

BreezeACCESS II

Indoor Subscriber Units

SU-R Series

Installation Manual

February 2002

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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.

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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 28cm (11 inches) is required between the antenna and all persons.

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.

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.

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1. INTRODUCTION

This manual describes installation guidelines for BreezeACCESS II SU-R Subscriber Units.

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 BreezeACCESS II line of products uses Frequency Hopping Spread Spectrum radios that operate in Time Division Duplex (TDD) mode in the license free 2.4 – 2.5 GHz frequency range.

The SU-R line of Subscriber Units comprises compact units that are designed for indoor installation. SU-R units are available in several models differing from each other in the type of supported data networks and availability of voice services as follows:

- SU-R-8D units support up to 8 Ethernet workstations / PCs (8 MAC addresses).
- SU-R-BD units provide a full bridge functionality supporting up to 512 MAC addresses.
- SU-R-8D1V support up to 8 Ethernet workstations / PCs and have an interface to a standard telephone set.

SU-R units are available either with two 3 dBi omni antennas (A models) or with an indoor wall/window mountable 7 dBi UNI-7, UNI-8.5 dBi antenna w/integral cable (-A7 models), or UNI-16 dBi antenna w/integral cable (mfr: Andrew).

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

2. BASIC INSTALLATION

2.1 Packing List

The SU-R units are shipped with the following units and accessories. The exact packing list varies depending on system configuration and ordered equipment.

- SU-R unit:
 - ⇒ SU-R-A with 2 omni antennas
 - or
 - ⇒ SU-R-A7 unit
- UNI-7 or UNI-8.5 antenna with 3 m cable and a mounting kit (with the SU-R-A7 units), or UNI-16 antenna with 7.5 meter cable and mounting kit.
- A power supply
- Wall mounting kit for the SU-R unit (two anchors and screws)
- An Ethernet cable (straight)

2.2 Other Required Items

The following items must be available for the installation

- An Ethernet cable (crossed) if the unit should be connected to a hub (the straight Ethernet cable supplied with the unit is intended for connecting it directly to a PC or to a hub's uplink port)
- A PC with terminal emulation program
- A monitor cable* for configuration and testing via the Monitor interface
- Installation tools and materials

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

2.3 Installation Overview

Standard installation involves the following steps:

1. Verify that all components of the packing list, described in Section 2.1, are intact and verify availability of the required items listed in Section 2.2.
2. Install the unit and antenna in optimal locations as described in Sections 2.4 and 2.5 and in the instructions supplied with the antenna.

Note: *To avoid drilling unnecessary holes, it is recommended to verify good connectivity with the base station prior to drilling holes in the locations intended for the SU-R unit and/or the detached antenna.*

3. Connect the antenna to the unit as described in Section 2.6.
4. Connect the power supply and the user's equipment to the unit as described in Section 2.7.
5. Configure the basic system parameters as described in Section 3.
6. Align the antenna for optimal connectivity (A7 models) and configure the Maximum Data Rate if applicable, as described in Chapters 4 and 5.
7. Check the functionality of the unit as described in Chapter 6.

2.4 Installation Guidelines

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

2.4.1 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 (-A7 models). The RF cable connecting the unit to the antenna should be as short as possible to guarantee minimum power loss.

- Keep the units well away from sources of heat, such as radiators, air-conditioners, etc.

2.4.2 Location of the Antenna

- Any physical object in the path between two units can cause signal attenuation. Common obstructions are buildings and trees. If a unit's antenna is installed indoors, the walls and/or windows between the two sites are physical obstructions. If the antenna is positioned outdoors, any buildings or other physical structure such as trees, mountains or other natural geographic features higher than the antenna and situated in the path between the two sites can constitute obstructions.
- Install indoor antennas as close as possible to a window (or wall if a window is not accessible) facing the required direction. The UNI-7 or UNI-8.5 antenna may also be attached to a fixed window. Avoid metal obstacles such as metal window frames or metal film anti-glare windows in the transmission path. Install outdoor antennas high enough to avoid any obstacles, which may block the signal.
- Position the antennas clear of metal furniture and away from moving metal objects such as metal fans or doors.

2.4.3 Antenna Diversity

In applications where no multipath propagation is expected, a single antenna is sufficient to ensure good performance levels. However, in cases where multipath propagation exists, BreezeCOM recommends that two antennas be used. This takes advantage of space diversity capabilities. By using two antennas per unit, the system can select the best antenna on a per-packet basis (every several milliseconds).

Multipath propagation is to be expected when there are potential reflectors between the Access Unit and Subscriber Units. These reflectors may be buildings or moving objects such as airplanes and motor vehicles. If this is the case, the radio signal does not travel in a straight line, but is reflected or deflected off of the object, creating multiple propagation paths.

When installing a single antenna, modify the transmit diversity option to either antenna 1 or antenna 2, according to the antenna being used.

2.4.4 Antenna Polarization

Antenna polarization must be the same at either end of the link. In most applications, the preferred orientation is vertical polarization. Above-ground propagation of the signal is better when it is polarized vertically. For integral omni antennas (A model), make sure that the antennas are

extended upward vertically in relation to the floor to achieve vertical polarization. **For the detached UNI-7, UNI-8.5 antenna (A7 model) or UNI-16 antenna**, follow the instructions included with the antenna.

2.5 Wall Mounting the Unit

Note: *To avoid drilling unnecessary holes, it is recommended to verify connectivity with the base station prior to drilling holes in the locations intended for the SU-R unit and/or the indoor antenna.*

The template on the packaging box can be used to mark the locations of the screws on the wall (drill right through the markings on the box).

After insertion of the anchors and screws, hang-on the unit on the two screws with the bottom panel (the side with the connectors) facing downward.

In SU-R-A models with integral antennas, extend the antennas upward vertically in relation to the floor to achieve vertical polarization.

2.6 Connecting the Antenna (A7 and UNI-16 models)

Connect the special adapter to antenna port 1 (marked 1) on the side of the unit. Push the adapter carefully into the hole using the alignment markings on the adapter and the unit, and turn it 180 degrees to firmly lock it.

2.7 Connecting the Unit to the Power Supply and to the CPE

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

1. Plug the output jack of the power transformer into the DC input jack (marked DC IN) located on the bottom panel of the unit.
2. Connect the supplied universal power transformer to a power outlet - 110/ 220VAC.
3. Use a straight Ethernet 10BaseT cable to connect the Ethernet port (marked ETH) to a PC or to a hub's uplink port. Use a crossed cable to connect to a hub.

4. For units with voice support, use the standard cable connected to the telephone set to connect the telephone to the telephone port (marked TEL).

3. CONFIGURING SYSTEM PARAMETERS

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

This manual 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, refer to Appendix B.*

3.1 Getting Started with the Local Terminal

1. Connect one end of the Monitor cable to the Monitor jack (marked MON) on the bottom panel of the 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).

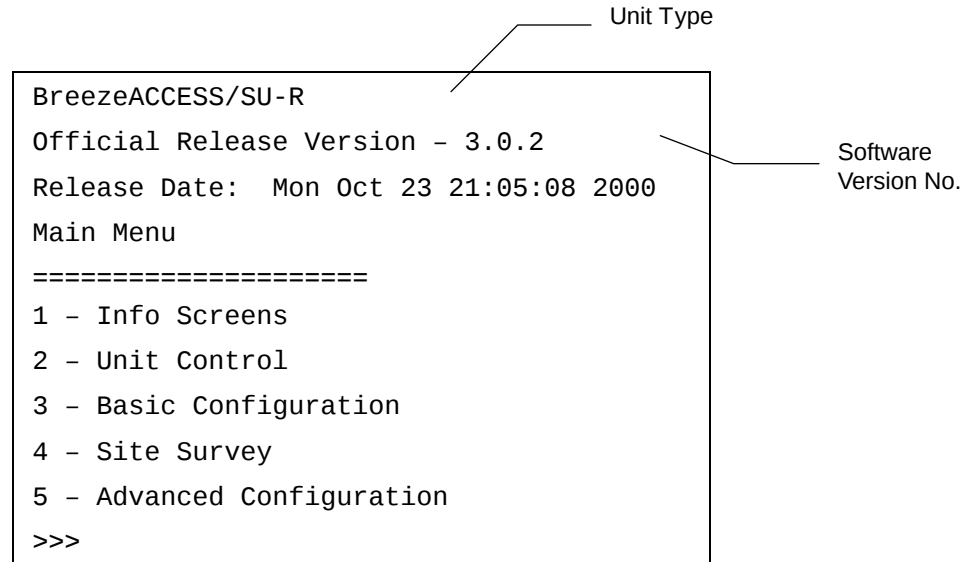


Figure 3-1. Main Menu

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.

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 following system parameters must be configured for each specific installation:

- ESSID
- IP Parameters: DHCP Client and/or IP Address, Subnet Mask and Default Gateway Address
- Transmit Antenna

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.

See Appendix C for more details on the basic parameters.

1. From the *main menu*, type **3** to access the *Basic Configuration* menu.
2. From the *Basic Configuration* menu, type **4** to access the *ESSID* selection screen. Enter the required ESSID.
3. Type **D** to access the *DHCP Client* menu. Type **1** to access the *DHCP Options* menu and select the required option. If the selected option was 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 7. Otherwise (if either the *Disable* or *Automatic* options were selected), perform steps 4-6.
4. Type **1** to access the *IP Address* selection screen. Enter the required IP address.
5. Type **2** to access the *Subnet Mask* selection screen. Enter the required subnet mask.
6. Type **3** to access the *Default Gateway Address* selection screen. Enter the required default gateway address.
7. Type **G** to access the *Transmit Antenna* selection screen. Enter the required selection. For SU-R-A7 units with a single antenna connected to antenna port 1, select 1 - use antenna # 1. For SU-R-A units with two integral antennas, select 0 – use two antennas.

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 (A7 AND UNI-16)

When using high gain antennas with a narrow beam width, an alignment procedure is necessary in order to optimize the quality of the link with the Access Unit.

For a Subscriber Unit with a directional antenna, you can either use the LED indicators on the front panel of the unit or view the Received Signal Strength Indication (RSSI) using the monitor program. In most installations, alignment using the LEDs is sufficient. The RSSI reading can be used when finer alignment is required (see 3.2).

Note: *Antenna alignment of the Subscriber Unit is possible only after the Access Unit you wish to associate with is operational and the basic parameters were properly configured as described in Section 3.2.*

4.1 Aligning the Antenna Using the LEDs

1. The H (high), M (medium) and L (low) LEDs on the front panel of the unit indicate the quality of the link. The higher the number of illuminated LEDs the better is the quality of the link.
2. Rotate the antenna left and/or right until you reach the point of maximal signal quality reading on the H, M and L LEDs. Make sure that at all times, the front of the antenna faces the general direction of the Access Unit. In some cases, e.g. when the unit is very close to the base station you may need to tilt the antenna upward or downward.
3. For proper operation, at least one (L) LED should be illuminated. If this is not possible, improve the link quality by placing the antenna at a higher point or in a different location.
4. After the antenna is optimally aligned, secure the antenna to guarantee that it will remain in the selected position.

4.2 Aligning the Antenna Using the Site Survey Menu

1. Start the Monitor program as described in Section 3.1.

2. From the *main menu*, type 4 to access the *Site Survey* menu. Type 4 to start the *Continuous Link Quality Display*. Each line in the display includes the number of frames that were received since the last measurement (total Rx) and the average RSSI for these frames.
3. Rotate the antenna left and/or right (or tilt it upward/downward) 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, the RSSI reading should be at least 38 units. When the maximum reading is less than 43 units, try to improve it by placing the antenna at a higher point or in a different location. For best performance it is recommended that the RSSI be higher than 65.
5. Press the **Esc** key to stop the test.
6. Secure the antenna to guarantee that it will remain in the selected position.

5. MAXIMUM DATA RATE CONFIGURATION

1. If the average RSSI reading using the Continuous Link Quality Display (see Section 4.1) is lower than 65, the unit should be configured in accordance with the following table:

RSSI	Recommended Maximum Data Rate
RSSI > 65	3Mbps
53 < RSSI < 65	2Mbps
RSSI < 53	1Mbps

2. From the *main menu*, type **3** to access the *Basic Configuration* menu. Type **5** to access the *Maximum Data Rate* menu.
 - Type **3** (3Mbps) if the RSSI reading is higher than 65 units.
 - Type **2** (2Mbps) if the RSSI reading is between 53 to 65 units.
 - Type **1** (1Mbps) if the RSSI reading is lower than 53 units.
3. Reset the unit for the new configuration to become effective

See Appendix C for more details on the Maximum Data Rate parameter.

6. VERIFYING PROPER OPERATION

6.1 Checking the LEDs

After completing the installation, the system starts operation. To verify proper operation, view the LEDs located on the front panel of the unit. Table 6-1 lists the various LED states.

Table 6-1. SU LEDs

Name	Description	Functionality	
POWER	Power supply	On – After successful power up Off – Power off	
H, M, L	Quality of received RF signal	H ○ M ○ L ○	Very low quality reception or not synchronized with Access Unit.
		H ○ M ○ L ●	Low quality reception (usually enabling 1Mbps traffic).
		H ○ M ● L ●	Medium quality reception (usually enabling 2 Mbps traffic).
		H ● M ● L ●	High quality reception (usually enabling 3 Mbps traffic).

6.2 Verifying the Ethernet Connection

Once you have connected the unit to an Ethernet outlet, 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 transmit traffic on the Ethernet port.

6.3 Verifying Data Connectivity

From the user's PC or from a portable PC connected to the unit, ping the Access Terminal, or try to connect to the Internet.

6.4 Verifying Telephone Connectivity (units with voice support)

To verify correct operation of the telephone, a test telephone with the default telephony parameters and a known IP address should be connected to the system (the location of the test telephone is determined by the system administrator).

Perform the following steps to verify telephone connectivity:

1. Use IP dialing to call the test telephone: dial * followed by the 12-digit IP address of the test telephone. Verify connectivity. During the conversation, verify that other party has your IP address.
2. After terminating the call, the other party should use the test telephone to call your IP address and verify that the telephone, including the ringing circuits, functions properly.

7. SPECIFICATIONS

7.1 Radio

Frequency	2.4 GHz ISM band	
Radio Access Method	FH-CDMA	
Operation Mode	Time Division Duplex	
Channel Bandwidth	1 MHz	
Output Power (at antenna port)	27 dBm typical. (can be reduced to 17 dBm-SW controlled)	
Antenna Gain	A model: 2 X 3 dBi Omni Antennas (OCX connector) A7 (UNI-7): 7 dBi (including 3 m cable w/ OCX connector) UNI-16 dBi antenna (including 7.5m cable w/OCX connector)	
Sensitivity (dBm at antenna port, BER $1E10^{-6}$)	1Mbps	-91
	2Mbps	-83
	3Mbps	-75
Data Rate	3Mbps max	
Modulation	Multilevel GFSK	

7.2 Data Communication

Standard Compliance	IEEE 802.3 CSMA/CD
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7.3 Voice Communication (units with voice support)

Protocol	H.323 Voice over IP compliant
Compression	G.723 6.3 Kbps compression, G.729 8 Kbps compression, G.711 64 Kbps transparent
Echo Cancellation	G.168, G.131

7.4 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

7.5 Interfaces

RF (Antenna)	2 x OCX jacks
Ethernet	10Base-T (RJ-45)
Telephone (units with voice)	RJ-11 standard Plain Old Telephone System (POTS) interface
Monitor	3-pin low profile
Power	DC socket for a power transformer

7.6 Electrical

External power Supply	100-250 VAC, 50-60 Hz, 0.5 A
Input voltage	5VDC

7.7 Mechanical

Without antenna and power supply	
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7.8 Environmental

Operating Temperature	0°C to 40°C
Operating Humidity	5%-95% non condensing

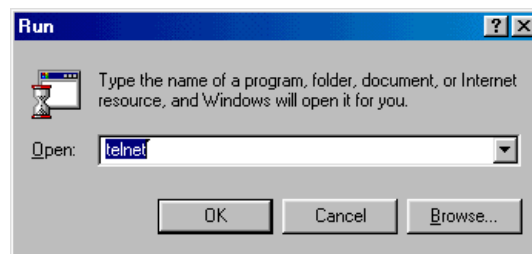
7.9 Standards Compliance, General

EMC	FCC part 15, EN 300 826
Safety	UL 1950, EN 60950
Environmental	ETS 300 019

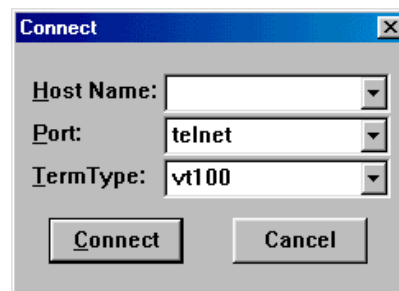
Appendix A. Using Telnet

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.

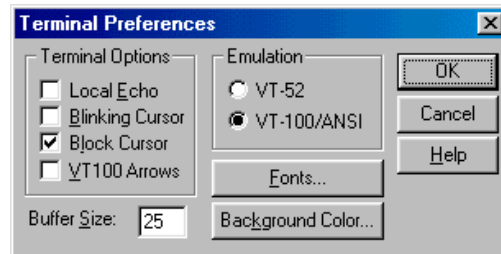


4. Select Connect-Remote System from the Telnet window menu. The following dialog box is displayed.



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

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: Basic Parameters

- **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.
- **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.

- **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.

- **Maximum Data Rate** – Displays the current maximum data rate, and allows entry of a new value for the maximum data rate.

BreezeACCESS units operate at 1 Mbps, 2 Mbps or 3 Mbps. Under certain conditions (compatibility reasons or range/speed trade-off), you may decide to limit the use of higher rates. If the quality of the link is not good enough, it is recommended to decrease the value of these parameters (the higher the data rate, the higher the error rate). Otherwise, there is a high probability that the unit will have to retransmit many frames several times before temporarily reducing the data rate. A high number of retransmissions reduces the overall throughput for the selected SU as well as for all the other SUs served by the same AU.

The link quality can be estimated based on the RSSI measurement using the Continuous Link Quality Display in the SU. If the measured RSSI is less than a certain threshold, it is recommended to decrease the Maximum Data Rate of the SU in accordance with the following table:

Recommended Maximum Data Rate	3Mbps	2Mbps	1Mbps
BreezeACCESS MMDS SU-I/ID	RSSI>65	53<RSSI<65	RSSI<53

The default value is 3 Mbps. Allowed values are 1, 2 or 3 Mbps.

The AU learns the Maximum Data Rate used by each SU during the association process, and uses this rate for transmissions to the specific SU.

- **Transmit Antenna** – Displays which antennas are used for transmission. SU-R units support transmit antenna diversity (2 antennas). During reception, a BreezeACCESS unit that is connected to two antennas dynamically selects the antenna where reception is optimal. In contrast, if the transmit antenna diversity is enabled, the unit selects the antenna from which it will transmit before the actual transmission. It usually uses the antenna last used for successful transmission. In installations where a model that can support antenna diversity is connected to a single antenna, Transmit Antenna Diversity should be configured to transmit only from that single antenna. Available selections are:

- ⇒ Use Two Antennas
- ⇒ Use Antenna No. 1
- ⇒ Use Antenna No. 2

The default selection is *Use Antenna No. 1* for SU-R-A7 units where a single antenna is connected to antenna port 1. For SU-R-A units with two omni antennas select *Use Two Antennas*.

