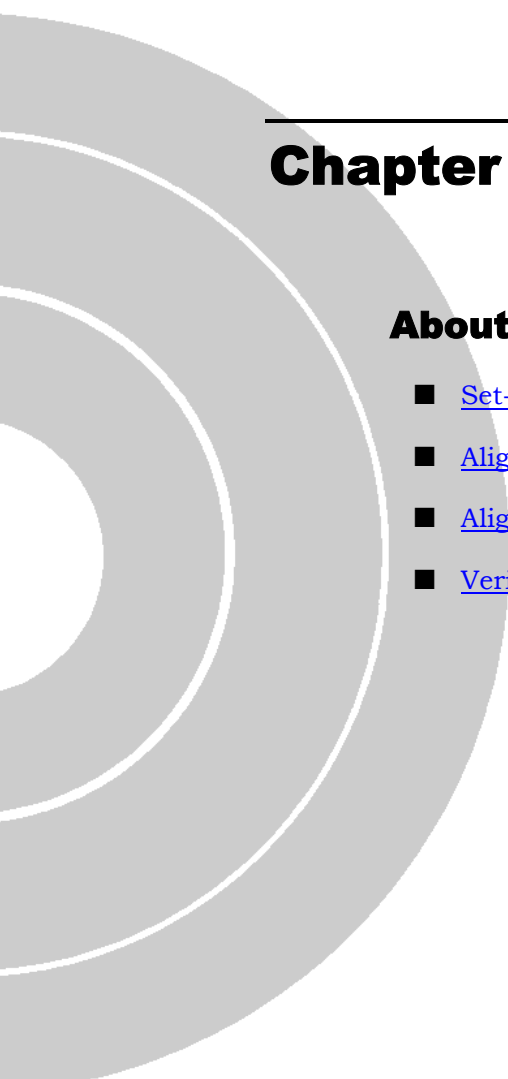


# 3

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## Chapter 3 - Commissioning

### About this Chapter

- [Set-Up and Initialization](#), page A-3
  - [Aligning the Cell Extender's SU-RA Antenna](#), page A-9
  - [Aligning the SU-I Subscriber Unit's Antenna](#), page A-11
  - [Verifying Proper Operation](#), page A-12
- 



## Set-up and Initialization

After completing the installation process, as described in the preceding chapter, the basic parameters must be configured to ensure that the unit operates correctly. Once the basic parameters have been configured, additional parameters can be remotely configured via the Ethernet port or the wireless link using Telnet or SNMP management, or by loading a configuration file.

### NOTE



**The decision on hopping frequencies to be used, based on the results of the Spectrum Analysis survey, must be made prior to starting the process of configuring basic parameters.**

## Accessing the Monitor Program



**To access the Monitor Program using the Monitor cable:**

To configure the Cell Extender, use the Dual Monitor cable to connect the Ethernet connector of the unit to the COM port of a PC running a terminal emulation program. The COM port connectors on the Dual Monitor cable are 9-pin D-type plugs. One plug connects to the SU interface module inside the unit and the other plug connects to the AU module.

To configure the SU-I, use a regular Monitor cable.

1. Run a terminal emulation program, such as HyperTerminal™.
2. Set the communication parameters as shown in Table 3-1.
3. Press Enter. The Select Access Level menu is displayed.
4. Select the required access level, depending on your specific access rights. A password entry request is displayed.
5. Enter your password and press Enter. The Main Menu is displayed.

| Table 3-1: Monitor Port Communication Parameters |                    |
|--|--------------------|
| Parameter  | Value              |
| Baud Rate  | 9600               |
| Data Bits  | 8                  |
| Stop Bits  | 1                  |
| Parity   | None               |
| Flow Control                                     | Xon/Xoff           |
| Connector  | Connected COM port |

**NOTE**

Following three unsuccessful login attempts (using incorrect passwords) from either the Monitor port or via Telnet, the monitor program is blocked for several minutes. To enable access to the monitor program during that time, the unit must be reset via SNMP or by disconnecting/reconnecting power.

**To access the Monitor Program locally using Telnet:**

1. Connect a PC to the Ethernet port using a crossover cable.
2. Configure the PC's IP parameters to enable connectivity with the unit. The default IP address is 10.0.0.1.
3. Run the Telnet program. The Select Access Level menu is displayed.
4. Select the required access level, depending on your specific access rights. A password entry request is displayed.
5. Enter your password and press Enter. The Main Menu is displayed.

**NOTE**

If the Telnet session is not terminated properly, for example, if you simply close the window, the monitor program is blocked for several minutes. To enable access to the monitor program during that time, the unit must be reset via SNMP or by disconnecting/reconnecting power.

## Configuring Basic Parameters

The Basic Configuration menu includes all the parameters necessary for the initial installation and operation of the Cell Extender and the SU-I units. In many installations, most of these parameters should not be changed from their default values. The basic parameters and their default values are listed in Tables 3-2 to 3-4. Once the basic parameters are configured, the unit must be reset in order to activate the new configuration.

The functionality of most parameters of BreezeACCESS 900 equipment is the same as for BreezeACCESS II units. Refer to BreezeACCESS II System Manual for detailed information on the applicable parameters.

The functionality of the several parameters in BreezeACCESS 900 is different than in BreezeACCESS II. These parameters are:

- Hopping Set and Hopping Sequence parameters are not available. The Hopping Standard in all BreezeACCESS 900 units is set to Flexible Hopping Definition. Refer to [Appendix D](#) for details on how to configure the required hopping frequencies using the Flexible Hopping Definition menu.
- Antenna Diversity is not supported. The Transmit Antenna parameter must always be configured to Antenna 2.
- Transmit power level is controlled by the Transmit Power parameter. The range is 3-23dBm in 1dB steps, and the default is 23dBm.

| <b>Table 3-2: Basic Parameters in the Cell Extender's SU</b> |                          |  |
|--|--------------------------|--|
| <b>Parameter</b>   | <b>Default Value</b>     | <b>Comment</b>   |
| IP Address   | 10.0.0.1                 |  |
| Subnet Mask  | 255.0.0.0                |  |
| Default Gateway Address                                      | 0.0.0.0                  |  |
| DHCP Options   | Disable                  |  |
| Access to DHCP   | From Wlan Only           |  |
| ESSID  | ESSID1                   |  |
| Transmit Power Control                                       | 15                       |  |
| ATPC Option  | Enable                   |  |
| Best AU Support  | Disable                  |  |
| Preferred AU MAC Address                                     | 00-00-00-00-00-00 (none) | Applicable only when Best AU Support is enabled  |
| Scanning Mode  | Active                   |  |
| VLAN Link Type   | Hybrid                   |  |
| VLAN ID-Management   | 65535                    |  |
| Authentication Algorithm                                     | Open System              | Can be changed to Shared Key only after configuring the WEP Key and the applicable Default Key ID. |
| Default Key ID   | 1                        |  |
| WEP Key 1-4  | 0000000000 (none)        |  |

| <b>Table 3-3: Basic Parameters in the Cell Extender's AU</b> |                                   |  |
|--|-----------------------------------|--|
| <b>Parameter</b>   | <b>Default Value</b>              | <b>Comment</b>   |
| IP Address   | 10.0.0.1                          |  |
| Subnet Mask  | 255.0.0.0                         |  |
| Default Gateway Address                                      | 0.0.0.0                           |  |
| DHCP Options   | Disable                           |  |
| Access to DHCP   | From Ethernet Only                |  |
| ESSID  | ESSID1                            |  |
| Operator ESSID Option  | Enable Operator ESSID (AU) ESSID1 |  |
| Operator ESSID   | ESSID1                            |  |
| Flexible Hopping Definition                                  |                                   | According to the spectrum analysis survey                                |
| Transmit Antenna   | Antenna 2                         | Must remain Antenna 2  |
| Transmit Level   | 23 dBm                            |  |
| ATPC Option  | Disable                           |  |
| VLAN Link Type   | Hybrid                            |  |
| VLAN ID-Management   | 65535                             |  |
| Authentication Algorithm                                     | Open System                       | Can be changed to Shared Key only after configuring at least one WEP Key |
| WEP Key 1-4  | 0000000000 (none)                 |  |

| <b>Table 3-4: Basic Parameters in the SU-I</b> |                          |  |
|--|--------------------------|--|
| <b>Parameter</b>                               | <b>Default Value</b>     | <b>Comment</b>   |
| IP Address                                     | 10.0.0.1                 |  |
| Subnet Mask                                    | 255.0.0.0                |  |
| Default Gateway Address                        | 0.0.0.0                  |  |
| DHCP Options                                   | Disable                  |  |
| Access to DHCP                                 | From Wlan Only           |  |
| ESSID  | ESSID1                   |  |
| Flexible Hopping Definition                    |                          | According to the spectrum analysis survey  |
| Transmit Antenna                               | Antenna 2                | Must remain Antenna 2  |
| Transmit Level                                 | 23 dBm                   |  |
| ATPC Option                                    | Enable                   |  |
| Best AU Support                                | Disable                  |  |
| Preferred AU MAC Address                       | 00-00-00-00-00-00 (none) | Applicable only when Best AU Support is enabled  |
| Scanning Mode                                  | Active                   |  |
| VLAN Link Type                                 | Hybrid                   |  |
| VLAN ID-Management                             | 65535                    |  |
| Authentication Algorithm                       | Open System              | Can be changed to Shared Key only after configuring the WEP Key and the applicable Default Key ID. |
| Default Key ID                                 | 1                        |  |
| WEP Key 1-4                                    | 0000000000 (none)        |  |

**NOTE**

Once the basic parameters are configured, the unit must be reset in order to activate the new configuration.



# Aligning the Cell Extender's SU-RA Antenna

The SNR bar display is located on the bottom panel of the SU-RA. The eight green LEDs are used for indicating the quality of the received signal. The higher the number of green LEDs indicating On, the higher the quality of the received signal. This section describes how to align the SU-RA antenna using the SNR bar display.

## NOTE



**Antenna alignment using the SNR bar display is possible only after the SU is associated with an Access Unit. The associated Access Unit must be operational and the basic SU's parameters must be correctly configured. If not, the unit will not be able to synchronize with the Access Unit. As the SNR measurement is performed on received frames, its results are meaningless unless the SU is associated with an Access Unit.**



## To align the SU-RA antenna:

1. Align the antenna, which is integrated into the front side of the SU-RA unit, by pointing it in the general direction of the Base Station.
2. Verify that the power indication of the unit is **On**.
3. Verify that the WLNK LED of the unit is **On**, indicating that the unit is associated with an Access Unit. If the WLNK LED is **Off**, check that the basic parameters are correctly configured. If the unit is still not associated with the AU, improve the quality of the link by changing the direction of the antenna or by placing the antenna at a higher or alternate location.
4. Rotate the antenna until the maximum SNR reading is achieved, where at least 1 green LED is on: If you encounter prolonged difficulty in illuminating the minimum required number of green LEDs, try to improve the reception quality by placing the antenna at a higher point or in an alternate location.
5. Secure the unit firmly to the pole.

## NOTE



**If you are having difficulties in obtaining a good RSSI, since the RSSI bar indicator is not precise, it is recommended that you use the Continuous Link Quality Display test for more precise alignment of the antenna.**



## Aligning the SU-I Subscriber Unit's Antenna

For antenna alignment, you can use either the 3 Signal Quality LED indicators on the front panel of the SU-I or view the Received Signal Strength Indication in the Site Survey menu. Typically, alignment using the Signal Quality LEDs is sufficient. This section describes how to align the SU-RA antenna using the Signal Quality LEDs.

### NOTE



Antenna alignment using the Signal Quality LEDs is possible only after the SU is associated with a Cell Extender's AU. The Cell Extender's AU must be operational and the basic SU's parameters must be correctly configured. If not, the unit will not be able to synchronize with the Cell Extender's AU. As the SNR measurement is performed on received frames, its results are meaningless unless the SU is associated with a Cell Extender's AU.



### To align the antenna of the SU:

1. Align the antenna by pointing it in the general direction of the Cell Extender.
2. Verify that the power indication of the unit is **On**.
3. Verify that the WLNK LED of the unit is **On**, indicating that the unit is associated with an Access Unit. If the WLNK LED is **Off**, check that the basic parameters are correctly configured. If the unit is still not associated with the Cell Extender's AU, improve the quality of the link by changing the direction of the antenna or by placing the antenna at a higher or alternate location.
4. Check the SIGNAL QUALITY L, M and H LEDs. The higher the number of LEDs that are on, the better the quality of the link. Rotate the antenna left and/or right until you reach the point of highest signal quality reading on the SIGNAL QUALITY LEDs. For proper operation, at least one (L) LED should be on. If this is not possible, improve the link quality by placing the antenna at a higher point or in an alternate location.
5. Secure the antenna firmly to the pole.

## Verifying Proper Operation

The following sections describe how to verify the correct functioning of the various unit, Ethernet connections and data connectivity.

### SU-RA-2.4 Radio Unit LEDs

To verify the correct operation of the SU-RA, examine the LED indicators located on the bottom panel of the unit.

The following tables list the provided LEDs and their associated indications.

| Name           | Description             | Functionality   |             |   |
|----------------|-------------------------|---|-------------|---|
| POWER          | Power Supply            | On - After successful power up<br>Off - Power off   |             |   |
| WLNK           | Wireless Link Activity  | Blinking - Receiving packets from the wireless link<br>Off - no reception of packets from the wireless link |             |   |
| ETHERNET       | Ethernet Activity       | Blinking - Reception of data from Ethernet LAN<br>Off - No reception of data from Ethernet LAN              |             |   |
| SIGNAL QUALITY | Received Signal Quality | H<br>M<br>L   | O<br>O<br>O | Very low quality reception or not synchronized with Access Unit |
|                |                         | H<br>M<br>L   | O<br>O<br>* | Low quality reception (usually enabling 1Mbps traffic)          |
|                |                         | H<br>M<br>L   | O<br>*<br>* | Medium quality reception (usually enabling 2 Mbps traffic)      |
|                |                         | H<br>M<br>L   | *<br>*<br>* | High quality reception (usually enabling 3 Mbps traffic)        |

| Table 3-6: SU-RA LEDs |                                  |   |
|-----------------------|----------------------------------|---|
| Name                  | Description                      | Functionality   |
| ETH                   | Ethernet activity indication     | <ul style="list-style-type: none"> <li>■ Off –No traffic activity detected on the Ethernet port</li> <li>■ Blinking–Data received from or transmitted to the Ethernet port</li> </ul> |
| WLNK                  | Wireless Link Activity Indicator | <ul style="list-style-type: none"> <li>■ Blinking– Packets received from the wireless link</li> <li>■ Off – No reception of packets from the wireless link</li> </ul>                 |
| ALARM                 | Alarm Indication                 | <ul style="list-style-type: none"> <li>■ On – A problem with the power amplifier or in the locking process of any of the synthesizers</li> <li>■ Off – Normal operation</li> </ul>    |

## Verifying the Ethernet Connection (SU-I)

Once you have connected the unit to a PC, verify that the Ethernet Integrity indicator (the yellow LED embedded in the Ethernet connector) is on, indicating that the unit is connected to an Ethernet segment. The Ethernet Activity indicator (the green embedded LED) should blink whenever the unit receives or transmits traffic on the Ethernet port.

## Verifying Data Connectivity (SU-I)

To verify data connectivity, from the end-user's PC or from a portable PC connected to the unit, ping the primary Access Unit, or try to connect to the Internet.

# A

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## **Appendix A - Wiring 10Base-T Jacks**

## Connecting a Hub to the CX



To connect a hub to the CX, use a straight-through cable, as shown in Figure A-1

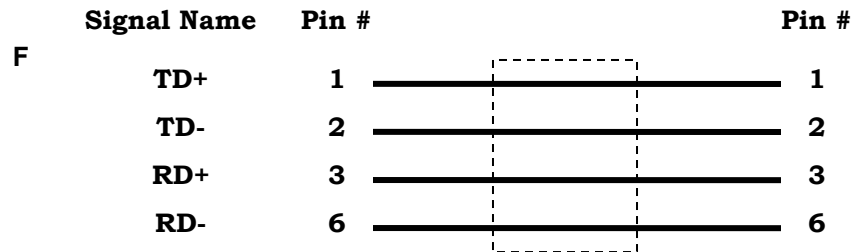


Figure A-1: Straight-Through Cable Connection

## Connecting a PC to the CX



To connect a PC to the CX, use a crossover cable, as shown in Figure A-2

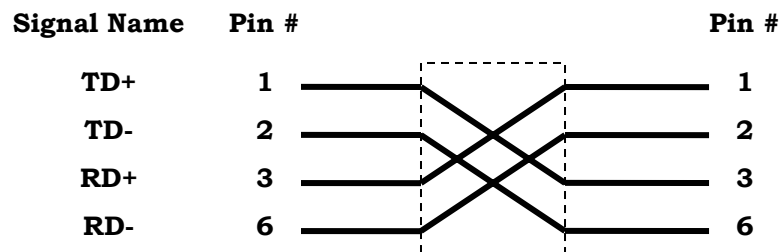


Figure A-2: Crossover Cable Connections

To establish which pin is pin number 1, hold the cable so that the end of the plastic RJ45 tip, which is the part that inserts first into the wall jack, is facing away from you. Flip the clip so that the copper side faces up. The springy clip is facing down and parallel to the floor. When looking down on the coppers, pin 1 is on the far left.



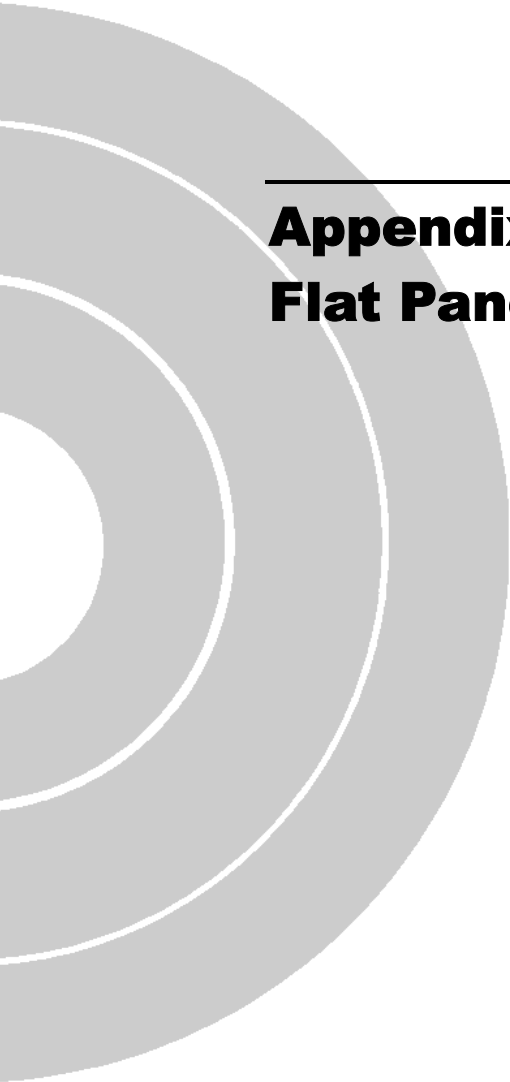




# B

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## **Appendix B - Mounting the 10 dBi Flat Panel Subscriber Antenna**



Vertical polarization: The POLARIZATION arrow should point upward or downward.

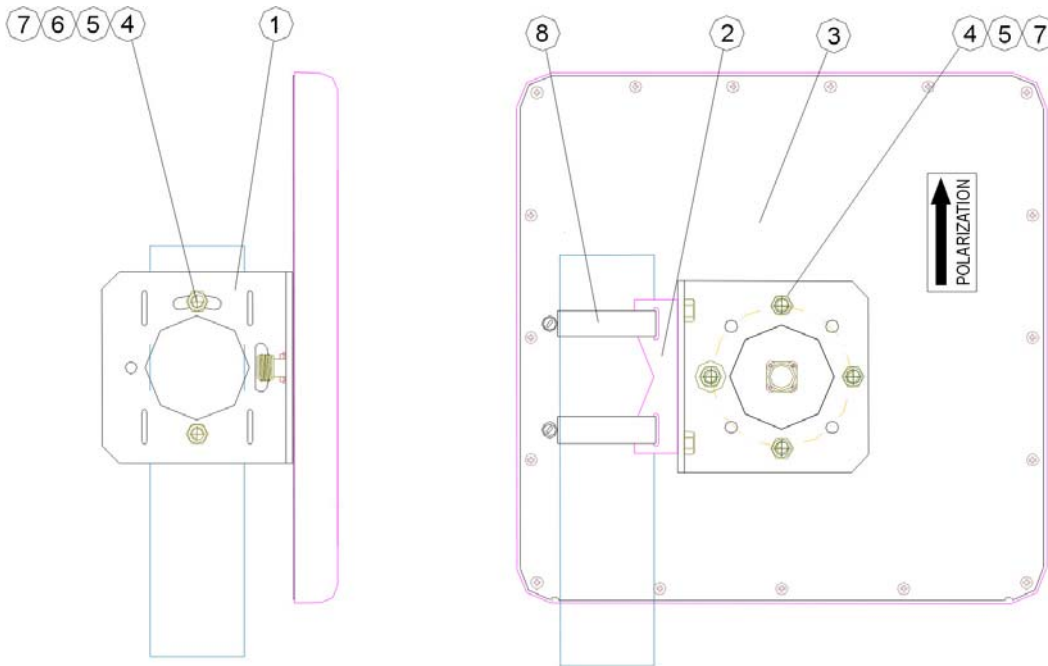
Horizontal polarization: The POLARIZATION arrow should be parallel to ground.

**CAUTION**

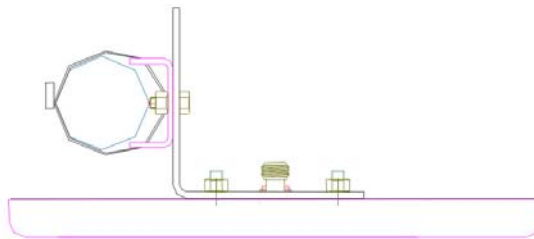


**Do not install antennas near power lines. Contact with high voltage lines is dangerous and can cause death or serious injury.**

## Mounting on a 1"-2.5" Pole



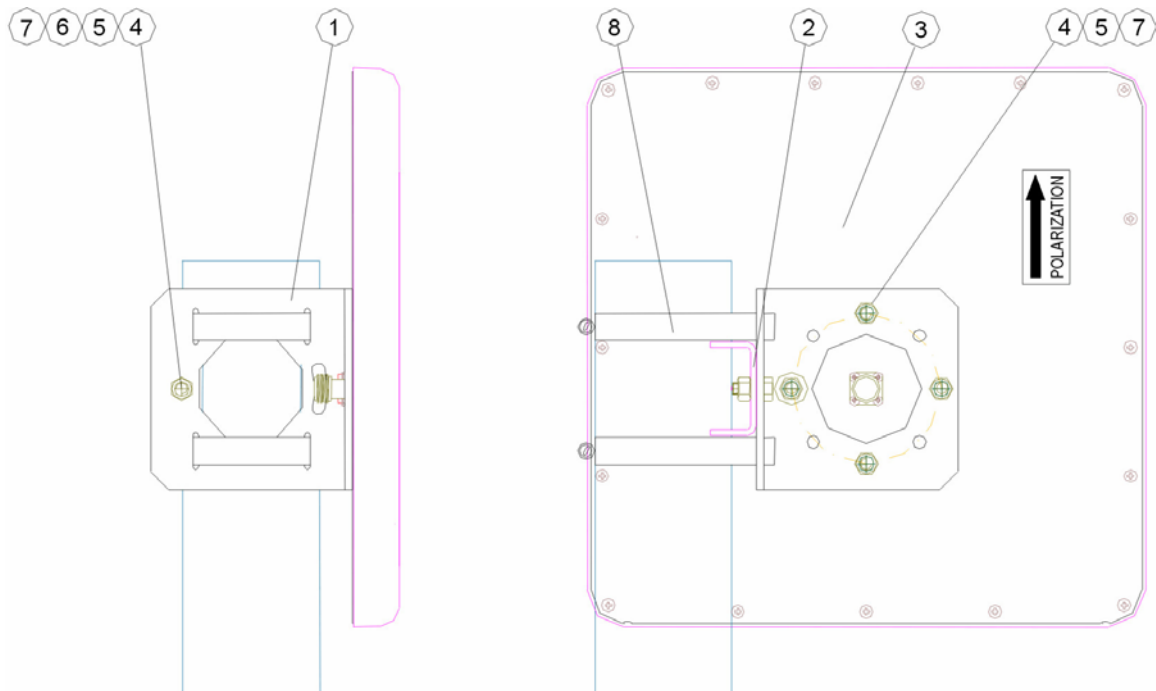
| ITEM No. | DESCRIPTION                 | QTY. |
|----------|-----------------------------|------|
| 1        | GRIP 1                      | 1    |
| 2        | GRIP 3                      | 1    |
| 3        | ANT. ASSY                   | 1    |
| 4        | NUT NC 1/4-20"              | 6    |
| 5        | SPRING WASHER #1/4          | 6    |
| 6        | FLAT WASHER #1/4            | 6    |
| 7        | SCREW NC 1/4 - 20 X 5/8"    | 2    |
| 8        | S.S BAND 75-110 & S.S SCREW | 2    |



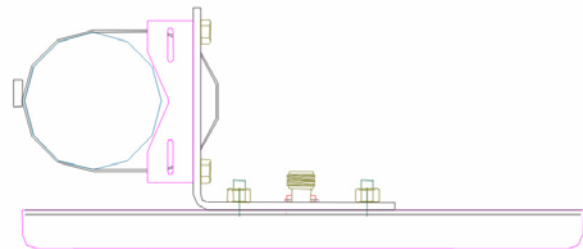
### Mounting instructions - Azimuth and Elevation Tilt

1. Place item No. 1 on the antenna, as illustrated in the drawing. Align with the screw holes.
2. Connect item No. 1 to the antenna with spring washers (5), flat washers (6) and nuts (4).
3. Tighten the nuts at a torque of 30 In\*Lbs.
4. Connect item No. 2 to item No. 1 as illustrated, with items 4,5,6,7. Leave screws slightly loose.
5. Connect item No. 2 to the pole with the hose clamps (8) and tighten to the pole with a torque of 30 In\*Lbs
6. Adjust the desired angle, and fully tighten the loose screws (paragraph 4).

## Mounting on a 2.5"-4" Pole



| ITEM No. | DESCRIPTION                 | QTY. |
|----------|-----------------------------|------|
| 1        | GRIP 1                      | 1    |
| 2        | GRIP 3                      | 1    |
| 3        | ANT. ASSY                   | 1    |
| 4        | NUT NC 1/4-20"              | 6    |
| 5        | SPRING WASHER #1/4          | 6    |
| 6        | FLAT WASHER #1/4            | 6    |
| 7        | SCREW NC 1/4-20 X 5/8"      | 2    |
| 8        | S.S BAND 75-110 & S.S SCREW | 2    |



### Mounting instructions - Azimuth and Elevation Tilt

1. Place item No. 1 on the antenna, as illustrated in the drawing. Align with the screw holes.
2. Connect item No. 1 to the antenna with spring washers (5), flat washers (6) and nuts (4).
3. Tighten the nuts at a torque of 30 In\*Lbs.
4. Connect item No. 2 to item No. 1 as illustrated, with items 4,5,6,7.
5. Connect item No. 1 to the pole with the hose clamps (8) and tighten to the pole with a torque of 30 In\*Lbs.
6. Adjust the desired angle, and fully tighten the loose screws.

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# C

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## **Appendix C - Lightning and Grounding Installation**



# Lightning and Grounding Installation

## Extra Items Needed

Your SU-I-1D-A10-900 subscriber unit comes with 1 DC grounding block – N type to provide an Earth ground connection. To complete the grounding installation you will need these items:

- 50ft. Grounding wire and clamps.
- Mounting screws, anchors, and coax cable clips.
- 2 Coax seal patches.
- A grounding block or connection to an Earth ground
- (Optional) 900 MHz Lightning arrestor for use in place of the grounding block in lightning prone areas where the antenna is placed at the building high point. Available from Alvarion, model number LA-900.

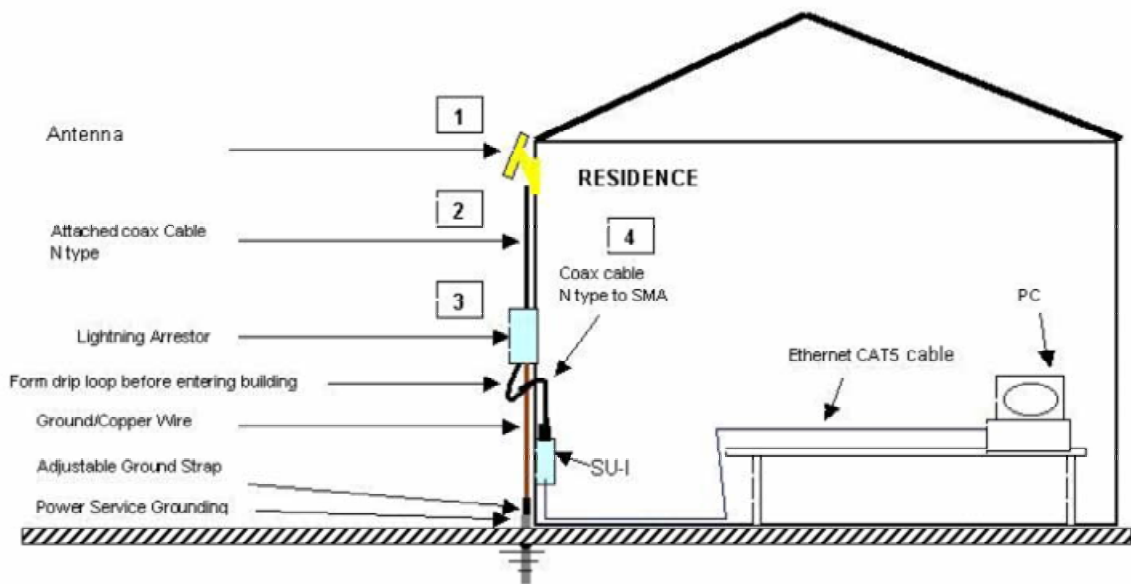


Figure C-1: Connections Diagram

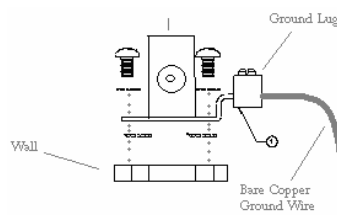


Figure C-2: Installing the Grounding Block or Lightning arrestor



# D

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## **Appendix D - Configuring Hopping Frequencies and Operational Sequences**



# Flexible Hopping Definition Mode

## General

The process of setting the hopping sequence using the Flexible Hopping Definition mode includes the following steps:

1. Select the frequencies to be used using the Flexible Hopping Definition menu
2. Define the method of generating the basic hopping sequence based on the set of selected frequencies, using the Scrambling Definition sub-menu. The method of generating the basic sequence also defines the hopping shift mechanism for generating different actual hopping sequences.
3. Configure the Hopping Shift parameter to define a different hopping sequence for each AU in order to minimize interference between adjacent AUs.

The Flexible Hopping Definition menu enables defining the hopping frequencies and the method of scrambling the selected frequencies for generating the basic hopping sequence. It also enables to view the selected hopping frequencies and the current hopping sequence (based on the previous selections made before the last reset). The new selections will come into effect only after the next reset.

The default selection (including the case where all frequencies were deleted) is a single frequency, 915 MHz.



# Frequencies Selection and Basic Sequence Generation Using the Flexible Hopping Definition Menu

The Flexible Hopping Definition menu includes the following options:

## Define Sub-Bands

The Define Sub-Bands option enables defining a new list of sub-bands and/or discrete frequencies. Enter a list of the required sub-bands and/or frequencies, using either sub-bands (f1-f2) or discrete frequencies, e.g. 904-910,915,919-925. use a comma to separate between entries, do not use spaces.

The usable center frequencies are from 904 to 926, using a 1 MHz resolution (904, 905, 906,...926). However, the channel spacing, which is the minimum distance between two consecutive frequencies, is 2 MHz. Thus, for example, the sequence 904,905 is not a valid entry because the distance between frequencies is less than 2 MHz, and it will be rejected.

When entering discrete frequencies, the actual center frequencies are defined. When entering a sub-ban, a guard band of 1 MHz on both sides is included, which means that the sub-band entries can start at 903 and end at 927. Defining for example the sub-band 903-909 will result in selecting the frequencies 904, 906, 908. The same set of frequencies (904, 906, 908) will be selected also if the defined sub band is 903-910. Defining the sequence 904-910,915,919-927 will result in selecting the frequencies 905, 907, 909, 915, 920, 922, 924 and 926.

The new selected set of frequencies (frequencies to be used) will become effective only after the next reset.

## Scrambling Definition

The Scrambling Definition menu enables defining the method of organizing the selected frequencies to form the actual hopping sequence to be used. Proper organization of the hopping sequence is essential to guarantee minimal cross interference among several neighboring cells that use the same sequence with different Hopping Shift values.

## Scrambling Mode

Defines the scrambling mode. The following options are available:

## Standard Scrambling

This mode is not recommended for sequences with 7 or more channels. The scrambled basic sequences for 3 to 6 frequencies when using Standard Scrambling are:

| <b>N (number of channels)</b> | <b>Scrambled Basic Sequence (channel indexes)</b> |
|-------------------------------|---|
| 3                             | 1, 3, 2   |
| 4                             | 1, 3, 2, 4  |
| 5                             | 1, 3, 5, 2, 4                                     |
| 6                             | 1, 3, 5, 2, 6, 4                                  |

Frequency 1 (index=1) is the lowest frequency in the list of frequencies to be used, frequency 2 is the next frequency and so on.

## Manual Scrambling

For customized definition of the hopping sequence, using the Manual Sequence Definition option (see below).

## Enhanced Scrambling

Automatically generates hopping sequences using an enhanced algorithm. It is recommended that Enhanced Scrambling rather than Standard Scrambling be used. If the Enhanced Scrambling Mode is selected, the Spanning Factor parameter (see below) must be configured in the AU. The Enhanced Mode is not suitable for sequences with 6 or less frequencies. If Enhanced Scrambling is selected with sequences that have 6 or less frequencies, then Standard Scrambling is used by default.

The scrambled sequence is generated according to the following rules:

1. The first channel in the basic scrambled sequence is frequency 1 (Frequency 1 (index=1) is the lowest frequency in the list of frequencies to be used, frequency 2 is the next frequency and so on.)
2. The index of each of the other channels is calculated by adding the Spanning Factor to the index of the previous channel. Note that the sequence is cyclic, meaning that adding 1 to the highest index in the sequence (Index=N where N is the number of channels in the sequence) will result in the first channel (Index=1).

The scrambled basic sequence can also be calculated using the formula:

$$P_x(j) = \{(j-1)*X\} \bmod(N) + 1$$

Where:

X is the Spanning Factor

N is the number of channels in the sequence (modulus)

J is the sequence index

Example: N=8, X=3

$$P_1(5) = \{(1-1)*3\} \bmod 8 + 1 = 1$$

$$P_2(5) = \{(2-1)*3\} \bmod 8 + 1 = 6$$

$$P_3(5) = \{(3-1)*3\} \bmod 8 + 1 = 3$$

$$P_4(5) = \{(4-1)*3\} \bmod 8 + 1 = 8$$

$$P_5(5) = \{(5-1)*3\} \bmod 8 + 1 = 5$$

$$P_6(5) = \{(6-1)*3\} \bmod 8 + 1 = 2$$

$$P_7(5) = \{(7-1)*3\} \bmod 8 + 1 = 7$$

$$P_8(5) = \{(8-1)*3\} \bmod 8 + 1 = 4$$

And the basic scrambled sequence is: 1, 4, 7, 2, 5, 8, 3, 6.

## Manual Sequence Definition

Manually defines the hopping sequence, using numbered channel indexes (from 1 to “Number of Hopping Frequencies”). The sequence length must be equal to “Number of Hopping Frequencies” (all the defined frequencies must be used).

## Erase Manual Sequence

Erases the manually defined hopping sequence.

## Spanning Factor (AU only)

Defines the Spanning Factor to be used by the Enhanced Scrambling mechanism. The Spanning Factor should be chosen so that the GCD (Greater Common Divisor) of the Spanning Factor and the Number of Hopping Frequencies would be 1 (e.g. for 8 frequencies possible values for the Spanning Factor are 1, 3, 5 and 7). The SU learns the value of the Spanning Factor from the AU during the association process.

Use of different spanning factors by non-synchronized neighboring base stations reduces the probability of interference between adjacent sectors.

Valid values: 1 to Number of Hopping Frequencies minus 1, provided it meets the GCD requirement as described above.

It is not recommended to use spanning factors of 1 and N-1, as they result in hopping on consecutive channel (assuming that the available channels are consecutive). In these cases the advantage of using frequency hopping is not fully utilized, since narrow band interference may affect several consecutive hops. Spanning factors of 2 and N-2 also result in a relatively poor spread of the hopping frequencies over the available frequency band.

Default Value: 1

**NO**



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**gured for the SU, than after completing the  
will use the Scrambling Mode of the AU.**

| <b>Number</b> | <b>Spanning Factor</b> | <b>Hopping Sequence</b> |
|---------------|------------------------|-------------------------|
| 7             | 1                      | 1, 2, 3, 4, 5, 6, 7     |
|               | 2                      | 1, 3, 5, 7, 2, 4, 6     |
|               | 3                      | 1, 4, 7, 3, 6, 2, 5     |
|               | 4                      | 1, 5, 2, 6, 3, 7, 4     |
|               | 5                      | 1, 6, 4, 2, 7, 5, 3     |
|               | 6                      | 1, 7, 6, 5, 4, 3, 2,    |
| 8             | 1                      | 1, 2, 3, 4, 5, 6, 7, 8  |
|               | 3                      | 1, 4, 7, 2, 5, 8, 3, 6  |
|               | 5                      | 1, 6, 3, 8, 5, 2, 7, 4  |
|               | 7                      | 1, 8, 7, 6, 5, 4, 3, 2, |

| <b>Table D-2: Spanning Factors and Hopping Sequences<br/>for Sequences with 7 to 12 Channels</b> |                        |                                       |
|--|------------------------|---------------------------------------|
| <b>Number of Channels</b>  | <b>Spanning Factor</b> | <b>Hopping Sequence</b>               |
| 9  | 1                      | 1, 2, 3, 4, 5, 6, 7, 8, 9             |
|  | 2                      | 1, 3, 5, 7, 9, 2, 4, 6, 8             |
|  | 4                      | 1, 5, 9, 4, 8, 3, 7, 2, 6             |
|  | 5                      | 1, 6, 2, 7, 3, 8, 4, 9, 5             |
|  | 7                      | 1, 8, 6, 4, 2, 9, 7, 5, 3             |
|  | 8                      | 1, 9, 8, 7, 6, 5, 4, 3, 2             |
| 10   | 1                      | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10         |
|  | 3                      | 1, 4, 7, 10, 3, 6, 9, 2, 5, 8         |
|  | 7                      | 1, 8, 5, 2, 9, 6, 3, 10, 7, 4         |
|  | 9                      | 1, 10, 9, 8, 7, 6, 5, 4, 3, 2         |
| 11   | 1                      | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11     |
|  | 2                      | 1, 3, 5, 7, 9, 11, 2, 4, 6, 8, 10     |
|  | 3                      | 1, 4, 7, 10, 2, 5, 8, 11, 3, 6, 9     |
|  | 4                      | 1, 5, 9, 2, 6, 10, 3, 7, 11, 4, 8     |
|  | 5                      | 1, 6, 11, 5, 10, 4, 9, 3, 8, 2, 7     |
|  | 6                      | 1, 7, 2, 8, 3, 9, 4, 10, 5, 11, 6     |
|  | 7                      | 1, 8, 4, 11, 7, 3, 10, 6, 2, 9, 5     |
|  | 8                      | 1, 9, 6, 3, 11, 8, 5, 2, 10, 7, 4     |
|  | 9                      | 1, 10, 8, 6, 4, 2, 11, 9, 7, 5, 3     |
|  | 10                     | 1, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2     |
| 12   | 1                      | 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12 |
|  | 5                      | 1, 6, 11, 4, 9, 2, 7, 12, 5, 10, 3, 8 |
|  | 7                      | 1, 8, 3, 10, 5, 12, 7, 2, 9, 4, 11, 6 |
|  | 11                     | 1, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2 |

## Show Flexible Hopping Parameters

Displays the following information:

- An updated list of the defined sub-bands and discrete frequencies to become effective after the next reset. A sub-band is defined by the first and last hopping frequency in a series of consecutive frequencies, with 3MHz separation between frequencies.
- An updated list of all the hopping frequencies to be used after the next reset.
- Scrambling Mode
- Manual Sequence Definition (if applicable)
- Spanning Factor (if applicable. In the SU it will be shown only when operating in the Enhanced Scrambling mode)
- The current sequence of operational hopping frequencies