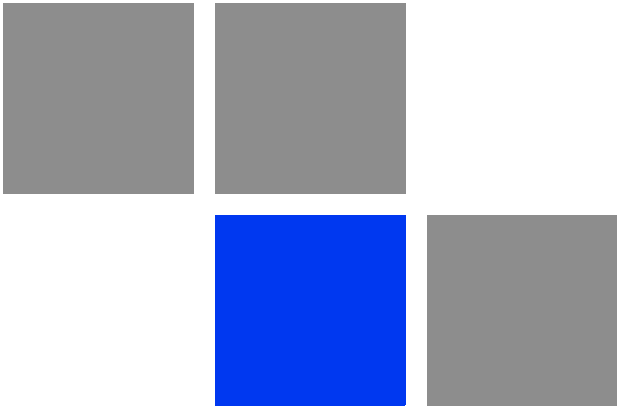




BreezeMAX Extreme®

PRELIMINARY

System Manual

Release
December 2008



Document History

Topic	Description	Date Issued
Preliminary Release for Early Field Trials	New System Manual	January 2009

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Radio Frequency Interference Statement

The Base Transceiver Station (BTS) equipment has been tested and found to comply with the limits for a class A digital device, pursuant to ETSI EN 301 489-1 rules and Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in commercial, business and industrial environments. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is

likely to cause harmful interference in which case the user will be required to correct the interference at the user's own expense.

FCC Radiation Hazard Warning

To comply with FCC RF exposure requirements in Section 1.1307 and 2.1091 of FCC Rules, the antenna used for this transmitter must be fixed-mounted on outdoor permanent structures with a separation distance of at least 2 meter from all persons.

R&TTE Compliance Statement

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

Safety Considerations - General

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

Grounding

BTS chassis, Power Feeders and Outdoor Units are required to be bonded to protective grounding using the bonding stud or screw provided with each unit.

Safety Considerations - DC Powered Equipment (BTS & Power Feeder)



CAUTION	ATTENTION
Risk of electric shock and energy hazard.Disconnecting one Power Interface Unit (PIU) disconnects only one PIU module. To isolate the BTS completely, disconnect both PIUs	Risque de décharge électrique et d'électrocution. La déconnexion d'un seul module d'alimentation (PIU) n'isole pas complètement la Station de Base. Pour cela, il faut impérativement débrancher les deux modules d'alimentation (PIU).

Restricted Access Area: The DC powered equipment should only be installed in a Restricted Access Area.

Installation Codes: The equipment must be installed according to the latest edition of the country national electrical codes. For North America, equipment must be installed in accordance with the US National Electrical Code and the Canadian Electrical Code.

Overcurrent Protection: A readily accessible Listed branch circuit overcurrent protective device, rated 60A for the BTS or 20A for the Power Feeder, must be incorporated in the building wiring.

CAUTION: This equipment is designed to permit connection between the earthed conductor of the DC supply circuit and the grounding conductor at the equipment. See installation instructions.

- The equipment must be connected directly to the DC Supply System grounding electrode conductor.
- All equipment in the immediate vicinity must be grounded in the same way, and not be grounded elsewhere.
- The DC supply system is to be local, i.e. within the same premises as the equipment.
- There shall be no disconnect device between the grounded circuit conductor of the DC source (return) and the point of connection of the grounding electrode conductor.

Lithium Battery

The battery on the NPU card is not intended for replacement.

Caution

To avoid electrical 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.

Outdoor Units and Antennas Installation and Grounding

Ensure that outdoor units, antennas and supporting structures are properly installed to eliminate any physical hazard to either people or property. Make sure that the installation of the outdoor unit, antenna and cables is performed in accordance with all relevant national and local building and safety codes. Even where grounding is not mandatory according to applicable regulation and national codes, it is highly recommended to ensure that the outdoor unit and the antenna mast (when using external antenna) are grounded and suitable lightning protection devices are used so as to provide protection against voltage surges and static charges. In any event, [Alvarion](#) [The Supplier](#) is not liable for any injury,

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Disposal of Electronic and Electrical Waste

Pursuant to the WEEE EU Directive electronic and electrical waste must not be disposed of with unsorted waste. Please contact your local recycling authority for disposal of this product.

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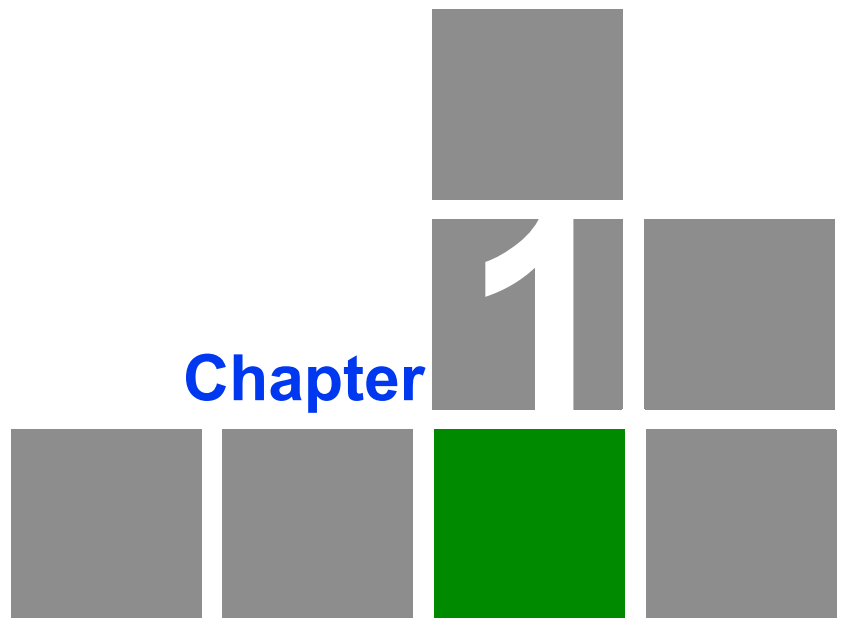
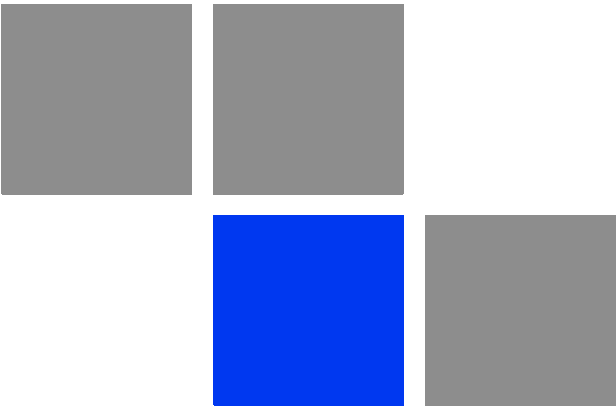
About This Manual

This manual describes the 4Motion solution, and details how to install, operate and manage the BTS system components.

This manual is intended for technicians responsible for installing, setting and operating the 4Motion BTS equipment, and for system administrators responsible for managing the system.

This manual contains the following chapters and appendices:

- **Chapter 1 - System description:** Describes the 4Motion BTS and its components.
- **Chapter 2 - Installation:** Describes how to install the BTS components.
- **Chapter 3 - Commissioning:** Describes how to configure basic parameters and validate units' operation.
- **Chapter 4 - Operation and Administration Using the CLI:** Describes how to use the Command Line Interface (CLI) for configuring parameters, checking system status and monitoring performance.
- **Appendix A - Antenna Configurations:** Describes the proposed antenna configurations that support the different available diversity scenarios.
- **Appendix B - Software Upgrade:** Describes how to load new software files using TFTP, and how to switch to a new software version in 4Motion units.
- **Glossary:** A listing of commonly used terms.



Chapter

System Description

In This Chapter:

- [“About WiMAX” on page 3](#)
- [“System Overview” on page 4](#)
- [“The Base Transceiver Station \(BTS\)” on page 19](#)
- [“Element Management Systems” on page 21](#)
- [“Specifications” on page 23](#)

1.1 About WiMAX

Emanating from the broadband world and using all-IP architecture, mobile WiMAX is the leading technology for implementing personal broadband services. With huge market potential and affordable deployment costs, mobile WiMAX is on the verge of a major breakthrough. No other technology offers a full set of chargeable and differentiated voice, data, and premium video services in a variety of wireless fashions - fixed, portable and mobile - that increase revenue and reduce subscriber churn.

WiMAX technology is the solution for many types of high-bandwidth applications at the same time across long distances and will enable service carriers to converge the all-IP-based network for triple-play services data, voice, and video.

WiMAX with its QoS support, longer reach, and high data capacity is positioned for fixed broadband access applications in rural areas, particularly when distance is too large for DSL and cable, as well as in urban/suburban areas of developing countries. Among applications for residential are high speed Internet, Voice Over IP telephony and streaming video/online gaming with additional applications for enterprise such as Video conferencing, Video surveillance and secured Virtual Private Network (with need for high security). WiMAX technology allows covering applications with media content requesting more bandwidth.

WiMAX allows portable and mobile access applications, with incorporation in notebook computers and PDAs, allowing for urban areas and cities to become “metro zones” for portable and mobile outdoor broadband wireless access. As such WiMAX is the natural complement to 3G networks by offering higher bandwidth and to Wi-Fi networks by offering broadband connectivity in larger areas.

The WiMAX Forum is an organization of leading operators and communications component and equipment companies. The WiMAX Forum’s charter is to promote and certify the compatibility and interoperability of broadband wireless access equipment that conforms to the Institute for Electrical and Electronics Engineers (IEEE) 802.16 and ETSI HiperMAN standards. The ultimate goal of the WiMAX Forum is to accelerate the introduction of cost-effective broadband wireless access services into the marketplace. Standards-based, interoperable solutions enable economies of scale that, in turn, drive price and performance levels unachievable by proprietary approaches, making WiMAX Forum Certified products.

1.2 System Overview

The BreezeMAX Extreme product is a high-capacity WiMAX communication system for Fixed and Mobile applications. It is compatible with the IEEE802.16e standard, and provides high performance and an advanced feature set.

The BreezeMAX Extreme is a full outdoor solution with maximum flexibility (frequency, TX power, power feeding, interface, GPS, antenna, diversity, self backhauling, embedded/centralized ASN-GW, WiFi AP, Alvaristar NMS support).

The system operates in the following frequencies: 3.4-3.6GHz, and 5.4-5.95GHz.

Three main types of the product are available: 22dBm radio (unlicensed frequencies) and 30/37dBm radio (licensed)

The BreezeMAX Extreme product family provides wireless access solutions for the following deployment scenarios:

- Low cost Point to Multi Point wireless access mass deployments in emerging markets for licensed and license exempt solutions to provide dual play services (Primary VoIP and Data).
- Vertical markets solutions for video surveillance, security and municipalities markets using Alvarion's licensed and un-licensed product portfolio.
- Business wireless access solutions for dual or triple play high quality services (Primary VoIP, Data, and Video).

BreezeMAX Extreme has the flexibility to provide coverage for all of Alvarion's existing frequencies for PtMP fixed and mobile solutions while also offering flexibility to support future frequencies. The product is a low cost, small, lightweight solution with many installation options.

The following figure describes the end-to-end WiMAX network:

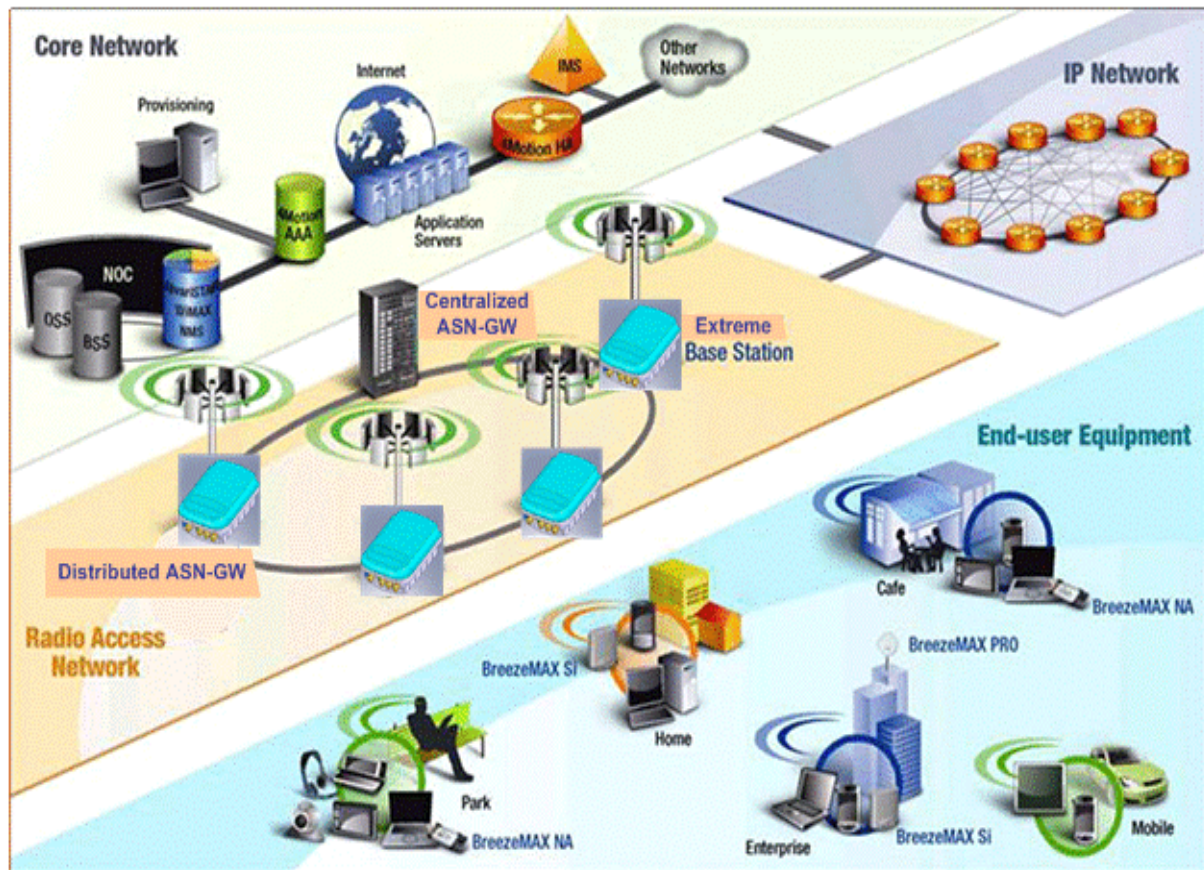


Figure 1-1: BreezeMAX Extreme Architecture

1.2.1 Main Features

The following features are supported by BreezeMAX Extreme:

- Wireless

The BreezeMAX Extreme product uses full duplex TDD (Time Domain Duplex) PTMP (Point-to-Multipoint) wireless access technique. TDD DL/UL ratios are configurable.

To prevent inter sector interference it is recommended to use the same TDD DL/UL ratio for the neighbor sectors.

- Capacity and Distance Enhancement

The BreezeMAX Extreme supports the following Capacity and Distance Enhancement methods:

- » MIMO Matrix B in DL direction
- » MRC (Maximum Receive Combine) beam forming algorithm in UL direction
- » Automatic rate adaptation to provide the optimal air link capacity in UL and DL direction for each user.
- » Open and close loop power control to prevent weak CPEs of neighbor sector from being interfered.

■ Enhanced Scheduler Functionality.

The BreezeMAX Extreme provides the optimal service using a Scheduler to allow the best performance, throughput and quality service. The Scheduler offers the following capabilities configured separately for UL and DL directions:

- » Configurable MIR and CIR
- » Three traffic strict priority levels: 0,1,2
- » COS supported are BE and nRT: BE uses only one priority: 0; nRT uses 2 priorities: 1,2
- » BE non-starvation is provided by a minimum internal CIR of 14Kbps
- » Lated packets drop mechanism
- » BE drop latency is 300ms
- » nRT drop latency is 200ms and 100ms considering selected priority levels 1 or 2 respectively.
- » Unsolicited Polling mechanism for nRT based on half of latency time.

■ Mobility is based on fast network entry mechanism.

- CPE Variety:

- » Sequans based CPE used for 5.xGHz solutions. Applicable CPEs include:
 - ◇ 10/100B-T Data only all outdoor CPE (CPE-Pro-S)
 - ◇ CPE-Pro-S with IDU-DV to support Data and SIP based VoIP services (up to 2POTS) .
- » Rosedale-2 based CPE used for 3.xGHz solutions. Applicable CPEs include:
 - ◇ 10/100B-T Data only all outdoor CPE (CPE-Pro-S)
 - ◇ 10/100B-T Data only all Si indoor CPE
 - ◇ CPE-Pro-S with IDU-DV to support Data and SIP based VoIP services (up to 2POTS) .
 - ◇ Si CPE with SRU to support Data and SIP based VoIP services (up to 2POTS).
- » NG (Network Gateway) to support WiFi and multiple data ports (up to 4 10/100B-T)

1.2.2 Services

The BreezeMAX Extreme provides:

- IP CS services
- DHCP transparent mode
- Service based configured Multicast and Broadcast connections
- Service based configurable internal relaying
- Service interfaces (VLAN, R6 interface using GRE only in BS mode, IPinIP only centralized ASN GW mode)
- DCSP and IEEE-802.1P marking methods and IEEE.802.1Q VLAN tagging method
- Full Bridge mode
- Downlink IP antispoofing

- Classifiers: discrete or range of DSCP values, or any classifier that defines all DSCP value range (0-63)
- Users Authentication by AAA Radiator for 5.xGHz and Alepo for 3.xGHz products
- Authentication protocol: MS Chap. V2 EAP TTLS over RFC-2865
- User Authentication by fully qualified Domain Name and Password and Calling station ID (CPE MAC)
- Service Authorization for users over RFC-2865 using vendor specific (Filter ID 11 attributes) to point to global Service Profile name and Multiple Service Flow name.
- Service accounting by RFC-2866.
- Applicable services per CPE:
 - » Data and CPE Management
 - » Data, VoIP and CPE Management
 - » Two Data services and CPE Management
- End to end VLAN service.

The following table describes the features as per system configuration:



Table 1-1: BreezeMAX Extreme Features per Configuration

Feature	Unlicenced	Licenced
Low power (22 dBm)	✓	
Medium power (30 dBm)		✓
High power (37 dBm)		✓
ASN-GW centralized		✓
ASN-GW embedded	✓	✓
IP-CS	✓	✓
End to end VLAN service	✓	✓

Table 1-1: BreezeMAX Extreme Features per Configuration

Feature	Unlicensed	Licensed
DFS	✓	
Diversity (STC/MIMO)	✓	✓
GPS	✓	✓
Frequency support	5.4- 5.95Gh	3.4-3.6 Gh
Indoor CPE support (MRC, OFDMA) switching antenna		✓
Channel spacing	5, 10 MHz	5, 10 MHz

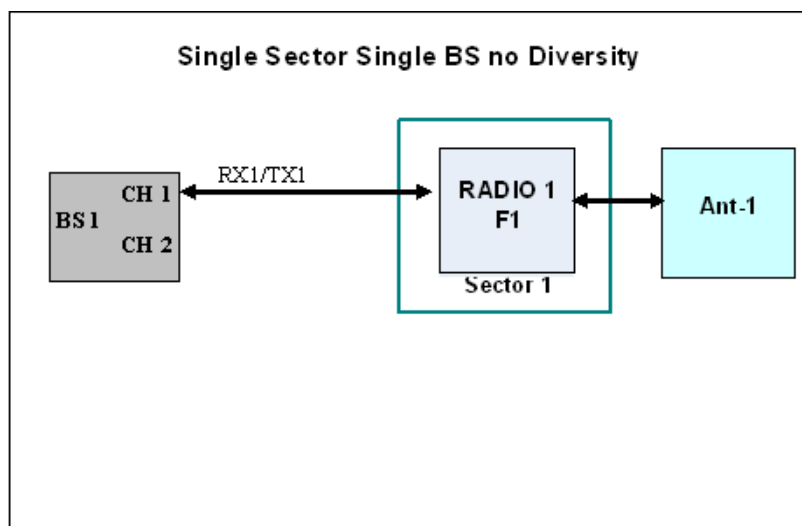
1.2.3 System Configurations

The BTS includes up to two 16E WiMax SoC with two radio channels connectable to 2 internal radio heads.

The different models can provide the following operation modes:

1.2.3.1 Single Sector Single BS with Diversity (for 5.x and 3.xGHz)

This system operation mode can be applicable in licensed and unlicensed frequency bands providing up to 10MHz BWs per sector.

**Figure 1-2: Single Sector Single BS with Diversity**

1.2.3.2 Single Sector Single BS without Diversity (for 5.x only)

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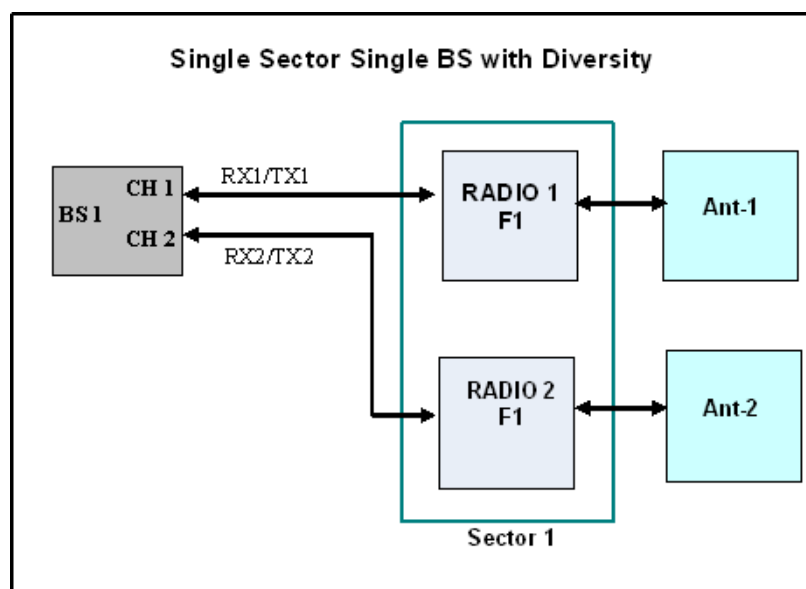


Figure 1-5: Single Sector Single BS without Diversity

1.2.4 System Components

The BreezeMAX Extreme family consists of the following elements:

- BTS with one 16e WiMAX SoCs (Sequans based System on Chip) with one or two radio heads using integrated or external antenna
- Internal GPS module for air link frames synchronization with hold-over mechanism (in case GPS connection is lost or has not reached satellite synchronization).
- Optional localized (distributed) access service network gateway (ASN-GW)
- Optional centralized, fully integrated ASN-GW, which may be offered as a part of an end-to-end solution that includes third-party partners' equipment
- Variety of indoor and outdoor power supplies feeding the BTS and self backhauling CPE.
- AAA server for central authentication, authorization and accounting services.

- Outdoor and indoor CPE versions supporting VoIP, Data, Switching, Bridging, tagging and marking functionality.
- AlvariSTAR central management system allowing multiple elements management for Radio and Services configuration and performance monitoring.
- AlvariCRAFT element management system allowing a single element management for BTS installation.
- Embedded Telnet Monitor allowing single element management for basic installation.
- StarACS – Automatic Configuration Server for CPEs management and monitoring.

1.2.5 WiMAX Network Reference Model

Figure 1-4 and Figure 1-5 show the basic mobile WiMAX network architecture, with a single ASN-GW and with multiple ASN-GWs, as defined by the WiMAX Forum NWG.

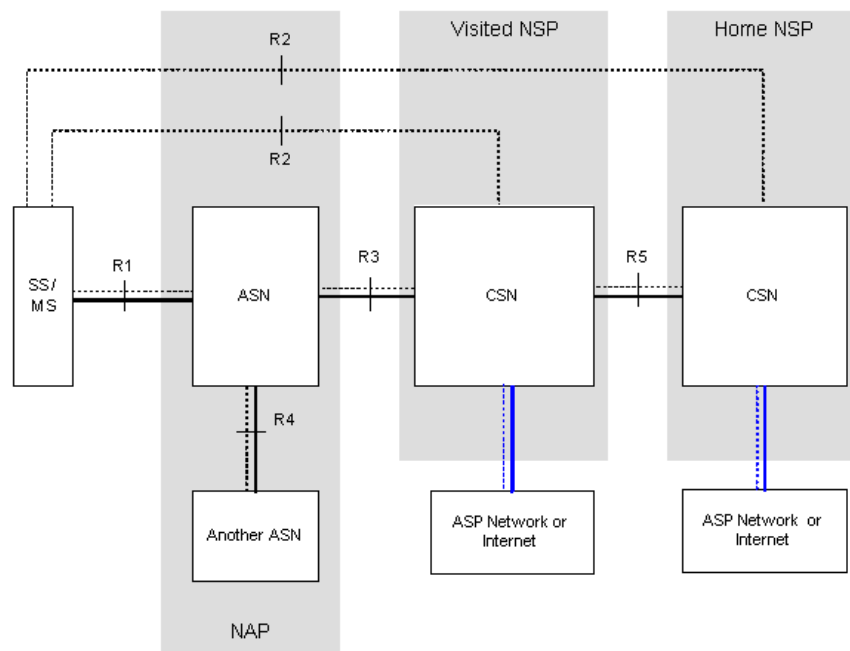


Figure 1-4: Mobile WiMAX Network Reference Model

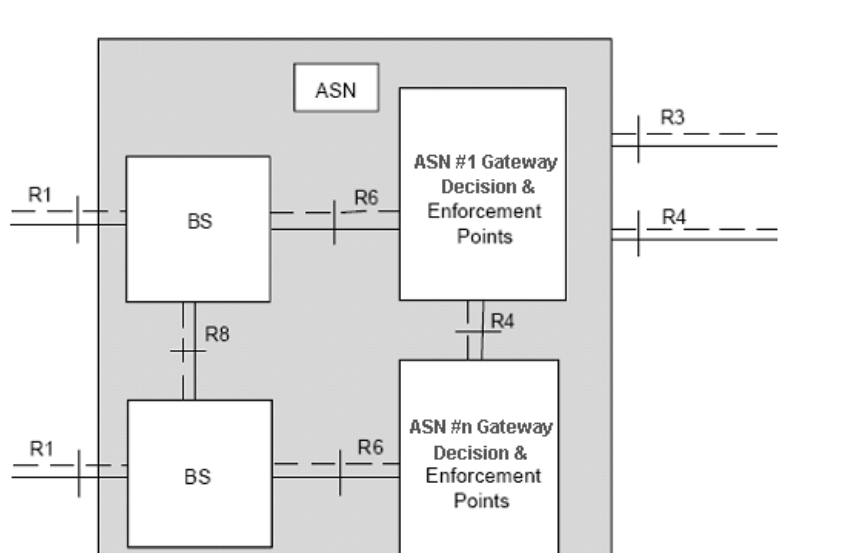


Figure 1-5: ASN Reference Model containing Multiple ASN-GWs

The various components and entities involved in the networking architecture are described in the next sections.

1.2.5.1 Access Service Network (ASN)

An ASN is defined as a complete set of network functions needed to provide radio access to a WiMAX subscriber. The ASN provides the following mandatory functions:

- WiMAX Layer-2 (L2) connectivity with WiMAX mobile station (MS)
- Transfer of AAA messages to the WiMAX subscriber's home network service provider (H-NSP) for authentication, authorization and session accounting for subscriber sessions
- Network discovery and selection of the WiMAX subscriber's preferred NSP
- Relay functionality for establishing Layer-3 (L3) connectivity with a WiMAX MS (i.e. IP address allocation)
- Radio resource management
- ASN-CSN tunneling

An ASN comprises network elements such as one or more base transceiver stations and one or more ASN gateways. An ASN may be shared by more than one connectivity service network (CSN).

1.2.5.2 Connectivity Service Network (CSN)

A CSN is defined as a set of network functions that provide IP connectivity services to WiMAX subscribers. A CSN may offer the following functions:

- MS IP address and endpoint parameter allocation for user sessions
- Internet access
- AAA proxy or server
- Policy and admission control based on user subscription profiles
- ASN-CSN tunneling support
- WiMAX subscriber billing and inter-operator settlement

- WiMAX services such as location-based services, connectivity for peer-to-peer services, provisioning, authorization and/or connectivity to IP multimedia services, and facilities to support lawful intercept services such as those compliant with Communications Assistance Law Enforcement Act (CALEA) procedures

A CSN is comprised of network elements such as routers, proxy/servers, user databases, and inter-working gateway devices.

1.2.5.3 Network Access Provider (NAP)

An NAP is a business entity that provides WiMAX radio access infrastructure to one or more WiMAX network service providers (NSPs). A NAP implements this infrastructure using one or more ASNs.

1.2.5.4 Network Service Provider (NSP)

An NSP is a business entity that provides IP connectivity and WiMAX services to WiMAX subscribers compliant with the established service level agreement. The NSP concept is an extension of the Internet service provider (ISP) concept, providing network services beyond Internet access. To provide these services, an NSP establishes contractual agreements with one or more NAPs. An NSP may also establish roaming agreements with other NSPs and contractual agreements with third-party application providers (e.g. ASP, ISP) for the delivery of WiMAX services to subscribers. From a WiMAX subscriber standpoint, an NSP may be classified as a home or visited NSP.

1.2.5.5 Base Station (BS)

check accuracy The WiMAX BS is an entity that implements the WiMAX MAC and PHY in compliance with the IEEE 802.16e standard. A BS operates on one frequency assignment, and incorporates scheduler functions for uplink and downlink resources.

The basic functionality of the BS includes:

- IEEE 802.16e OFDMA PHY/MAC entity
- R6 and R8 functionality according to NWG definitions
- Extensible Authentication Protocol (EAP) relay
- Control message authentication
- User traffic authentication and encryption

- Handover management
- QoS service flow management entity

1.2.5.6 ASN Gateway (ASN-GW)

check accuracy The ASN-GW is a network entity that acts as a gateway between the ASN and CSN. The ASN functions hosted in an ASN-GW may be viewed as consisting of two groups - the decision point (DP) and enforcement point (EP). The EP provides bearer plane functions, and the DP provides non-bearer plane functions.

The basic DP functionality of the ASN-GW includes:

- Implementation of EAP Authenticator and AAA client
- Termination of RADIUS protocol against the selected CSN AAA server (home or visited AAA server) for MS authentication and per-MS policy profile retrieval
- Storage of the MS policy profile
- Generation of authentication key material
- QoS service flow authorization entity
- AAA accounting client

The basic EP functionality of the ASN-GW includes:

- Classification of downlink data into generic routing encapsulation (GRE) tunnels
- Packet header suppression functionality
- DHCP functionality
- Handover functionality

The WIMAX Forum NWG has adopted two different approaches for ASN architecture - centralized and distributed: In the centralized approach there is at least one central ASN-GW, and the BTS NPU operates in transparent mode, as shown in [Figure 1-6](#).

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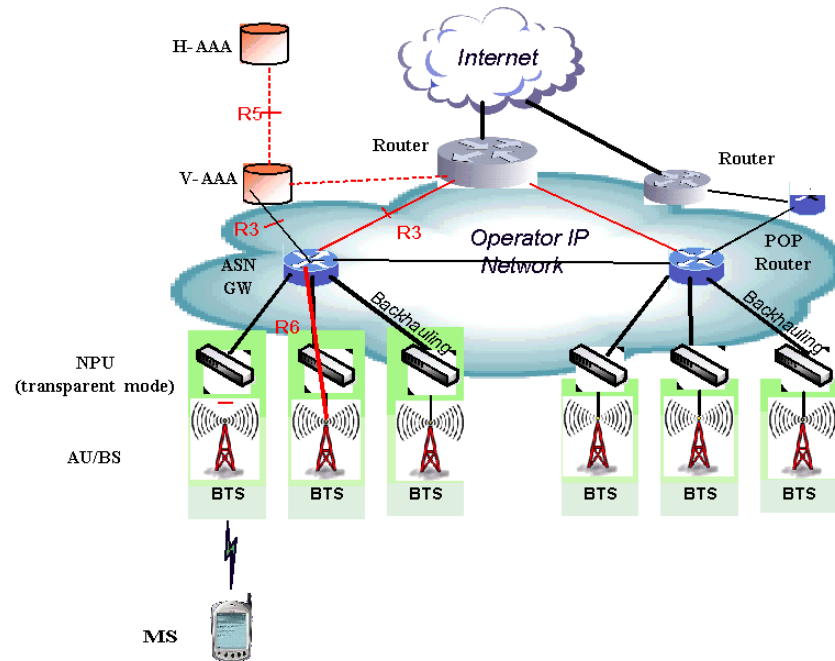


Figure 1-6: Centralized Network Reference Model

In the distributed approach, the BTS NPU operates in ASN-GW mode, as shown in Figure 1-7.

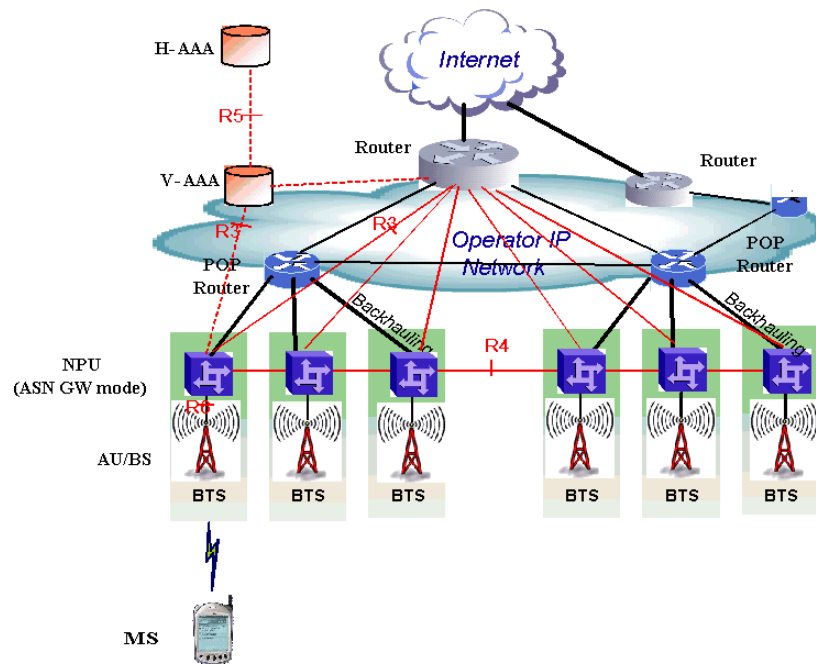


Figure 1-7: Distributed Network Reference Model

Alvarion believes in providing operators with the flexibility to select the mobile WiMAX network topology that best suits their needs and existing network architecture. Therefore, BreezeMAX Extreme is designed to support both distributed and centralized topology approaches according to WiMAX Forum NWG profile C.

1.2.5.7 Reference Points

- **Reference point R1** consists of the protocols and procedures between the MS and ASN as per the air-interface (PHY and MAC) specifications (IEEE 802.16e).
- **Reference point R2** consists of protocols and procedures between the MS and CSN associated with authentication, services authorization and IP host configuration management. This reference point is logical in that it does not reflect a direct protocol interface between the MS and CSN. The authentication part of reference point R2 runs between the MS and CSN operated by the home NSP, however, the ASN and CSN operated by the visited NSP may partially process the aforementioned procedures and mechanisms. Reference point R2 might support IP host configuration management running between the MS and CSN (operated by either the home NSP or visited NSP).
- **Reference point R3** consists of the set of control plane protocols between the ASN and CSN to support AAA, policy enforcement and mobility management

capabilities. It also encompasses the bearer plane methods (e.g. tunneling) to transfer user data between the ASN and CSN.

- **Reference point R4** consists of the set of control and bearer plane protocols originating/terminating in various functional entities of an ASN that coordinate MS mobility between ASNs and ASN-GWs. R4 is the only interoperable reference point between similar or heterogeneous ASNs. R4 is supported only when Centralized ASN GW is deployed.
- **Reference point R5** consists of the set of control plane and bearer plane protocols for internetworking between the CSN operated by the home NSP and that operated by a visited NSP. R5 is supported only when Centralized ASN GW is deployed.
- **Reference point R6** consists of the set of control and bearer plane protocols for communication between the BS and ASN-GW. The bearer plane consists of an intra-ASN data path between the BS and ASN gateway. The control plane includes protocols for data path establishment, modification and release control in accordance with the MS mobility events. R6 is supported only when Centralized ASN GW is deployed.
- **Reference point R8** consists of the set of control plane message flows and optional bearer plane data flows between the base stations to ensure a fast and seamless handover. The bearer plane consists of protocols that allow data transfer between base stations involved in the handover of a certain MS. R8 is supported only when Centralized ASN GW is deployed.

NOTE



All reference points are logical and do not necessarily imply a physical or even direct connection. For instance, the R4 reference point between ASN-GWs might be implemented across the NAP internal transport IP network, in which case R4 traffic might traverse several routers from the source to the destination ASN-GW.

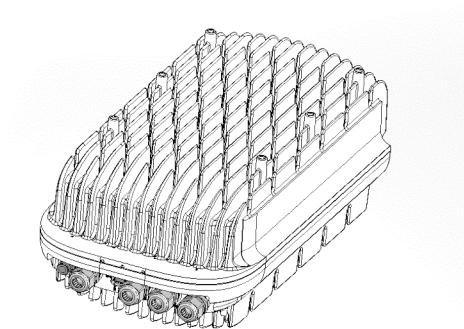
1.3 The Base Transceiver Station (BTS)

The BTS includes up to two 16E WiMax SoC with two radio channels connectable to two internal radio heads.

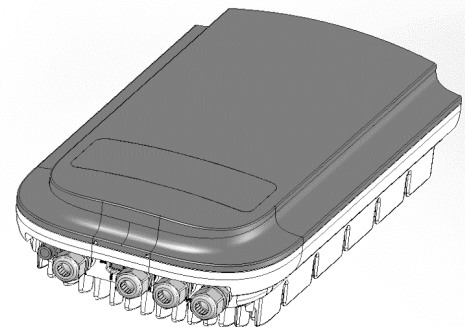
The different models of the unit can provide the following operational modes:

- 1 Single WiMax SoC using 2nd Order Diversity - This system operation mode can be applicable in licensed and unlicensed frequency bands providing up to 10MHz BWs per sector.
- 2 Dual WiMax SoC using 2nd Order Diversity - This system operation mode can be applicable in licensed and unlicensed frequency bands providing up to 20MHz BWs per sector.

The BTS housing depends on power consumption figures; The following figures show the BTS cases of the high power and low/medium power BTSs.



High Power (HP) BTS



Low Power/Normal Power
(LP/NP) BTS

Figure 1-8: BTS Housing

1.3.1 Antenna

In the BreezeMAX Extreme architecture, the antenna is approached as an independent element. This provides the operator with the flexibility to select the antennas source according to its supplier policy. To ensure the availability of antennas that complement the BreezeMAX Extreme solution, Alvarion works closely with several antenna suppliers to ensure availability of antennas that comply with its requirements.

In cases where the operator prefers other antenna vendors, Alvarion can provide a recommended antenna specification based on the required antennas types.

For more information on recommended antenna configurations and required antennas refer to [“Antenna Configurations” on page 835](#).

Table 1-2: BTS Antennas

Product	Description
BS ANT 65/3.X DP	Antenna 3.3-3.8GHz, 65° sector Dual polarization, Terminating Connector: N female
BS ANT 90/3.X DP	Antenna 3.3-3.8GHz, 90° sector Dual polarization, Terminating Connector: N female
BS ANT 60V/3.3-3.8	Antenna 3.3-3.8 GHz, 60° sector vertical polarity, Terminating Connector: N female, Total gain 16.5 dBi.
BS ANT 90V/3.3-3.8	Antenna 3.3-3.8 GHz, 90° sector vertical polarity, Terminating Connector: N female, Total gain 15 dBi. .
Omni ANT 3.4-3.6	Omni antenna 3.4-3.6 Ghz, Terminating connector: N female, Total gain: 10 dBi.

1.3.2 GPS

GPS is used to synchronize the air link frames of Intra-site and Inter-site located Base Transceiver Stations to ensure that in all Base Stations the air frame will start at the same time, and that all Base Stations will switch from transmit (downlink) to receive (uplink) at the same time. This synchronization is necessary to prevent Intra-site and Inter-site interference and Base stations saturation (assuming that all Base Stations are operating with the same frame size and with the same DL/UL ratio).

In order for the system to be synchronized, the GPS have to first acquire at least 4 satellites. After that the GPS reception can be reduced to 1 satellite. If no satellite is received the BTS will go to holdover state where internal clock is provided to synchronize the BTS.

1.4 Element Management Systems

The end-to-end IP-based architecture of the system enables full management of all components, using standard management tools. An SNMP agent in the NPU implements proprietary MIBs for remote setting of operational modes and parameters of the Base Transceiver Station equipment. Security features incorporated in the equipment restrict the access for management purposes.

Alvarion offers the following management tool:

1.4.1 AlvariSTAR

AlvariSTAR is a comprehensive carrier-class Element Management System (EMS) for Alvarion's Broadband Wireless Access systems. AlvariSTAR is designed for today's most advanced Network Operation Centers (NOCs), providing the network Operation, Administration and Maintenance (OA&M) staff and managers with all the network surveillance, monitoring and configuration and service provisioning capabilities required to effectively manage the network while keeping the resources and expenses at a minimum.

AlvariSTAR offers the network's OA&M staff with a unified, scalable and distributable management system. Utilizing distributed client-server architecture, the user is provided with a robust, scalable and fully redundant management system in which all single points of failure can be avoided.

AlvariSTAR provides the following management functionality:

- Device Discovery
- Device Inventory
- Topology
- Fault Management
- Configuration Management
- Service Management
- Data Collection
- Performance Monitoring

- Device embedded software upgrade
- Security Management
- Northbound interface to other Network Management Systems.

1.4.2 AlvariCRAFT

AlvariCRAFT is an SNMP (Simple Network Management Protocol) application designed for on-line management of BreezeMAX system components. This utility simplifies the installation and maintenance of small size installations by easily enabling the change of settings or firmware upgrade for one Base Station/Micro Base Station at a time, including the managed device's components and associated SUs.

AlvariCRAFT allows accessing a wide array of monitoring and configuration options, including:

- Device Manager for the selected Base Station, including it's NPU, AUs and SUs
- Selected unit configuration modification
- Local Service Profiles verification and modification
- Local Service Provisioning
- Firmware upgrade for the NPU, AUs and SUs
- On-line performance data monitoring
- Export of configuration details to a CSV file
- Support for Telnet cut-through to the Base Station and http cut-through to Gateways behind connected SUs.

1.5 Specifications

1.5.1 Radio

Table 1-3: Applicable Bands

Band		Frequency Range (MHz)	Frequency Default (MHz)	Frequency Resolution	License
2.x	2.3	WCS: 2305÷2320, 2345÷2360	2310	250KHz	Licensed
		ROW: 2300÷2400	2305	250KHz	Licensed
	2.5	2496÷2690	2505	250KHz	Licensed
3.x	3.3	3300÷3400	3305	250KHz	Licensed
	3.5	3400÷3600	3405	250KHz	Licensed
	3.6	3600÷3800	3605	125KHz	Licensed
5.x ^a	4.9	4900÷5470			
	5.4	5470÷5725	5475	2.5MHz	Unlicensed
	5.8	5725÷5850			

- a. 5.x Frequency resolution depends on applicable bandwidth: 5MHz for 10 and 20MHz bandwidths and 2.5MHz for 5MHz. The table defines maximal frequency resolution figures

1.5.1.1 3.xGHz Radio Performance

Table 1-4: 3.xGHz Radio - General Performance Specifications

Parameter	Value
Frequency Range First Priority (30dBm &36dBm)	3400MHz-3600MHz
Frequency Range Second Priority (30dBm &36dBm)	3300MHz-3400MHz
Frequency Range Third Priority (30dBm &36dBm)	3600MHz-3800MHz
Frequency Resolution	125KHz
BW	5MHz and 10MHz
Power Consumption 30dBm With 70% Duty Cycle	20W
Power Consumption 36dBm With 70% Duty Cycle	60W
Operating Temperature Range	-40 to +65
Antennas	V, Dual Slant (60°, 90°, 120°) and Omni

Table 1-4: 3.xGHz Radio - General Performance Specifications

Parameter	Value
Tx Diversity methods	2 nd order CDD, STC, MIMO Matrix B
Rx Diversity methods	2 nd order MRC

Table 1-5: 3.xGHz Radio - Receiver Performance Specifications

Parameter	Min.	Typ.	Max.	Units
Noise Figure		4.5	5.5	dB
Input P1dB Out Of Band	-20		-	dBm
Input P1dB In Band	-40		-	dBm
SNR at 60MHz for -70dBm Input BW 5MHz	31	32		dB
SNR at 60MHz for -70dBm Input BW 10MHz	28	29		dB
DSB Integrated Phase Noise	35	37	-	dBc
Image Rejection for IF 520MHz	70	80	-	dBc
In Band Ripple		3	4	dBp-p
Power Consumption			2.5	W
Antenna Port Return Loss	-10	-12	-	dB

Table 1-6: 3.xGHz Radio - Transmitter Performance Specifications

Parameter	Min.	Typ.	Max.	Units
Output Power Range For Min SNR 32DB for 36dBm Product	30		36	dBm
Output Power Accuracy (1dB Step)			+/-1	dB
Output Power Range For Min SNR 32DB for 30dBm Product	24		30	dBm
Output Power Accuracy (1dB Step)			+/-1	dB
In Band Ripple		3	4	dBp-p
DSB Integrated Phase Noise	35	37	-	dBc
Antenna Port Return Loss	-10	-12	-	dB
Noise Floor & Spurious for 1MHz RBW			-50	dBm
Power Consumption 100% Duty Cycle			80	W

Table 1-7: 3.xGHz Radio - Best Effort Performance Specifications

Parameter	Min.	Typ.	Max.	Units
Max Output Power		36		dBm

1.5.1.2 5.xGHz Radio Performance

Table 1-8: 5.xGHz Radio - General Performance Specifications

Parameter	Value
Frequency Range (2 Bands)	5470 MHz-5900 MHz
BW	5 MHz and 10 MHz
Frequency Resolution	2.5 MHz for BW=5 MHz 5MHz for BW=10 MHz
Power Consumption With 70% Duty Cycle	8W
Operating Temperature Range	-40 to +65
Antennas	V, Dual Slant (60°, 90°, 120°) and Omni
Tx Diversity methods	2 nd order CDD, STC, MIMO Matrix B
Rx Diversity methods	2 nd order MRC

Table 1-9: 5.xGHz Radio - Receiver Performance Specifications

Parameter	Min.	Typ.	Max.	Units
Noise Figure		4.5	5.5	dB
Input P1dB Out Of Band	-20		-	dBm
Input P1dB In Band	-40		-	dBm
SNR at 60MHz for -70dBm Input BW 10MHz	28	29		dB
SNR at 60MHz for -70dBm Input BW 20MHz	25	26		dB
DSB Integrated Phase Noise	35	37	-	dBc
Image Rejection for IF 810MHz	70	80	-	dBc
In Band Ripple		3	4	dBp-p
Power Consumption			2.5	W
Antenna Port Return Loss	-10	-12	-	dB

Table 1-10: 5.xGHz Radio - Transmitter Performance Specifications

Parameter	Min.	Typ.	Max.	Units
Output Power Range For Min SNR 32DB all Frequency Band	0		22	dBm
Output PowerAccuracy 11dbm - 22dbm (1dB Step)			+/-1	dB
Output PowerAccuracy 0dbm - 10dbm (1dB Step)			+/-2.5	dB
In Band Ripple		3	4	dBp-p

Table 1-10: 5.xGHz Radio - Transmitter Performance Specifications

DSB Integrated Phase Noise	35	37	-	dBc
Antenna Port Return Loss	-10	-12	-	dB
Noise Floor and spurious) for 1MHz RBW			-40	dBm
Power Consumption 100% Duty Cycle			10	W

Table 1-11: 5.xGHz Radio - Best Effort Performance Specifications

Parameter	Min.	Typ.	Max.	Units
BW Support		5,10, 20		MHz

1.5.2 Sensitivity

Table 1-12: Sensitivity, AWGN @ PER=1%

Modulation and Coding Rate	Sensitivity (dBm), 5 MHz Bandwidth	Sensitivity (dBm), 10 MHz Bandwidth
QPSK 1/2 Repetition 6	-106	-103
QPSK 3/4	-96	-93
16QAM 1/2	-94	-91
16QAM 3/4	-90	-84
64QAM5/6		-80

1.5.3 Data Communication (Ethernet Interfaces)

Table 1-13: Data Communication (Ethernet Interfaces)

Item	Description
Standard Compliance	IEEE 802.3 CSMA/CD, 803.3U
Ports	100BASE-TX 10BASE-T
Data Port Speed	10/100 Mbps, Full Duplex with Auto Negotiation

1.5.4 Configuration and Management

Table 1-14: Configuration and Management

Item	Description
In Band (IB) Management via Data Port	■ SNMP ■ Telnet
SNMP Agents	SNMP ver 2 client MIB II (RFC 1213), Private MIBs on
Software Upgrade	Using TFTP
Configuration Upload/Download	Using TFTP

1.5.5 Standards Compliance

Table 1-15: Standards Compliance, General

Type	Standard
EMC	■ CE - EU EMC Directive EN 301 489 -1/4 ■ FCC - US EMC test according to FCC part 15 Subpart B (Emissions test)
Safety	■ UL/CUL UL60950-1/22, CSA60950-1/22 (for US & Canada) ■ CB IEC-60950-1/22 ■ CE EN60950-1/22 ■ AS/NZS AS/NZS 3260 (Australia / New Zealand) – optional
Environmental	ETSI 300 019: ■ ETSI 300 019-2-4 for outdoor ■ ETSI 300 019-2-3 for indoor
Radio	■ EN 302 502 ■ EN 302 326 ■ ETSI EN 301 893 ■ FCC p.15.407, p.15.247, p.27
Lightning	■ ITU-T - K.21 Resistibility of Telecommunication Equipment Installed in Customer Premises to over voltages and over currents. ■ EN-61000-4-5 Lightning protection over the antenna.
Other	■ IEEE 802.3-Std 2000 Edition- Part 3: Carrier Sense multiple access with collision detection (CSMA/CD) access method & physical layer specifications ■ IEEE 802.16e-2005 ■ IEEE 802.16-2004

1.5.6 Environmental

The outdoor equipment in operation complies with ETSI 300 019-2-4 Class T4.1E requirements.

Table 1-16: Outdoor Equipment Environmental Specification

Item	Description
Low Operating Temperature	-40°C (IEC-68-2-1) cold start is required.
High Operating Temperature	+60°C (IEC-68-2-2).
Temperature change	0.5°C / minute between -40°C to +60°C (IEC-68-2-14).
Humidity	5 to 95% none condensation. (IEC-60068-2-56).
Rain	(ETSI 300 019-2-4), IP-67
Random Vibration	according to ETSI 300 019-2-4 V2.2.2 (2003) T4.1E.
Shock	according to ETSI 300 019-2-4 V2.2.2 (2003) T4.1E
Salt Fog	IEC68-2-11Ka
Solar Radiation	(IEC-68-2-5), MIL-STD-810D.
Wind speed survival	220Km/hr (CS3)
Wind speed operational	160Km/hr. (CS3) for operating stability.
Ice loading	(CS-3) 25mm radial ice density 7kN/m3

The indoor equipment in operation complies with ETSI 300 019-2-3 Class 3.2 requirements.

Table 1-17: Indoor Equipment Environmental Specification

Item	Description
Low Operating Temperature	-5°C (IEC-68-2-1)
High Operating Temperature	45°C (IEC-68-2-2)
Temperature change	-5 ÷ 45°C (IEC-68-2-14).
Humidity	(IEC-68-2-56).
Random Vibration	(IEC 68-2-64).
Shock	(IEC-68-2-27).

1.5.7 Electrical

The BS models can use different Radios providing different output Tx power described in the following table:

Table 1-18: BTS Tx Power Levels

Level	Applicable Bands (GHz)	Range (dBm)	Resolution (dB)	Default (dBm)
Low	5.x	0 – 22	1	22
	2.x	23 – 32	1	32
	3.x	20 – 30	1	30
High	2.x	27 – 37	1	37
High	3.x	27 – 37	1	37

■ Voltage input:

- » Power may be supplied by PoE or DC power source
- » 36V ÷ 60VDC, nominally 48/55VDC recommended nominal value is 55VDC.

■ Current consumption

The following is assumed for BM Extreme elements power consumption:

- » Digital board power consumption including GPS: 30W
- » 22dBm RF channel power consumption: 13W 100% Tx
- » 30dBm RF channel power consumption: 30W 100% Tx
- » 37dBm RF channel power consumption: 85W 100% Tx
- » Power supply efficiency: minimum 85%
- » Power up peak: 5A peak current for input capacitors charging
- » Peak current duration: 250µs.

Table 1-19: Power Requirements without Cable Loss

	Unlicensed BM Extreme 22dBm		Standard Power BM Extreme 30dBm		High Power BM Extreme 37dBm	
	1 channel	2 channels	1 channel	2 channels	1 channel	2 channels
Digital	26W	26W	26W	26W	26W	26W
Radio with PS efficiency	15.5W	31W	33W	66W	94W	188W
Total	41.5W	57W	59W	92W	120W	214W
With powerful CPU	N/A	N/A	69W	102W	130W	224W
With Wi-Fi AP	N/A	N/A	N/A	N/A	N/A	N/A
With Self backhauling	70W	85W	95W	130W	160W	250W

The minimal power supply voltage is limited by backhaul minimal input power. The following table defines power supply minimal output voltage and Extreme BTS maximal consumption. All the mentioned cables are 16-gauge shielded.

Table 1-20: Required Power Supply for 16 Gauge Power Cables

BST type	Wires	90m Cable	70m Cable	50m Cable	30m Cable
High Power	4	51V / 287W	51V / 277W	48V / 271W	48V / 262W
Standard Power	2	51V / 150W	50V / 145W	48V / 141W	48V / 136W
	4	48V / 140W	48V / 138W	48V / 135W	48V / 133W
Low Power	2	48V / 95W	48V / 92W	48V / 90W	48V / 88W
	4	48V / 90W	48V / 89W	48V / 88W	48V / 87W

The minimal power supply output voltage is 51V.

Table 1-21: Required Power Supply for 24 Gauge PoE without Self-backhauling

BST type	Wires	90m Cable	70m Cable	50m Cable	30m Cable
Low Power SISO(42W)	4	54V / 49W	54V / 47W	54V / 45W	54V / 44W
Low Power MIMO(57W)	4	N/A	54V / 66W	54V / 63W	54V / 60W

The minimal power supply output voltage for PoE is 54V.

■ Protection:

The protection mechanism meets ETSI EN 300 132-2 requirements. No damage is caused to the equipment under the following conditions:

- » Overvoltage: input disconnection when voltage is higher than 60VDC in steady state.
- » Undervoltage: input disconnection when voltage is lower than 36VDC in steady state.
- » Inverse voltage polarity: input disconnection on inverse input voltage polarity.

Output short circuit when BTS feeding self-backhaul element: output disconnection on the circuit short.

Transmit power levels at antenna connector as function of Chanel bandwidth and antenna type (BreezeMAX Extreme 5.4 Base station, 5470 MHz – 5725 MHz

Table 1-22:

Antenna type	RF chains/CH BW	Transmitted power (dbm)
Sector, 17dbi	1RF chain /5MHz	7.7
Sector, 17dbi	2RF chains/5MHz	4.7
Sector, 17dbi	1RF chain /10MHz	10.7
Sector, 17dbi	2RF chains/10MHz	7.7
Internal, 15.5dbi	1RF chain /5MHz	8.5
Internal, 15.5dbi	2RF chains/5MHz	8.5
Internal, 15.5dbi	1RF chain /10MHz	11.5
Internal, 15.5dbi	2RF chains/10MHz	11.5
Omni, 8dbi	1RF chain /5MHz	16.7
Omni, 8dbi	2RF chains/5MHz	13.7
Omni, 8dbi	1RF chain /10MHz	19.7
Omni, 8dbi	2RF chains/10MHz	16.7

1.5.8 Dimensions and Weights

The BTS weight and dimensions depend on the unit configuration:

■ Low Power and Normal/Medium Power unit:

- » Weight: 10.7kg
- » Dimensions: 510x280x147mm (HxWxD)

■ High Power unit:

- » Weight: 17.5kg
- » Dimensions: 511x280x216mm (HxWxD)

1.5.9 Antennas

Table 1-23: Base Station External Antennas

Item	Description
BS ANT 65/3.X DS	3.3-3.8GHz, 65° sector Dual Slant, Terminating Connector: N female, 16.5 dBi
BS ANT 90/3.X DS	3.3-3.8GHz, 90° sector Dual Slant, Terminating Connector: N female, 15.5 dBi
BS ANT 60V/3.3-3.8	3.3-3.8 GHz, 60° sector vertical polarity, Terminating Connector: N female, Total gain 16.5 dBi.
BS ANT 90V/3.3-3.8	3.3-3.8 GHz, 90° sector vertical polarity, Terminating Connector: N female, Total gain 15 dBi. .
Omni ANT 3.4-3.6	Omni antenna 3.4-3.6 Ghz, Terminating connector: N female, Total gain: 10 dBi.
AN 1353	Sector antenna, 5.15-5.875 GHz, gain 17 dBi
AN 1299	Omni-antenna, 5.15-5.875 GHz, gain 8 dBi

Table 1-24: Antenna Specifications

Parameter	Antenna AN1426-01	Antenna AN1427-01	Antenna AN1428-01	Antenna AN1429-01	Notes
RF frequency	4.9-5.9 GHz	4.9-5.9 GHz	4.9-5.9 GHz	3.3-3.8 GHz	
VSWR	1.7:1				Maximum

Table 1-24: Antenna Specifications (Continued)

Parameter	Antenna AN1426-01	Antenna AN1427-01	Antenna AN1428-01	Antenna AN1429-01	Notes
Number of RF ports	1	2	2	2	
Gain per beam	15dBi	15.5 dBi	15 dBi	13 dBi	Minimum value
Polarization	Vertical	Dual slant	Dual slant	Dual slant	
Azimuth beam width	90°	65°	90°	90°	
3 dB Elevation beam width	8°	8°	8°	13°	Typical value for 350mm height. If the mechanical enclosure allows more space, 7° is preferable
Port to Port isolation	N/A	-25 dB min.	-25 dB min.	-25 dB min.	
Elevation side lobe level	-17dB max				
Cross polarization	> 15 dB for dual slant antennas > 20 dB for vertical antennas				
Front to back ratio (Include the range of 180°±80° in the azimuth cut)	25dB				
Electrical Down tilt	Fixed 0° tilt				
Mechanical Down tilt	Part of radio enclosure				
Input impedance	50 ohm				
Input power rms, per port	20W				
Input power peak, per port	250W				
Input impedance	50 ohm				
Lightning protection	DC grounded				

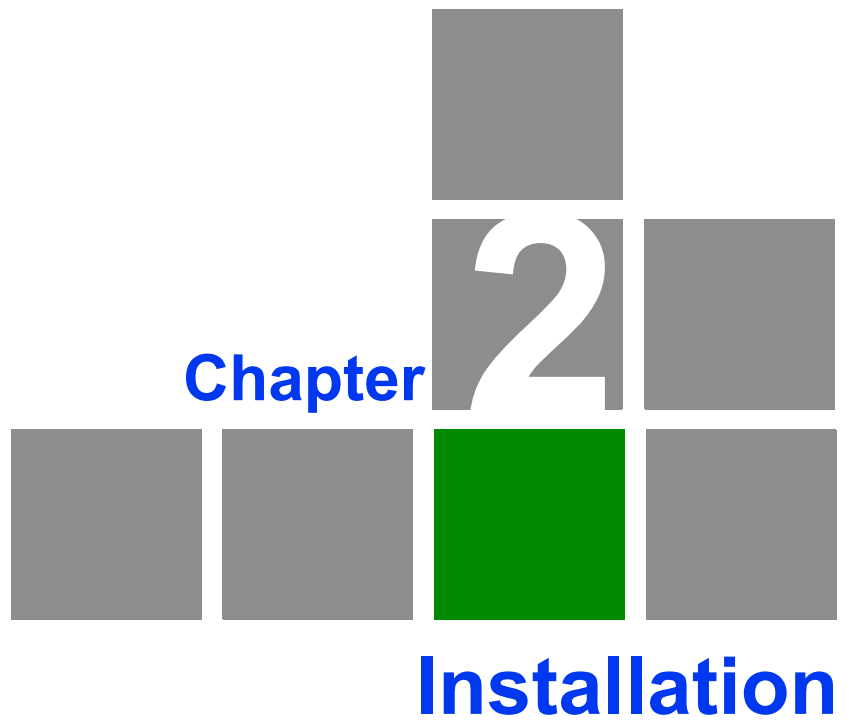
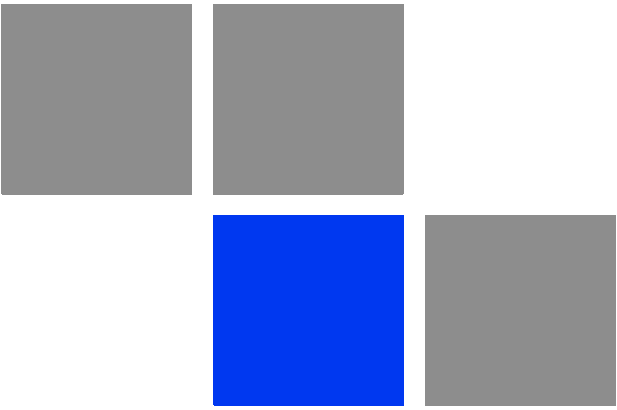
1.5.10 GPS

Table 1-25: GPS Specifications

Item	Description
Receiver Architecture	At least 8 Parallel channels to be able to receive 8 simultaneous satellites. Band: L1 1575.42 MHz Code: C/A
Antenna	Polarization: Right hand circular Antenna type: Active micro strip patch antenna Antenna Radome: Molded UV protected conical plastic Radome. Antenna housing: Aluminum bottom housing Azimuth: 360° Elevation Coverage: 0° to 90° Lightning protection: DC Grounded
Acquisition time	Hot (with current almanac, position, time, and ephemeris): 15sec typ. Warm (with current almanac, position, and time): 40 sec typ. Cold : 60 sec typ.
Position accuracy	Less than 20m
Timing accuracy	< 50ns for 1PPS. < 20ns in position hold mode.
Data message	Latitude, Longitude, height, velocity, heading, UTC and GPS time, GPS sync quality indicator, Num of Satellites in use etc. by using NMEA and TSIP protocols.
1PPS interface	RS-485
Control channel	Asynchronous Serial 9600bps RS-422 (RX, TX, 1 start bit, 8 Data bits and 1 stop bit).
Power requirements	3.3 VDC (2.7VDC - 3.3VDC), Power Consumption < 150mW
Environmental Directives	Outdoor equipment in operation compatible with ETSI 300 019-2-4 Class T4.1E directives.
Operating temperature	-40 to +60°C
Storage temperature	-40 to +70°C
Humidity	Up to 95% non condensing
Rain	IEC 68-2-18 method 2.2

Table 1-25: GPS Specifications

Item	Description
Solar Radiation	UV light protected Radome in accordance with UL-94-HB and normal operation required under direct solar radiation in the operating temperature mentioned above.
Random Vibration	IEC 68-2-64
Shock	IEC-68-2-29
Salt and Fog	IEC-68-2-11
Wind	160Km/h operating, 220Km/h survival
ESD	EN61000-4-2
Emission	FCC Part 15, class B. CE (Radiated & Conducted Emission) EN55022 Class B
Radiated Immunity	EN61000-4-3
EFT	EN61000-4-4
Surges for Lightning protection	ITU-T K.21
Conducted Immunity	EN61000-4-6
EU EMC directives	EN 301 489 - 1/4
US EMC directives	FCC part 15 Subpart B
Safety	UL/CUL: UL60950 (for US) CE: EN 60950-1/22 (for EU) AS/NZS AS / NZS 3260 (Australia / New Zealand)



In This Chapter:

- [“Equipment and Accessories” on page 43](#)
- [“Installation Guidelines” on page 47](#)
- [“Mounting the BTS” on page 52](#)
- [“Connectors” on page 60](#)
- [Connecting the Cables](#)

2.1 Equipment and Accessories

- Antennas and cables
- All outdoor AC/DC
- GPS antenna

Table 2-1: Equipment and Accessories

Product	Description
Base Station - B-MAX Extreme	
XTRM-BS-1DIV-3.5-EXT-HP	BreezeMAX Extreme All outdoor base station, 36dBm transmit power, single sector 2x2, 2nd order diversity, MIMO, 3400-3600Mhz. Including mounting kit. Limited up to 50 subscribers.(upgrade option by SW license) External antennas should be ordered seperately.
XTRM-BS-1DIV-3.5-EXT-HP-20Mhz-opt	BreezeMAX Extreme All outdoor base station, 36dBm transmit power , single sector 2x2, 2nd order diversity, MIMO, 3400-3600Mhz. Including mounting kit. Limited up to 50 subscribers.(upgrade option by SW license) Optionaly can upgrade to 20Mhz channel BW by SW license.
XTRM-BS-1DIV-3.5-EXT-HP-20Mhz	BreezeMAX Extreme All outdoor base station, 36dBm transmit power , single sector 2x2, 2nd order diversity, MIMO, 3400-3600Mhz. Including mounting kit. Limited up to 50 subscribers.(upgrade option by SW license). Up to 20Mhz channel BW.

Table 2-1: Equipment and Accessories

Product	Description
XTRM-BS-1SIS-3.5-EXT-SP	BreezeMAX Extreme All outdoor base station, 30dBm transmit power , single sector 1x1 ,no diversity, 3400-3600Mhz Limited up to 50 subscribers (upgrade option by SW license). External antennas should be ordered seperately.
XTRM-BS-2SIS-3.5-EXT-SP	BreezeMAX Extreme All outdoor base station, 30dBm transmit power (standard power-SP), dual sector 1x1, no diversity, 3400-3600Mhz. Including mounting kit. Limited up to 50 subscribers.(upgrade option by SW license). External antennas should be ordered seperately.
XTRM-BS-1DIV-3.5-90DS-SP	BreezeMAX Extreme All outdoor base station, 30dBm transmit power (standard power-SP), Single sector 2x2, 2nd order diversity, MIMO, 3400-3600Mhz, integrated dual polarization 90° antenna. Including mounting kit. Limited up to 50 subscribers.(upgrade option by SW license).
XTRM-BS-1DIV-3.5-EXT-SP	BreezeMAX Extreme All outdoor base station, 30dBm transmit power (standard power-SP), Single sector 2x2, 2nd order diversity, MIMO, 3400-3600Mhz. Including mounting kit. Limited up to 50 subscribers.(upgrade option by SW license). External antennas should be ordered seperately.
SW License - optional	
Upgrade to 150 CPEs	SW license to upgarde Sector capaci y from 50 to 150 CPEs
Upgrade to 250 CPEs	SW license to upgarde Sector capaci y from 50 to 250 CPEs
Upgrade from 150 to 250 CPEs	SW license to upgarde Sector capaci y from 150 to 250 CPEs
Upgrade to 2x10Mhz channel BW	Increase channel BW to 2x10Mhz

Table 2-1: Equipment and Accessories

Product	Description
Internal ASN-GW license	SW license to activate internal distributed ASN-GW for up to 250 subscribers. The ASN-GW can serve subscribers only from the co located extreme sector.
GPS Equipment	
GPS Antenna kit- Normal	GPS antenna Kit including antenna, 3m cable, pole mount bracket and mounting band.
GPS antenna kit - bullet	GPS antenna Kit including Bullet antenna, 25m cable, pole mount bracket and mounting band and lightning protectors.
GPS chaining cable	chaining cable to chain GPS signal between 2 colocated Extreme base station
BST Antennas	
BS ANT 65/3.X DP	Antenna 3.3-3.8GHz, 65° sector Dual polarization, Terminating Connector: N female
BS ANT 90/3.X DP	Antenna 3.3-3.8GHz, 90° sector Dual polarization, Terminating Connector: N female
BS ANT 60V/3.3-3.8	Antenna 3.3-3.8 GHz, 60° sector vertical polarity, Terminating Connector: N female, Total gain 16.5 dBi.
BS ANT 90V/3.3-3.8	Antenna 3.3-3.8 GHz, 90° sector vertical polarity, Terminating Connector: N female, Total gain 15 dBi. .
Omni ANT 3.4-3.6	Omni antenna 3.4-3.6 Ghz, Terminating connector: N female, Total gain: 10 dBi.
Antenna cables	
OAC LMR-400-1-0.5	Outdoor unit to Antenna Cable, for use with BreezeACCESS models including outdoor units Length: 0.5m. Connectors: N male / N male 90 degree angle. Total loss @ 2.4 / 2.6 / 3.5 / 3.8 GHz: 1dB
OAC LMR-400-1-1	Outdoor unit to Antenna Cable, for use with BreezeACCESS models including outdoor units Length: 1m. Connectors: N male / N male 90 degree angle. Total loss @ 2.4 / 2.6 / 3.5 / 3.8 GHz: 1dB
OAC LMR-400-1-1.5	Outdoor unit to Antenna Cable, for use with BreezeMAX models including outdoor units Length: 1.5m. Connectors: N male / N male 90 degree angle. Total loss @ 2.4 / 2.6 / 3.5 / 3.8 GHz: 1dB
Cables	
CAT5 Ethernet cable for backhaul 30m	CAT5 cable for LAN backhauling connection, 30m

Table 2-1: Equipment and Accessories

Product	Description
CAT5 Ethernet cable for backhaul 90m	CAT5 cable for LAN backhauling connection,90m
DC power cable 30m for HP Extreme unit	power cable for connecting high power 36dBm Extreme unit (PN 935000)
DC power cable 90m for HP Extreme unit	power cable for connecting high power 36dBm Extreme unit (PN 935000)
DC power cable 30m for SP Extreme unit	power cable for connecting standard power 30dBm Extreme unit
DC power cable 90m for SP Extreme unit	power cable for connecting standard power 30dBm Extreme unit
Other accessories	
Mounting bands - 4 unit kit	Mounting bands for Extreme BTS to connect to poles larger than 4".
Power supply options	
AC/DC adapter SP	AC to DC convertor to connect Extreme standard power devices to AC power
AC/DC adapter HP	AC to DC convertor to connect Extreme high power devices to AC power
Ac power cord Eu	AC power cord 250v for Europe
Ac power cord US	AC power cord 125v for USA

2.1.1 Mounting kit



2.2 Installation Guidelines

The pole mounting is available for all configurations. The Unlicensed and NormalPower configurations support +2°/-10° tilting and 45° vertical plane rotation. High Power units support the rotation only.

2.2.1 Possible Locations

The BTS can be installed in the following locations:

- Normal mast (round)
- Streetlight mast (round or other shape, e.g hexagonal, quadrangular, etc.)
- Towe leg
- Water tower
- Building roof – without a mast or tower on the roof

The following sections detail each of the available installations.

2.2.1.1 Normal Mast Installation

Normal mast installation can include 1, 3, 4 or 6 sectors.

Single sector configuration can include self backhauling. For other installations, the backhauling will be provided by the operator.

- Single Sector Installation with backhauling includes the following connections:
 - » AC or DC 10m, 20m, 30m or 50m and 70m cables
 - » GPS antenna 3m cable
 - » Self backhauling 5m or 10m cable
 - » External antenna 0.5m cable
- Three and Four Sectors Installations:

Three and four sectors should be installed in single level and include the following connections:

» For Unlicensed BTS:

- ◇ PoE 10m, 20m, 30m or 50m cable for each sector.
- ◇ GPS antenna 3m cable – for master unit only.
- ◇ GPS chaining 3m cable between the sectors.
- ◇ External antenna 0.5m cable

» For Medium and High Power BTS:

- ◇ AC or DC 10m, 20m, 30m, 50m or 70m cable for each sector. Short cables (e.g. 3m or 5m) with splitter can be used. An additional cable linked to the lower parts of the mast can be used in this case.
- ◇ GPS antenna 3m cable – for master unit only.
- ◇ GPS chaining 3m cable between the sectors.
- ◇ External antenna 0.5m cable

■ Six-Sectors Installation

Six sectors should be installed in two levels with three sectors in each level. The connections are the same as used for 3 sectors except that 2 GPS antennas are required, one for each floor. Assuming that the installation distance between the levels cannot exceed 3m, the lower level cable should be 6m and the higher floor cable should be 3m.

2.2.1.2 Streetlight Mast Installation

Single sector with backhauling should be used with the following cables:

- AC or DC 10m cable
- GPS antenna 3m cable
- Self backhauling 5m cable
- External antenna 0.5m cable

2.2.1.3 Triple or Quadruple Towers and Water Tower Installations

This kind of installation can involve 1 sector, 3 sectors, 4 sectors or 6 sectors.

Single sector can include self backhauling. For other installations, the backhauling will be provided by the operator.

■ Single Sector Installation with backhauling includes the following connections:

- » AC or DC 10m, 20m, 30m or 50m cable
- » GPS antenna 3m cable
- » Self backhauling 10m cable
- » External antenna 0.5m cable

■ Three and Four-Sectors Installations

Three and four sectors should be installed in a single level and includes the following connections:

- » For Unlicensed BTS:
 - ◇ PoE 10m, 20m, 30m or 50m cable for each sector
 - ◇ GPS antenna 3m, 10m or 20m cable – for master unit only
 - ◇ GPS chaining 3m, 5m or 10m cable between the sectors
 - ◇ External antenna 0.5m cable
- » For Medium and High Power BTS:
 - ◇ AC or DC 10m, 20m, 30m or 50m cable for each sector. Short cables (e.g. 3m or 5m) with splitter can be used. An additional cable linked to lower parts of the mast can be used in this case.
 - ◇ GPS antenna 3m cable – for master unit only.
 - ◇ GPS chaining 3m, 5m or 10m cable between the sectors.
 - ◇ External antenna 0.5m cable

■ Six-Sectors Installation

Six sectors should be installed in 2 levels with 3 sectors in each floor. The connections are the same as used for 3 or 4 sectors except that 2 GPS antennas are required, one for each floor.

2.2.1.4 Building Roof Installation

The BTS can be installed on the building roof without mast or tower.

Building roof installations can include 1 sector, 3 sectors, 4 sectors or 6 sectors.

Single sector can include self backhauling. For other installations, the backhauling will be provided by the operator.

- Single Sector Installation with backhauling includes the following connections:

- » AC or DC 10m, 20m, 30m or 50m cable
- » GPS antenna 3m cable
- » Self backhauling 10m cable
- » External antenna 0.5m cable

- Multiple Sectors Installation:

Three, four or six sectors should be installed in single level and include the following connections:

- » For Unlicensed BTS:
 - ◇ PoE 10m, 20m, 30m or 50m cable for each sector.
 - ◇ GPS antenna 3m cable – for master unit only.
 - ◇ GPS chaining 3m, 5m, 10m or 20m cable between the sectors.
 - ◇ External antenna 0.5m cable.
- » For Medium and High Power BTS:
 - ◇ AC or DC 10m, 20m, 30m or 50m cable for each sector. Short cables (e.g. 3m or 5m) with splitter can be used. An additional cable linked to lower parts of the building can be used in this case.
 - ◇ GPS antenna 3m cable – for master unit only.

- ◇ GPS chaining 3m, 5m, 10m or 20m cable between the sectors.
- ◇ External antenna 0.5m cable.

2.3 Mounting the BTS

All installations involve the tilt extension.

Rotation enabled: $\pm 45^\circ$

Tilt enabled: $+2^\circ$ to -10°

2.3.1 Assembling the Tilt Extension on the BTS

- 1 Assemble the tilt extension bracket on the BTS and fasten its screws.

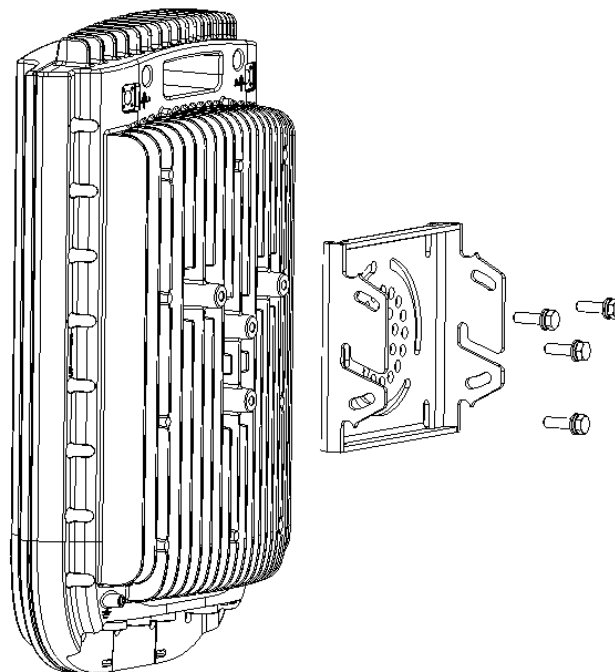


Figure 2-1: Assembling the Tilt Extension Bracket on BTS

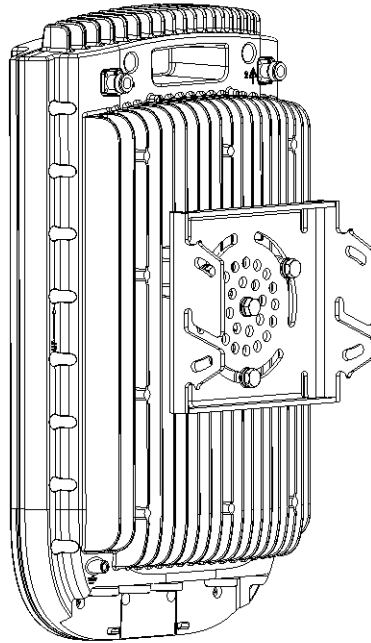


Figure 2-2: Tilt Extension Bracket Installed on BTS

2.3.2 Installing the BTS on a 2" - 4" Mast

Using a carriage with tilt extension and heavy duty metal clamps

- 1** Open the packaging and remove the BTS and screws.
- 2** Thread the four threaded rods through the carriage and the clamps.
- 3** Attach the carriage and the clamps to the mast and tighten on both sides using the supplied washers, spring washers and nuts.

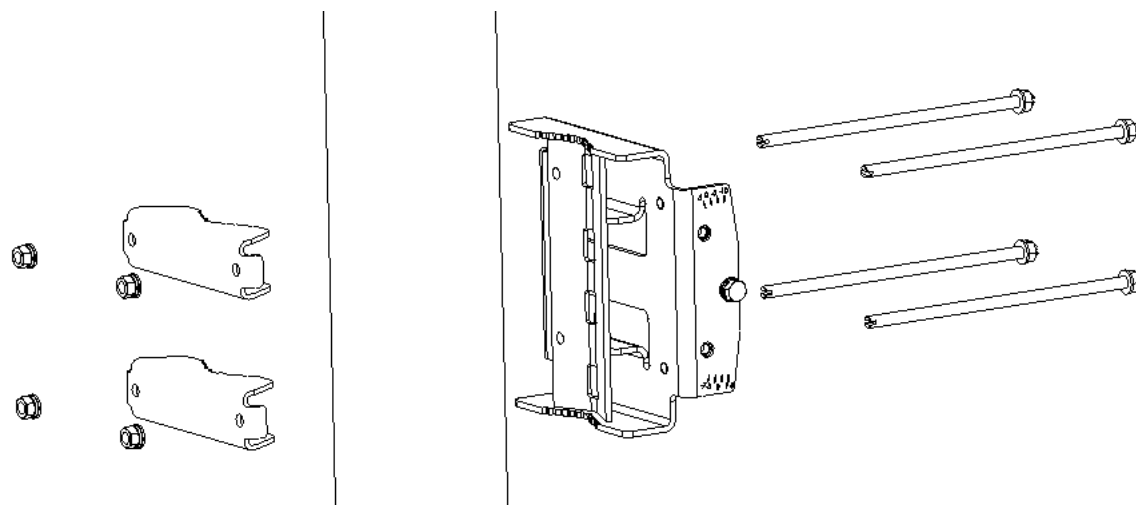


Figure 2-3: Assembling BTS Carriage and Clamps

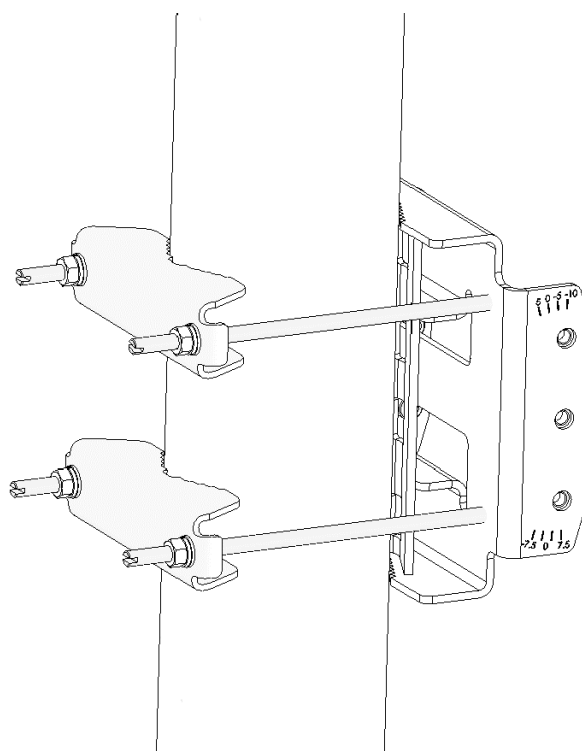


Figure 2-4: BTS Carriage and Clamps Installed

- 4 Thread screws through the middle-side holes of the carriage ([Figure 2-5](#)).

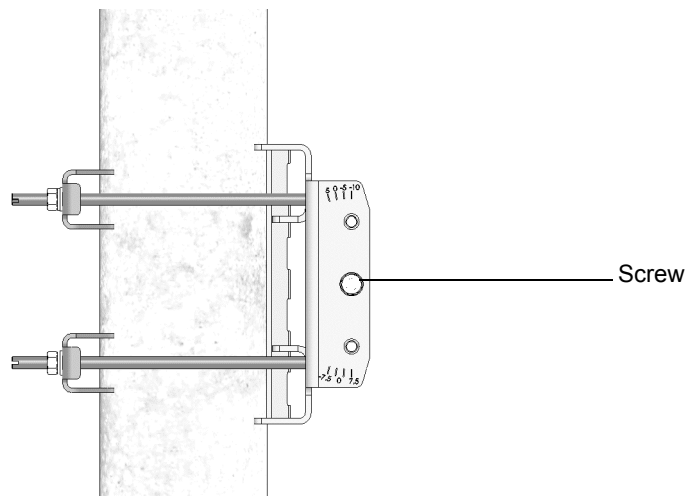


Figure 2-5: Installed Carriage - Side View

- 5 Hang the BTS with the tilt extension on the middle screw of the BTS carriage (see [“Assembling the Tilt Extension on the BTS” on page 52](#)).
- 6 Attach and fasten all the screws at both sides of the BTS carriage bracket.

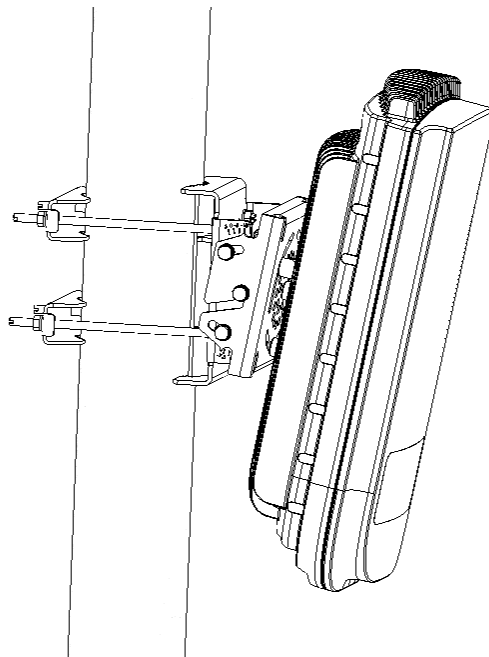


Figure 2-6: Mounting the BTS

- 7 If required, assemble the external antennas at the top of the BTS by screwing them in.

2.3.3 Installation the BTS on a 4" (or more) Mast

Using the tilt extension, and heavy duty metal bands.

- 1 Assemble the tilt extension on the BTS and fasten its three screws (see [“Assembling the Tilt Extension on the BTS” on page 52](#)).
- 2 Thread the metal strips through the BTS carriage (see [Figure 2-7](#)).
- 3 Attach the carriage to the pole and fasten the metal strips (see [Figure 2-7](#)).
- 4 Thread screws through the middle-side holes of the carriage (see [Figure 2-7](#)).

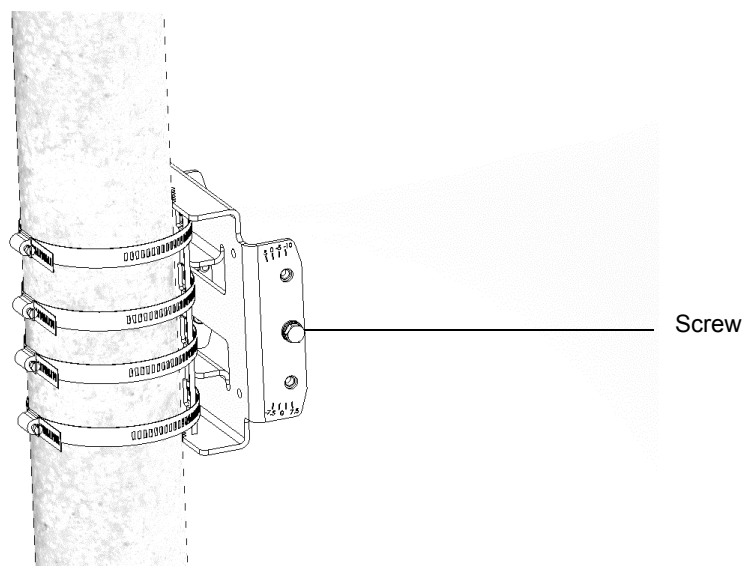


Figure 2-7: Installed Carriage - Side View

- 5 Hang the BTS with the tilt extension on the middle screw of the tilt bracket.
- 6 Attach and fasten all the screws at both sides of the tilt bracket (see [Figure 2-8](#)).
- 7 If required, assemble the external antennas at the top of the radio-head by screwing them in.

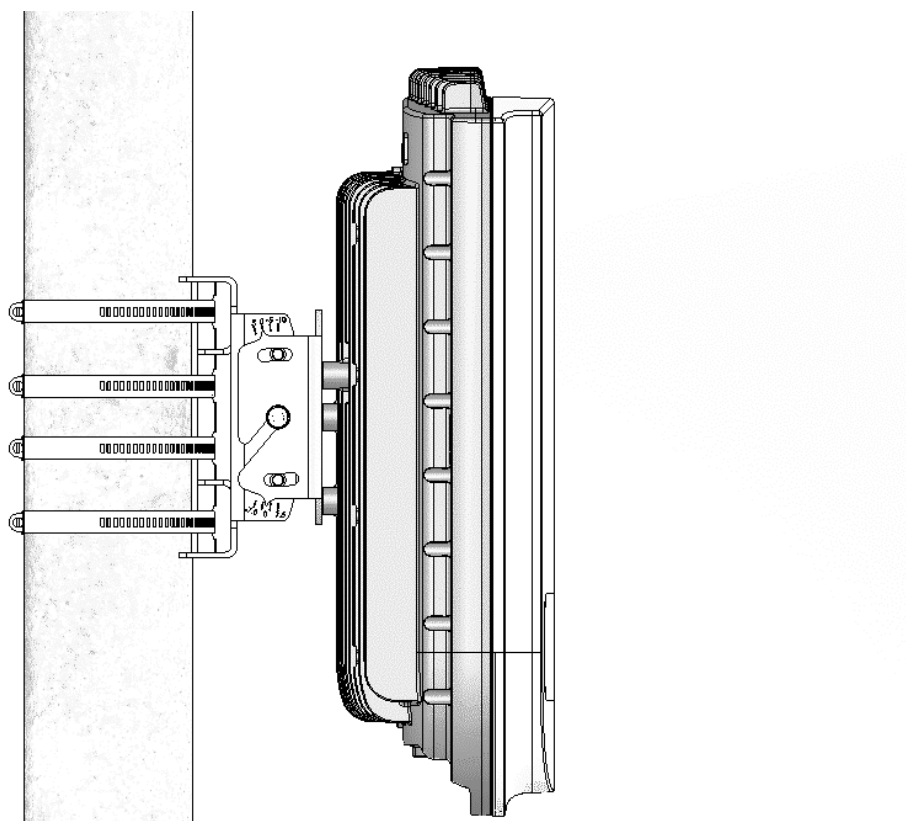


Figure 2-8: Unit Installed with Tilt Bracket

2.4 Installing GPS

The GPS is connected to the GPS/SYNC IN connector. Before connecting the cable, make sure that the length of the cable is sufficient to reach the BTS.

Mounting Kit:

Table 2-2: GPS Mounting Kits

Item	Description
GPS Antenna kit- Normal	■ Antenna ■ 3m cable ■ Pole mount bracket ■ Mounting band
GPS antenna kit - bullet	■ Bullet antenna ■ 25m cable ■ Pole mount bracket ■ Mounting band ■ Lightning protectors
GPS chaining cable	Cable to chain GPS signal between 2 colocated Extreme base stations



To install the GPS:

- 1 Place the bracket on a flat surface and thread the supplied pipe through the bracket hole and into the GPS antenna. Hand-tighten until snug. Do not over-tighten or use a tool. Make sure that the connector (male) is on the open side of the bracket.
- 2 Connect the interface cable to the antenna. hand-tighten the connector on the interface connector using the locking ring for securing the connection. Do not over-tighten to avoid stripping the connector.
- 3 Use the supplied clamps to assemble the GPS and bracket on a pole. Use the M8 nuts, washers, and spring washers to lock the clamps to the bracket. Apply torque 9 [N*m] (80 [lbs*in]).

2.5 Connectors

Fast release and RFI shielded connectors (with locking) are used in the system.

To protect the ODU connectors, the connectors are sealed for outdoor units. A sealed compartment can also be used.

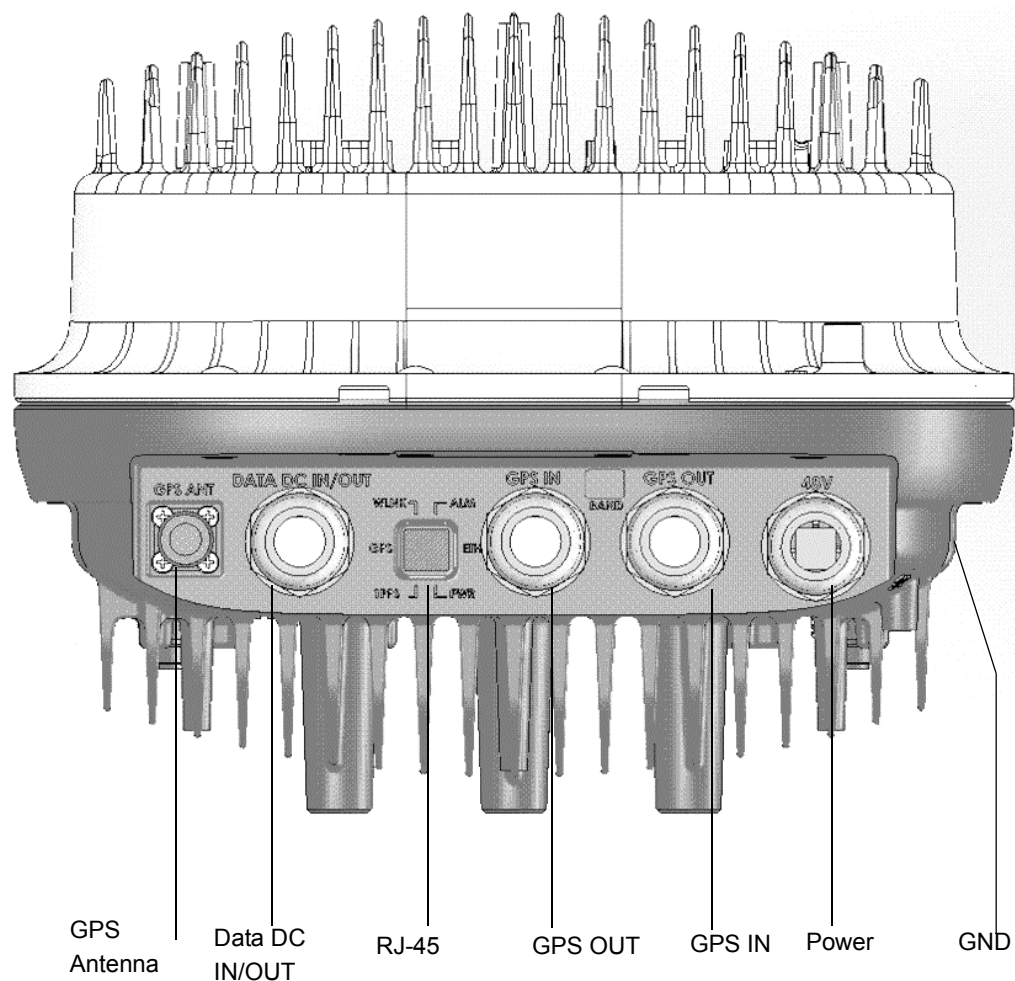


Figure 2-9: BTS Panel View

The following connectors are accessible from outside the enclosure:

Table 2-3: External Connectors

Connection	Type	N	Section
Data Port	RJ-45	1	Section 2.5.1.1

Table 2-3: External Connectors

Connection	Type	N	Section
External RF Antenna	N-type	2	Section 2.5.1.2
GPS Antenna	TNC	1	Section 2.5.1.3
GPS In	RJ-45	1	
GPS Out	RJ-45	1	
DC source	4-pin Mini Fit High Current Molex 39-29-1048	1	Section 2.5.1.4

2.5.1 External Connectors

2.5.1.1 Data Port

The Data port support the following features:

- » Standard RJ-45 Connector
- » IEEE 802.3 compliant 100BASE-TX and 10BASE-T ports
- » IEEE 803.3u Auto-Negotiation support for automatic speed and duplex selection

The ODU Data connector provides 10/100BASE-T connectivity according to [Table 2-4](#):

Table 2-4: ODU Data Connector (RJ-45) Pinout

Pin No.	Signal Name	Description	I/O Type
1	ETH_TXP	Ethernet Tx Data + (positive)	Output
2	ETH_TXN	Ethernet Tx Data – (negative)	Output
3	ETH_RXP	Ethernet Rx Data + (positive)	Input
4	+48/+55VDC	Positive Power from IDU/to Backhaul CPE	Input/Output
5	-48/-55VDC	Negative Power from IDU/to Backhaul CPE	Input/Output
6	ETH_RXN	Ethernet Rx Data – (negative)	Input
7	+48/+55VDC	Positive Power from IDU/to Backhaul CPE	Input/Output
8	-48V/-55VDC	Negative Power from IDU/to Backhaul CPE	Input/Output

NOTE

48V signals are of Output type when BTS ODU feeds backhaul CPE. In other configurations the signals type is Input.

2.5.1.2 External RF Antenna Connection

Two N-type connectors are used for external antenna connection. The connectors should have impedance 50Ω and be lightning protected.

2.5.1.3 GPS Connection

A TNC connector is used for GPS antenna connection.

GPS In and GPS Out Connectors: The neighbouring BTSs can be synchronized by single GPS source when chain connection is used . Two RJ-45 connectors are used for GPS synchronization: GPS-IN is an input from previous BTS and GPS out as an output to next BTS.

Table 2-5: GPS In / GPS Out Connectors Pinout

Pin No.	Signal Name	Description	I/O Type
1	TERM_P	Chain Termination + (positive)	Input
2	TERM_N	Chain Termination – (negative)	Input
3	10M_CLK_P	10MHz Clock + (positive)	Input/Output
4	GPS_MNG_P	GPS Management + (positive)	Input/Output
5	GPS_MNG_N	GPS Management – (negative)	Input/Output
6	10M_CLK_N	10MHz Clock – (negative)	Input/Output
7	1PPS_P	10MHz Clock + (positive)	Input/Output
8	1PPS_N	Negative Power Input from IDU	Input/Output

2.5.1.4 Power Connection

External DC power supply should be connected using 4-pin cable with the following pinout:

■ Pins 1 and 2: +DC

■ Pins 3 and 4: –DC

The power connector type is 4-pin Mini Fit High Current connector model Molex 39-29-1048.