

**Winetworks
WiN70xx-2
802.16e
Compact Base Station
Specification**

REV 3.02

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Table of Contents

1 Purpose and Scope of the Document	8
2 Abbreviations	9
3 Referenced Documents	12
4 General Description	13
4.1 Introduction.....	13
4.2 Product View	14
4.3 Mounting kit	16
4.4 Antenna Configurations.....	17
4.5 Main Features	18
4.6 cBST Feature List.....	19
4.7 Conformance to WiMAX Forum Requirements	26
4.8 Modes of operation	26
4.9 Block Diagram.....	27
5 Connectors/Interfaces	28
5.1 Introduction.....	28
5.2 Combo Connectors	29
5.3 WiMAX Antenna ports.....	30
5.4 GPS Antenna port (Optional)	30
5.5 Console port.....	31
5.6 Chassis Ground connection	31
6 Radio and PHY	32
6.1 Introduction.....	32
6.2 Common Radio & PHY Features	32
6.3 Radio Receiver Spec.....	33
6.4 Radio Transmitter Spec	36
6.5 Other PHY features.....	39
7 BaseBand / MAC	40
7.1 Introduction.....	40
7.2 Service Flows and QoS.....	40

7.3 Mobility	41
7.4 BST Synchronization.....	42
7.5 Capacity	43
7.6 Security	44
7.7 R6 Interface to the ASN-GW	45
8 Power	46
8.1 Introduction.....	46
8.2 Input Power.....	46
9 Management	47
9.1 Introduction.....	47
9.2 Local Display.....	47
9.3 Switches and controls	47
9.4 SW download/Upgrade.....	47
9.5 cBST Managed Parameters.....	48
9.6 Web- page management	48
9.7 SNMP management	49
10 Configurations and Options.....	50
10.1 Introduction.....	50
10.2 cBST Identification.....	50
10.3 cBST SW options	50
11 Regulations	51
11.1 Introduction.....	51
11.2 Environmental Spec.....	51
11.3 EMI/RFI.....	51
11.4 Safety	52
11.5 Radio.....	52
11.6 Reliability	52
11.7 Maintainability.....	52
12 Mechanical.....	53
Appendix A – WiN Cable Specifications	55

List of Figures

FIGURE 4-1: THE CBST CHASSIS	14
FIGURE 4-2: CBST CHASSIS INSIDE VIEW	15
FIGURE 4-3: CBST MOUNTING KIT.....	16
FIGURE 4-4: CBST BLOCK DIAGRAM	27
FIGURE 5-1: CBST PANEL AND CONNECTORS.....	28
FIGURE 5-2: COMBO CONNECTOR	29
FIGURE 5-3: CONSOLE CONNECTOR.....	31
FIGURE 6-1 : TRANSMITTER SPECTRAL MASK (ETSI 7MHZ).....	38
FIGURE 12-1: BASE STATION MECHANICAL PARTS	53
FIGURE 12-2: MECHANICAL DIMENSIONS.....	54

List of Tables

TABLE 3-1: REFERENCED DOCUMENTS	12
TABLE 4-1: CBST FEATURE TABLE	19
TABLE 5-1: COMBO CONNECTOR PINS.....	29
TABLE 5-2: ETHERNET PORT DATA	30
TABLE 5-3: MAINTENANCE CONNECTOR	31
TABLE 6-1: COMMON RADIO & PHY PARAMETERS.....	32
TABLE 6-2: RECEIVER SPEC	33
TABLE 6-3: CBST RECEIEVR SENSITIVITY	34
TABLE 6-4: CBST RECEIVER NOMINAL POWER.....	34
TABLE 6-5: CBST CO-CHANNEL INTERFERENCE	35
TABLE 6-6: CBST AACR.....	35
TABLE 6-7: CBST RX SPURIOUS EMMISIONS	35
TABLE 6-8: CBST RX EMMISIONS SETUP	36
TABLE 6-9: TRANSMITTER SPEC.....	36
TABLE 6-10: TRANSMITTER CONSTALATION ERROR	37
TABLE 6-11: SPECTRUM RESOLUTION BANDWIDTH USED IN SPURIOUS MEASUREMENT SETUP	38
TABLE 7-1: MAXIMUM USER SERVICE FLOWS.....	43
TABLE 7-2: MAXIMUM SYSTEM RATES*	43
TABLE 8-1: INPUT POWER RELATED PARAMETERS	46
TABLE 9-1: CBST PARAMETERS.....	48
TABLE 11-1: CBST EMI/RFI STANDARD COMPLIANCE	51
TABLE 11-2: CBST SAFETY STANDARD COMPLIANCE	52
TABLE 11-3: CBST RADIO STANDARD COMPLIANCE.....	52

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1 Purpose and Scope of the Document

This document describes and specifies the Compact Base Station (cBST) equipment – WiN7013-2, WiN7025-2, WiN7035-2 and WiN7037-2.

The cBST is designed for fixed, nomadic, portable and mobile applications. It is designed to be outdoor equipment. The product may be updated or changed from time to time. These changes will be reflected in the coming versions of the document. WiNetworks reserves the right to change this document and/or the product with no prior notice.

The document is constructed in the following manner:

- Section 2 contains a list of abbreviations used in this document.
- Section 3 lists the documents referenced in this document.
- Section 4 provides a general description and block diagram of the product.
- Section 5 describes the external interfaces, of all types, used in the product.
- Section 6 provides the spec of the cBST PHY - modem and radio.
- Section 7 provides the spec of the MAC part of the cBST.
- Section 8 describes input power characteristics of the cBST.
- Section 9 the management features of the cBST (local management and SNMP agent)
- Section 10 describes the various configurations and options for the cBST.
- Section 11 provides the regulatory specifications related to safety, electrical and environmental standard conformance of the cBST unit
- Section 12 provides the mechanical specifications

2 Abbreviations

Following is a list of abbreviations, acronyms and terms used in this document:

3-DES	Triple Data Encryption Standard
AA	Anchor Authenticator also called Network Authenticator Server (NAS)
AAA	Authentication, Authorization, and Accounting
AACR	Adjacent and Alternate Channel Rejection
AES	Advanced Encryption Standard
AK	Authorization Key
AKA	Authentication and Key Agreement
ARQ	Automatic Repeat request
ASN	Access Service Network
cBST	Compact Base Station
BE	Best Effort
BW	Bandwidth
BWA	Broadband Wireless Access
CBC	Cipher Block Chaining
CCI	Co-Channel Interference
CCM	Counter with CBC-MAC
CID	Connection Identifier
CLI	Command Line Interface
CMAC	Cipher-based Message Authentication Code
CPE	Customer Premise Equipment
CS	Convergence Sub-layer
CSN	Connectivity Service Network
DES	Data Encryption Standard
DHCP	Dynamic Host Configuration Protocol
DL	Down Link
EAP	Extensible Authentication Protocol
SSCHAPv2	Microsoft Challenge Handshake Authentication Protocol version 2
EAP-TLS	EAP with TLS

EAP-TTLS	EAP with TTLS
FA	Foreign Agent
GW	Gateway
HA	Home Agent
IEEE	Institute of Electrical and Electronics Engineers
IP	Internet Protocol
IPSec	IP Security
IPv4	Internet Protocol Version 4
IPv6	Internet Protocol Version 6
ITU	International Telecommunications Union
LAN	Local Area Network
LOS	Line Of Sight
LSB	Least Significant Bit
MAC	Medium Access Control
Mb/s	Megabit per second
SS	Mobile Station
NAI	Network Access Identifier
NLOS	Non Line Of Sight
NWG	NetWorking Group
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
PCB	Printed Circuit Board
PHY	Physical layer
PKM	Privacy Key Management
PMP	Point-to-MultiPoint
PSK	Pre Shared Key
PtP	Point to Point
QoS	Quality of Service
RADIUS	Remote Access Dial In User Service
RG	Residential Gateway
rtPS	real-time Polling Service

Rx	Receiver
SA	Security Association
SF	Service Flow
SNMP	Simple Network Management Protocol
SoC	System on Chip
SS	Subscriber Station
TCP	Transmission Control Protocol
TDM	Time Division Multiplexing
TDMA	Time Division Multiple Access
TLS	Transport Layer Security
TTLS	Tunneled Transport Layer Security
Tx	Transmitter
UDP	User Datagram Protocol
UGS	Unsolicited Grant Service
UL	Uplink
VLAN	Virtual Local Area Network
VoIP	Voice over IP
WiMAX	Worldwide Interoperability for Microwave Access
WiNMS	WiNetworks Network Management System
WiNPS	WiNetworks Power System
X.509 ITU	Standard for digital public-key certificate issued by a CA

3 Referenced Documents

The following documents are referenced in this spec. Their relevancy is as specified in this doc.

Table 3-1: Referenced Documents

Ref	Document Name	Issuing Date
1	IEEE 802.16-2004	1 Oct 2004
2	IEEE 802.16e-2005 Cor 2-2007	28 Feb 2006
3	WiMAX Forum NWG R1.1.0	11 Jul 2007
4	WiMAX Forum Mobile System Profile Rev 1.2.2	17 Nov 2006

4 General Description

4.1 Introduction

WiNetworks compact base stations (cBST) are members of the Win-Max™ E family, a line of WiMAX broadband wireless access systems, based on the IEEE802.16e Mobile WiMAX standard. The cBST works with standard WF NWG 802.16e ASN-GW profile C and required networking servers (e.g. AAA server, HA, DHCP server). For example the cBST passed IOT with Cisco ASN GW 7301 or 7604 using R6 protocol.

The cBST is a single sector, one box, all outdoor which can be mounted on a wall or a pole.

WiNetworks architecture allows flexible and scalable deployments starting with one sector and up to any number of co-located sectors in a single site.

The cBST can serve any certified CPE including the WiN5xxx-2 WiNetworks's Outdoor CPE and other compatible products, Indoor CPE, PC-Card, USB Dongle or any Mobile SS.

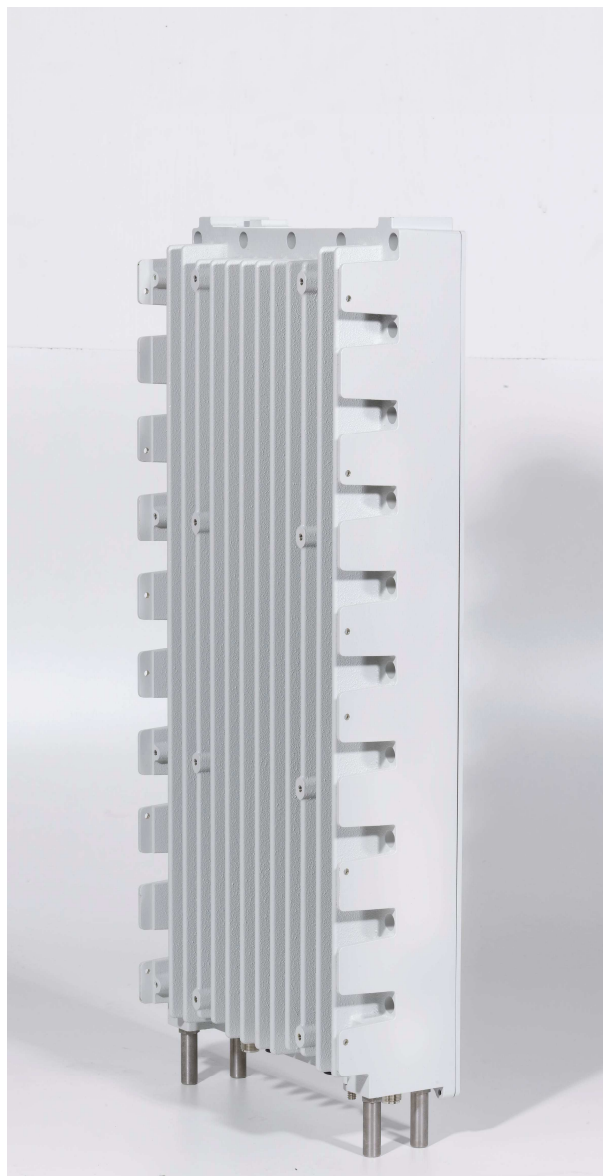
The cBST can be managed by WiNetworks WinNMS – Network Management System or by any other NMS system.

Power feed and traffic aggregation can be implemented by WiNetworks WinNPS product or by any 48VDC power supply unit.

4.2 Product View

The product view is shown in the following figure:

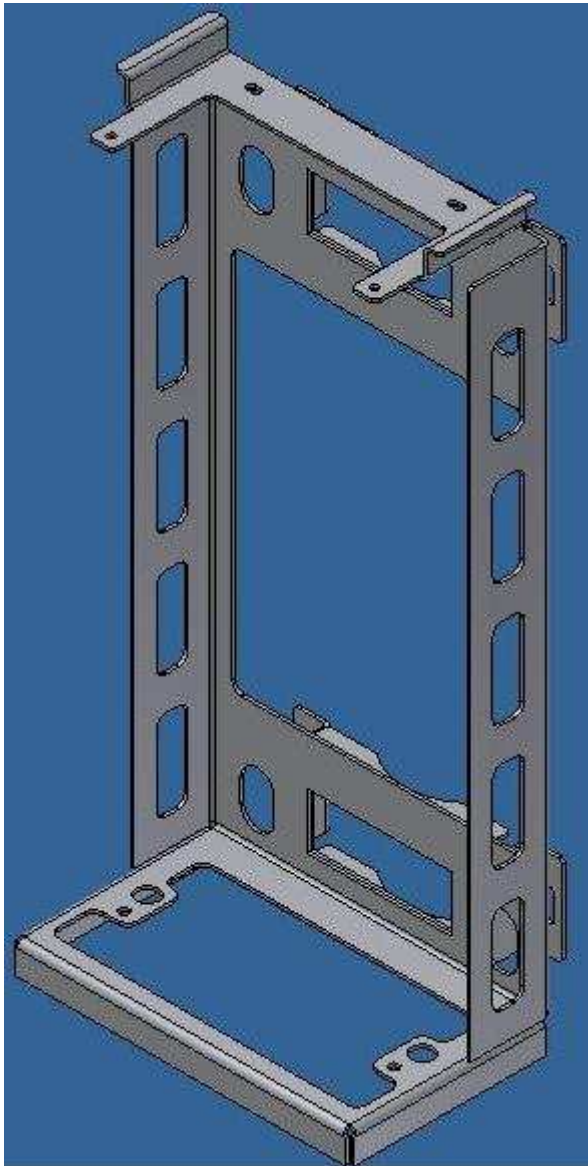
Figure 4-1: The cBST Chassis



4.3 Mounting kit

The chassis can be connected to a wall or a pole with a mounting kit, described in the following figure. The kit is good for a Single sector cBST on a pole or on a wall.

Figure 4-3: cBST mounting kit



4.4 Antenna Configurations

The cBST can be used with several types of WiMAX and GPS antennas:

4.4.1 WiMAX antennas

The cBST can use the following antennas

- 2 Omni antennas (default)
- 2 sector antennas
- 1 cross polarized antenna.

The antennas are connected to the cBST by RF cables with N-Type connectors.

4.4.2 GPS Antenna

A GPS antenna will be mounted on the top of each cBST to drive the internal GPS receiver.

The antenna type is Trimble: 57861-00 Bullet antenna, 3V, TNC connector.

The antenna cable will be routed outside the chassis to the GPS connector at the bottom.

Cable type: RG-59

Cable length: 1m

Max cable length allowed: 22m

4.5 Main Features

- IEEE802.16e standard compliance.
- Mobile-WiMAX compliance based on WF wave 2 System Profile.
- Supporting the following frequency range:
 - WiN7013-2: 1350 – 1400 MHz with 5, 7 & 10 MHz Channels
 - WiN7025-2: 2490-2690 MHz with 5 & 10 MHz Channels (WF Band Class 3)
 - WiN7035-2: 3400-3600 MHz with 5, 7 & 10 MHz Channels (WF Band Class 5L)
 - WiN7037-2: 3600-3720 MHz with 5, 7 & 10 MHz Channels (WF Band Class 5H)
- Supporting up to 1024 registered subscriber units
- One box, all-outdoor - easy to install on walls and poles
- High Link **performance** in NLOS conditions using OFDMA technologies.
- TDD Operation.
- IP Convergence Sub Layer
- Adaptive modulation to optimize throughput and enhance performance.
- Automatic Transmit Power Control (ATPC) to allow for optimal network deployment and interference avoidance.
- Supports various data traffic types with several levels of QoS, SLA and BW management.
- R6 Profile C ASN GW Interface

4.6 cBST Feature List

Table 4-1: cBST Feature Table

Feature	Specification	Notes
General		
Interfaces	10/100 Base-T FE port + power x 2	Proprietary combo connector
	GPS antenna – TNC connector	For GPS synchronization option
	RS232 console connector	Proprietary connector
	Antenna ports – 2 x N-Type	WiMAX Antennas
Application Services Supported	Data, Video, VoIP	The ability to support different services is derived from the E2E characteristics of good throughput, latency, Jitter and PER/BER under different service flows.
Maximum User Data Rates – bps (bit per seconds)	33 Mbps downlink 10 Mbps uplink	Setup for testing BW=10MHz ; 64QAM, rate 5/6 CTC; DL:2100pps ; UL:826pps
Maximum User Data Rates - pps (Packets Per Second)	28000 pps downlink 7400 pps uplink	For 5 mSec frame
Portability	Supported	
Mobility	Supported	
Number of Antennas	2	
Antenna Types	2xOmni 2xSector Dual Slant (dual polarization)	
Re-Use	1,3	
TX Power	+ 31 +/- 1dBm	P1dB @ antenna port
	+ 21 +/- 1dBm	Average @ antenna port
TX Power control dynamic range	15 dB	
Form Factor [WxHxD]	27cm x 60cm x 10cm	
Weight	15Kg	
Operating temperature	-40°C to + 46° C	Ambient temperature. Withstand 1120W/sq m solar radiation
Cold start	-40°C	

Feature	Specification	Notes
Storage temperature	-40°C to 80°C	
Humidity	5% to 100%	
Weather protection	IP66	
MTBF	>100,000 hrs	
Management		
802.16 management mode	Support 802.16 non-managed mode	IP Based: SNMP v2 or Web Browsing
Base Station Management	Support 802.16i MIB standard	Allows remotely to “Get” and “Set” Standard MIB definition still in process.
SW upgrade	SW upgrades through FTP	
Local technician support	Console port	CLI
PHY		
RF Band	3.4-3.6 GHz (WiN7035-2) 3.6-3.72 GHz (WiN7037-2) 2.490-2.690 GHz (WiN7025-2) 1.35-1.4 GHz (WiN7013-2)	ETSI & International
WF Band Class	Class 5L WiN7035-2 Class 5H WiN7037-2 Class 3 for WiN7025-2	
Dynamic adaptation	Supported	Both UL and DL
Sensitivity	10e-6 BER for QPSK-1/2 over 10MHz channel: – 94dBm. 10e-6 BER for QPSK-1/2 over 5 MHz channel: – 97dBm	Advanced receiver technique such as MRC Will add another ~3 to 10dB to system gain
Number of RF Channels	2x TX 2x RX	
Adjacent Rejection	16QAM ¾: +11dB 64QAM 2/3: +4dB	
First Alternate Rejection	16QAM ¾: +30dB 64QAM 2/3: +23dB	
Duplex Mode	TDD	
Modulation Level	DL: QPSK 1/2 and 3/4 16-QAM 1/2 and 3/4 64-QAM 1/2, 2/3, 3/4 and 5/6	

Feature	Specification	Notes
	UL: QPSK 1/2 and 3/4 16-QAM 1/2 and 3/4 64-QAM 1/2, 2/3, 3/4 and 5/6	
Coding Schemes	data randomization convolutional coding (CC), with both mandatory and optional interleaving repetition coding convolutional turbo coding (CTC)	
Channel BW/FFT Length	3.5MHz/512 5MHz/512, 7MHz/1024, 10MHz/1024	
Permutations	DL: FUSC, PUSC, PUSC with all subchannels UL: PUSC	
Channel Resolution	250KHz	
Ranging types	Initial Ranging Periodic Ranging Handoff Ranging	
Feedback	Fast Feedback CQICH Encoding	
Statistics	RSSI Physical CINR measurement on preamble Physical/Effective CINR, measurement on pilots (PUSC) Physical/Effective CINR, measurement on pilots (FUSC)	
Power Control	open-loop power control closed-loop power control	
MAP Support	Normal Compressed Sub-DL-UL	
SSTTG\SSRTG	50usec	
Max Decoded input signal	-20dBm	@ Antenna port
DL\UL Ratio	(35, 12) (34, 13) (33, 14)	Number of OFDM Symbols in DL and UL for 5 and 10 MHz BW

Feature	Specification	Notes
	(32, 15)	
	(31, 16)	
	(30, 17)	
	(29, 18)	
	(28, 19)	
	(27, 20)	
	(26, 21)	
	(24, 09)	Number of OFDM Symbols in DL and UL for 7 MHz BW
	(23, 10)	
	(22, 11)	
	(21, 12)	
	(20, 13)	
	(19, 14)	
	(18, 15)	
Latency	UL:60mS max DL:20mS max	The IP-IP latency in UGS, including the SS and cBST
cBST synchronization	GPS IEEE1588 (optional)	
MAC		
Major Packet Classification	IP Classification	
Convergence sub-layer	Internet Protocol (IPv4) Internet Protocol (Ipv6) Ipv4 with Header Compression (ROHC) Ipv6 with Header Compression (ROHC)	Including header suppression support (PHS)
IP Packet Classification in the UL	Classification based on DSCP/IP TOS field; Classification based on IP Protocol/Next Header field; Classification based on IP masked Source Address; Classification based on IP Destination Address; Classification based on protocol source port range; Classification based on protocol destination port range;	
Sub-header and Extended Sub-header	Supported	

Feature	Specification	Notes
Concatenation	Supported	
Fragmentation	Supported	
Packing	Supported	
Frame Length	5mS	
Classification rules origin	BS initiated only	
QoS and scheduling	Dynamic Service Admission (DSA) initiated by cBST or CPE Dynamic Service Change (DSC) initiated by cBST or CPE Dynamic Service Delete (DSD) initiated by cBST or CPE	
Supported services	Best Effort (BE) Unsolicited Grant service (UGS) Real-Time Variable Rate (RT-VR) Non-Real-Time Variable Rate (NRT-VR) Extended Real-Time Variable Rate (ERT-VR)	
Number of CID	DL: 4800 UL: 4800	Without management CID
Network Entry and Initialization	cBST negotiates basic capabilities; MS Registration 802.16 Authorization policy support CID and SAID Updates expedited network re-entry from idle mode	
Idle mode and Paging	Supported	either initiated by the cBST or MS
Sleep Mode	Supported	
ARQ	Selective ACK entry Cumulative ACK entry Cumulative with Selective ACK entry Cumulative ACK with Block Sequence ACK	
HARQ	Supported Categories 1,2, and 3	
Multicast Broadcast Service	Supported	
Framing Capabilities	DL 5 different zones 10 concurrent bursts 16 bursts per frame	

Feature	Specification	Notes
	UL 3 different zones	
Handover (HO)		
HO Procedures	HO initiated by cBST support HO initiated by MS support Metric Triggered HO Requests Resource Retention Support CDMA HO Ranging Support negotiating of "HO authorization policy" during HO (i.e. between BSs)	
Neighbor advertisement	Supported	
Scanning for cell selection	Supported	MS Requests Scanning Interval Allocations from cBST, and Unsolicited Scanning Interval Allocation by cBST
Handover optimization	Supported	
CID and SAID Updates	Supported	
hand over time	<= 50msec	
Authorization, Authentication, Crypto-suites, Security Associations		
Network Authentication	Un-Authenticated PKMv2 EAP – TLS,TTLS	
Data Security	Encryption: AES Authorization: CMAC	CCM-Mode 128-bit AES, CCM Mode, AES Key Wrap with 128-bit key
Security Association	static, primary and dynamic SA	
Networking		
WiMAX Forum R6 Profile C	1. Network Entry MS Pre-Attachment. Single EAP Authentication and No (Null) Authentication modes. EAP-TLS and EAP-TTLS are supported. EAP Authentication Relay Protocol. Key Change Directive. MS Attachment. 2. MS/cBST-triggered Re-authentication. 3. Path Management Messages for ISF and Secondary SFs.	

Feature	Specification	Notes
	4. DHCP-based address allocation. 5. Deregistration/Network Exit. 6. Multiple Host support. 7. GRE Tunnel format. 8. R6 transport protocol, retransmissions (and timers), errors and duplicate transaction handling. 9. R6 Message and TLV definitions. 10. R6 error handling	
Compatibility	CISCO ASN-GW	
Inter & Intra ASN GW	supported	
Network infrastructure for management	Provisioning Network exit	
HO type	Hard HO	
Location Services	Supported	
MIP	Simple, Proxy, Client	
MBS	Supported	
DSX	Supported	
cBST accounting	Supported	
RRM	MS&cBST initiate HHO Controlled (MS & cBST decision) Admission Control Congestion control Adaptive RRM Parameters Network & RF Optimization	
QoS Marking	Supported	
Certification & Regulations		
Safety	EN60950-1	
	UL60950-1	For WiN7037-2 & WiN7025-2
	CE mark	
Radio	ETSI EN 302-026-1,-2	PtMP 3-11GHz
	FCC Part 90 subpart Z	3.65-3.7GHz for WiN7037-2 only
	FCC Part 27	For WiN7025-2 only
EMI/RFI	FCC part 15 class A	3.65-3.7GHz for WiN7037-2 and WiN7025-2 only
	ETSI EN 301 489-1, -4	

Feature	Specification	Notes
Environmental	ETSI EN 300 019 Sub-parts parts 2-1 to 2-7	IP66
WiMAX Forum	16e Wave 2 certified	

4.7 Conformance to WiMAX Forum Requirements

The commercial version of the product will meet the WF wave 2 mandatory requirements, except where otherwise indicated in this document. Interim deliveries of the product (for trials, alpha and beta versions) may support partial functionality and may have reduced capabilities according. The cBSTis using the Sequans 2130 SoC.

4.8 Modes of operation

Duplexing mode: TDD

Topology modes:

- Point to Multi Point

Operation:

- Fixed
- Nomadic
- Mobile

Connection to SS:

- Unicast
- Broadcast
- Multicast

5 Connectors/Interfaces

5.1 Introduction

The cBST Chassis has the following connectors/interfaces:

- 2 Combo Connectors (for 48VDC and Ethernet)
- 2 Antenna connectors – N Type Female
- 1 Management connector (serial interface)
- 1 (Chassis) Ground connection – 1 Screw ETSI type
- 1 GPS Antenna connector TNC female (optional)

These connectors are shown in the following figure:

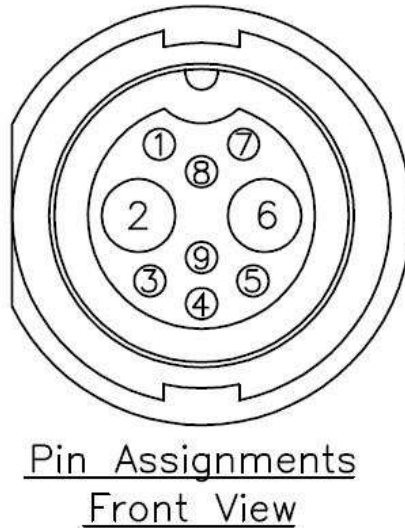
Figure 5-1: cBST Panel and Connectors



5.2 Combo Connectors

The cBST has two Combo connectors. The connectors carry the 48V input and the Ethernet ports and are described in the following drawing:

Figure 5-2: Combo Connector



The combo connector is female. One Combo connector will be connected to the power source and Ethernet aggregator (WiNPS like). The other combo connector can be used to daisy chain a second, nearby cBST.

For the electrical parameters of the power module, see section **Error! Reference source not found.**

Table 5-1: Combo connector pins

Pin #	Connection	Notes
1	Reserved	
2	48V -	floating
3	+TX Ethernet	
4	-TX Ethernet	
5	+RX Ethernet	
6	48V +	floating
7	Reserved	
8	Reserved	
9	-RX Ethernet	

5.2.1 Ethernet Data

The Ethernet port is the connection to the backhaul network. It carries all the data to the ASN-GW and other servers. It has the following characteristics:

Table 5-2: Ethernet Port Data

Parameter	Value
Ethernet Standard Compliance	IEEE 802.3 CSMA/CD
Ethernet Port	10/100 Mbps, Half/Full Duplex with Auto Negotiation
Traffic Classification	DiffServ (DSCP)

5.2.2 Chaining of cBST's

The power pins of the two connectors are chained internally (without a fuse between them). The Ethernet ports of the two connectors are separately terminated on the internal Ethernet switch in the cBST. One of the combo connectors is connected with a long cable (up to 100m) to the power source and traffic aggregator of the site. The other combo connector is connected with a short cable to another cBST in the same site. The cables can be ordered from WiNetworks. Note that the long cable carries the power and the data for the two cBST's. In this configuration, the maximum traffic rate for the two base stations is 100Mb/s.

5.3 WiMAX Antenna ports

The WiMAX antenna connectors are 2 x N-Type Female connectors.

5.4 GPS Antenna port (Optional)

The cBST has one TNC connector for the GPS antenna. This connector is mounted and used only when the GPS timing option was selected. The internal GPS receiver provides the timing signals to the WiMAX circuitry.

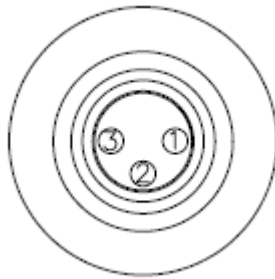
5.5 Console port

The chassis has a 3-pin maintenance female connector, used by a technician to connect a “console”. The port is used by a maintenance person to communicate with the processor when the normal management interfaces cannot be used. The console port is based on RS-232 serial standard and support a standard terminal connection.

The technician can configure and monitor the base station through CLI (Command Language Interface) for low level debug.

The connector is shown in the following figure:

Figure 5-3: Console Connector



The maintenance connector pin out is listed in the following table:

Table 5-3: Maintenance connector

Pin #	Connection	Notes
1	TX	
2	RX	
3	GND	Signal Ground

Cable type: 3 wires 28AWG

Cable connectors: DB9F, proprietary 3 pin console connector

Cable length: 2m

5.6 Chassis Ground connection

A ground cable may be connected to the cBST chassis.

The Chassis includes 1 ETSI type screw for cBST grounding connection.

6 Radio and PHY

6.1 Introduction

This section describes the radio features and specifications of the cBST. The cBST has 2 full transceivers; each is equipped with a power amplifier..

6.2 Common Radio & PHY Features

The following table lists the features and specs applicable to both the transmitter and receiver:

Table 6-1: Common Radio & PHY Parameters

Parameter	Value
Frequency	1.35GHz to 1.4GHz for WiN7013-2 2.496GHz to 2.69GHz for WiN7025-2 3.4GHz to 3.6GHz for WiN7035-2 3.6GHz to 3.72GHz for WiN7037-2
Radio Access Method	IEEE802.16-2005 (16e S-OFDMA)
Duplexing Mode	TDD
Channel Bandwidth	3.5, 5, 7, 10 MHz
Frequency Resolution	0.25 MHz
Number of Antennas	2
Antenna Types	2xOmni, 2xSector or Dual Slant
FFT	512, 1024 FFT points
Modulation	QPSK, 16QAM, 64QAM (DL and UL)
FEC	Convolution Code (CC), Turbo Code (CTC), repetition
Permutations	DL: PUSC, PUSC all sub-channels, FUSC ; UL: PUSC
DL:UL Ratio	From 1:1 (50%) to 3:1 (75%)
Cyclic Prefix	1/8
Frame Length	5mS