



BreezeACCESS MMDS

Subscriber Units

SU-A-D-MMDS Series

SU-E-D-MMDS Series

Installation Manual

July, 2000

Cat. No. 213100

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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 Subscriber Unit components and its cables.

Caution

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

To comply with FCC RF exposure requirements in section 1.1307, a minimum separation distance of 64 cm (26 inches) is required between the antenna and all persons.

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: 100-240VAC, 50-60Hz.

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 antenna and cable 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 MMDS SU-A and SU-E series of Subscriber Units.

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

The BreezeACCESS MMDS line of products uses Frequency Hopping Spread Spectrum radios that operate in Time Duplex Division (TDD) mode in the 2.500GHz – 2.686GHz frequency range.

SU-A and SU-E series Subscriber Units are comprised of an indoor unit (SU-NI) and an outdoor unit. In the SU-A product line, the outdoor unit (SU-RA) contains the radio module and an integral flat antenna. In the SU-E series, the outdoor unit (SU-RE) contains the radio module and an interface to an external antenna (not included). The indoor unit provides the interface to the user's equipment and is powered from the mains via its SU-PS power supply unit. The SU-NI 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.

The SU-A/E-D-MMDS series include the following products:

- SU-A/E-1D-MMDS: supports a single Ethernet device
- SU-A/E-8D-MMDS: supports up to 8 Ethernet workstations/PCs
- SU-A/E-BD-MMDS: supports a LAN (a bridge functionality)

Note: *The information contained in this manual is applicable to BreezeACCESS MMDS units with software release 2.5.*

2. BASIC INSTALLATION

2.1 Packing List

- SU-NI Indoor unit
- Outdoor unit
 - ⇒ SU-RA with integral antenna
 - or
 - ⇒ SU-RE with a connector to an external antenna (not included)
- SU-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 SU-NI unit

2.2 Other Items Required for Installation

- IF cable* (available from BreezeCOM in different lengths)
- Grounding cable with an appropriate termination
- Antenna* and RF cable* (SU-E only)
- Ethernet cable (straight)
- A portable PC with terminal emulation software
- Monitor cable* (supplied with the base station equipment)
- Installation tools and materials.

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

2.3 General Installation Scheme

Figure 2-1 depicts the general installation scheme for BreezeACCESS SU-A MMDS Subscriber Units; Figure 2-2 depicts the general installation scheme for BreezeACCESS SU-E MMDS Subscriber Units.

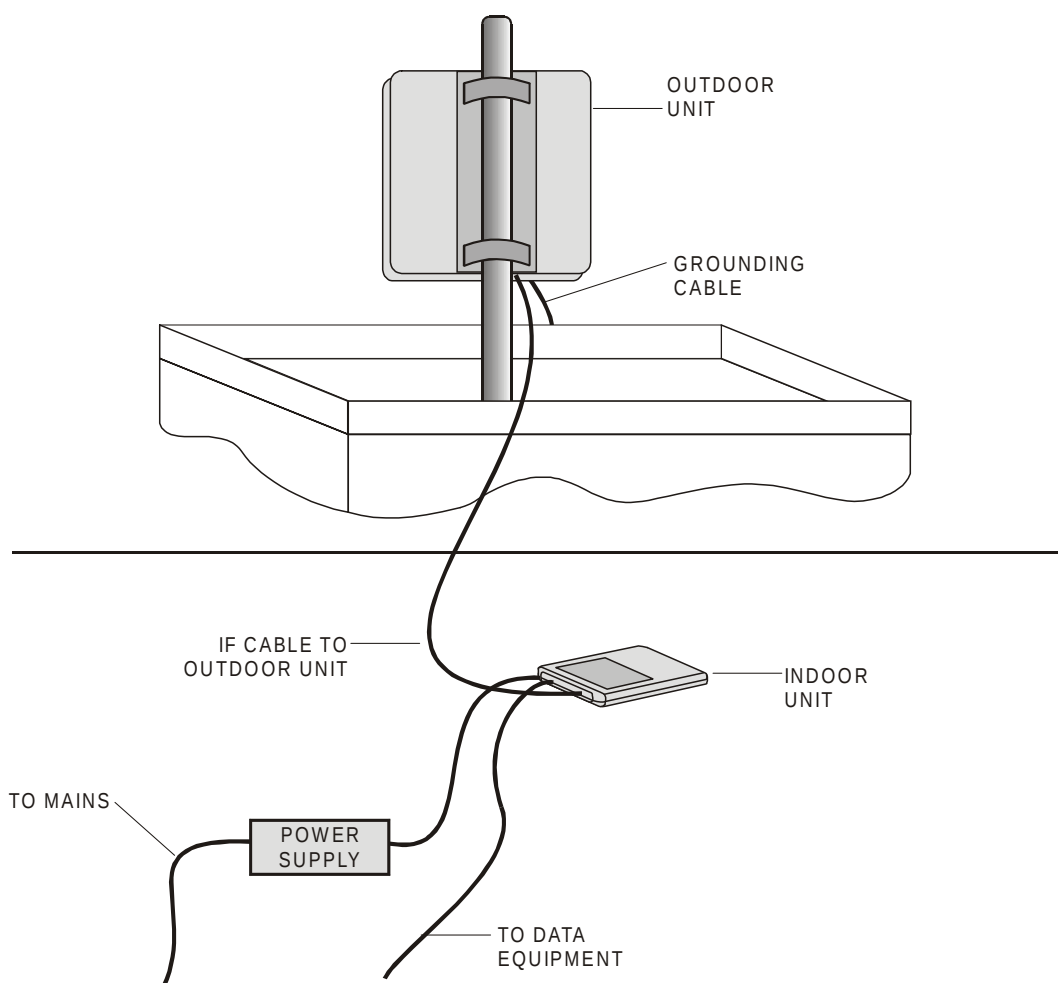


Figure 2-1. SU-A General Installation Scheme

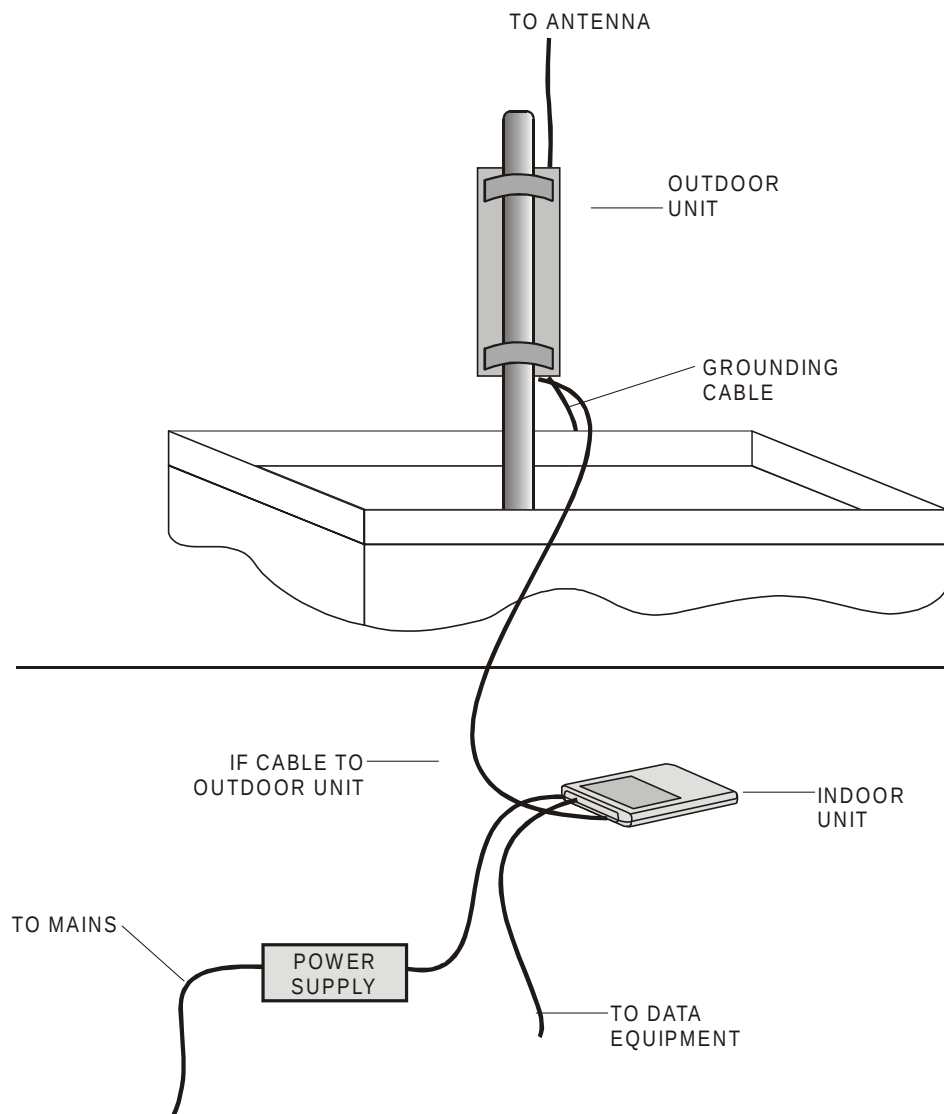


Figure 2-2. SU-E General Installation Scheme

2.4 Guidelines for Selection of Equipment Locations

Select appropriate locations for the Outdoor unit and for the Indoor unit using the following guidelines.

SU-RA

- The SU-RA Outdoor unit should be mounted on a pole and should be installed on a rooftop or a side-wall where a direct line of sight with the Base Station antenna can be established. The higher the unit, the better the achievable link quality.
- The antenna (integrated on the front side of the SU-RA Outdoor unit) should be directed towards the Base Station. The unit should be installed in a way that allows optimal alignment towards the Base Station. The location should also be selected to allow easy access to the unit for installation and testing.

SU-RE

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

SU-RA/RE

- The SU-RA/RE is connected to the SU-NI by means of an IF cable carrying signaling, control signals and power. The IF frequency is 440 MHz. The maximum allowed attenuation of the IF cable connecting the Outdoor unit to the Indoor unit is 15dB and the maximum allowed DC resistance (the sum of the DC resistance of the inner and outer conductors) is 1.5 ohm. This allows for 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 1 provides details regarding some popular 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 to use a higher quality double-shielded cable such as the LMR 240 or LMR 400 (manufactured by *Times Communications*).

Table 1: IF Cables

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

- The Indoor unit should be installed in as close as possible to the building's entry point of the IF cable. The location of the Indoor unit should also take into account the need to connect it to a power mains outlet and to the CPE.

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.

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 Unit

2.5.1 Pole 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, allowing use of the special 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 2-3 shows the locations of the holes, grooves and screw holes on the rear side of the Outdoor unit.

Figure 2-4 illustrates the method of installing an SU-RA Outdoor unit on a pole, using the brackets and open-ended screws.

Figure 2-5 illustrates the method of installing an SU-RE Outdoor unit on a pole, using the brackets and open-ended screws.

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

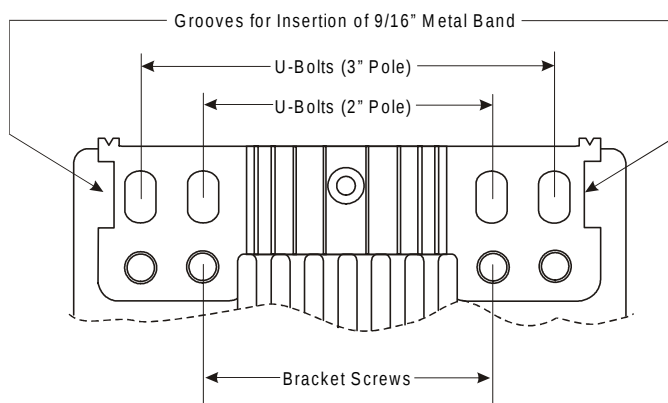


Figure 2-3. Holes/Grooves/Screw holes

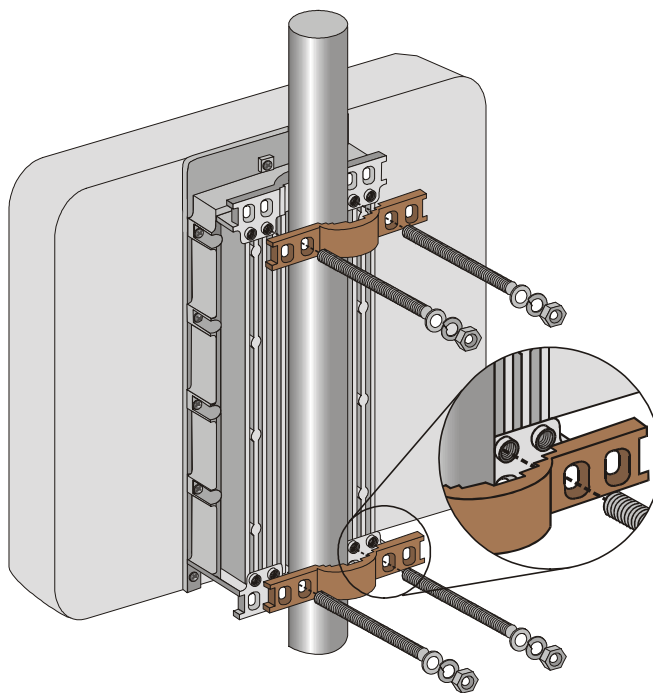


Figure 2-4. SU-RA 2" Pole Mounting Installation Using the Supplied Brackets (see note on next page)

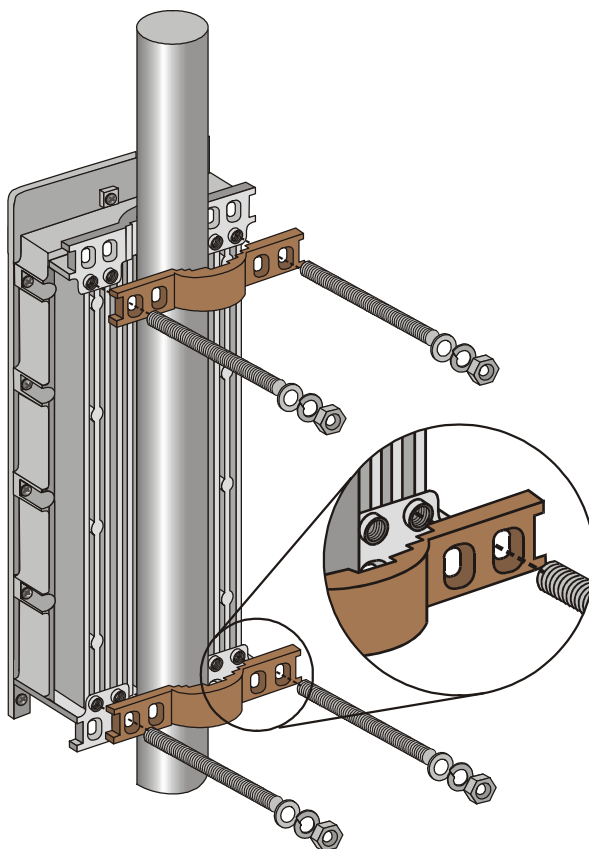
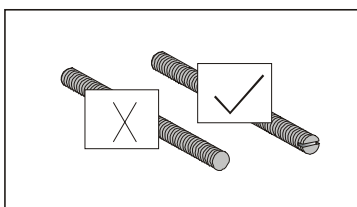


Figure 2-5. SU-RE 3" Inch Pole Mounting Installation Using the Supplied Brackets

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 (SU-RE)

Connect an RF cable between the ANT connector (located on the top panel of the SU-RE unit) and the antenna.

2.5.3 Connecting the Ground and IF Cables

The Ground terminal (marked $\oplus$) and the IF cable connector (marked IF) are located on the bottom panel of the SU-RA/RE Outdoor unit, shown in Figure 2-6.

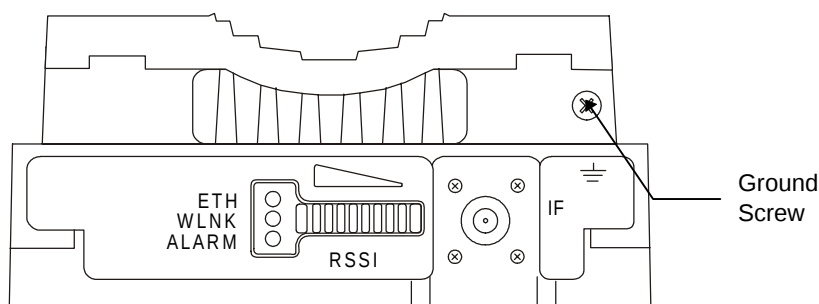


Figure 2-6. SU-RA/RE Outdoor Unit Bottom Panel

1. Connect one end of the ground 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 SU-NI unit prior to connecting/disconnecting the IF cable.

2.6 Installing the SU-NI Indoor Unit

1. Place the SU-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 SU-PS 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 other end of the mains power cord to the SU-PS. Connect the mains power plug to a mains power outlet.

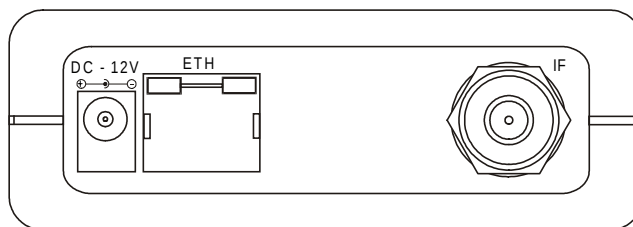


Figure 2-7. SU-NI Rear Panel

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

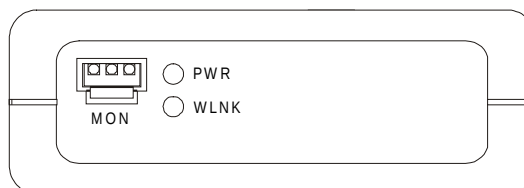


Figure 2-8. SU-NI Front Panel

6. Use a straight Ethernet 10baseT cable to connect a PC (SU-A/E -1D), or a hub (SU-A/E-8D or SU-A/E-BD) to the Ethernet port (marked ETH) located on the rear panel of the SU-NI unit.

3. CONFIGURING SYSTEM PARAMETERS

After completing the installation process, as described in the preceding section, proceed with the 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, after setting IP address. For further information, see Appendix A.*

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 SU-NI Indoor 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.

<i>Baud rate</i>	9600
<i>Data bits</i>	8
<i>Stop bits</i>	1
<i>Parity</i>	None
<i>Flow Control</i>	Xon/Xoff
<i>Connector</i>	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 enter. The main menu appears (refer to Figure 3-1).

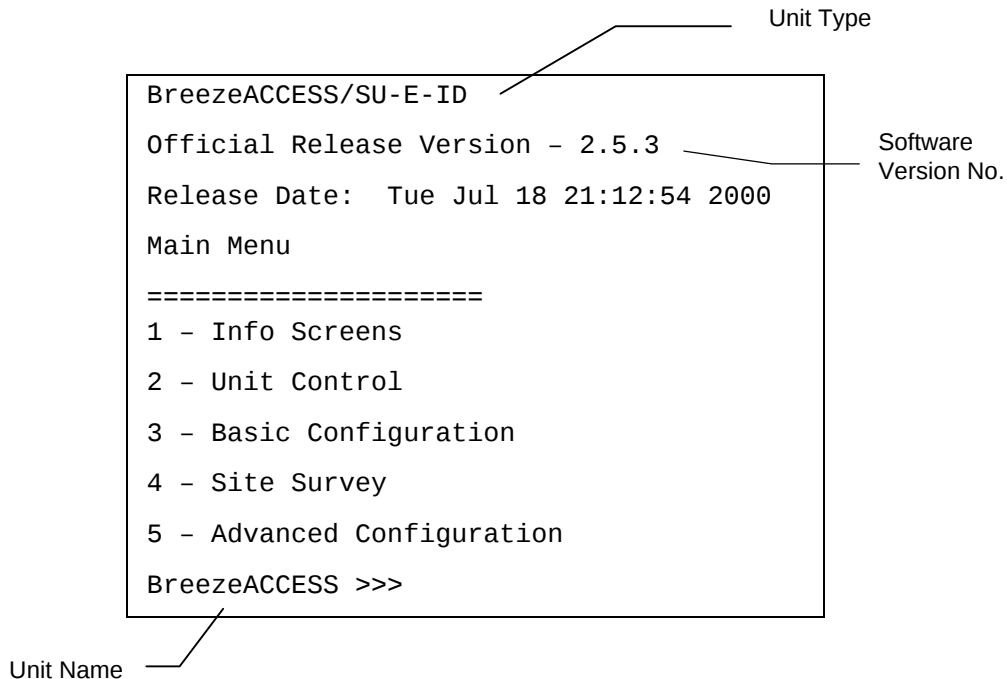


Figure 3-1. Main Menu

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 at any time by simultaneously pressing the **Ctrl** and **X** keys.
 - 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 Configuration Parameters

The following system parameters must be configured for each specific installation:

- *ESSID*
- *IP Address*
- *Subnet Mask*
- *Default Gateway Address*
- *Hopping Band*
- *Frequency Offset*
- *Flexible sub-bands Definition (if Flexible Hopping was selected in the Hopping Band menu)*

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

Subscriber Units should be configured after the applicable Access Unit is operational. When configuring Subscriber Units, the first parameter that should be configured is the *ESSID*. Otherwise the unit will not successfully synchronize with the Access Unit and will continuously reset itself, thus interfering with the configuration process.

1. From the *main menu*, type **3** to access the *Basic Configuration* menu.

```
BreezeACCESS/SU-E-ID
Official Release Version - 2.5.3
Release Date: Tue Jul 18 21:12:54 2000

Basic Configuration
=====
1 - IP Address
2 - Subnet Mask
3 - Default Gateway Address
4 - ESSID
5 - Maximum Data Rate
6 - Frequency Offset
H - Hopping Band
F - Flexible sub-bands Definition
X - Transmit Power Control
S - Show Basic Configuration
BreezeACCESS >>>
```

Figure 3-2. Basic Configuration Menu

2. From the *Basic Configuration* menu, type 1 to access the *IP Address* selection screen. Enter the required IP address.
3. Type 2 to access the *Subnet Mask* selection screen. Enter the required subnet mask.
4. Type 3 to access the *Default Gateway Address* selection screen. Enter the required default gateway address.
5. Type 4 to access the *ESSID* selection screen. Enter the required ESSID.
6. Type 6 to access the *Frequency Offset* selection screen. Enter the required offset.
7. Type H to access the *Hopping Band* selection screen. Enter the required hopping band.
8. If Flexible Hopping was selected in the Hopping Band selection menu, type **F** to access the Flexible sub-bands Definition menu. Use the Add/Delete sub-bands screens to define the required frequencies. See Appendix B for a list of the standard frequencies as a function of the allocated channel(s).

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. ALIGNING THE ANTENNA

Note: *Antenna alignment using the RSSI bar display is possible only after the Access Unit you wish to associate with is operational and the ESSID, Hopping Band and Frequency Offset parameters were properly configured. Otherwise the unit will not be able to synchronize and associate with the Access Unit. As the RSSI measurement is performed on received frames, its results are meaningless as long as the unit is not associated with an AU.*

1. Verify that the Power indication (the Yellow LED of the BSSI bar display) is ON.
2. Align the antenna (integrated into the front side of the SU-RA Outdoor unit, or separate if the unit is an SU-RE) to point towards the general direction of the base station.
3. The RSSI bar display is located on the bottom panel of the Outdoor unit (refer to Figure 2-6). The 8 green RSSI LEDs are used for reading the Received Signal Strength Indication. The higher the number of green LEDs that are ON, the higher the level of the received signal. Rotate the antenna left and/or right until you reach the point of maximum RSSI reading. Make sure that at all times, the front of the antenna faces the general direction of the base station.
4. For proper operation, at least one green LED should be ON. If you cannot reach a point where at least one green LED is ON, try to improve the reception quality by placing the antenna at a higher point or in a different location.

Note: *In some cases (e.g., when the Subscriber Unit is very close to the Base Station), the antenna might have to be installed at an appropriate angle, in order to ensure that it is directed towards the Base Station antenna).*

5. Tighten the bracket screws (or the U-bolts/metal band), firmly securing the unit to the pole.

5. VERIFYING CORRECT OPERATION OF THE OUTDOOR UNIT

To verify correct operation, view the LED indicators located on the bottom panel of the Outdoor unit as shown in Figure 2-6 on page 10.

The following table lists the various LED states.

Table 2: SU-RA/RE Outdoor Unit 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
WLNK	Wireless link activity	Blinking – Receiving packet from the wireless link Off – No reception of packets from the wireless link
ETH	Ethernet activity	Blinking – Data received from or transmitted to Ethernet LAN Off – No activity on the Ethernet LAN
RSSI	Bar display	Displays the Received Signal Strength Indication. The higher the number of green LEDs that are ON, the higher the level of the received signal.
	Yellow LED	On - Power On Off – Power is not received from the Indoor unit
	8 Green LEDs	RSSI in 4 dB resolution starting at –91dBm
	Red LED	Received signal strength is –40dBm or higher

Note: Verifying proper operation of the Outdoor unit using the LEDs as described above is possible only after completion of the configuration and alignment processes.

6. RSSI MEASUREMENT AND MAXIMUM DATA RATE CONFIGURATION

6.1 Performing the RSSI Measurement

The Average RSSI Continuous Display test allows a continuously updated display of the average Received Signal Strength Indication. As the test measures only the desired signal of properly received frames, it is a good indication to the quality of the received signal.

Note: *As the RSSI bar indicator is not accurate, it is recommended always to perform the Average RSSI Continuous Display test after the antenna was optimally aligned.*

1. Start the Monitor program as described in Section 3.1.
2. From the *Main Menu* Type 4 to access the *Site Survey* menu.
3. Type 4 to activate the Average RSSI Continuous Display selection screen.
4. On the screen you will get a continuously updated display of RSSI measurements. To stop the test, press the Esc key.

6.2 Configuring The Maximum Data Rate

5. Use the following table to determine the recommended Maximum Data Rate.

Table 3: RSSI vs. Maximum Data Rate

RSSI	Maximum Data Rate
Higher than 97	3 Mbps
From 86 to 97	2Mbps
Lower than 86*	1 Mbps

* If the RSSI is lower than 80 units the link quality is too low and should be improved through installing the antenna in a different and/or a higher location.

2. If the measured average RSSI is less than 97 units, the default Maximum Data Rate of 3 Mbps is too high and should be decreased.
3. From the *Basic Configuration* menu select 5 to access the *Maximum Data Rate* selection menu.
4. Configure the Maximum Data Rate according to Table 3 above.
5. Reset the unit for the new configuration to become effective.

7. VERIFYING CORRECT OPERATION

7.1 General

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 SU-NI Indoor unit as shown in Figure 2-8 on page 11.

Table 4 lists the various LED states.

Table 4: SU-NI LEDs

Name	Description	Functionality
PWR	Power supply	On – After successful power up Off – Power off
WLNK	Wireless link activity	Blinking –Receiving packet from the wireless link Off – No reception of packets from the wireless link
ETH connector embedded LED	Ethernet activity	On- Receive/Transmit on Ethernet port Off- No Receive/Transmit on Ethernet port
ETH connector embedded LED	ETH Link Integrity	On- Unit is connected to Ethernet segment Off- Unit is not connected to Ethernet segment

7.2 Verifying Data Connectivity

From the user's PC or from a portable PC connected to the unit, Ping the unit or try to connect it to the Internet.

8. SPECIFICATIONS

8.1 Radio

Frequency	2.500GHz – 2.686GHz	
Radio Access Method	FH-CDMA or TDMA	
Operation Mode	Time Duplex Division	
Channel Bandwidth	2 MHz	
Antenna Gain (SU-RA)	17dBi, 20°	
Output Power (at antenna port)	29 dBm typical. Power Control range: 20 dB	
Sensitivity (dBm at antenna port, BER 1E10 ⁻⁶)	1Mbps 2Mbps 3Mbps	-93 -86 -77
Data Rate	3Mbps max	
Modulation	Multilevel GFSK	

8.2 Data Communication

Standard Compliance	IEEE 802.3 CSMA/CD
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8.3 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

8.4 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
Accounting	RADIUS compatible client
Security	Authentication and filtering
Software upgrade	TFTP download

8.5 Interfaces

Interface	Outdoor unit	SU-NI indoor unit
IF	TNC jack, lightning protected	TNC jack, lightning protected
RF (SU-E)	N-Type jack	
Ethernet		10Base-T (RJ-45) with 2 embedded LEDs
Monitor		3-pin low profile
Power	12 VDC via the IF cable	DC Plug for the SU-PS power supply

8.6 Electrical, Mechanical and Environmental

	Outdoor Unit	SU-NI Indoor Unit
Power	12 VDC from SU-NI via the IF cable	SU-NI: 12VDC/MMDSA from SU-PS SU-PS: 100 – 240 VAC, 47-63 Hz
Mechanical	SU-RA: 30cm x 30cm x 7.2 cm, 3 kg SU-RE: 30cm x 12cm x 5 cm, 2.2 kg.	SU-NI: 13cm x 8.6cm x 3cm, 0.5 kg. SU-PS: 10cm x 6.5cm x 3.5cm, 0.4 kg.
Operating Temperature	-40 ⁰ C to 60 ⁰ C	0 ⁰ C to 40 ⁰ C
Operating Humidity	5%-95% non condensing, Weather protected	5%-95% non condensing

8.7 Standards Compliance, General

EMC	FCC part 15, FCC part 21
Safety	UL 1950
Environmental	GR - 63 - CORE (Bellcore)

APPENDIX A. USING TELNET

Use the following procedure to connect to BreezeACCESS MMDS 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 IP parameters of the PC are configured to enable connectivity with the unit.
3. Run a Telnet application and use the IP address of the unit to be managed as the Host Name.
4. Set Port to *Telnet* (this is the default).
5. Set Terminal Type to *VT100* (this is the default).
6. Enter the Service Provider password.
7. When the password is recognized, the following message is displayed:

You have entered.

8. Press **Enter**, the Breeze ACCESS Monitor is displayed on the screen.

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

APPENDIX B. MMDS CHANNELS AND FREQUENCIES

Channel Name	Frequency Band (MHz)	Low Frequency (MHz)		High Frequency (MHz)	
		Actual	Value in Add/Delete Sub-bands menu	Actual	Value in Add/Delete Sub-bands menu
A1	2500 - 2506	2501.5	2501	2504.5	2504
B1	2506 - 2512	2507.5	2507	2510.5	2510
A2	2512 - 2518	2513.5	2513	2516.5	2516
B2	2518 - 2524	2519.5	2519	2522.5	2522
A3	2524 - 2530	2525.5	2525	2528.5	2528
B3	2530 - 2536	2531.5	2531	2534.5	2534
A4	2536 - 2542	2537.5	2537	2540.5	2540
B4	2542 - 2548	2543.5	2543	2546.5	2546
C1	2548 - 2554	2549.5	2549	2552.5	2552
D1	2554 - 2560	2555.5	2555	2558.5	2558
C2	2560 - 2566	2561.5	2561	2564.5	2564
D2	2566 - 2572	2567.5	2567	2570.5	2570
C3	2572 - 2578	2573.5	2573	2576.5	2576
D3	2578 - 2584	2579.5	2579	2582.5	2582

Channel Name	Frequency Band (MHz)	Low Frequency (MHz)		High Frequency (MHz)	
		Actual	Value in Add/Delete Sub-bands menu	Actual	Value in Add/Delete Sub-bands menu
C4	2584 - 2590	2585.5	2585	2588.5	2588
D4	2590 - 2596	2591.5	2591	2594.5	2594
E1	2596 - 2602	2597.5	2597	2600.5	2600
F1	2602 - 2608	2603.5	2603	2606.5	2606
E2	2608 - 2614	2609.5	2609	2612.5	2612
F2	2614 - 2620	2615.5	2615	2618.5	2618
E3	2620 - 2626	2621.5	2621	2624.5	2624
F3	2626 - 2632	2627.5	2627	2630.5	2630
E4	2632 - 2638	2633.5	2633	2636.5	2636
F4	2638 - 2644	2639.5	2639	2642.5	2642
G1	2644 - 2650	2645.5	2645	2648.5	2648
H1	2650 - 2656	2651.5	2651	2654.5	2654
G2	2656 - 2662	2657.5	2657	2660.5	2660
H2	2662 - 2668	2663.5	2663	2666.5	2666
G3	2668 - 2674	2669.5	2669	2672.5	2672
H3	2674 - 2680	2675.5	2675	2678.5	2678
G4	2680 - 2686	2681.5	2681	2684.5	2684