BreezeACCESS

Base Station Equipment

Installation Manual

February, 2001
Cat. No. 213155

Trade Names

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Statement of Conditions

The information contained in this manual is subject to change without notice. BreezeCOM shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this manual or equipment supplied with it.

Warranty

In the following warranty text, “the Company” shall mean:

- BreezeCOM Ltd., for products located outside the USA.
- BreezeCOM Inc., for products located in the USA.

This BreezeACCESS product is warranted against defects in material and workmanship for a period of one year from date of purchase. During this warranty period the Company will, at its option, either repair or replace products that prove to be defective.

For warranty service or repair, the product must be returned to a service facility designated by the Company. Authorization to return products must be obtained prior to shipment. The buyer shall pay all shipping charges to the Company and the Company shall pay shipping charges to return the product to the buyer.

The Company warrants that the firmware designed by it for use with the unit will execute its programming instructions when properly installed on the unit. The Company does not warrant that the operation of the unit or firmware will be uninterrupted or error-free.

Limitations of Warranty

The foregoing warranty shall not apply to defects resulting from improper or inadequate maintenance by the buyer, buyer supplied interfacing, unauthorized modification or misuse, operation outside of the environmental specifications for the product, or improper site preparation or maintenance. No other warranty is expressed or implied. The Company specifically disclaims the implied warranties of merchantability and fitness for any particular purpose.

BreezeCOM shall not be liable to any person for any special or indirect damages, including, but not limited to, loss of profits or revenues, loss of use or damage to any associated equipment, cost of capital, cost of substitute products, facilities or services, downtime costs or claims resulting from any cause whatsoever arising from or in any way connected with the manufacture, sale, handling, service, repair, maintenance or use of the products. In no event shall the company's liability exceed the purchase price denoted on the invoice.

Electronic Emission Notice

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

This 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 requirements in section 1.1307, a minimum separation distance as defined in the following table is required between the antenna and all persons:

Product	**Minimum Distance**
BreezeACCESS MMDS, SU-A/E	64 cm (26 inches)
BreezeACCESS II, SU-A/E	2 m (79 inches)

R&TTE Compliance Statement

This equipment complies with the appropriate essential requirements of Article 3 of the R&TTE Directive 1999/5/EC.

Information to User

Any changes or modifications of equipment not expressly approved by the manufacturer could void the user's authority to operate the equipment.

Safety Considerations

For the following safety considerations, "Instrument" means the BreezeACCESS Base Station equipment components and cables.

Caution

To avoid shock, do not perform any servicing unless you are qualified to do so.

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.

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.

Antenna Installation and Grounding

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

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1. INTRODUCTION

This manual describes installation guidelines for BreezeACCESS base station equipment, including the stand-alone AU-E/A-NI-Access Units and the modular AU-E/A-BS-Units with the BS-SH rack mounted shelf.

The BreezeACCESS Broadband Wireless Access system allows access service providers to provide high-speed IP connectivity services to their subscribers. To support IP-based services effectively BreezeACCESS systems employ wireless packet data switching technology.

The AU-A/E-NI and the AU-A/E-BS Access Units are comprised of an indoor unit and an outdoor unit. In the AU-A-NI and AU-A-BS products, the outdoor unit (AU-RA) contains the radio module and an integral flat antenna. In the AU-E-NI and AU-E-BS products, the outdoor unit (AU-RE) contains the radio module and an interface to an external antenna (not included).

The indoor unit of the AU-A/E-NI is a stand-alone unit (AU-NI) that is powered from the mains via its AU-PS power supply unit. The indoor unit of the AU-A/E-BS is a module (BS-AU) that is designed for insertion into the BS-SH shelf. The BS-SH, which is a 3U shelf suitable for installation in 19" racks, can contain up to six BS-AU active modules and one or two BS-PS power supply modules. The shelf is powered from a –48VDC power source. Power supply redundancy is supported through the optional use of a second BS-PS power supply module.

The indoor unit provides the interface to the network. It also contains an IF (Intermediate Frequency) module and is connected to the outdoor unit via a 50-ohm coaxial IF cable. The IF cable serves for transmission of the 440MHz IF signal between the indoor and the outdoor units. It also serves for transferring power (12VDC), management and control signals from the indoor unit to the outdoor unit.

BreezeACCESS products use Frequency Hopping Spread Spectrum radios and are available in the following frequency bands:

- **BreezeACCESS II** products operate in Time Division Duplex (TDD) mode in the 2.4-2.5GHz frequency band. The exact frequencies vary in accordance with specific country's radio regulations. BreezeACCESS II products are available with an output power at the antenna port of either 26dBm (HP), 15dBm (GP), 7dBm (MP) or 2dBm (LP).

- **BreezeACCESS MMDS** products operate on Time Division Duplex (TDD) mode in the 2.500-2.686GHz frequency band.

- **BreezeACCESS XL** products operate in Frequency Division Duplex (FDD) mode, and are currently available in the following frequency bands:

Model	**Uplink Band (GHz)**	**Uplink-Downlink Separation (MHz)**
BreezeACCESS 3.5a	3.410-3.452	100
BreezeACCESS 3.5a1	3.400-3.450	100
BreezeACCESS 3.5b	3.450-3.500	100
BreezeACCESS 3.5e	3.425-3.450	50
BreezeACCESS 2.6b	2.551-2.593	74
BreezeACCESS 3.3	3.300-3.324	76
BreezeACCESS 3.8	3.925-4.015	-320

Note: *The information contained in this manual is applicable to BreezeACCESS units with software release 3.0 and up.*

2. BASIC INSTALLATION

2.1 Packing List – Modular Shelf Equipment

2.1.1 BS-SH Base Station Shelf

- BS-SH shelf (with blank panels)
- Rubber legs for optional desktop installation

Note: *Unless ordered otherwise, each BS-SH will be shipped with one BS-PS power supply installed.*

2.1.2 AU-A/E-BS Access Units (up to six per shelf)

- Outdoor unit:
  - ⇒ AU-RA with integral antenna

    OR
  - ⇒ AU-RE with a connector to an external antenna (not included)
- Pole mounting kit for the outdoor unit (with two brackets, four sets of screws, nuts and washers)
- BS-AU Network Interface module
- Monitor cable

2.1.3 BS-PS Power Supply (one or two per shelf)

- BS-PS Power Supply module
- Power cable

2.2 Packing List – Stand-alone AU-A/E-NI Access Unit

- AU-NI indoor unit
- Outdoor unit:
  - ⇒ AU-RA with integral antenna

    OR
  - ⇒ AU-RE with a connector to an external antenna (not included)
- AU-PS power supply with a mains power cord
- Pole mounting kit for the Outdoor unit (with two brackets, four sets of screws, nuts and washers)
- Wall mounting kit for the AU-NI unit

2.3 Other Items Required for Installation

- IF cable (s)* (one for each AU)
- Grounding cable(s) with an appropriate termination (one for each AU)
- Ethernet cable(s) (straight, one for each AU)
- Antenna(s)* and RF cable(s)* (AU-E-NI or AU-E-BS only)
- A portable PC with terminal emulation software
- Installation tools and materials.

Items marked with an asterisk (*) are available as options from BreezeCOM.

2.4 Guidelines for Selection of Equipment Location

Select appropriate locations for the equipment using the following guidelines:

- The outdoor unit can be pole—or wall mounted. Its location should allow easy access to the unit for installation and testing.
- The AU-RA unit with its integrated antenna, or the external antenna connected to the AU-RE unit, should be installed where it provides coverage of all subscriber units in the area it is intended to serve. The higher the AU-RA or the antenna, the better coverage it can provide.

- The AU-RE outdoor unit should be installed as near as possible to its antenna.

***Note**: The distance between any two antennas should be greater than 40 cm.*

- The outdoor unit is connected to the indoor unit by means of a coaxial IF cable carrying signals, controls and power. The IF frequency is 440 MHz. The maximum allowed attenuation of the IF cable is 15dB and its maximum allowed DC resistance (the sum of the DC resistance of the inner and outer conductors) is 1.5 ohm. This allows for cable lengths 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 data regarding several industry-standard cables such as RG 58 and RG 213. If the spectral environment is polluted with noise in the 440 MHz band, it is recommended to use a higher quality double-shielded cable such as LMR 240 or LMR 400 (manufactured by Times Communications).

Table 2-1. IF Cables

Cable Type	RG 58	RG 213	LMR 240	LMR 400
Maximum cable Length (m)	30	100	65	150

- The BS-SH and its modules and the SU-NI are designed for indoor operation, i.e., inside buildings, a suitable cabinet or a shelter. Air temperature control might be necessary – the equipment is designed to operate over the temperature range 0°C to 45°C.

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

The system complies with the ETS 300 385 standard and is protected against secondary lightning strikes when its outdoor unit is properly grounded according to the applicable country-specific industry standards for protection of structures against lightning. The system complies with EN 61000-4-5, test level 3 (2kV).

Failure to do so may void the BreezeACCESS product warranty and may expose the end user or the service provider to legal and financial liabilities. BreezeCOM and its resellers or distributors are not liable for injury, damage or violation of regulations associated with the installation of outdoor units or antennas.

2.5 Installing the Outdoor Radio Unit

2.5.1 Mounting the Outdoor Unit

The outdoor unit can be secured to the pole using one of the following options:

- Special brackets and open-ended screws (supplied with each unit). There are two pairs of screw holes on the rear of the unit, allowing use of the brackets with various pole widths.
- U-bolts - size A (inner installation holes, up to 2" pole).
- U-bolt - size B (outside installation holes, up to 3" pole).
- Metal bands (9/16" wide, minimum 12" long).

Figure 2-1 shows the locations of the U-bolt holes, band grooves and screw holes on the rear side of the unit.

Figure 2-2 illustrates the method of installing an AU-RE unit on a pole using the supplied brackets and open-ended screws. The installation of an AU-RA unit with an integral antenna is very similar to the installation of an SU-RE unit.

Note: *Make sure to install the unit with the bottom panel (the panel with the IF connector) facing downward.*

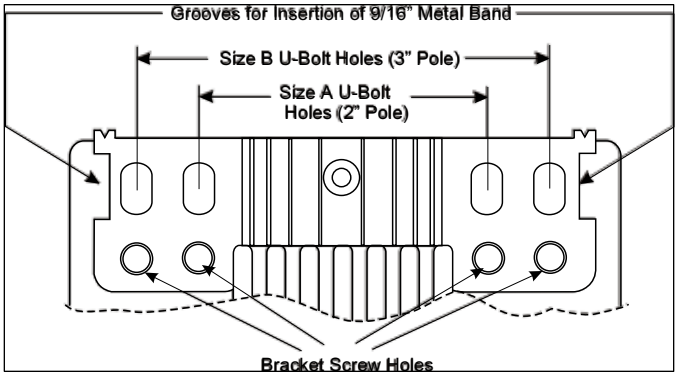


Figure 2-1. Holes/Grooves/Screw Holes

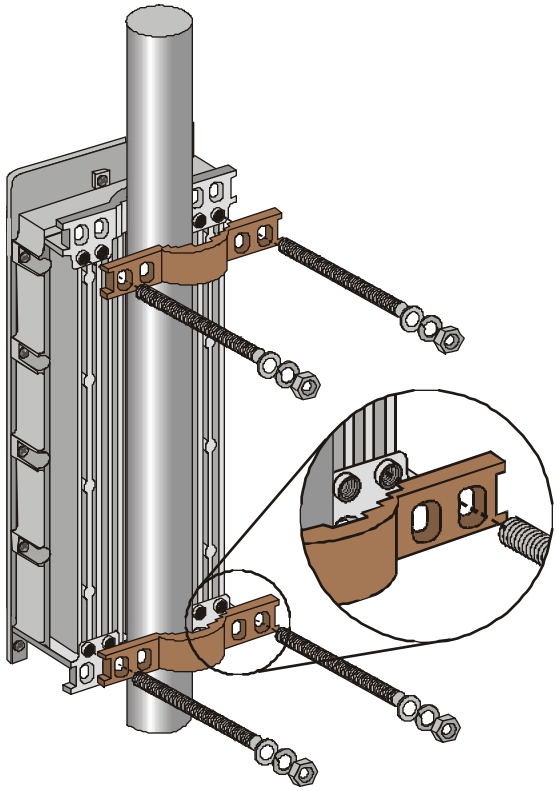
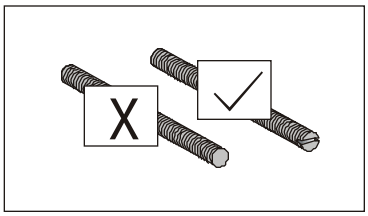


Figure 2-2. AU-RE 3" Pole Mounting Installation Using the Special Brackets

***Note**: When inserting the open-ended screws, make sure to insert them with the grooves pointing outwards; these grooves are intended to allow fastening of the screws with a screwdriver.*



2.5.2 Connecting the Antenna Cable (AU-RE)

Connect an RF cable between the ANT connector (marked ANT) and the antenna.

In BreezeACCESS II and BreezeACCESS MMDS AU-RE units, the ANT connector is located on the top panel of the unit. In BreezeACCESS XL units, the ANT connector is located on the bottom panel.

2.5.3 Connecting the Ground and IF Cables

The Ground terminal (marked ⏚) and the IF cable connector (marked IF) are located on the bottom panel of the Outdoor unit, shown in Figure 2-3 and in Figure 2-4.

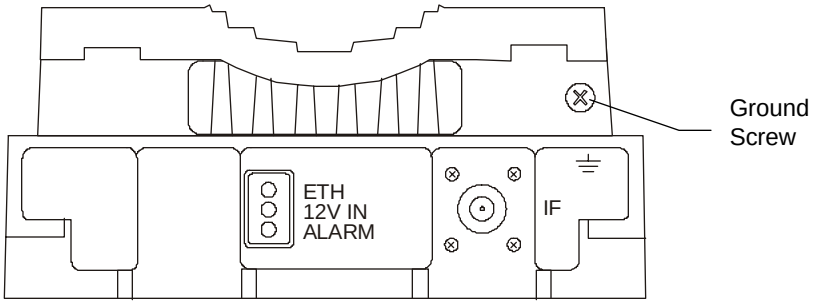


Figure 2-3. BreezeACCESS II and BreezeACCESS MMDS AU-RA/AU-RE Radio Unit Bottom Panel

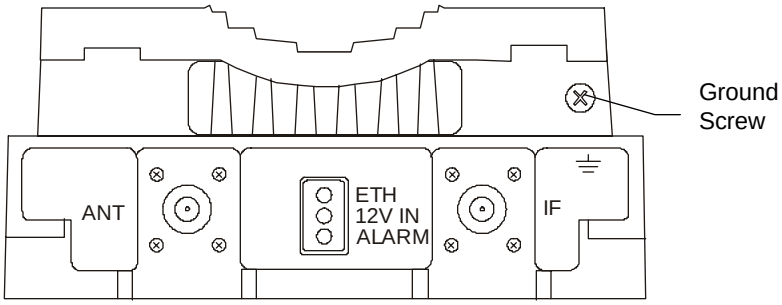


Figure 2-4. BreezeACCESS XL AU-RE Radio Unit Bottom Panel

Note: *The bottom panel of the BreezeACCESS AU-RA radio unit is identical to the one shown in Figure 2-4, but does not have the ANT connector.*

1. Connect one end of the grounding cable to the Ground terminal and connect the other end to a good ground connection.

2. Connect the coaxial cable to the IF connector. Verify that the length of the IF cable is sufficient and that it can easily reach the Indoor unit.

Note: *Make sure to switch OFF the power of the indoor unit prior to connecting/disconnecting the IF cable.*

2.6 Installing the Modular Shelf Indoor Equipment

2.6.1 BS-SH Slot Assignments

The Base Station shelf has ten slots, as shown in Figure 2-5

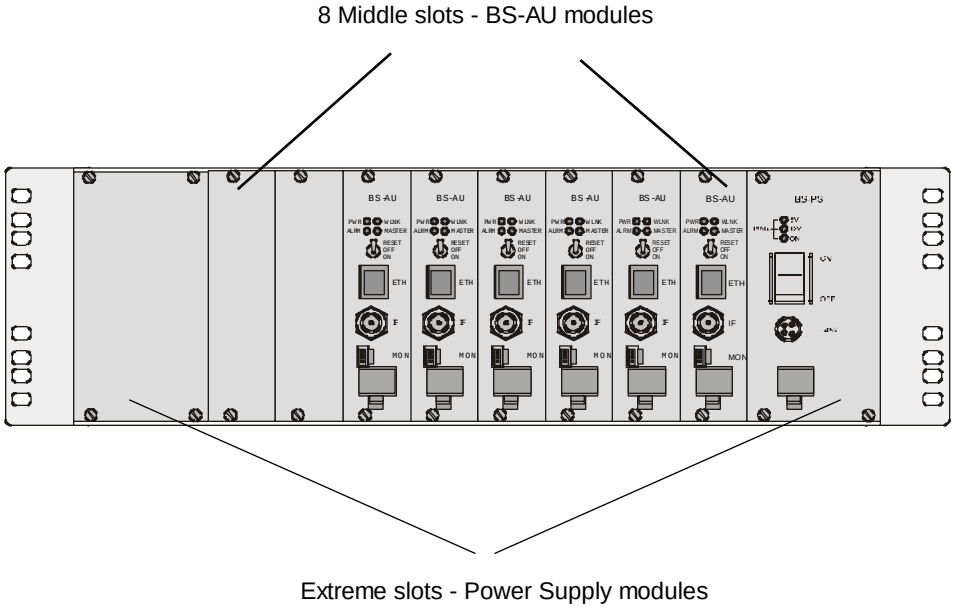


Figure 2-5. Shelf Slot Assignments

The two wide slots on the both sides of the shelf accommodate the BS-PS power supply modules. The shelf is designed to support power supply redundancy through the use of two Power Supply modules. If a single power supply is used, it can be inserted in any of the two available slots.

The remaining eight slots can accommodate up to six active BS-AU modules. Two extra slots are for future use. Active BS-AU modules can be installed in any of the 8 slots. Unused slots should be covered by blank panels.

2.6.2 The BS-AU

The BS-AU front panel is shown in Figure 2-6.

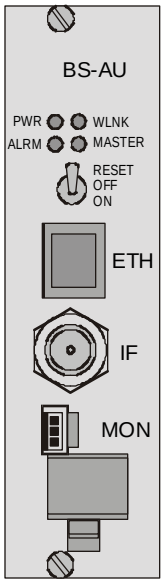


Figure 2-6. BS-AU Front Panel

The BS-AU provides the following interfaces:

An Ethernet connector (ETH) for connecting the BS-AU to the network. This connector should be connected to a straight Ethernet cable.

An IF connector for connecting the BS-AU to an outdoor AU-RE or AU-RA radio unit. The outdoor radio unit provides the air link between the BS-AU and the remote Subscriber Units.

A MON connector for connecting an ASCII terminal with terminal emulation software for configuration and maintenance purposes.

The BS-AU front panel LEDs are described in Table 2-2.

Table 2-2: BS-AU LEDs

Name	Description	Functionality
PWR	Power supply 12 VDC	On – 12 VDC power is supplied to AU-RE Off – 12 VDC power is not supplied to AU-RE
WLNK	Wireless link activity	Blinking –Receiving packet from the wireless link Off – No reception of packets from the wireless link
ALRM	ALARM Indication	On – Loss of hopping synchronization (slave units)
MASTER	Master Indication	On – The unit is configured as a Master
ETH connector embedded (orange) LED	Ethernet activity	On- Receive/Transmit on Ethernet port Off- No Receive/Transmit on Ethernet port
ETH connector embedded (green) LED	ETH Link Integrity	On- Unit is connected to Ethernet segment Off- Unit is not connected to Ethernet segment

The switch on the BS-AU front panel controls the supply of 12 VDC power to the outdoor unit via the IF cable. The momentary RESET position of this switch is for resetting the outdoor unit. In the OFF position, power is not supplied to the outdoor unit, even when the BS-AU unit is still ON.

2.6.3 The BS-PS

The BS-PS provides power to all the modules installed in the BS-SH rack. The BS-PS front panel is shown in Figure 2-7.

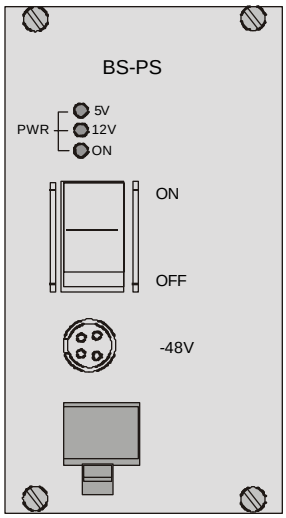


Figure 2-7. BS-PS Front Panel

The BS-PS provides a single connector (marked -48V) for connecting the -48VDC power source to the module. The color codes of the cable wires are:

black *-48VDC*
red *+ (Return)*

The switch turns the mains power to the power supply ON and OFF.

Table 2-3. BS-PS Power Supply LEDs

Name	Description
ON	-48 VDC is available and Power Supply is ON
5V	The 5V power supply module is OK and power is consumed (at least one BS-AU module is inserted)
12V	The 12V power supply module is OK and power is consumed (at least one AU-RA/RE unit is connected)

2.6.4 Shelf and Modules Installation Procedure

1. Install the BS-SH rack in a 19" cabinet (or place on an appropriate shelf/table). When mounting the BS-SH on a desktop, screw on the rubber legs shipped with unit.
2. Carefully insert the BS-PS Power Supply and the BS-AU modules into their intended slots and push firmly until they are securely locked; refer to Section 2.6.1 for a description of the slot assignments. Close the captive screws attached to each module. Place blank covers over all the unused slots.
3. Connect the IF cable(s) to the connector(s) marked IF located on the front panel(s) of the BS-AU module(s) shown in Figure 2-6. The other side of the IF cable should already be connected to the outdoor unit.
4. Connect the DC power cord to the –48 VDC In jack (marked –48V) located on the front panel of the BS-PS power supply shown in Figure 2-7. If a redundant power supply module is installed, connect a power cable to it as well.
5. Connect the power cord(s) to the –48VDC power source. Connect the black wire to the -48VDC contact of the power source. Connect the red wire to the + (Return) contact. Connect the shield to the Ground.
6. Switch the BS-PS power supplies to ON. Verify that all the power indicator LEDs on the BS-PS front panel are ON. Refer to Table 2-3 for a description of these LEDs.
7. Set the switches on the front panel of all BS-AU modules in the rack to ON.

Note: *Disconnect the IF cable from the BS-AU module before inserting or removing it to/from the BS-SH shelf.*

2.7 Installing the AU-NI Indoor Unit

1. Place the AU-NI unit in an appropriate location on a shelf or a table. The unit can be wall mounted using the installation materials provided with the unit. Use a 6mm (1/4") drill and the supplied template plate for easy and accurate marking of the holes.
2. Connect the AU -PS DC power cord to the DC In jack (marked DC-12V) located on the rear panel of the Indoor unit (shown in Figure 2-7).
3. Connect the IF cable to the IF connector (marked IF) on the rear panel of the Indoor unit. The other side of the IF cable should already be connected to the Outdoor unit.
4. Connect the mains power cord to the AU -PS. Connect the mains power plug to a mains power outlet.

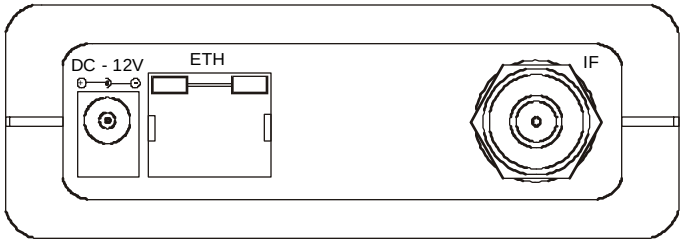


Figure 2-8. AU -NI Rear Panel

5. Verify that the Power LED (marked PWR) located on the front panel of the Indoor Unit is turned ON.

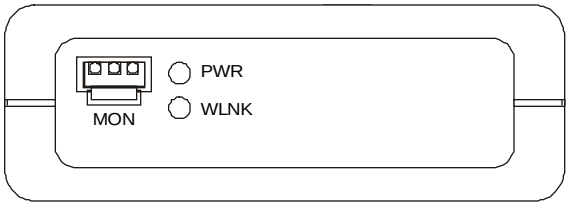


Figure 2-9. AU -NI Front Panel

6. Use a straight Ethernet 10baseT cable to connect the base station network (e.g., a hub, switch or router) to the Ethernet port (marked ETH) located on the rear panel of the AU-NI unit.

3. CONFIGURING SYSTEM PARAMETERS

After completing the installation process as described in the preceding section, proceed with configuration of the basic system parameters.

This section covers the configuration of basic installation parameters. Refer to the Administration Manual for information related to other parameters.

Note: *Optionally, the product can be configured using Telnet over the Ethernet port. See Appendix A of this manual for further information.*

3.1 Getting Started with the Local Terminal

1. Connect one end of the Monitor cable to the MON jack on the front panel of the BS-AU module or the AU-NI unit. Connect the second end of the cable to the COM port of the terminal. The COM port connector on the Monitor cable is a 9 pin D-type plug.

2. Run a terminal emulation program (e.g., ProComm or Windows HyperTerminal) using the following setup:

Baud rate	9600
Data bits	8
Stop bits	1
Parity	None
Flow Control	Xon/Xoff
Connector	Available Com Port

3. Press **Enter**. The *Select Access Level* menu appears. Select the access level according to your authorized access level. You will be requested to enter your password. After entering the correct password, press the Enter key. The *main menu* appears as shown in Figure 3-1

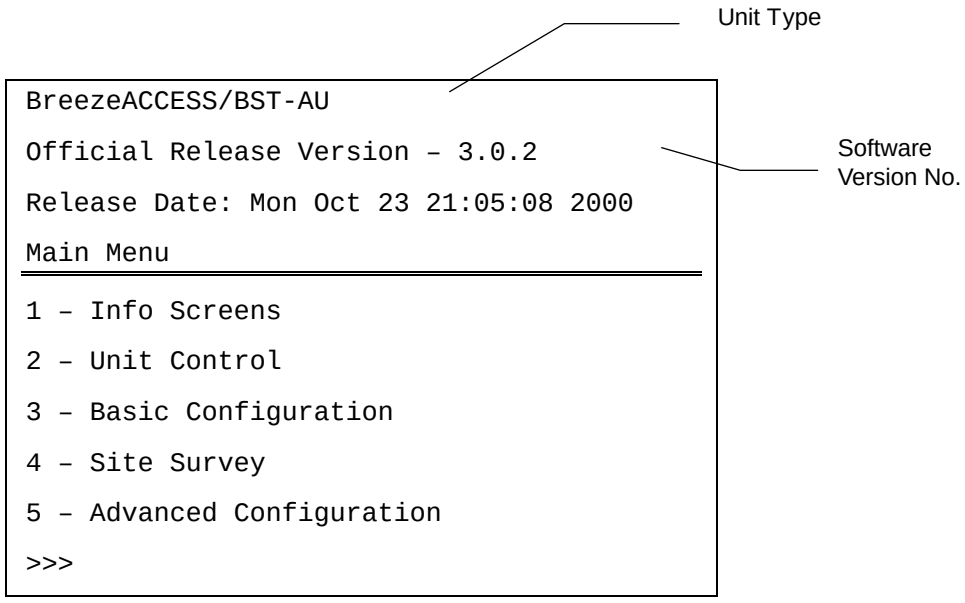


Figure 3-1. Main Menu

The appearance of the displayed *Main Menu* varies in accordance with the access level.

- For users with read only access rights, only the *Info Screens* option is displayed. Users with this access level cannot access the *Unit Control*, *Basic Configuration*, *Site Survey and Advanced Configuration* menus.
- For users with Installer access rights, the first four menu items (*Info Screens*, *Unit Control*, *Basic Configuration* and *Site Survey)* are displayed. Users with this access level cannot access the *Advanced Configuration* menu.
- For users with Administrator access rights, the full *Main Menu* will be displayed. These users can access all the menu items.

4. Operate the monitor program as follows:

    - Type an option number to open/activate the option. You may need to press the Enter key in some cases.

    - Press the Esc key to exit a menu or an option.

    - You can log-out and exit the monitor program from the *Main Menu* by simultaneously pressing the Ctrl and X keys. The session is terminated automatically after a specific time of inactivity, determined by the Log-out Timer. The default value for the Log-out Timer is 5 minutes.

    - Reset the unit after making configuration changes for the new values to take effect.

    - You can view the current parameters' configuration by selecting 1 in the Main Menu to Access the Info Screens menu, and then selecting 2 in the Info Screens menu to view the Basic Configuration parameters.

3.2 Configuring Basic Parameters

The Basic parameters that must be properly configured in all Access Units during the installation process include the ESSID, IP related parameters and frequency related parameters. Proper configuration of these parameters is essential in order to guarantee connectivity with the Subscriber Units, allowing remote configuration of other parameters via either the wired or the wireless network. Configure the following parameters according to the instructions supplied by the system administrator:

- Parameters common to all product lines:

    ⇒ ESSID

    ⇒ IP Parameters: DHCP Client and/or IP Address, Subnet Mask and Default Gateway Address

- Parameters specific to BreezeACCESS II Access Units:

  ⇒ Hopping Sequence

  ⇒ Hopping Set

  ⇒ Hopping Sync (if using more than one AU-BS)

- Parameters specific to BreezeACCESS XL Access Units:

  ⇒ Hopping Band

  ⇒ Frequency Offset

  ⇒ Flexible Hopping Definition

Note: *There are several ways to define the hopping frequencies using various subsets of the above parameters. The parameters to be used depend on the specific model as well as on specific system requirements, as determined by the system administrator.*

  ⇒ Hopping Shift (if using more than one AU-BS)

  ⇒ Hopping Sync (if using more than one AU-BS)

- Parameters specific to BreezeACCESS MMDS Access Units:

  ⇒ Flexible Hopping Definition

  ⇒ Hopping Shift (if using more than one AU-BS)

  ⇒ Hopping Sync (if using more than one AU-BS)

Note: *You must select Reset Unit in the Unit Control menu for the changes to take effect.*

See Appendix B for more details on the basic parameters.

3.2.1 Configuring Parameters Common to All Product Families

1. From the *main menu*, type **3** to access the *Basic Configuration* menu.
2. From the *Basic Configuration* menu, type **D** to access the *DHCP Client* menu. Type **1** to access the *DHCP Options* menu and select the required option. If the option was selected to other than *Disable*, type **2** to access the *Access to DHCP* menu and select the required option. If the *DHCP Only* option was selected, go to step 6. Otherwise (if either the *Disable* or *Automatic* options were selected), perform steps 3-5.
3. Type **1** to access the *IP Address* selection screen. Enter the required IP address.
4. Type **2** to access the *Subnet Mask* selection screen. Enter the required subnet mask.
5. Type **3** to access the *Default Gateway Address* selection screen. Enter the required default gateway address.
6. Type **4** to access the *ESSID* selection screen. Enter the required ESSID.
7. For BreezeACCESS II units, proceed to Section 3.2.2. For BreezeACCESS XL units, proceed to Section 3.2.3. For BreezeACCESS MMDS units, proceed to Section 3.2.4.

3.2.2 Configuring Parameters Specific to BreezeACCESS II

1. Type **7** to access the *Hopping Sequence* menu. Enter the required hopping sequence.
2. Type **8** to access the *Hopping Set* selection screen. Enter the required hopping set.
3. If more than one AU-BS is used, they should be synchronized for optimal spectrum utilization. Type **6** to access the Hopping Sync selection screen. Enter the required hopping sync status (Master or Slave).

Note: *Only one AU should be defined as a Master. The other units should be defined as Slaves. If only one AU is used, it should be defined as Idle.*

3.2.3 Configuring Parameters Specific to BreezeACCESS XL

1. Type **H** to access the Hopping Band selection screen. (if this screen is available).Select the required option.

2. If the selected Hopping Band option was one of the fixed bandwidths (10MHz, 12MHz,…) or Single Channel, type **8** to access the Frequency Offset selection screen. Enter the required value.

3. If the selected Hopping Band option was Flexible Hopping Definition, or if the *Hopping Band* option is not available in this model, type F to access the Flexible Hopping Definition menu. Type **2** to access the Channel Spacing selection screen (if available), and select the required value. Type **1** to access the Define Sub-bands option and enter the required dub-bands/frequencies. To verify that the required sub-bands/frequencies were entered properly, type S to view the selected Sub-bands/frequencies.

If more than on AU-BS is used, they should be synchronized for optimal spectrum utilization, as follows:

1. Type **6** to access the Hopping Sync selection screen. Enter the required selection (Master or Slave)

2. Type **7** to access the Hopping Shift selection screen. Enter the required value.

Note: *Only one AU should be defined as Master. The other units should be defined as Slaves. If only one AU is used, it should be defined as Idle.*

3.2.4 Configuring Parameters Specific to BreezeACCESS MMDS

1. Type **F** to access the *Flexible Hopping Definition* menu. Enter the required Channels/frequencies. See Appendix C for a list of the standard MMDS channels and frequencies.

2. If more than one AU-BS is used, they should be synchronized for optimal spectrum utilization. Type **6** to access the *Hopping Sync* selection screen and enter the required option (Master or Slave). Type **7** to access the Hopping Shift selection screen, and enter the required value.

Note: *Only one AU should be defined as Master. The other units should be defined as Slaves. If only one AU is used, it should be defined as Idle.*

3.3 Reset Unit

1. From the *main menu*, type **2** to access the *Unit Control* menu.

2. Type **1** to access the *Reset Unit* menu. Type **1** to reset the unit so that new configuration settings are applied.

Note: *Should you make any mistakes during configuration or encounter any problems associated with system configuration parameters, you may configure the unit back to the factory defaults, as follows:*

*Type **2** in the Unit Control menu to access the Set Factory Defaults menu. Type in **2** (Set Factory defaults-Full) to load the default values. Reset the unit for the factory defaults values to take effect.*

---

4. VERIFYING CORRECT OPERATION

4.1 Verifying Correct Operation of the AU-A/E-BS

After completing the installation as described above, the system starts operation. To verify correct operation, view the LED indicators located on the front panel of the BS-AU modules as shown in Table 2-2 on page 13.

Note: *If the Access Units are not synchronized, reset the Master BS-AU unit and then the Slave units to re-synchronize them.*

4.2 Verifying Correct Operation of the AU-A/E-NI

To verify proper operation, view the LED indicators located on the front and rear panels of the AU-NI unit as described in Table 4-1.

Table 4-1. AU-NI LEDs

Name	Description	Functionality
PWR	Power Supply 12VDC	On – 12VDC power is supplied to the AU-NI Off –Power is not supplied to the AU-NI
WLNK	Wireless link activity	Blinking –Receiving packet from the wireless link Off – No reception of packets from the wireless link
ETH connector embedded (green) LED	Ethernet activity	On – Receive/transmit on Ethernet port Off – No receive/transmit on Ethernet port
ETH connector embedded (orange) LED	Ethernet integrity	On – Unit is connected to Ethernet segment Off – Unit is not connected to Ethernet segment

4.3 Verifying Correct Operation of the Outdoor Unit

To verify proper operation, view the LED indicators located on the bottom panel of the Outdoor unit as shown in Figure 2-3 on page 9.

Table 4-2 lists the various LED states.

Table 4-2. AU-RA/RE LEDs

Name	Description	Functionality
ALARM	Alarm Indication	On – A problem with the power amplifier or in the locking process of any of the synthesizers Off –Normal operation
12V IN	12V DC power supply	On – 12VDC power is supplied to the unit Off – 12VDC is not available
ETH	Ethernet activity	Blinking – Data received from or transmitted to Ethernet LAN Off – No activity on the Ethernet LAN

***Note**: Verifying proper operation of the outdoor unit using the LEDs as described above is possible only after completion of the configuration process.*

5. SPECIFICATIONS

5.1 Radio

5.1.1 BreezeACCESS II

Frequency	2.4GHz ISM band	
Radio Access Method	FH-CDMA	
Operation Mode	Time Division Duplex	
Channel Bandwidth	1 MHz	
Output Power (at antenna port)	26 dBm (HP) or 15dBm (GP) or 7dBm (MP) or 2 dBm (LP) typical. Power Control range: 20 dB	
Sensitivity (dBm at antenna port, BER $1E10^{-6}$)	1Mbps	-87
	2Mbps	-81
	3Mbps	-73
Data Rate	3Mbps max	
Modulation	Multilevel GFSK	

5.1.2 BreezeACCESS XL

Frequency	Model	Uplink Band (GHz)	Uplink-Downlink Separation (MHz)
	BreezeACCESS 3.5a	3.410-3.452	100
	BreezeACCESS 3.5a1	3.400-3.450	100
	BreezeACCESS 3.5b	3.450-3.500	100
	BreezeACCESS 3.5e	3.425-3.450	50
	BreezeACCESS 2.6b	2.551-2.593	74
	BreezeACCESS 3.3	3.300-3.324	76
	BreezeACCESS 3.8	3.925-4.015	-320
Radio Access Method	FH-CDMA		
Operation Mode and Standard	Frequency Division Duplex, EN 301 253		
Bandwidth Allocation	Up to 50MHz (CEPT 14-03, CEPT 12-08)		
Channel Bandwidth	2 MHz		
Sub-channel Spacing	2 MHz, 1.75 MHz, 1 MHz (depending on model)		
Output Power (at antenna port)	27 dBm typical. Power Control range: 20 dB		
Sensitivity (dBm at antenna port, BER $1E10^{-6}$)	1Mbps	-93	
	2Mbps	-86	
	3Mbps	-78	
Data Rate	3Mbps max		
Modulation	Multilevel GFSK		

5.1.3 BreezeACCESS MMDS

Frequency	2.500GHz –2.686GHz	
Radio Access Method	FH-CDMA or TDMA	
Operation Mode	Time Division Duplex	
Channel Bandwidth	2 MHz	
Output Power (at antenna port)	29 dBm typical. Power Control range – 20 dB	
Sensitivity (dBm at antenna port, BER $1E10^{-6}$)	1Mbps	-93
	2Mbps	-86
	3Mbps	-78
Data Rate	3Mbps max	
Modulation	Multilevel GFSK	

5.2 Outdoor Unit to Indoor Unit Communication

IF Frequency	440 MHz
IF cable Impedance	50 ohm
Maximum IF cable Attenuation	15dB
Maximum IF cable DC Resistance	1.5 ohm

5.3 Configuration and Management

Local Management	Via MON port, Monitor program using terminal emulation
Remote Management	SNMP, Telnet, TFTP
Remote Management Access	From Wired LAN, Wireless Link
SNMP Agents	MIB II, Bridge MIB, Private MIBs
Security	Authentication and filtering
Software upgrade	TFTP download

5.4 Interfaces

Interface	Outdoor Unit	Indoor Equipment
RF (AU-E)	N-Type jack lightning protected	
IF	TNC jack, lightning protected	TNC jack, lightning protected
Ethernet		10BaseT (RJ-45) with two embedded LEDs
Monitor		3-pin low profile
Power	12 VDC via the IF cable	4-pin power connector (BS-PS) DC plug for the AU-PS power supply (AU-NI)

5.5 Electrical

Outdoor Unit	12 VDC via the IF cable
Indoor Modular Shelf Equipment	-48 VDC, 200 W for a fully equipped shelf AU (Indoor + Outdoor): 25W
Indoor AU-NI Unit	AU-NI: 12VDC/2.5A from AU-PS AU-PS: 100 - 240 VAC, 47-63 Hz

5.6 Mechanical

Outdoor Unit	AU-RE: 30cm x 12cm x 5cm, 2.2 kg AU-RA: Depending on specific model
Indoor Modular Shelf Equipment	BS-SH: 19",3U, depth 26cm, 6 kg. Fully loaded
Indoor AU-NI Unit	AU-NI: 13cm x 8.6cm x 3cm, 0.5 kg AU-PS: 10cm x 6.5cm x 3.5cm, 0.4 kg

5.7 Environmental

	Outdoor Unit	**Indoor Equipment**
Operating Temperature	-40^0C to 60^0C	0^0C to 45^0C
Operating Humidity	5%-95% non-condensing Weather protected	5%-95% non condensing

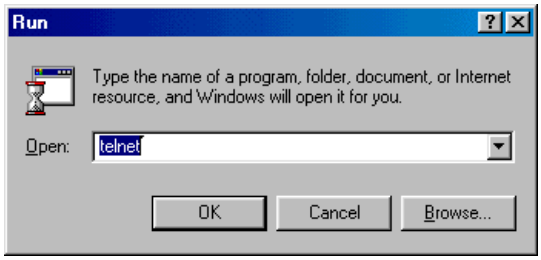
5.8 Standards Compliance, General

Type	**Unit**	**Standard**
EMC	BreezeACCESS II	FCC Part 15.247, EN 300 826 (LP models)
	BreezeACCESS MMDS	FCC Part 15.247
	BreezeACCESS XL	ETS 300 385
Safety	All Products	UL 1950, EN 60950
Environmental	All Products	ETS 300 019
Radio	BreezeACCESS II	FCC Part 15.247, ETS 300 328 (LP)
	BreezeACCESS MMDS	FCC Part 21
	BreezeACCESS XL	EN 300 253 (V 1.1.1), RSS 192

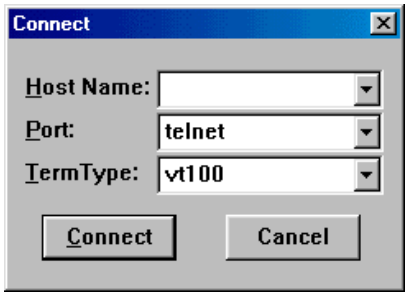
APPENDIX A. USING TELNET

Use the following procedure to connect to BreezeACCESS units via a Telnet session.

1. Connect the PC to the Ethernet port of the unit (or the hub to which the unit is connected) using a straight Ethernet cable. If you connect the PC directly to a unit that is normally connected to a hub, use a crossed Ethernet cable. You may also connect the PC to any Ethernet port on the network and communicate with the unit to be managed via the wired or wireless media.
2. Make sure that the PC's IP parameters (IP address and subnet mask) are configured to enable connectivity with the unit.
3. Start the Telnet application by selecting Start, Run and then typing Telnet in the Run dialog box.



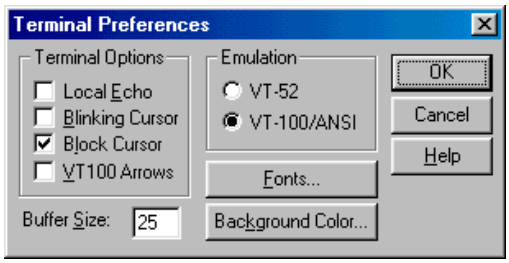
4. Select Connect-Remote System from the Telnet window menu. The following dialog box is displayed.



5. In the *Host Name* field, enter the IP address of the unit to be managed.

6. Set the *Port* field to Telnet (this is the default).

7. Set the *Terminal Type* to VT100 (this is the default). If the VT100 option in not available, do the following. Select Terminal-Preferences from the Telnet window menu and click the VT-100/ANSI radio button (as shown below).



8. Click  in the Connect dialog box. The Select Access Level of the Monitor program should be displayed.

9. To exit the Telnet session, choose *Disconnec*t from the *Connect* menu. (The session is terminated automatically, after a specific time of inactivity is determined by the Log-out Timer).

APPENDIX B. BASIC PARAMETERS

The following parameters are relevant to all BreezeACCESS products.

- **IP Address** – Displays the current IP address of the unit and allows entry of a new IP address (4 x 3 digit octets, separated by dots). The default IP Address is 010.000.000.001.
- **Subnet Mask** – Displays the current subnet mask of the unit and allows entry of a new subnet mask (4 x 3 digit octets, separated by dots). The default mask is 255.000.000.000.
- **Default Gateway Address** – Displays the current address of the default gateway of the unit and allows entry of a new default gateway address (4 x 3 digit octets, separated by dots). The default gateway address is 000.000.000.000.
- **ESS ID** – The ESSID (Extended Service Set ID) of the unit (up to 32 printable ASCII characters). The ESSID is a string used to identify a wireless network. It prevents the unintentional merging of two co-located wireless networks. An SU can only associate with an AU that has an identical ESSID. Use different ESSIDs to segment the wireless access network and add security to your network. The default value is *ESSID1*.

Note: *The ESSID string is case-sensitive.*

- **DHCP Client**
  - ⇒ **DHCP Options –** Displays the current status of the DHCP (Dynamic Host Configuration Protocol) support, and allows selecting a new operation mode. The available options are:
    - ∗ **Disable** – Use manual procedure for configuring the IP parameters.
    - ∗ **DHCP Only –** Search for a DHCP Server and obtain the IP parameters from it (IP Address, Subnet Mask and Default Gateway Address).

- **Automatic** – Search for a DHCP Server for configuration of the IP parameters. If a DHCP Server is not found within approximately 40 seconds, use the currently configured IP parameters.

The default is Disable.

⇒ **Access to DHCP -** To define the port through which the unit is allowed to communicate with a DHCP server. The options are the following:

- From Wlan Only
- From Ethernet Only
- From Both Ethernet & Wlan

  The default for an Access Unit is From Ethernet Only. The default for a Subscriber Unit is From Wlan Only.

Parameters Specific for BreezeACCESS II

The following parameters are set in BreezeACCESS II products.

- **Hopping Sequence** – Displays the Hopping Sequence of the unit.
  A hopping sequence is a pre-defined series of channels (frequencies) that are used in a specific, pseudo-random order as defined in the sequence. The unit "hops" from frequency to frequency according to the selected sequence. When more than one AU is co-located in the same area, it is recommended to assign different hopping sequences to each AU.

  Hopping Sequences are grouped in three hopping sets (see Hopping Set parameter below). When setting up multiple AUs in the same site, always choose hopping sequences from the same Hopping Set to reduce the possibility of collisions on the wireless media. This parameter is only set in the AU. All the SUs learn it from the AU during the association process.

  The permitted range depends on the applicable hopping standard (see Table 5-1 on the next page). The default value is 1.

- **Hopping Set** – Displays the selected hopping set. Each hopping standard has 3 hopping sets. The hopping set selected in this screen determines which hopping sequences are available in the Hopping Sequence screen. Always use the same hopping set per site (with different hopping sequences) to minimize the possibility of collisions on the wireless media. The default value is 1.

  This parameter is set only in the AU. All the associated SUs learn its value from the AU during the association process.

- **Hopping Sync** (BS-AU only) – Displays the current Hopping Sync status of the unit and allows defining a new status. When several AUs that use the same hopping set and different hopping sequences are co-located, their operation should be synchronized in terms of hopping sequence initialization and timing. One unit must be specified as a Master Unit and all other units must be specified as Slave units. Available options are:

  ⇒ **Idle** – No synchronization (stand-alone operation)

  ⇒ **Master** – The AU that serves as a Master unit providing synchronization signals to the Slave units

  ⇒ **Slave** – An AU that operates as a Slave

  The default is Idle.

Note: *Synchronization is not allowed by the radio regulations in certain countries. In units using such standards, the Hopping Sync option is not supported. See Table 5-1 for information on synchronization support in the standards of various countries.*

Table 5-1. Country Standards Supported by BreezeACCESS II

Country Standard	Frequency Range [MHz]	Number of Channels	Hopping Sequences per Hopping Set	Hopping Sync Support
Australia	2400 to 2463	60	20	No
Canada	2450 to 2483.5	30	10	No
Europe ETSI	2400 to 2483.5	79	26	Yes
France	2446 to 2483.5	35	11	Yes
Israel	2418 to 2457	35	11	Yes
Korea	2427 to 2454	23	4	Yes
Japan	2470 to 2497 or 2400 to 2483.5	23 or 79	4 or 26	Yes
Netherlands	2452 to 2470	15	5	Yes
Spain	2447 to 2473	27	9	Yes
US FCC	2400 to 2483.5	79	26	No
Mexico	2450 to 2483.5	30	10	Yes
Rest of America	2400 to 2483.5	79	26	Yes

Parameters Specific for BreezeACCESS MMDS

The following parameters are set in BreezeACCESS MMDS products.

- **Hopping Shift** –Displays the current value of the hopping shift parameter and allows entry of a new hopping shift value. This parameter is available only in Access Units – the Subscriber Units learn it during the association process.

  When several Access Units that use the same hopping frequencies are collocated, the Hopping Shift parameter is used to define a different hopping sequence for each AU. The target is to achieve a minimal level of cross interference between AUs through maintaining a minimal distance of 3 MHz between the frequencies used by adjacent AUs at any given moment. Thus, the collocated AUs should use different hopping shifts.

  The available range for hopping shifts is dependent on the number of frequencies selected and is equal to the number of hopping frequencies -1 (minus 1). The Hopping Shift parameter does not have any effect when using a single frequency. The default value of the Hopping Shift parameter is 0.

- **Flexible Hopping Definition** – Allows adding and removing frequencies to the list of hopping frequencies; displays 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 Flexible Hopping is based on using the standard MMDS 6MHz channels and frequencies. See Appendix C for a detailed list of the standard channels, as well as the frequency band and the hopping frequencies for each of these channels.

  The Flexible Hopping menu includes the following options, allowing adding/removing standard MMDS channels or adding/removing discrete standard hopping frequencies.

⇒ **Add Frequencies** – Allows adding discrete hopping frequencies or frequency ranges. Enter a list of frequencies and/or frequency ranges to be added, e.g. 2501.500,2407.500-2519.500, 2525.500.Use a comma to separate between entries (no spaces). The allowed entries are from 2500 to 2688 in steps of 0.5MHz. The frequencies (either the start and stop frequencies of a range or discrete frequencies) can be in the following formats:

MHz Resolution, e.g. 2520

kHz resolution, e.g. 2501.000,2505.500 (you must enter 3 digits after the dot).

The minimal channel spacing between frequencies is 3MHz. When entering a range, this will be the default channel spacing (e.g. for the range 2510-2516 the hopping frequencies will be 2510, 2513 and 2516 MHz).

It is recommended to use the standard MMDS frequencies. See Appendix C for a list of the standard MMDS frequencies.

⇒ **Remove Frequencies** - Allows removing frequencies from the existing list. Enter a list of frequencies and/or frequency ranges to be removed, using the same guidelines as in Add Frequencies above

⇒ **Add Channels** – Allows defining a new list of channels or adding channels to an existing list. Enter a list of channels to be added, e.g. A1,B3,D2. Use a comma to separate between entries (no spaces). See Appendix C for a list of the channels and the hopping frequencies for each of the channels.

⇒ **Remove Channels** – Allows removing channels from existing list. Enter a list of channels to be removed, using the same guidelines as in Add Channels above.

⇒ **Erase All** – Allows erasing all the entries from the list.

⇒ **Show Flexible Hopping Parameters** – Allows viewing 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.
- The current sequence of operational hopping frequencies

- **Hopping Sync** (BS-AU only) – Displays the current Hopping Sync status of the unit and allows defining a new status. When several AUs that use the same frequencies and different Hopping Shifts are co-located, their operation should be synchronized in terms of Hopping Shift initialization and timing. One unit must be specified as a Master Unit and all other units must be specified as Slave units. Available options are:
  - ⇒ Idle – No synchronization (stand-alone operation)
  - ⇒ Master – The AU that serves as a Master unit providing synchronization signals to the Slave units
  - ⇒ Slave – An AU that operates as a Slave

  The default is Idle.

Parameters Specific for BreezeACCESS XL

The following parameters are only relevant to BreezeACCESS XL products.

Note: *The Hopping band and Hopping Offset parameters are applicable for applications that use a 2MHz channel spacing. For other channel spacing values, or for hopping bands/frequency configurations that are not supported by the standard Hopping Band values, use Flexible Hopping Definition as described on page 41.*

- **Hopping Band** – Displays the current bandwidth and allows entry of a new bandwidth. The bandwidth is determined based on the specific conditions of the license to use a given frequency band, and on other considerations. The available selections are 10, 12, 14, 24, 28, 36, 42 and 50 MHz (some selections are not available in models with a total available bandwidth lower than 50 MHz). In addition, a Single Channel selection is also available.

- **Frequency Offset** – Displays the current offset of the Hopping Band from the beginning of the available frequency range, and allows entry of a new offset. The offset is measured in channels, where each channel is 2 MHz. For example, in products operating in the 3.5a band (3.410-3.452 GHz uplink), a Frequency Offset of 5 (10 MHz) will cause the hopping band to start at 3.420 GHz for the uplink and at 3.520 GHz for the downlink. The maximum value of the Frequency Offset is determined by the overall available bandwidth and the selected Hopping Band (Hopping Band should be selected before selecting the Frequency Offset).

  The default Frequency Offset is 0.

  When setting this parameter, consider the following relationship:
  Max. Frequency Offset (channels) = (Overall Bandwidth-Hopping Band)/2.
  For example, in products operating in the 3.5a band with an overall bandwidth of 42 MHz, if the selected Hopping Band is 12 MHz then the allowed range for Frequency Offset is from 0 to 15 channels.

  Notes: *In Single Channel mode, using the minimum (0) and the maximum values of the Frequency Offset parameter will result in transmitting at the edges of the band without using any guard band.*

  The Frequency Offset parameter does not have any effect on the Flexible Hopping mode.

- **Hopping Shift** – Displays the current Hopping Shift parameter and allows entry of a new value. Available only in AUs. All the associated SUs learn the value of the Hopping Shift parameter from the AU during the association process. The Hopping Shift parameter is used to provide different operational hopping sequences when several co-located Access Units use the same band (and hence the same basic hopping sequence). This minimizes the cross interference among these AUs and sallow for better spectrum utilization. Each unit represents a shift of one channel between hopping sequences. The allowed range depends on the defined band.

  When setting this parameter, consider the following relationship.

  Max. Hopping Shift (channels) = Number of hopping frequencies-1.
  The default Hopping Shift is 0. The minimum recommended shift between two adjacent AUs is 2.

- **Flexible Hopping Definition**– Allows defining the sub-bands to be used; displays the selected sub-bands, the hopping frequencies that will be used as a result of these selections and the current hopping sequence (based on the previous selections made before the last Reset). The new settings will go into effect only after the next Reset.

Note: *The algorithm that determines the operational hopping sequence (the actual hopping sequence based on rearranging the order of the selected hopping frequencies) when using Flexible Hopping Definition is different than the one used when fixed Hopping Bands are selected, even when the selected set of hopping frequencies is the same. Therefore, all units in the same base station (all AUs and associated SUs) must use the same hopping frequencies selection method (fixed Hopping Band or Flexible Hopping Definition).*

The Flexible Hopping mode is intended primarily for use in cases where the operating band cannot be defined by the Hopping Band and Frequency Offset parameters. This includes the following instances:

⇒ When the bandwidth of the operating band is different from the standard bands available in the Hopping Band menu.

⇒ When the operating band is comprised of two or more non-continuous bands.

⇒ When the required Channel Spacing is other than 2MHz.

The Flexible Hopping menu includes the following options:

⇒ **Channel Spacing** – Allows defining a new value for the Channel Spacing parameter, if the unit supports selection between several channel spacing values. Some models may support only a single value for the Channel Spacing parameter, in which case this parameter is not available. The Channel Spacing parameter defines the minimum distance between consecutive hopping frequencies. In addition, the Channel Spacing parameter also determines the guard band, which is the distance of the first hopping frequency in each sub-band from the beginning of the sub-band, as well as the minimum distance of the last hopping frequency in each sub-band from the end of the sub-band.

⇒

Channel Spacing	Guard Band
1MHz	1MHz
1.75MHz	0.75MHz
2MHz	1MHz

The available selections in products that support all the options are 1, 1.75 and 2MHz. In some products only a subset of these options may be available. The default is 2MHz.

Note: *Changing the value of the Channel Spacing will erase the current list of defined Sub-bands/frequencies*

⇒ **Define Sub-bands** – Allows 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. 3410-3418,3425,3430-3434. The frequencies (either the start and stop frequencies of a sub-band or discrete frequencies) can be in the following formats:

- MHz Resolution, e.g. 3420
- kHz resolution, e.g. 3430.250, 3445.500, 3412.000 (you must enter 3 digits after the dot)

When using a Channel Spacing of 1 or 2 MHz, the entries should be on a 1MHz grid (e.g. 3410, 3413).

When using Channel Spacing of 1.75MHz, the usable frequencies are on a grid of 0.250MHz, the first one being at a distance of 0.750MHz from the beginning of the radio band. Therefore, for products using the 3.5a band, the usable frequencies (uplink) are 3410.750, 3411.000, 3411.250……

This is also the list of valid entries for discrete frequencies. When defining sub-bands, the entries must be on a grid of 0.250MHz that starts at the beginning of the radio band. Therefore, for products using the 3.5a band, the list of valid entries for defining discrete frequencies as well as sub-bands' start and end frequencies, is 3410, 3410.250, 3410.500…….

Use a comma to separate between entries. Use a hyphen to define sub-bands (no spaces).

When a discrete frequency is defined, it is the actual hopping frequency to be used. When a sub-band is defined, the hopping frequencies are determined by the value of the Channel Spacing parameter (see Channel Spacing above).

***Note**: Channel Spacing parameter should be configured prior to defining a new set of sub-bands.*

The entries are frequencies in the lower radio band (uplink frequencies, except for 3.8GHz products where the downlink frequencies should be used).

The following are invalid combinations and will be rejected:

* Two overlapping sub-bands, e.g. 3410-3420,3418-3422.
* Combinations trying to force a distance between channels smaller than the Channel Spacing, e.g. 3420.500, 3421.000(with a Channel Spacing of 1.75MHz).

Examples:

* The selected sub-band is 3419-3431MHz. The Channel Spacing is 2MHz. The hopping frequencies are: 3420, 3422, 3424, 3426, 3428 and 3430MHz. (6 frequencies)
* The selected sub-band is 3419-3431MHz. The Channel Spacing is 1MHz. The hopping frequencies will be: 3420, 3421, 3422, 3423, 3424, 3425, 3426, 3427, 3428, 3429 and 3430MHz (11 frequencies)
* The selected sub-band is 3419-3430MHz. The Channel Spacing is 1.75MHz. The hopping frequencies will be 3419.750, 3421.500, 3423.250, 3425.000, 3426.750 and 3428.500 (6 frequencies). Note that the actual used band (including the o.750MHz guard bands) is only 3419-3429.250MHz.

***Note**:*	*The hopping frequencies are calculated for each sub-band separately. Therefore, the hopping frequencies calculated for two consecutive sub-bands may differ from the hopping frequency calculated for a single "combined" band (e.g. the result for the entries 3410-3420,3420-3420 may differ from the results for the entry 3410-3430).*

- **Hopping Sync** (Access Unit only) – Displays the current Hopping Sync status of the unit and allows defining a new status. When several AUs that use the same sub-bands and different Hopping Shifts are co-located, their operation should be synchronized in terms of hopping sequence initialization and timing. One unit must be specified as a Master Unit and all other units must be specified as Slave units. Available options are:
  - ⇒ **Idle** – no synchronization (stand-alone operation)
  - ⇒ **Master** – The AU that serves as a Master unit providing synchronization signals to the Slave units
  - ⇒ **Slave** – An AU that operates as a Slave

APPENDIX C. MMDS CHANNELS AND FREQUENCIES

Channel Name	Frequency Band (MHz)	Low Frequency (MHz)	High Frequency (MHz)
A1	2500 - 2506	2501.5	2504.5
B1	2506 - 2512	2507.5	2510.5
A2	2512 - 2518	2513.5	2516.5
B2	2518 - 2524	2519.5	2522.5
A3	2524 - 2530	2525.5	2528.5
B3	2530 - 2536	2531.5	2534.5
A4	2536 - 2542	2537.5	2540.5
B4	2542 - 2548	2543.5	2546.5
C1	2548 - 2554	2549.5	2552.5
D1	2554 - 2560	2555.5	2558.5
C2	2560 - 2566	2561.5	2564.5
D2	2566 - 2572	2567.5	2570.5
C3	2572 - 2578	2573.5	2576.5
D3	2578 - 2584	2579.5	2582.5
C4	2584 - 2590	2585.5	2588.5

Channel Name	Frequency Band (MHz)	Low Frequency (MHz)	High Frequency (MHz)
D4	2590 - 2596	2591.5	2594.5
E1	2596 - 2602	2597.5	2600.5
F1	2602 - 2608	2603.5	2606.5
E2	2608 - 2614	2609.5	2612.5
F2	2614 - 2620	2615.5	2618.5
E3	2620 - 2626	2621.5	2624.5
F3	2626 - 2632	2627.5	2630.5
E4	2632 - 2638	2633.5	2636.5
F4	2638 - 2644	2639.5	2642.5
G1	2644 - 2650	2645.5	2648.5
H1	2650 - 2656	2651.5	2654.5
G2	2656 - 2662	2657.5	2660.5
H2	2662 - 2668	2663.5	2666.5
G3	2668 - 2674	2669.5	2672.5
H3	2674 - 2680	2675.5	2678.5
G4	2680 - 2686	2681.5	2684.5

APPENDIX D. FCC-CERTIFIED ANTENNAS FOR BREEZEACCESS II

Table D-1 lists the FCC-certified antennas that can be ordered from BreezeCOM.

Table D-1. BreezeCOM FCC-Certified Antennas

BreezeCOM Antenna Kit	Antenna Gain; H & V Coverage
AN1079	17.5 dBi; 60° x 7°
TBD	18 dBi; 60 H or V
UNI-24	24 dBi; 6° x 10°
UNI-16	16 dBi; 28° x 28°
UNI-13	13 dBi; 46° x 28°
OMNI-8	8 dBi; 3z5f60° x 13°
OMNI-6	6 dBi; 360° x 20°
SU-RA integral Antenna	17 dBi; 20° x 20°

Note: *According to the FCC rules 15.247 (3), when operating the equipment in a multi-point system the RF output power must be adjusted according the gain of the antenna to limit the EIRP to a maximum of 36 dBm. Refer to Table D- 2 on the next page for details on required adjustment, when using the HP (High Power) models with 26 dBm power output at the antenna port.*

Table D- 2. Required Adjustments

Antenna Gain (dBi)	Allowed RF Power in dBm (at antenna port)	Required Attenuation from Maximum Power (dB)
24	12	14
18	18	8
17	19	7
16	20	6
13	23	3
<10	26	0

Use the Transmit Power Control parameter to change the gain of the Tx power circuits as required. A value of 15 represents the highest transmit power level. A lower value represents a lower transmit power level. The allowed range is from 0 to 15. The default value is 15 (maximum power). The effect of this parameter on the transmitted power is not linear. In addition, it is affected by the length (attenuation) of the IF cable.

Table D- 3 on the next page displays transmit power control parameters values required to decrease the transmitted power by approximately 5 dB, 10 dB and 15 dB as a function of cable length (refers to RG-58).

Table D- 3. Transmit Power Control Values to Achieve Attenuation from Maximum Power

RG 58 Cable Length (m)	Value for 5 dB Attenuation	Value for 10 dB Attenuation	Value for 15 dB Attenuation
0-6	5	2	0
12	6	3	0
18	7	5	2
24	8	6	3
30	8	7	4

Use the factors in Table D- 4 to calculate the applicable values of the Transmit Power Control parameter for other cable types, as a function of the cable length. For example, a 40 m long RG 213 cable is equivalent to a 40/2.2 = 18 m long RG 58 cable.

Table D- 4. Factors (Cable Loss/RG 58 Loss)

Cable	RG 213	LMR 400	LMR200	LMR 240
Factor *	2.2	4.2	1.6	2.2

* To calculate the factors for other cables types, use the following formula:
Factor = Loss per meter / 0.37