



WiMAX

PicoPlus Base Station

User Manual

**Doc No.: PPBS_UM 6-JAN-10
REV-02**

CONFIDENTIAL

About this Guide

This User Manual describes the procedures for commissioning, mounting, installing and managing the PicoPlus Base Station.

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Revision History

Date	Author	Description	Revision
AUG 2009	tothepoint	Initial	A0

Safety Precautions

To avoid injury and to prevent equipment damage, observe the safety precautions below.

- Outdoor installation procedures should be performed by quality professionals following all safety and the other requirements and acting in accordance with standard practices and procedures. Failure to meet safety requirements and/or non-standard practices and procedures could result in personal injury and/or damage to equipment.
- Always observe standard safety precautions during installation, operation and maintenance of this product.
- This equipment must be installed according to country national electrical codes.
- Any changes and modifications to the device and the accessories must be approved by Runcom.
- All equipment and accessories must be installed in a restricted access area.
- Observe all the labels on the equipment, providing operation details and warnings.
- Read and follow the installation instructions provided in this manual.
- In case of using cables that are not provided with the equipment package, ensure these cables comply with the regulatory inspection authorities and are the responsibility of the customer.
- Do not move or ship equipment unless it is properly packed in its original wrapping and shipping containers.

Electrical Shock Prevention

- When connecting equipment to the AC and DC voltage supplies, ensure proper polarity.
- Disconnect the power source before installing or maintaining the power wiring.

- Do not operate the equipment if there is any failure or damage to electrical components.
- Do not touch exposed connections, components or wiring when power is on.
- Install the equipment and the grounded DC supply circuits in adjacent cabinets.
- Protect the DC power source with an adjacent circuit breaker.
- The equipment must be properly grounded before attempting to operate or perform any repairs.

RF Exposure

To avoid RF exposure - Installation of antennas must comply with the FCC RF exposure requirements.

Radio Interference

This equipment generates and radiates radio frequency energy and if not installed and used in accordance with the instruction manual, may cause interference to radio communications.

To avoid interferences:

- Avoid conjunction with any other antenna or transmitter.
- In case of Radio Interference: Relocate the antenna and Increase separation between the equipment and the receiver (e.g. connect to a separate circuit or outlet).

FCC

General: 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 in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- a) Reorient or relocate the receiving antenna.
- b) Increase the separation between the equipment and receiver.
- c) Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- d) Consult the dealer or an experienced radio/TV technician.

Warning: Modifications not expressly approved by the manufacturer could void the user authority to operate the equipment under FCC Rules

Installation Rules:

1. Unit is intended for installation in Restricted Access Location only.
2. Unit shall be installed on/above concrete or other non combustible surface only.
3. The minimum distance between the BS antennas and the public zone is at least 1 meter
4. The unit shall be installed at least 5 meters above the ground level
5. When unit is installed outdoors length of exposed outdoor wiring shall not exceed 130ft (46meters)
6. Unit earthing screw terminal shall be permanently connected to protective earth in building installation in accordance with applicable national code and regulations.
7. The screen of the coaxial cables (connections to outdoor antennas) shall be permanently connected to protective earth in building installation.
8. In Finland, Norway and Sweden unit shall be installed in a Restricted Access Location where equipotential bonding has been applied (e.g. telecommunication center).
9. Unit power line 48VDC shall be protected by 2-pole circuit breaker, suitably certified in accordance with applicable national code and regulations, and rated not more than 2A.
10. Unit shall be installed only by qualified service person.

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1 Introducing the PicoPlus BS

Runcom's PicoPlus fully integrated outdoor WiMAX BS provides flexible, cost-effective WiMAX network deployment solutions where increased capacity and coverage is required.

'All-in-one' architecture combined with simple, single-handed installation and fast rollout make these BSs an ideal solution for operators that want to get in on the ground floor of WiMAX deployment at significant CAPEX reductions and maximum return on their network deployment.

The PicoPlus is a uni-sector base station that operates with omni or sectorized antennas, and provides 99.995% availability and carrier grade service.

Based on Runcom's RNx2000 chip set architecture, PicoPlus BSs provide adaptable solutions, allowing interoperability with other MSS devices as well as ASN-GW vendors.

The commissioning and installation procedure is fast and simple:

- Use a provided RCMS GUI application to configure the basic parameters.
- Use the same provided bracket to mount on a wall or pole.
- Connect the power, antennas and Ethernet connection.
- Verify connection and set additional parameters via the RCMS GUI application.
- Remote management via Runcom's NMS or any standard MIB browser.

Features

- All-in-one integrated packaging of RF and Baseband components
- Full compliance with IEEE802.16e-2005
- Frequency Bands (model dependant): 2.3GHz, 2.5GHz, 3.5GHz - other bands are optional
- Small footprint, single-handed quick installation and simple provisioning
- Fast roll-out for service providers
- Seamless and cost-effective integration with a Backhaul network
- Optional integrated backhaul link via WiMAX R1 interface
- Supports up to four antennas (model dependent) for advanced beam-forming techniques
- High performance with Quality of Service (QoS) settings
- Support for the latest R6 interface and GRE tunneling to ASN-GW.
- Remote NMS management via Runcom's NMS application

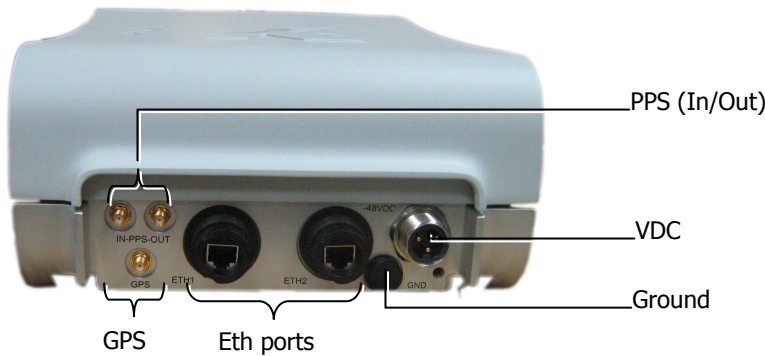
1.1 PicoPlus Interfaces and Accessories

The interfaces of the PicoPlus BS are distributed over two panels. Each of these panels is referred to according to the corresponding interfaces.

NOTE: Install the BS so the power, GPS and communication interfaces face DOWN.

1.1.1 GPS, Power and Communication Interfaces

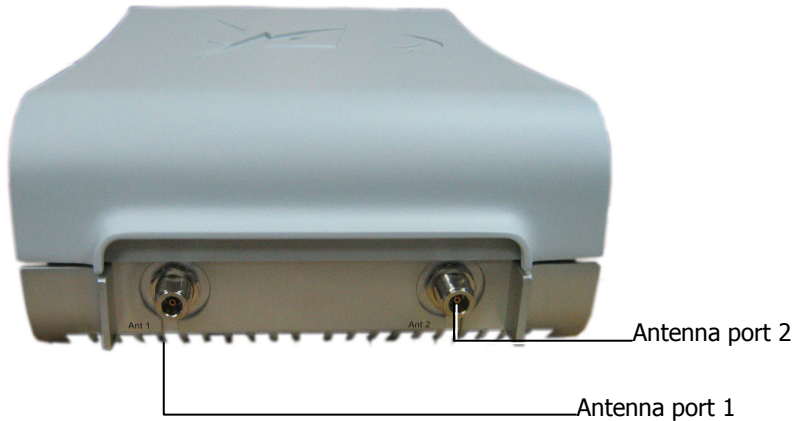
NOTE: Install the BS on the wall or pole with this panel facing DOWN.



Connector	Description
GPS	Connects to an external (optional) GPS antenna. The GPS antenna is ordered separately. Connector Type: ITT CANNON APD DIN 72585
ETH1	Primary Fast Ethernet connector. Used for initial setup (and standalone tests), and for connection to the backhaul network (in normal installations). Connector Type: RJ-45 TYCO part no 1546907-1
ETH2	Second Ethernet port for local and out-of-band management. In future versions, you will be able to daisy-chain this port to ETH1 in an adjacent Base Station (located in the same BS site) in order to allow a single Ethernet connection to the Backhaul. ETH2 port can also function as a serial port (connection through the cable supplied in the kit). This function is useful if the unit is not accessible via an IP address connection.
PPS	PPS In and PPS Out can be used for synchronization of multiple sectors, where the PPS Out of one sector is connected to the PPS In of the next BS (daisy chained). This is relevant only for adjacent sectors at the same BS site. Connector Type: SMA sealed Industrial
-48VDC	Power connector. External DC power connector (-48VDC) for outdoor deployment. Connector Type: RJ-45
GND	Ground blind hole connector. In normal installations, connect to the pole on which the unit is mounted. (The BS unit does not include a lightning arrester.)

1.1.2 BS RF Antenna Interfaces

NOTE: Connect the two antenna cables via a splitter.



Connector	Description
ANT1	External RF connector for the Main external antenna. Connector Type: RJ-45 TYCO part no 1546907 1
ANT2	External RF connector for the Diversity external antenna. Connector Type: RJ-45 TYCO part no 1546907 1

1.2 Supported Antennas

1.2.1 RF Antennas

Two external antennas are supported for diversity.

NOTE 1: Specs for dual-slant antennas described in section 6.2

NOTE 2: Future options will support an integrated antenna array

You may use any other antenna type or model, keeping in mind that the antenna type or model should be based on the RF planning that was performed in preparation for deployment at the specific site and is dependent upon the coverage and throughput requirements of the site.

1.2.2 GPS Antenna

A GPS antenna is provided with PicoPlus BS. The antenna is connected to the PicoPlus BS via a coax cable (maximum distance of 10 meters) and it can be mounted on a pole.

NOTE: The Holdover time (duration that BS synchronization is retained – from the point in time in which the GPS antenna is disconnected) is determined by the internal GPS. Currently – approximately 8 hours.

1.3 Optional Accessories

The following accessories are **not** provided with the basic kit, and can be ordered as an option.

Element	Description
Power Supply	110-220v AC/DC converter for -48VDC power supply
RF Antenna	External directional antenna with pole mounting kit

1.4 Installation Procedure – Workflow

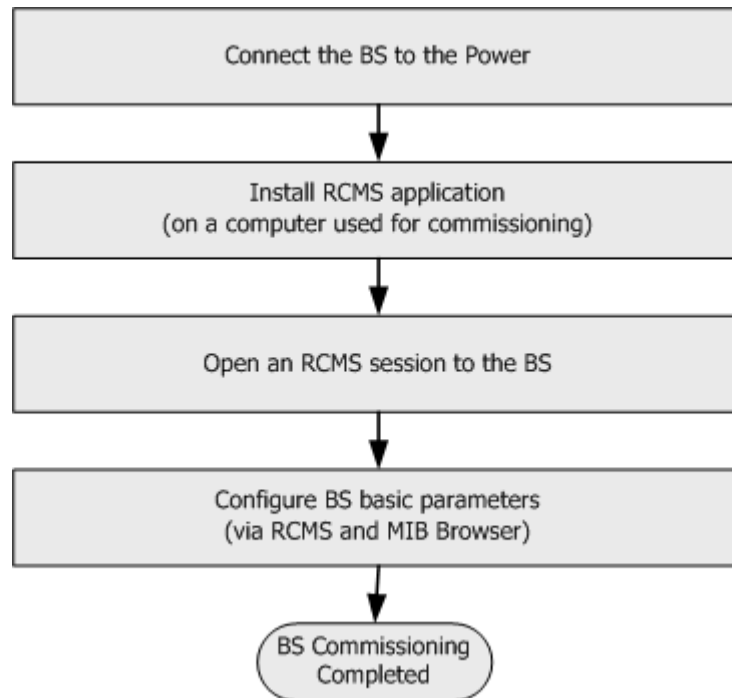
The PicoPlus installation procedure consists of the following phases:

1. **Commissioning the BS** (see Chapter 2) – Initial power connections and configuring the basic parameters required for BS communication and remote management.
2. **Mounting and Installing the BS and BS-Accessories** (see Chapter 3) – Connecting all relevant accessories and cables and mounting the BS on either a pole or wall.

2 Commissioning Procedure

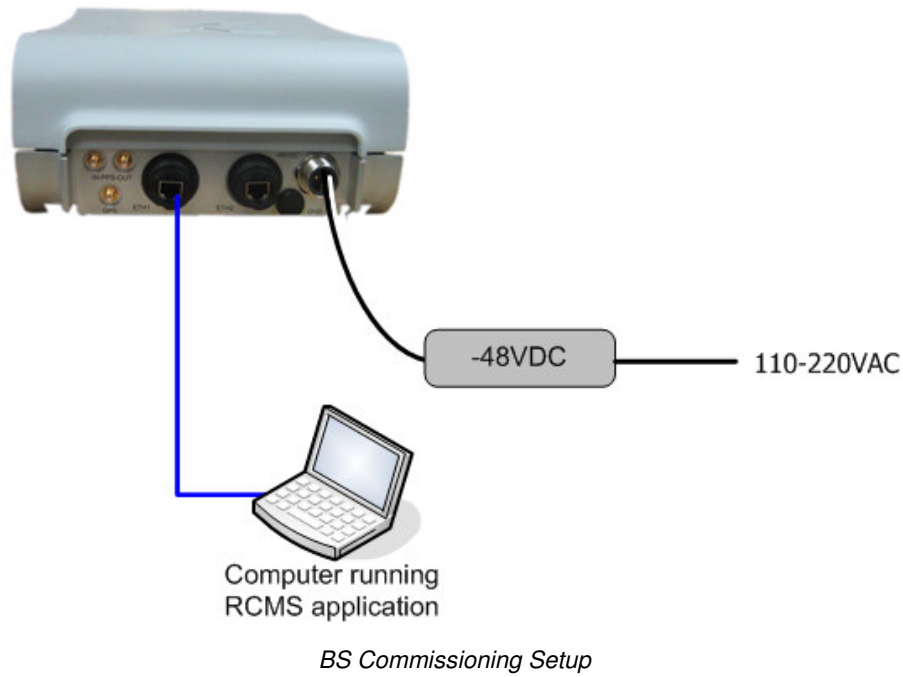
Before mounting the PicoPlus BS on a pole or wall, the BS should be commissioned, by configuring the basic parameters required for communication and remote management.

The BS commissioning procedure consists of the following steps



- Connect the power to the BS.
- Install and run the RCMS application (provided on the Setup CD) on a computer used for commissioning.
- Open an RCMS session to the BS.
- Set the BS basic parameters to allow future remote management connection and basic traffic (some of these parameters are configured using RCMS and others using a standard MIB Browser).

The Commissioning Setup is shown in the following figure:



2.1 Connecting the Power to the BS



To connect the BS Power

Use the provided (BS) power cable to connect the BS **VDC Power** connector to an indoor - 48 VDC power supply.

2.2 Installing and Running RCMS-BS Management Application

The RCMS-BS is a management application used for initial setup. Install the RCMS-BS application on a computer used for the BS setup.

NOTE: The RCMS application and all the corresponding files are available on the Setup CD provided with the BS.

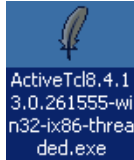
To install and run the RCMS-BS application:

- *Before* installing the RCMS application - install the **ActiveTcl Interpreter**.
- Install the RCMS application.
- Import the updated (BS) **MIB File** (identified by *.my extension) into the RCMS application.

2.2.1 Installing the ActiveTCL Interpreter

Install **ActiveTcl Interpreter version 8.4.13.0** on your PC.

This is provided by Runcom with the RCMS-BS installation package. It is also available as a freeware download from ActiveState.



Note: The RCMS-BS application is only compatible with ActiveTcl Interpreter version 8.4.13.0. and higher.

2.2.2 Install and Run the RCMS BS Application

1. Access **RcmsbsSetup.exe** file (either from the Setup CD or download from the Runcom server).
2. Double click the **RcmsSetup.exe** file to install the RCMS-BS.
3. Follow the prompts.

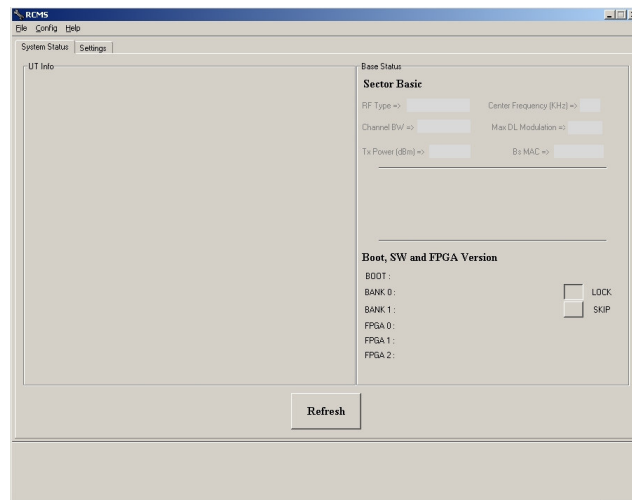
NOTE: Upon completion, it is recommended to create the **RCMS-BS** application shortcut on your desktop.

4. Double-click the **RCMS-BS** icon on your desktop:

Or

Click your windows **Start** button and select: **Programs → RCMS → RCMS-BS.**

5. The RCMS-BS window appears.

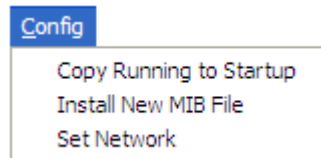


2.2.3 Importing the MIB File

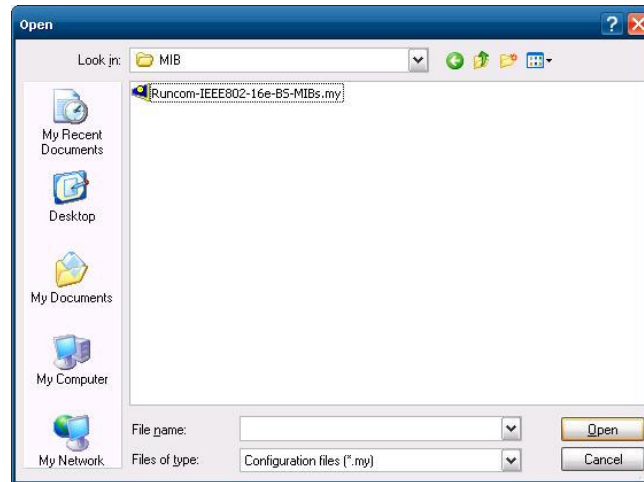
NOTE Be sure to import the latest (BS) MIB. Repeat this procedure with each version change in the BS MIBs.

To load the MIB file to the RCMS-BS:

1. From the RCMS-BS **Config** menu, select **Install New MIB File**.



2. From the displayed file selection window, choose the relevant MIB file (*.my extension) and click **Open** to import into the RCMS-BS database.



2.3 Opening a Session to the BS

This section describes the steps required for opening a session to the BS.

The procedure consists of the following steps:

- Physically connecting a computer to the BS.
- Configuring the computer to communicate with the BS.
- (Via the RCMS-BS), configuring the BS to communicate with the computer.

2.3.1 Physical Connection between BS and Computer

Physical connection: Connect the Ethernet port of the computer running the RCMS-BS application to the **BS ETH-1** port using an Ethernet cross-cable.

NOTE: Some computers may have the cross-cable function built in, in which case a standard Ethernet cable may be used.

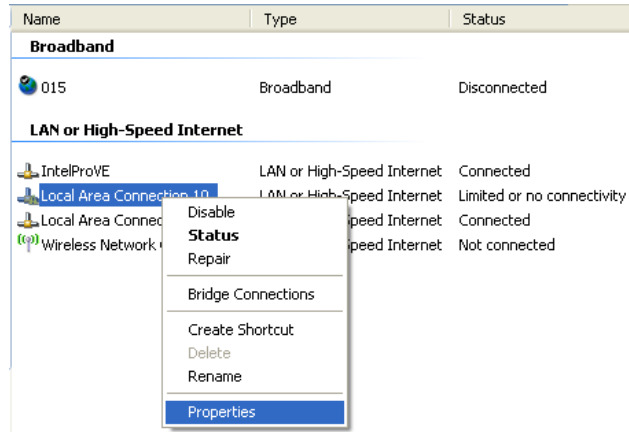


2.3.2 Configuring the Computer's IP Address and Disabling Firewall

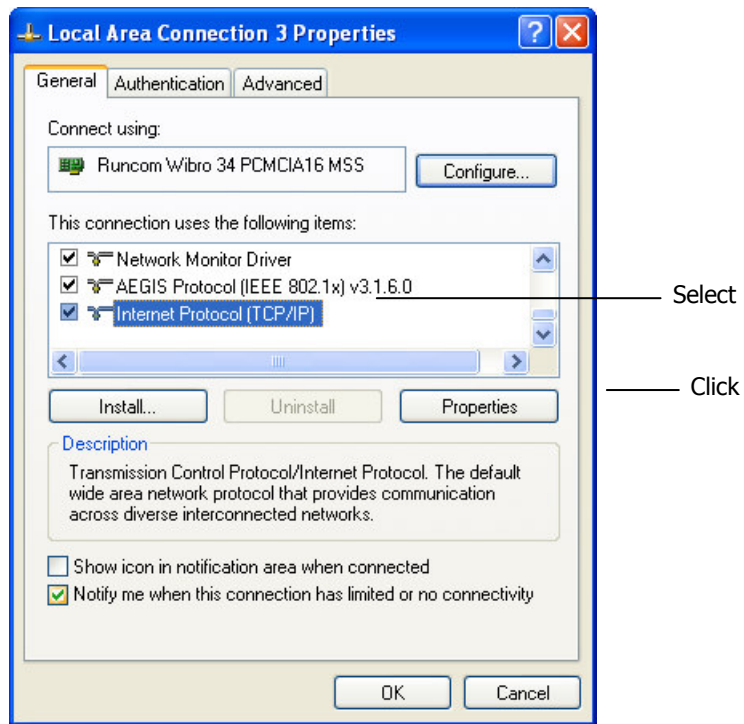
1. Set the computer IP address fields to match the BS's subnet:

NOTE: The procedure may vary depending on your specific OS.

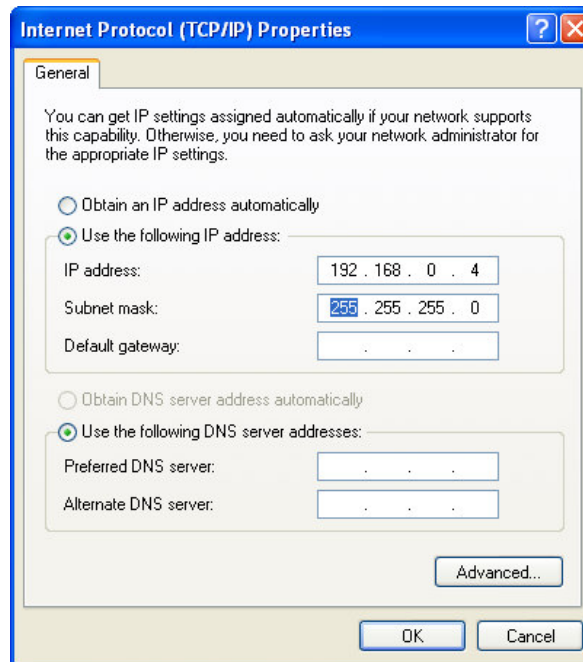
- In the **Network Connections** pane, right-click on the **Local Area Connection** corresponding to the BS connection.
- Select Properties.



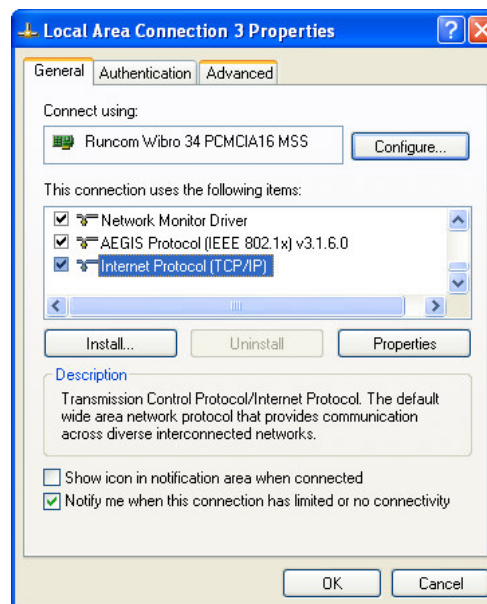
The following window appears.



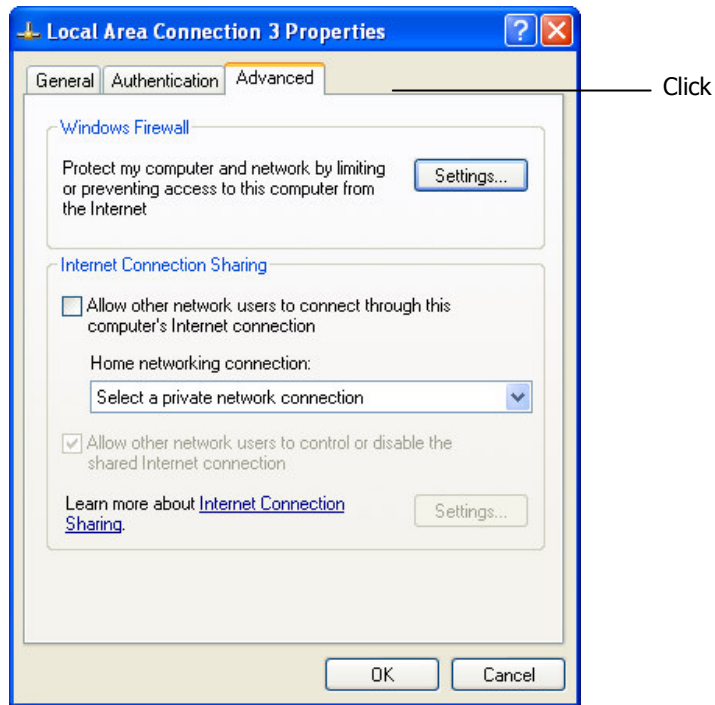
- In the General tab, select Internet Protocol (TCP/IP) and click the Properties button. The following dialog appears.



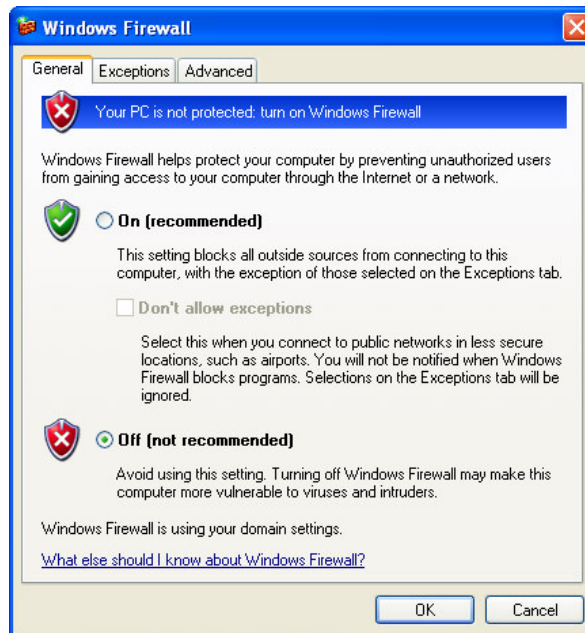
- Assign the computer a Static IP address as follows:
 - Select **Use the following IP address**.
 - In the **IP address** assign an IP address other than the BS IP address (Default BS IP Address: 192.168.0.20).
 - In the **Subnet mask** – set the subnet to the same subnet as the BS (Default BS Subnet: 255.255.255.0).
 (It is not required to define the Default Gateway).
- Click **OK**. The following dialog appears.



2. Disable the Firewall as follows:
 - Click the **Advanced** tab. The following tab appears.



- Click the **Settings** button. The following tab appears.



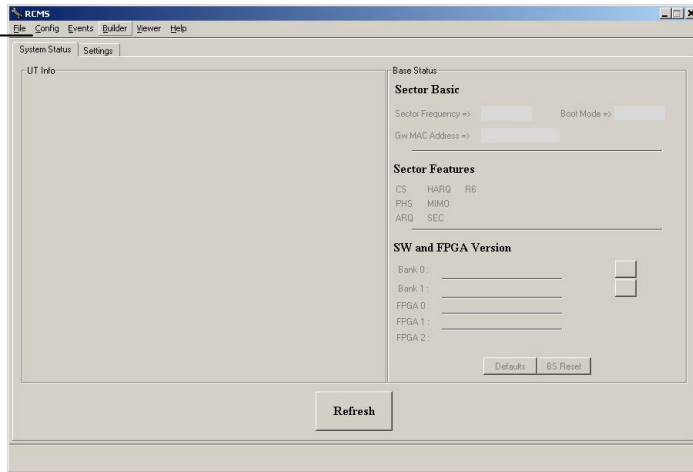
- Select the **Off** option to turn OFF the Firewall and click **OK**.

2.3.3 Enabling the BS to Communicate with the Computer

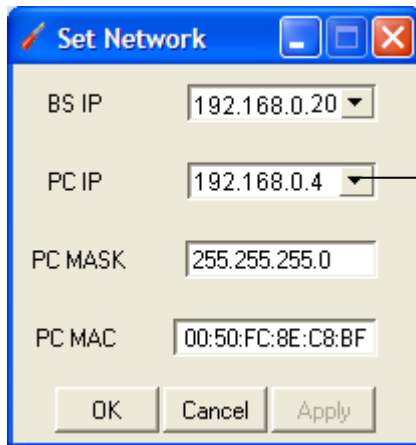
Configure the RCMS-BS application with the computer's IP, to allow the BS to recognize it:

- (If not already running) run the RCMS-BS application.
- From the **Config** menu, select the **Board IP** option.

From **Config** menu, select **Board IP**



- The Board IP window appears.



Set to the computer's IP Address

- Enter the IP Address parameters of the computer connected to the BS
- Click **OK**.

NOTE: If there is a problem connecting to the base station, the following message appears at the bottom of the window: **No response from Base!**

To fix the connection, recheck the cable connection between the PC and the base station and the connection fields described above.

2.3.4 What Next?

Configure the BS basic parameters according to the following section.

2.4 Setting Basic Parameters for Remote Management and for Traffic Transfer

This section describes how to set the basic parameters required for remote management and for traffic transfer over the link.

Some of the parameters are set using the RCMS application and others are set using the MIB Browser (or any other standard MIB Browser applications).

NOTE: Chapter 4 fully describes all the options available on the RCMS.

2.4.1 Setting BS Minimum Parameters

The following minimum BS parameters are defined via the **RCMS**:

- Base Station IP (if desired)
- Center Frequency

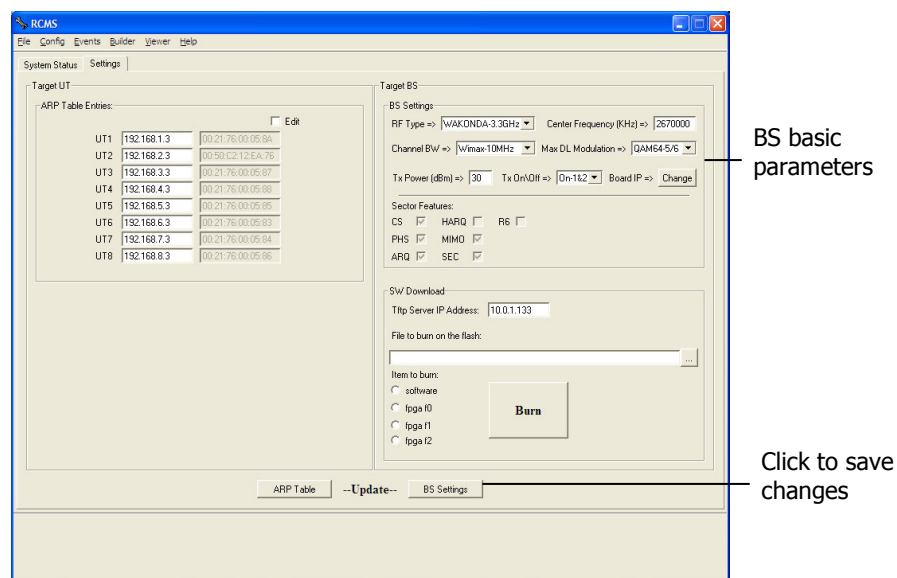
The following parameters are updated via the (RCMS) **MIB browser**.

- ASN-Gateway IP
- R6_mode
- Null_Authentication or Authentication_EAP_TTLS

2.4.1.1 Setting BS Minimum Parameters via RCMS

To set BS Minimum Parameters

1. It is assumed that a session is already opened to the BS.
2. In the RCMS-BS window, click the **Settings** tab.



3. In the **BS Settings** area, define the following:
 - **Sector Frequency [KHz]** – central frequency between the upper and lower cutoff frequencies.
 - The default IP Address of the BS is **192.168.0.20**. To change the address, click the Board IP **Change** button.
 - Click the (Update) **BS Settings** button to save the changes on to the BS.

2.4.1.2 Setting BS Minimum Parameters via a Standard MIB Browser

Configure additional parameters for communication with the ASN-GW

Use a standard MIB browser to configure the following ASN-GW and Security parameters:

- ASN-Gateway IP Address
- R6_mode (disable/enable)
 - GdbNvAirLink.R6Mode 0x00000002
 - GdbNvAirLink.OperationMode 0x00000000
 - GdbNvAirLink.SectorProfile.MacProfile.m_CsAssocMode 0x00000002
 - # router IP parameter at the ASN-GW in Hex (10.0.1.101 = 0x0A000165)
 - GdbNvAirLink.SectorProfile.R6Profile.m_AsnGwIp 0x0A000165
 - # GRE port at the ASN-GW connect to the BS in Hex (10.220.0.101 = 0x0ADC0065)
 - GdbNvAirLink.SectorProfile.R6Profile.m_AuthenticatorIp 0x0ADC0065
 - # Setting for R6
 - GdbNvAirLink.BootMode 1
 - GdbNvMngmnt.Logger.fLogEnable 1
 - GdbNvMngmnt.Logger.LevelFilter 0
 - GdbNvMngmnt.Logger.severityFilter 0
- Null_Authentication
 - #GdbNvAirLink.SectorProfile.UtCapabilitiesProfile.SecurityProfile.m_EapInitialNetworkSupport 0
 - #GdbNvAirLink.SectorProfile.UtCapabilitiesProfile.SecurityProfile.m_EapReEntrySupport 0
 - #GdbNvAirLink.SectorProfile.UtCapabilitiesProfile.SecurityProfile.m_CMACESupport 0
- Authentication_EAP_TTLS
 - GdbNvAirLink.SectorProfile.UtCapabilitiesProfile.SecurityProfile.m_EapInitialNetworkSupport 1
 - GdbNvAirLink.SectorProfile.UtCapabilitiesProfile.SecurityProfile.m_EapReEntrySupport 1
 - GdbNvAirLink.SectorProfile.UtCapabilitiesProfile.SecurityProfile.m_CMACESupport 1
- Standalone_mode
 - GdbNvAirLink.BootMode 1

3 Installing the PicoPlus BS

After commissioning the PicoPlus BS, the unit is ready for installation.

The procedure consists of the following steps:

- Choosing the installation location and mounting the BS on a pole or on a wall
- Mounting the RF and GPS antennas in the appropriate locations
- Connecting the RF and GPS antennas to the BS
- Connecting Ground, Power and ETH cables to the BS
- Performing an End-to-End traffic test

3.1 Mounting the Base Station

The PicoPlus BS is provided with a mounting kit which includes all the mounting elements (e.g. mounting-bracket, torques, screws etc.). The BS can be mounted either on a pole or on a wall.

NOTE: The same mounting bracket is used for the wall and the pole installation.

When mounting the BS, note the following

- The PicoPlus BS is typically installed in an upright vertically aligned position with the power, Ethernet and GPS connectors facing DOWN.
- The PicoPlus BS should be installed on the rear side of the RF antenna to prevent self-reflections.

3.1.1 BS Installation Location

This section describes the criteria that should be considered when selecting the PicoPlus BS installation location. The BS can be mounted on either a pole or a wall.

To choose BS Installation location

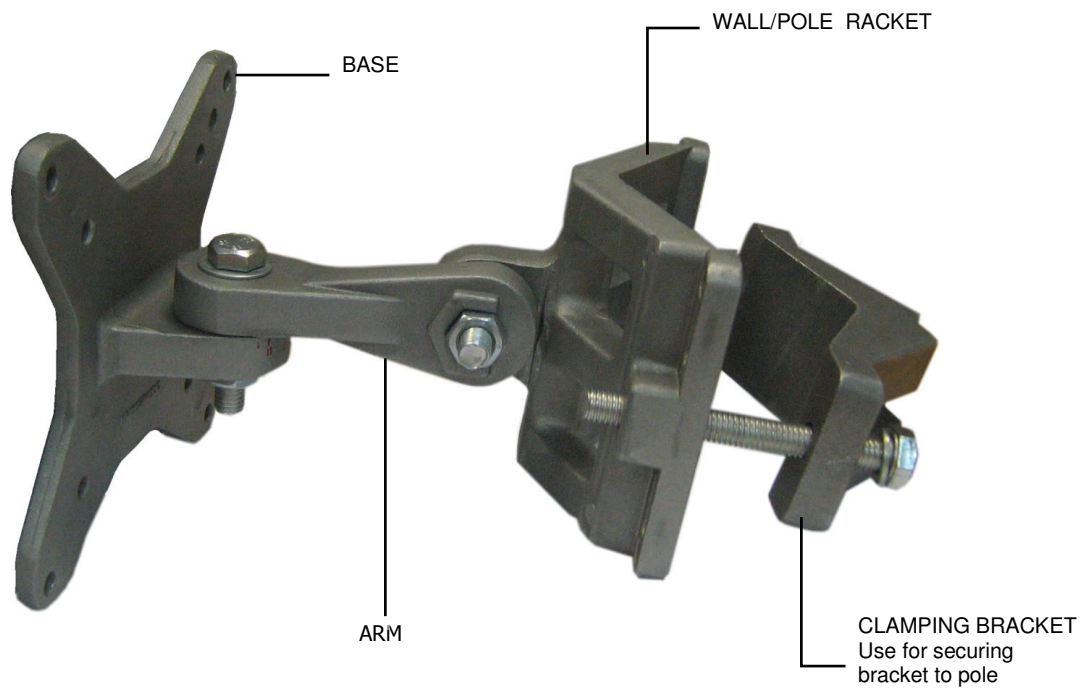
- Verify that the pole/wall location corresponds to the site plan and takes into account local regulations and maintenance access.
- The unit should be mounted in the highest possible point. Reception will increase according to the height of the antennas.
- The diameter of the pole on which the base station and antenna are to be mounted is either:
 - 1.00-1.75" or
 - 1.75-3.00"
- Verify that the pole is properly grounded.
- Verify that the pole has lightning protection.

- Verify that there is safe access to the pole, free of any obstacles or other danger for installers of the PicoPlus BS.
- Verify that there are no power lines near the pole.



3.1.2 Mounting Bracket Description



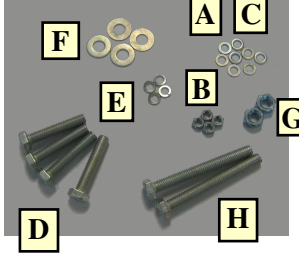
The figure below shows the BS mounting bracket.

NOTE: The same mounting bracket is used for the wall and the pole installation.



The Bracket elements are described in the following table.

Element	Description
	BRACKET BASE. This part is connected to the BS.
	BRACKET ARM. This part provides the tilt ability, and connects between the Bracket BASE and MAIN SUPPORT.

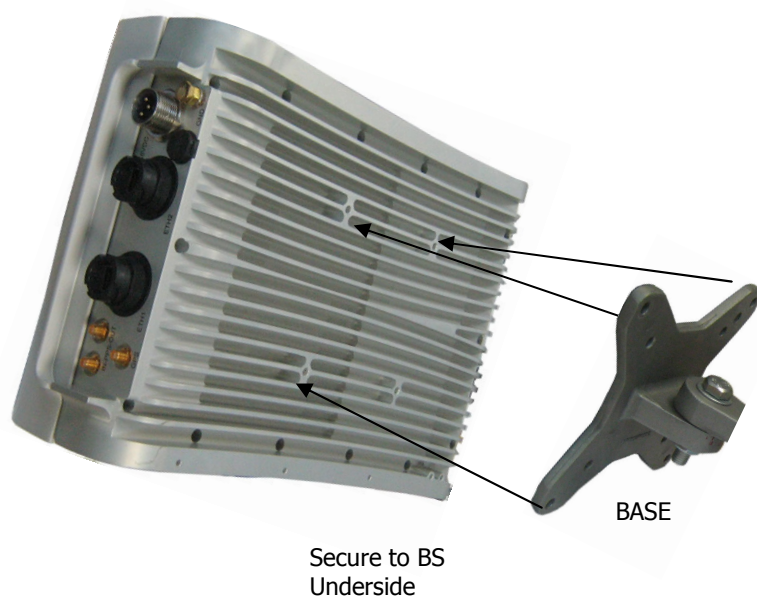
Element	Description
	<p>WALL/POLE BRACKET</p> <p>Used for connecting the bracket to the wall.</p>
	<p>CLAMPING BRACKET</p> <p>Used for securing the bracket to the pole.</p>
	<p>Provided screws, nuts and washers:</p> <ul style="list-style-type: none"> A. 4x flat washer M5 B. 4x nut M5 C. 4x spring washer M5 (seems as flat washers) D. 4x bolt M8x50 E. 4x washer spring M8 F. 4x washer flat M8 G. 2x nut M8 H. 2x bolt M8x70 I. 4x bolt M5x16 - missing

3.1.3 Mounting On a Pole

Note: When installing on a pole, leave at least 40cm space between the BS and the top of the pole for lightning protection.

To install the BS on a pole

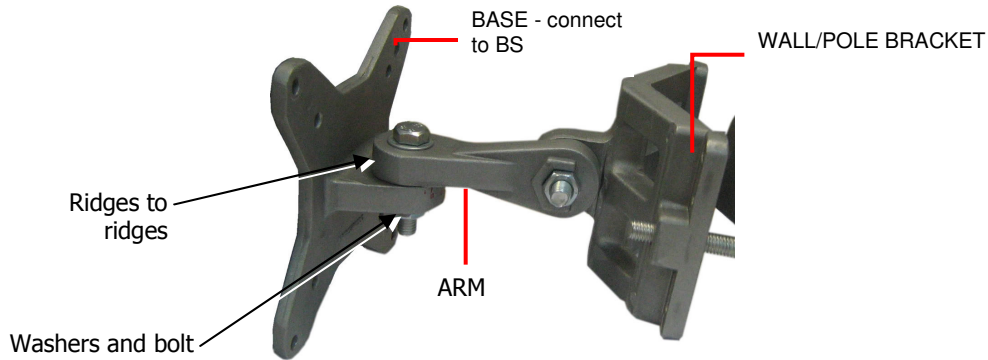
1. Secure the **Bracket Base** to the BS underside:
 - Secure the **Bracket Base** to the underside of the BS, using the provided screws, as shown below:



- Verify that the orientation of the hole in the BASE is aligned with the elevation axis.
- Use a tightening torque of 5.7N/m to tighten.

2. Assemble the bracket elements:

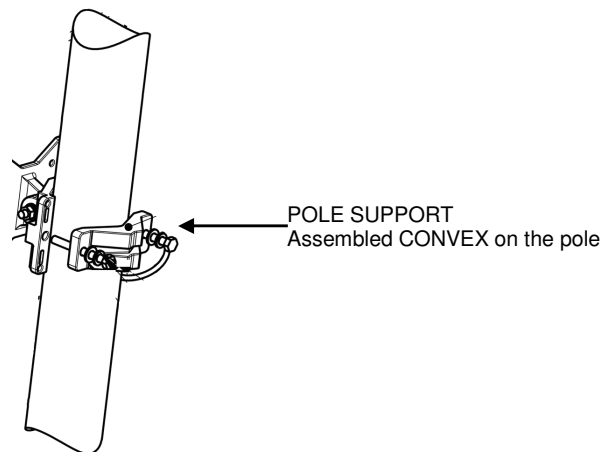
- Secure the **WALL/POLE BRACKET** to the **Bracket Arm** and then to the **Bracket Base** using the provided screws, as shown below:



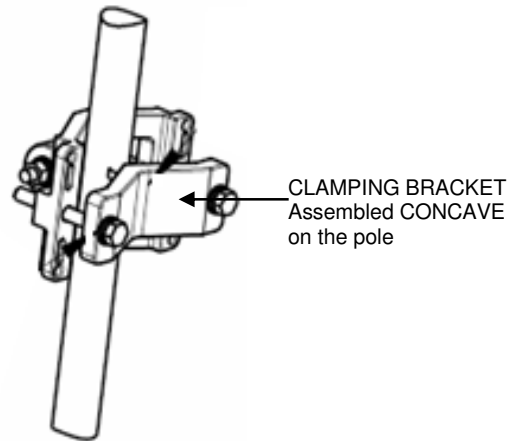
Note: The bolt head should be positioned in the socket on the Bracket BASE.

- Use a tightening torque of 24 N/m to tighten.
3. Mount the BS on the pole, where the procedure varies slightly according to the pole diameter:

For poles with a diameter of 1.75-3.00”:



- Mount the BS on the pole using the bracket **Pole Support** as shown above. Assemble the bracket CONVEX as shown.
- Tighten the bracket using the provided screws, according to the pole diameter.
- Use a tightening torque of 14N/m to tighten.

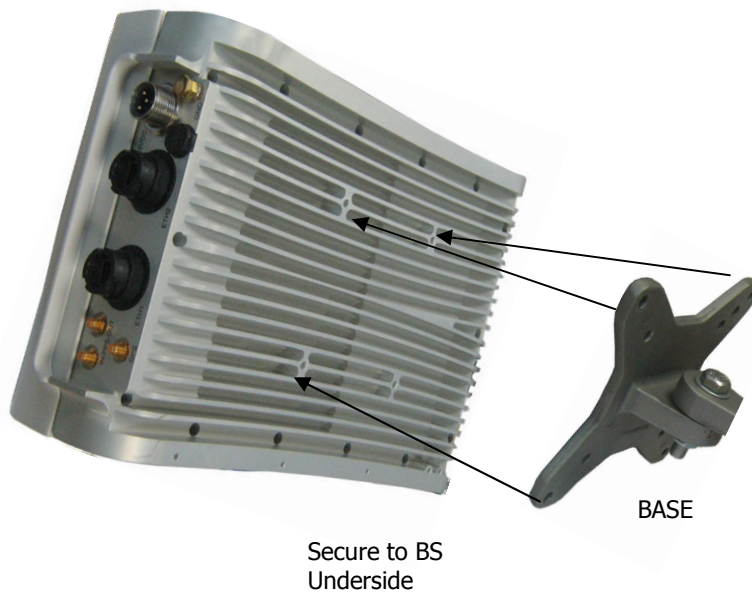
For poles with a diameter of 1.00-1.75”:

- Mount the BS on the pole using the **Clamping Bracket** as shown above. Assemble the bracket **CONCAVE** as shown.
- Tighten the bracket using the provided screws.
- Use a tightening torque of 14N/m to tighten.

3.1.4 Mounting On a Wall

1. Secure the **Bracket Base** to the BS underside:

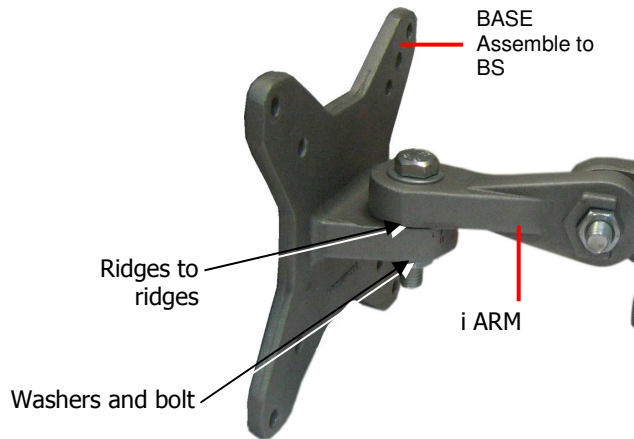
- Secure **Bracket Base** to the underside of the BS, using the provided screws, as shown below:



- Verify that the orientation of the hole in the BASE is aligned with the elevation axis.
- Use a tightening torque of 5.7N/m to tighten.

2. Assemble the bracket elements:

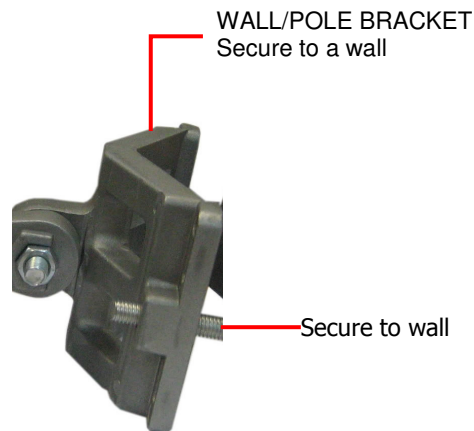
- Secure the **Bracket Arm** to the **Bracket Base** using the provided screws, as shown below:



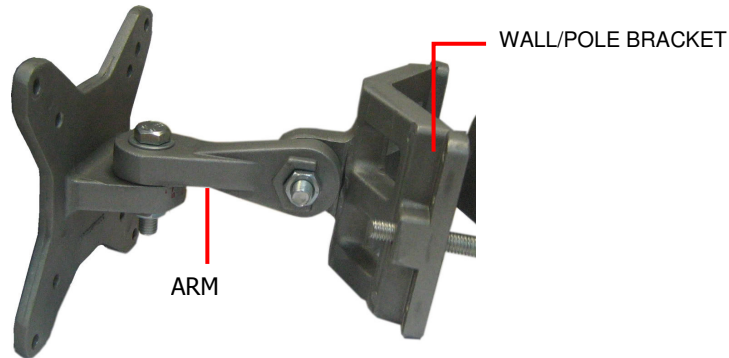
Note: The bolt head should be positioned in the socket on the Bracket BASE.

3. Mount the BS on the wall:

- Mount the **WALL/POLE BRACKET** on the wall in the appropriate position. Note the azimuth orientation when doing so.



- Attach the **Bracket Arm** to the **WALL/POLE BRACKET** using the provided screws.



Note: The bolt head should be positioned in the ARM socket.

- Use a tightening torque of 24 N/m to the azimuth and elevation hardware.

3.2 Mounting the Antennas

After mounting the base station on a pole or wall, mount the RF and GPS Antennas in the selected locations according to the instructions given in this section.

3.2.1 Mounting the RF Antenna

3.2.1.1 RF Antenna Location Criteria

- To avoid frequency reuse problems caused by unwanted reflections, the main part of the antenna must be clear of any metal objects for a range of parameter to 20 meters.
- Make sure that there are no obstacles located in front of the RF antenna, such as poles, transmission equipment from other vendors or another Runcom RF antenna.

3.2.1.2 RF Antenna Mounting

NOTE: The antenna is mounted and adjusted using the provided antenna mounting kit.

To mount the RF Antennas:

- Use the supplied **RF antenna (pole) mounting kit** to attach the antenna to the pole.
- Connect the antenna's **ANT** connector to the BS **ANT-1** and **ANT-2** RF connector using the provided **0.5 -1 meter coax cable**.
- Tilt the antenna as required. The antenna's mounting kit enables the antenna to be tilted along two axes.
- The antenna position can be fine-tuned at a later stage.

3.2.2 Mounting the GPS Antenna

The GPS antenna is assembled onto the pole. It connects to the BS via a coax cable towards the GPS RF connector.

Criteria for selecting the GPS antenna location

- The whole **antenna area** is exposed to the sky.
- GPS antenna should not be more than **10 meters** from the PicoPlus (excessive cable length may cause interference).

3.3 Connecting the Base Station Cables

This section describes the BS antenna, power and Ethernet cables.

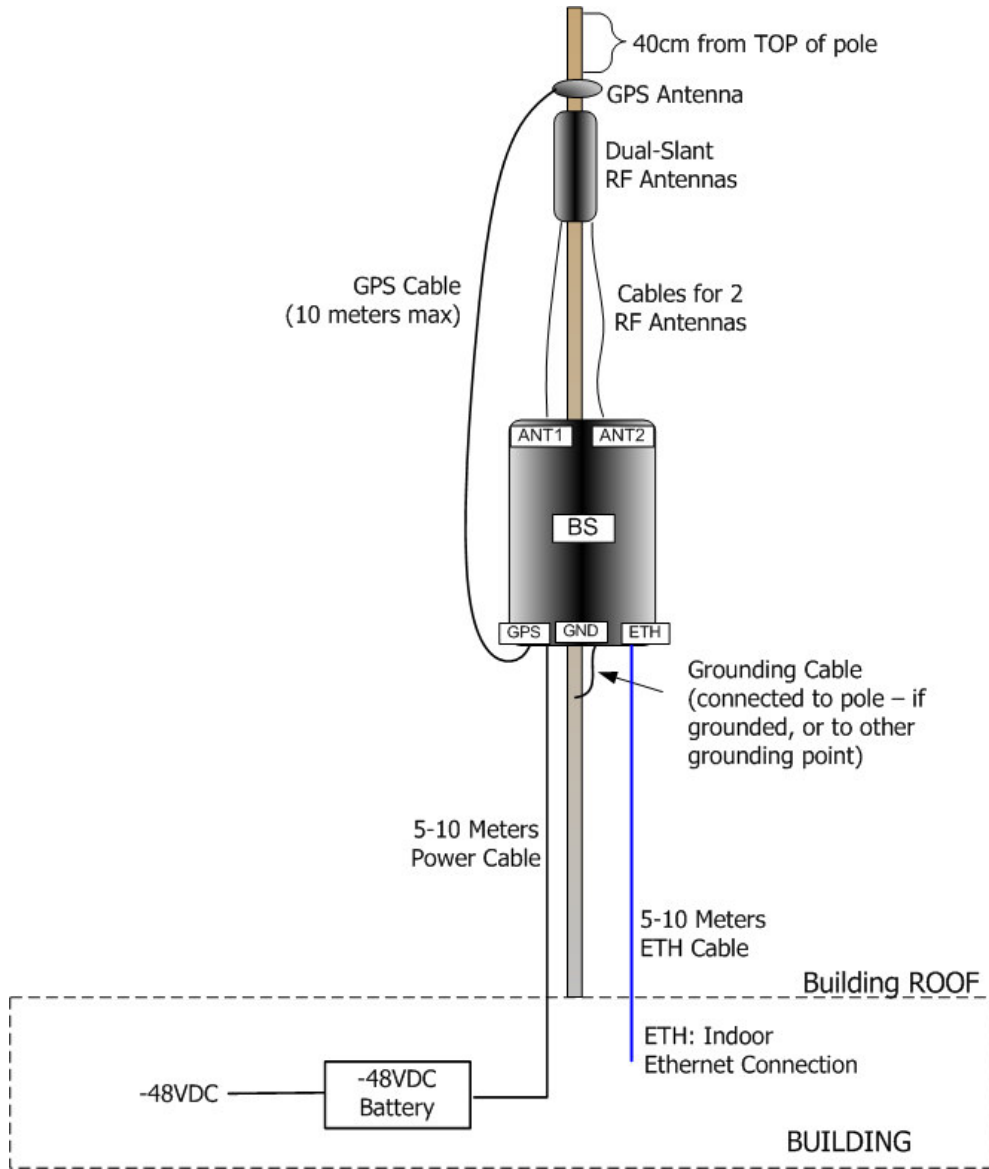
To connect the antennas to the BS

- **RF Antennas:** Connect coax cables from each RF antenna to the **BS ANT1** and **ANT2**.
- **GPS Antenna:** Connect a coax cable (10 meters max) from the **GPS** antenna to the **BS GPS** connector.
- **Ground:** Use the provided grounding cable to **ground** the BS to the pole (if pole is grounded), or to a grounding point.
- **Power:** Run the 5-10 meter power cable from the BS **Power** connector down the pole, to the provided -48 V power converter that is located indoors (i.e. in a building or in a caravan).

Note: It is recommended to connect a battery (for backup) to the -48VDC power supply.

- **Ethernet:** Run the 5-10 meter Ethernet cable of the base station from the **ETH** connector at the bottom of the base station down the pole and connect it to an indoor Ethernet connector, such as in a building or in a caravan

If necessary, secure the cables to the pole so that it is not loose using plastic strips.

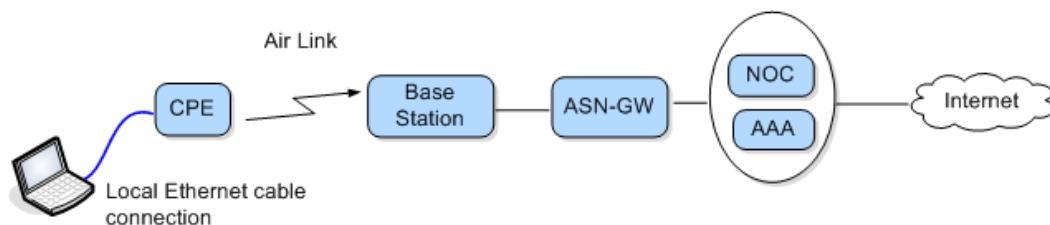


3.4 End-to-End Traffic Test

After the system is installed, it is recommended to perform an End to End (E2E) test to test communication and traffic transference over the link.

In this test, a computer connected to a CPE (that is configured to operate with the BS) sends a ping message towards the NOC (Network Operations Center) and AAA (Authentication, Authorization and Accounting center). Receiving an answer from the NOC/AAA side by the CPE's PC assures that the system is configured and operating properly.

The following figure shows the end-to-end test elements.



To perform the test

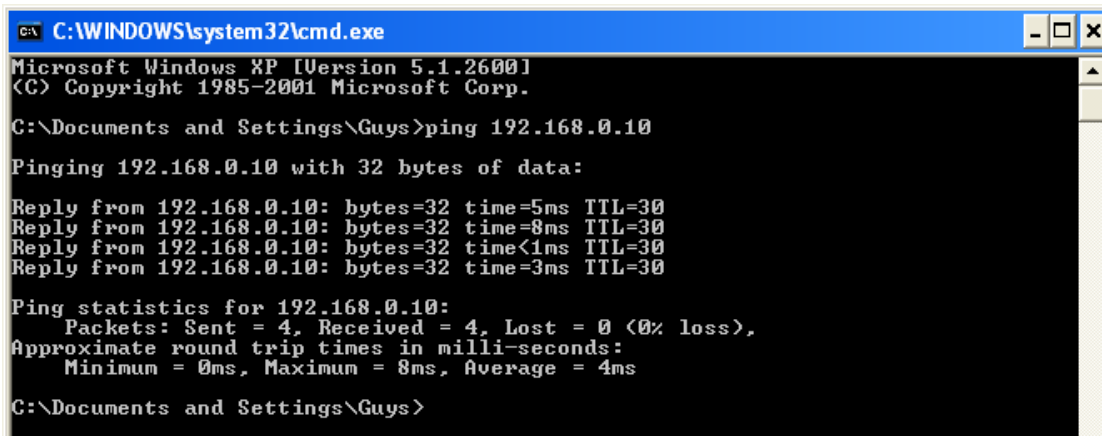
1. Ensure that the BS is configured with the:
 - Center frequency
 - ASN-GW IP address and security parameters (see 2.4.1)
2. Connect the BS to a CPE configured with the:
 - Center Frequency
3. Connect a computer configured to communicate with the CPE (see section 2.3.2 – using the CPE IP address subnet) to the CPE Ethernet port using a cross-cable.
4. Use Telnet to send a ping command from the CPE computer to the NOC IP Address.

3.4.1 Performing a PING Test

To verify connectivity

1. Open a Command Prompt window from the computer connected to the CPE
2. Select Start → Run and enter cmd.
3. Enter a **Ping** command that pings the NOC.

The following shows a **Ping** command:



```
C:\WINDOWS\system32\cmd.exe
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\Guys>ping 192.168.0.10

Pinging 192.168.0.10 with 32 bytes of data:

Reply from 192.168.0.10: bytes=32 time=5ms TTL=30
Reply from 192.168.0.10: bytes=32 time=8ms TTL=30
Reply from 192.168.0.10: bytes=32 time<1ms TTL=30
Reply from 192.168.0.10: bytes=32 time=3ms TTL=30

Ping statistics for 192.168.0.10:
    Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
    Approximate round trip times in milli-seconds:
        Minimum = 0ms, Maximum = 8ms, Average = 4ms

C:\Documents and Settings\Guys>
```

4. Verify that the link has been established properly according to the reply received from the NOC.
5. If no 'ping' reply is received, check connections and required configuration parameters.

3.5 What Next?

Your installation has now been completed. You can now use the RCMS application or any standard MIB Browser to manage the BS and perform any additional configuration, monitoring and maintenance operations.

4 RCMS Application

The RCMS application is used to configure and to monitor the most common BS parameters, and to perform SW updates. In addition, the RCMS provides access to a MIB Browser and an Events definition tool.

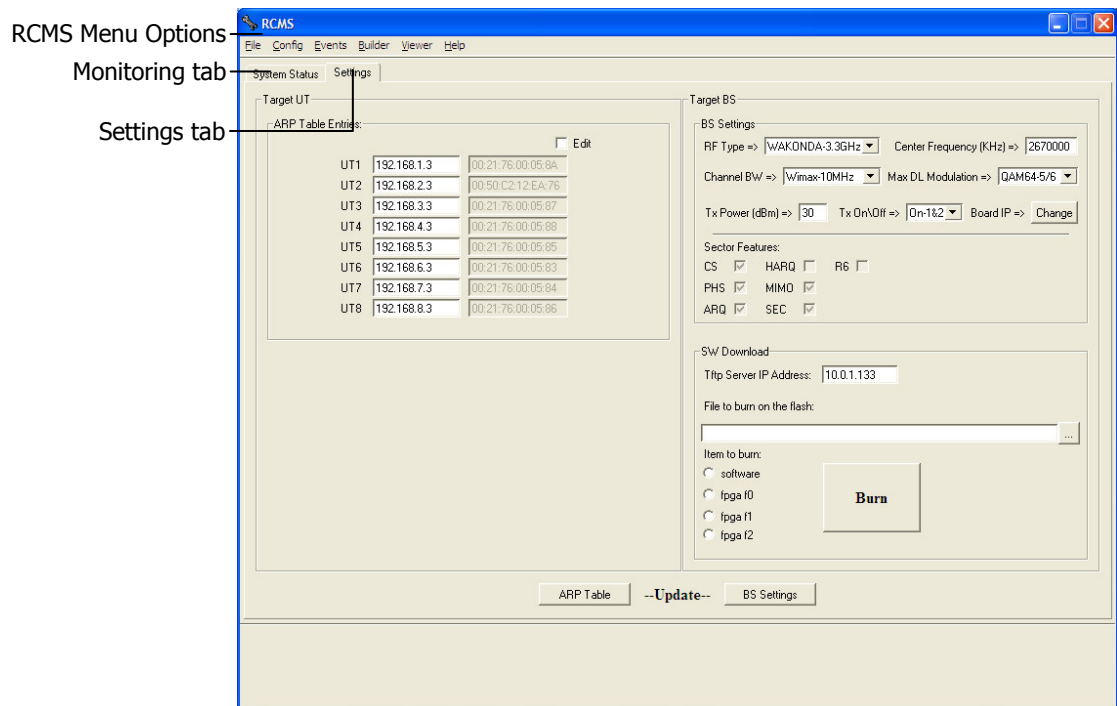
The RCMS application Basic Operations are described in this chapter. For RCMS Administrative options see chapter 5

4.1 Navigating the RCMS Application

The RCMS-BS application consists of two tabs that are always displayed:

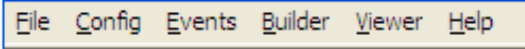
- Settings tab – used for configuration and upgrade operations (see 4.2)
- System Status tab – used for viewing configured parameters and monitoring status (see 4.3)

Additional capabilities are provided by the RCMS Menu Options (see 4.1.1).



4.1.1 RCMS Menu Options

The RCMS menu options are described in the table below.



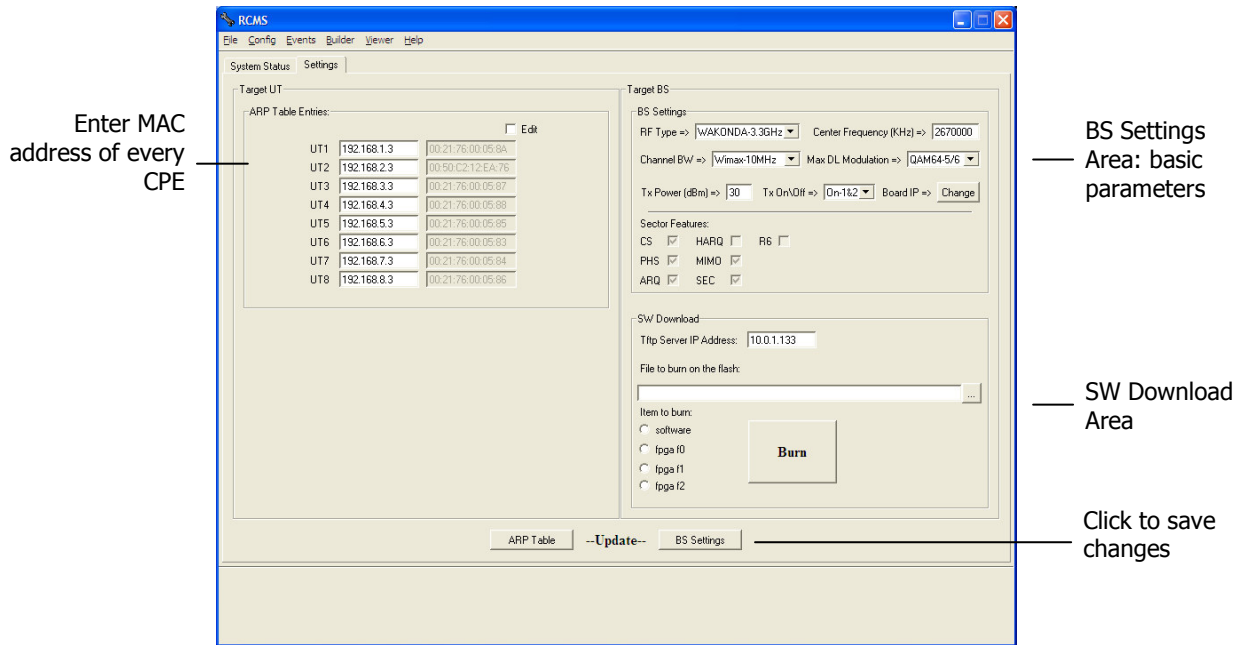
Menu Options	Description
<p>File</p> <ul style="list-style-type: none"> Save Open Exit 	Used to perform configuration file management options (see 5.1).
<p>Config</p> <ul style="list-style-type: none"> Copy Running to Startup Install New MIB File Set Network 	Used to configure and setup the RCMS application (see 2.2.3, 2.3.3).
<p>Events</p> <ul style="list-style-type: none"> SW Events Import MessageFile.h Open Profile Save Profile Select All Unselect All Close Tab 	Used to manage the BS Events.
<p>Builder</p> <ul style="list-style-type: none"> New Script Open Script Save Script Clear Screen Close Tab 	Allows building and running custom Tcl scripts (see 5.4.1)
<p>Viewer</p> <ul style="list-style-type: none"> New MIBs View Open View Save View Remove Selected Close Tab 	MIB Viewer tool (see 5.3)
<p>Help</p> <ul style="list-style-type: none"> About 	RCMS Version information.

4.2 Settings Tab

The Settings tab includes the following areas:

- BS Settings – used to configure BS parameters and sector features
- ARP Table Entries – used to define the MAC addresses of the connected CPEs
- SW download – used to update BS SW and FPGAs (described in Chapter5.2)

This section describes the parameters provided in each area.



4.2.1 BS Settings

The following table describes the parameters provided in BS Settings area.

Note: Click the (Update) **BS Settings** button to save the changes on to the BS.

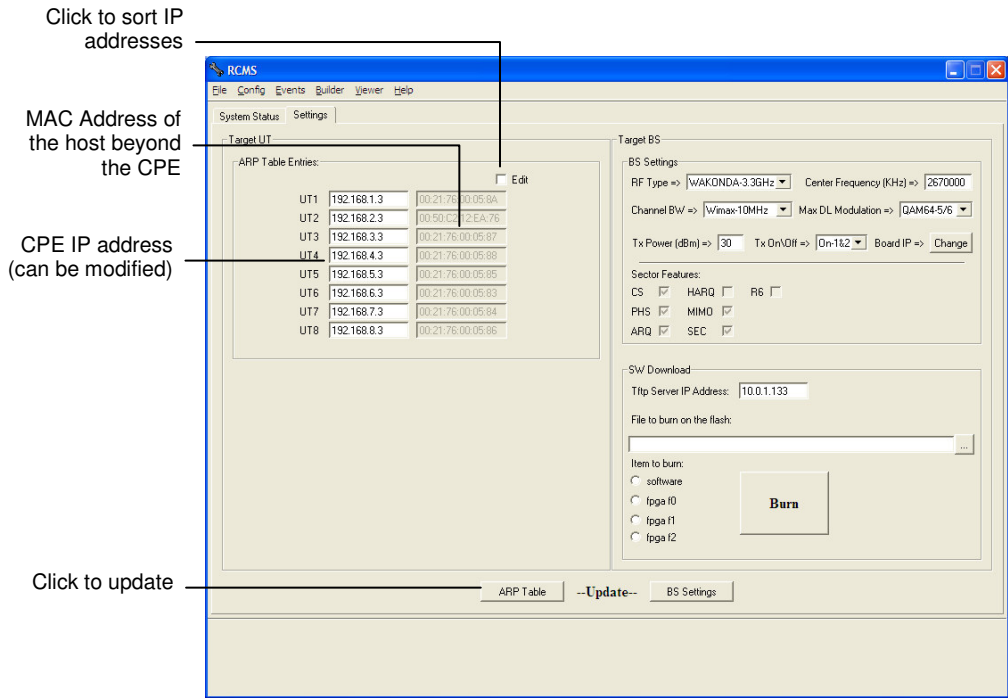
Parameter	Description
Sector Frequency [KHz]	Center frequency
Boot Mode	Specifies the MAC layer Boot Mode. Values: <ul style="list-style-type: none"> ○ 2 – Waiting for Access Control Router (ACR) activation; All parameters are retrieved from the ACR. ○ 1 – Activation is done immediately upon power up (not waiting for ACR); Parameters are taken from the GDB memory. ○ 0 – Waits for ACR activation. Parameters are taken from the GDB memory.

Parameter	Description
GW MAC Address	MAC address of the gateway used by the BS.
Sector Features	BS Sector Features: <ul style="list-style-type: none"> ○ CS – Convergence Sub Layer ○ PHS – Payload Header Separation ○ ARQ – Automatically Repeat Requests ○ HARQ – Hybrid Automatically Repeat Requests ○ MIMO – Multiple Input Multiple Output ○ SEC – Security ○ R6 – R6 protocol

4.2.2 ARP Table Entries Setup

The **ARP Table Entries** area is used to view the automatically detected IP address of the CPE and the *MAC addresses* of the host beyond the CPE.

NOTE: To sort the ARP table entries in a different order, check mark the **Edit field, and re-organize the entries.**



To configure the CPE IP addresses

- Click the IP-Address field of the table entry to be updated.
- Enter the IP address corresponding to the MAC address of every detected CPE.
- Click the (update) **ARP Table** button to update the ARP table.

4.3 System Status Tab (Monitoring)

The **System Status** tab displays the status and the parameters of the BS grouped in areas, as described in the following table.

Area	Description
Base Stations Status	Shows BS configured parameters (for setup details see 4.2.1).
Sector Features Status	Applied features (for setup details see 4.2.1).
UT Info Status	Status and information of the connected CPEs (for setup details 4.2.2)
SW and FPGA Version Status	Currently loaded and running versions (for setup details see 5.2).

This section describes the monitored parameters provided in each area.

NOTE: Use the **Refresh** button to update the displayed information.

The screenshot shows the RCMS System Status window. It is divided into several sections:

- UT Info:** A table showing connected CPEs with columns for ID, UL, DL, UClrr, DCrr, and HRoom. Each row has 'Connect', 'Reset', and 'More' buttons.
- Base Status:** A section for 'Sector Basic' parameters including RF Type, Center Frequency, Channel BW, Max DL Modulation, Tx Power, and B MAC.
- Sector Features:** A section for 'Sector Features' including CS, HARQ, R6, PHS, MIMO, and ARQ, SEC.
- Boot, SW and FPGA Version:** A section for 'Boot, SW and FPGA Version' with 'Defaults' and 'BS Reset' buttons. It lists versions for BOOT, BANK 0, BANK 1, FPGA 0, FPGA 1, and FPGA 2.

Annotations in the image point to:

- Connected CPEs:** Points to the UT Info table.
- BS basic parameters:** Points to the Base Status section.
- SW and FPGA Versions:** Points to the Boot, SW and FPGA Version section.

4.3.1 Base Station Status

The following BS Basic parameters are provided:

Parameter	Description
Sector Frequency [KHz]	Center frequency
Boot Mode	Specifies the MAC layer Boot Mode. Values: <ul style="list-style-type: none"> ○ 2 – Waiting for Access Control Router (ACR) activation; All parameters are retrieved from the ACR. ○ 1 – Activation is done immediately upon power up (not waiting for ACR); Parameters are taken from the GDB memory. ○ 0 – Waits for ACR activation. Parameters are taken from the GDB memory.
GW MAC Address	MAC address of the gateway used by the BS.

4.3.2 Sector Features Status

This following Sector Features' status is displayed:

Sector Features	Description
CS	Convergence Sub Layer
PHS	Payload Header Separation
ARQ	Automatically Repeat Requests
HARQ	Hybrid Automatically Repeat Requests
MIMO	Multiple Input Multiple Output
SEC	Security
R6	R6 protocol

4.3.3 UT Info Status

The UT Info area displays a table of the connected CPEs (referred to as User Terminals in the tab).

Each connected UT is shown in a separate row, showing the Link status and Quality. Operation buttons are used to control individual (per row) or all CPE operations.

You may also configure the polling intervals (default: 1sec).

Connected:		UL	DL	UCinr	DCinr	HRoom	Poll every: 1		
UT1	00:21:76:00:05:8A	2	2	+22.9	28	30	Connect	Reset	More
UT2	00:50:C2:12:EA:76	2	2	+21.0	28	8	Connect	Reset	More
UT3	00:21:76:00:05:87	2	2	+23.0	27	33	Connect	Reset	More
UT4	00:21:76:00:05:88	2	2	+23.5	25	30	Connect	Reset	More
UT5	00:21:76:00:05:85	2	2	+19.5	28	30	Connect	Reset	More
UT6	00:21:76:00:05:83	2	2	+21.5	28	32	Connect	Reset	More
UT7	00:21:76:00:05:84	2	2	+22.5	27	29	Connect	Reset	More
UT8	00:21:76:00:05:86	2	1	+22.7	28	31	Connect	Reset	More

Connect All Reset All

The available CPE information and control options are described below.

4.3.3.1 CPE Information Fields

For each listed CPE, the following information is provided:

Parameter	Description
MAC Address	CPE MAC address (automatically identified).
UL	Number of uplink connections for this CPE (0 indicates no connection).
DL	Number of downlink connections for this CPE (0 indicates no connection).
UCinr	Uplink Cinr (Carrier to Interference-plus-Noise Ratio) of this CPE connection.
DCinr	Downlink Cinr (Carrier to Interference-plus-Noise Ratio) of this CPE connection.
HRoom	Headroom – remaining dynamic range for CPE operation.

4.3.3.2 CPE Control Buttons

The following CPE control buttons are available:

Per....	Control Button	Description
CPE	Connect	Retry to establish a connection to this CPE (when no connection exists).
	Reset	Reset the connection between this CPE and the BS.
	More	Specify the connection settings for this CPE (useful just before using the Connect button).
Global	Connect All	Retry to establish a connection to all CPEs
	Reset All	Resets the connection between all of the CPEs and the BS.

Note: After performing Reset or Reset All, click the Refresh button to display the updated data.

4.3.3.3 CPE Polling Interval

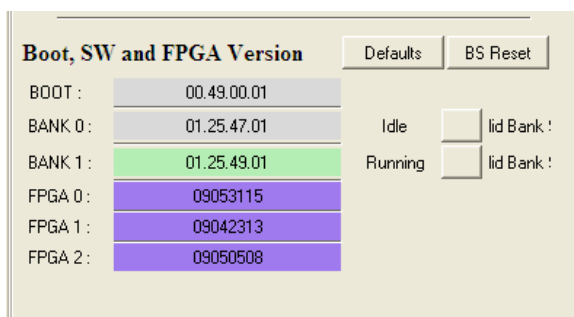
To set or modify the polling interval

Check mark the **Poll Every** field and specify the time interval (in seconds) in which polling will be performed.

4.3.4 SW and FPGA Version Status

The **SW and FPGA Version** area provides information on the currently running and stored FPGA and software versions.

- The bank storing the currently running version is marked as **Running**.
- The bank used for temporary storage is marked as **Idle**.
- Use the **Skip** button to switch between the banks.



Two additional operation buttons are provided:

- **Defaults** – revert to default SW and FPGA versions.
- **BS Reset** – reboots the BS and loads the relevant BANK, according to user specifications.

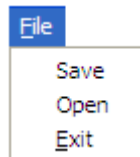
5 Administrative Operations

This chapter describes the following RCMS application administrative capabilities:

- Configuration file management
- Managing SW and FPGAs versions
- The embedded MIB Browser tool
- Event monitoring and management

5.1 Configuration File Management

The RCMS application provides options for viewing and saving the current configuration file loaded onto the BS.



To save the configuration settings

- From the RCMS application *File* menu, select **Save**.

To open this RCMS configuration file

- From the RCMS application *File* menu, select **Open**.

The following shows an example of the configuration file that is saved.

Note: Editing the configuration file is not recommended.

```

current.txt (C:\Autotest\code) - GVPM
File Edit Tools Syntax Buffers Window Help
3.5GHz-5MHz-32x1S 3.5GHz-5MHz-35x1Z]
set tdata(sectFrg) 0
set tdata(bsSU) 01.16.12.02
set tdata(bsID) 27952
set tdata(utSU) 206.70.23.12
set tdata(utID) 09622
#####
# BS features list
#####
set bsFeatures (list CS PHS ARQ)
set subVers (list sectorCapabilities sectorPhiIndicator eqSupportIndicator)
#####
# Active BS
#####
set actbs 3
#####
# Base-1 Parameters
#####
set BS(1.BoardIP) 192.168.0.27
set BS(1.Freq) 2357000
set BS(1.pcIP) 192.168.0.7
set BS(1.pcMIBR) 255.255.255.0
set BS(1.pcMAC) 00:00:00:00:00:00
set BS(1.ceCap) 2
set BS(1.ulcMax) 16
set BS(1.plcMax) 16
set BS(1.CS_selectFlag) 0
set BS(1.PHS_selectFlag) 0
set BS(1.ARQ_selectFlag) 0
# Base-2 Parameters
#####
set BS(2.BoardIP) 192.168.0.21
set BS(2.Freq) 2365000
  
```

5.2 Upgrading the BS SW and FPGA Versions


The BS SW and FPGA versions can be updated and downloaded to the BS via the RCMS Settings tab, SW Download area:



The screenshot shows a window titled "SW Download" with the following fields and controls:

- Tftp Server IP Address:
- File to burn on the flash: ...
- Item to burn:
 - software
 - fpga f0
 - fpga f1
 - fpga f2
-

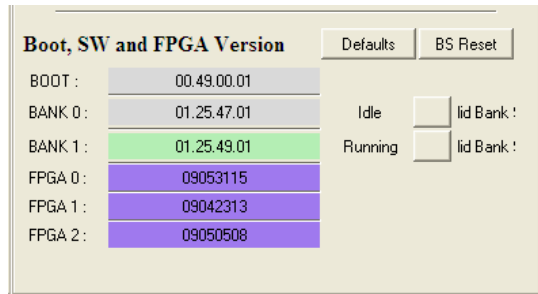
To perform SW or FPGA version upgrades

1. In the RCMS-BS window, click the **Settings** tab.
2. In the SW Download area, **TFTP Server IP Address**, enter the address of the FTP server from which the SW or FPGA version will be downloaded.
3. Under **File to burn on the flash**, click the Browse button  to browse for the directory where the SW or FPGA firmware version to be downloaded is located.
4. Under **Items to burn**, select the type of file to be downloaded: Software, FPGA F0/F1/F2.

Note: Each FPGA (F0, F1, F2) handles a different part of the BS PHY Layer firmware.

5. Click the **Burn** button to burn the specified item on the BS.

The RCMS System Status tab **SW and FPGA Version** area provides information on the currently running and stored FPGA and software versions, and allows switching between the versions.



- The bank storing the currently running version is marked as **Running**.
- The bank used for temporary storage is marked as **Idle**.

To switch between the running and stored versions

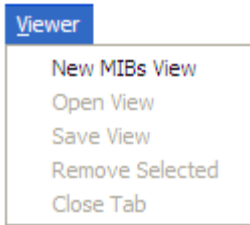
- Click the **Skip** button to switch between the banks.

Two additional operation buttons are provided:

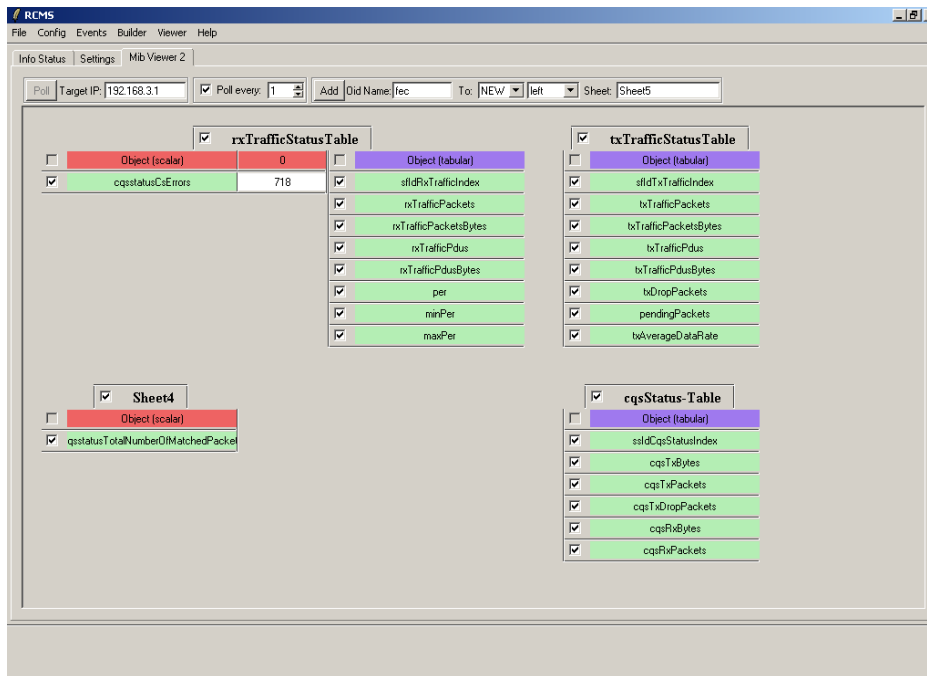
- **Defaults** – revert to default SW and FPGA versions.
- **BS Reset** – reboots the BS and loads the relevant BANK, according to user specifications.

5.3 Using the RCMS MIB Browser (RCMS Viewer Tab)

To display the **Viewer** tab, from the **Viewer** menu, select **New MIBS View**.



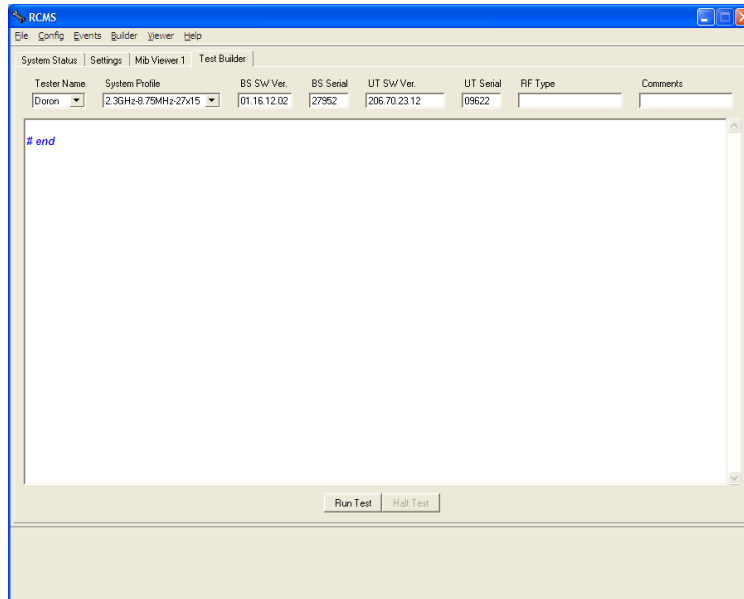
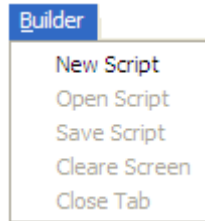
The **Viewer** tab enables you to view the base station parameters in the same way as they can be viewed in a standard MIB Browser, as shown below:



5.4 Additional Configuration Options

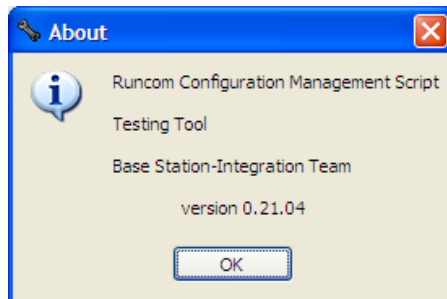
5.4.1 Builder

The Builder tab is used for building and running custom Tcl scripts.



5.4.2 Help

The Help tab provides information about the current RCMS Version:



6 Appendix A: Technical Specifications

The PicoPlus BS installation procedure involves the following accessories:

- RF Antennas
- GPS Antenna (Optional)
- Mounting kit

This section details the specifications for the PicoPlus BS and accessories.

6.1 PicoPlus BS Specifications

Radio

Number of sectors	Single sector unit
Frequency	2.3-2.7GHz, 3.3-3.8GHz (other frequencies are optional)
FFT	512, 1024, 2048
FEC	Convolution Code and Turbo Code
Channel bandwidth	3.5 MHz, 5 MHz, 7 MHz, 8.75 MHz, 10 MHz, optional 20 MHz
Duplex method	TDD, optional FDD/HFDD
Central frequency resolution	125 KHz
Maximum output power (without Antenna)	30 dBm per antenna
Antennas:	
Type	Integrated Sectorized 11dbi (120°) / 15dbi (90°) OR External dual slant antenna
Number	2 dual slant
Connectors	2x N-Type, 50 ohm, lightning protected
Modulation and coding rates	DL/UL: QPSK (1/2, 3/4) , 16 QAM (1/2, 3/4), 64 QAM (2/3 , 3/4, 5/6) (64 QAM is optional for UL)
Diversity Supported	MIMO A/B , STC, SISO
GPS	Integrated
Synchronization	Integrated GPS module with on board synchronization unit IEEE1588 and Backhauling self synchronization are optional
Management	
Network Management	SNMPv2/v3, standard and proprietary MIB
System Configuration	SNMP, FTP, CLI
Software Upgrade	Remote TFTP upgrade of firmware and programming

Interfaces

Network Interfaces	2x10/100 BaseT, Optional 1xGE and optical interface SX/LX
Northbound Interface	Profile C, R6 per SF GRE tunnel, Profile B is optional
Connectors	2xN-Type for external antenna 50 ohm, External synchronization option, external GPS antenna option, power connector, 2xRJ-45

Electrical Characteristics

Power Source	-36 to -72 VDC < 60Watt
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Physical and Environmental

Dimensions	39cm (L) x 24cm (W) x 12cm (H)
Weight	5000 grams / not including mounting kit
Operating external temperature	Industrial -40°C to 55° C
Operating humidity	95% non-condensing

Standards Compliance*

Safety	EN 60950-1, EN 60950-22
Environmental	IEC 60529-1, IP66
Radio	FCC Part 27 , Part 90; EN302 623 , EN302 544
EMC	FCC part 15, class B ; ETSI EN 301489-1

(*) Standardizations and FCC are preliminary

Mode	5Mhz channel	7Mhz channel	10Mhz channel
QPSK 1/2	3.7 Mbps	4 Mbps	7.5 Mbps
QPSK 3/4	5.4 Mbps	7 Mbps	11Mbps
16QAM 1/2	7.1 Mbps	9 Mbps	14 Mbps
16QAM 3/4	10 Mbps	12 Mbps	21 Mbps
64QAM 2/3	14 Mbps	16 Mbps	29 Mbps
64QAM 3/4	17 Mbps	19 Mbps	35 Mbps

(*) preliminary results

6.2 Dual-Slant RF Antennas Specifications

6.2.1 Dual-Slant Antenna (2.3-2.7 GHz; 17 dBi)

Dual-Slant Antenna (2.3-2.7 GHz; 17 dBi; 65° (MT-364040/ND))

Gain	16 dBi (min) @ 2.3 - 2.5 GHz 17.5±0.5 dBi @ 2.5 - 2.7 GHz
VSWR	1.5:1 (typ), 1.7 :1(max)
Azimuth Beamwidth @ 13.5dBi	65° (typ)
Elevation Beamwidth @ -3 dB	7° (typ)
Polarization	Dual Linear, ± 45°
Cross-polarization	-20 dB (max) @ 2.3 - 2.5 GHz -17 dB (max) @ 2.5 - 2.7 GHz
Side Lobes Level Azimuth and Elevation	Meets ETSI EN 302 326- V1.1.2 (2006-03)
Side Lobes Level for Azimuth in the range (± 100 to ± 180 from Boresight)	-20 dB (max) @ 2.3 - 2.5 GHz -25 dB (max) @ 2.5 - 2.7 GHz
Front-to-Back Ratio	-30 dB (max)
Port-to-Port Isolation	23 dB (min), 30 dB (typ)
Input Impedance	50 (ohm)
Input Power	20 W (CW), 250 W (peak)
Lightning Protection	DC grounded

6.2.2 Dual-Slant BTS Antenna (3.3-3.8 GHz; 17 dBi)

Dual-Slant BTS Antenna (3.3-3.8 GHz; 17 dBi; 65° (MT-404067/ND))

Electrical	
Gain	16 dBi (min) @ 3.3-3.4 GHz
	17.5 ±0.5 dBi @ 3.5-3.8 GHz
VSWR	1.5 : 1 (typ) 1.8:1 (max)
Azimuth Beamwidth @ 13.5dBi	65° (typ)
Elevation Beamwidth @ -3 dB	7.5° (typ)
Polarization	Dual Linear, ± 45°
Cross-polarization	ETSI EN 302 326 V.1.1.2 (2006-03)
Side Lobes Level Azimuth and Elevation	Meets ETSI EN 302 326- V1.1.2 (2006-03)
Side Lobes Level for Azimuth in the range (± 100 to ± 180 from Boresight)	-25dB (max) @ 3.3-3.5 GHz
	-30dB (max) @ 3.5-3.8 GHz
Front-to-Back Ratio	-30 dB (max)
EN 302 326 V.1.1.2 (2006-03)	
Port-to-Port Isolation	25 dB (min) @ 3.3-3.7 GHz
	20 dB (min) @ 3.7-3.8 GHz
Input Impedance	50 (ohm)
Input Power	20 W (CW), 250 W (peak)
Lightning Protection	DC grounded