

symmetry access network

Advanced, flexible and cost effective

Offering proven radio diversity technology, an innovative base station platform, and complete support for mobile (802.16e-2005) and fixed (802.16d-2004) WiMAX, symmetry allows operators to cost-effectively roll out mobile, nomadic and fixed broadband wireless services.

CBS5000

Superior performance and features in a compact form factor

The CBS5000 is the building block of a network of WiMAX broadband wireless cells, providing subscribers with multi-megabit data rates for Internet, multimedia and VoIP applications.

The CBS5000 is an advanced WiMAX base station platform built around a carrier-grade gigabit router and an array of powerful digital signal processors. The same hardware platform supports both **symmetryMXe** airlinks with full 802.16e-2005 compliance for mobile WiMAX networks, and **symmetryMX** airlinks with certified 802.16d-2004 compliance for fixed and nomadic applications.

Each CBS5000 base station includes the CBS5000 indoor unit and corresponding outdoor WiMAX Broadband Radio Units (WBRUs), which perform the RF transceiver functions for each radio sector. A single CBS5000 indoor unit can support up to three separate WiMAX radio sectors, while presenting a single unified interface to the core network.

The CBS5000 allows operators to cost-effectively blanket an urban or suburban area for mobile, nomadic and fixed services, and provides the ability to cover larger rural areas with one of the industry's best link budgets. Supporting STC, MIMO or AAS, the CBS5000 offers maximum spectrum re-use, optimal interference mitigation and maximum network throughput. For the subscriber, this means the most reliable broadband wireless connection available today.

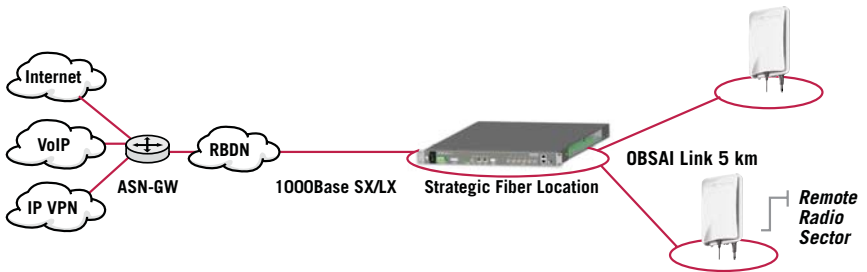
The CBS5000 is compact, consumes little power and occupies a small footprint, making it extremely easy and cost-effective to deploy in existing infrastructures, such as buildings, and shelters.

- Ideal building block for deploying multimedia IP access networks.
- Supports both the mobile WiMAX 802.16e standard and the fixed/ nomadic 802.16d standard, allowing operators to deliver mobile, nomadic, and fixed broadband services using a single hardware platform.
- Software upgradeable, so that a migration from 802.16d to 802.16e or later revisions can easily be implemented with minimum network impact.
- Proven STC diversity technology; provides support for MIMO 2X2 and 4X4 technologies.
- Optical network and radio interfaces for easy deployment of remote base stations and remote radio sectors using metropolitan optical networks as backhaul.

CBS5000 Platform

Cost-effective

- Compact base station that can be deployed in small footprint.
- Up to three sectors per base station, with two transceivers per sector to support STC and 2x2 MIMO, for improved link budget and in-building penetration.
- Supports one sector with four transceivers per sector for 4X4 MIMO.
- Delivers RF power at the antenna for a high link-budget at a fraction of the power consumption and cost of larger, ground-based stations.
- Two backhaul options: 10/100/1000 optical fiber or 100/1000BASE-T.
- Embedded GPS synchronization eliminates need for separate GPS receiver.
- High-reliability, rugged and weatherproof design of ODU.



Optical network interfaces

The CBS5000 can connect to the core network and its transceivers using long-range optical interfaces.

With optical core network interfaces (1000 Base SX/LX), the base station can connect directly to high speed optical transport networks, simplifying deployment of remote base stations.

The transceivers connect to the CBS5000 indoor unit over a standard Open Base Station Architecture Initiative (OBSAI) interface, with a range up to 5 Km. This extended range facilitates deployment of remote radio sectors, while the OBSAI standard interface allows operators to benefit from the evolution of industry-standard radio modules.

Mission-critical applications with 1+1 redundancy

The CBS5000 can optionally be equipped with full IDU redundancy to ensure high system availability and end-user satisfaction.

symmetryMX allows operators to access the huge market for fixed and nomadic broadband services, while delivering the dependable services residential and enterprise users demand.

- Certified WiMAX 802.16d network equipment assures operators' investment, while a deep and mature ecosystem of suppliers drives cost-effective solutions.
- Optimal solution for residential, small office – home office (SOHO), small and medium enterprises (SME), and multi-dwelling applications.
- Allows operators to build a base of nomadic subscribers without the cost, complexity, and regulatory hurdles involved in deploying a full mobile network.
- Enhanced **symmetryMX** air interface offers better link stability, superior in-building coverage, and larger capacity, using proven STC technology.
- An advanced QoS system increases subscriber capacity, enables differentiated services, and ensures customer satisfaction.

Fixed and nomadic services

symmetryMX is the solution of choice for carriers that envision providing a wider range of profitable voice and broadband data services—like VoIP, high-speed Internet, IP VPN, video-conferencing, streaming audio and video, and gaming—or for backhauling WiFi Hot-zones.

Thanks to an advanced QoS system, **symmetryMX** offers true multimedia capabilities and per-service quality policy enforcement.

For optimized VoIP quality and capacity, **symmetryMX** offers Advanced Voice capability, including full support for the UGS service class, along with Call Admission Control to dynamically allocate bandwidth, manage congestion, and avoid degradation, replicating traditional voice service behaviour.

A unique WiMAX service creation environment permits operators to create profitable differentiated services quickly and easily.

A sophisticated and flexible VLAN handling scheme allows operators to efficiently manage VLAN connections to deliver enterprise VPN services, simplify network integration, and enable multiple ISPs to share a single access network.

Nomadic users can enjoy the benefits of nearly seamless broadband services anywhere they stop to use their PC, indoors or outdoors. **symmetryMX**'s advanced RF capabilities improve indoor coverage, where nearly all PC use takes place.

Airlink profiles

- 2.5 GHz, TDD duplexing with dynamic uplink and downlink ratio control. Supports multiple channel bandwidths including 3.5 MHz and 5 MHz.
- 3.5 GHz, TDD duplexing with dynamic uplink and downlink ratio control. Supports 3.5 MHz, 5.0 MHz, and 7.0 MHz channel bandwidths.
- 3.5 GHz FDD duplexing with 1.75 MHz, 3.5 MHz, and 7.0 MHz channel bandwidths.
- 10.5 GHz FDD duplexing with 3.5 MHz and 7.0 MHz channel bandwidths.
- **symmetryMX** seamlessly integrates key advanced WiMAX technologies—including sub-channelization, antenna diversity, adaptive modulation, power control, space time coding and bandwidth optimization—to optimize spectrum usage, and improve NLOS coverage and in-building penetration.

Security

DES Encryption with X.509 certificate exchange for authentication

symmetryMXe

With **symmetryMXe**, operators will tap into the explosive demand for ubiquitous mobile and nomadic broadband IP services.

- Advanced **symmetryMXe** air interface offers better link stability, superior in-building coverage, and larger capacity, using proven STC technology.
- Delivers a full range of services: VoIP, high-speed Internet, IP VPN, videoconferencing, streaming audio, video, and gaming.
- Optional layer 2 convergence-sublayer to support Ethernet bridge operation and VLAN applications.
- Optional 64QAM uplink support improves capacity and user experience for fixed/nomadic applications.

Mobility

To enable mobility, the **symmetryMXe** base station implements a series of functions including Mobile IP sessions, as well as handover functions. The base station is capable of doing intra- and inter-BS handoff and relies on the interaction with an Access Service Network to handle both Mobile IP sessions and handovers.

The WiMAX Forum Network Working Group has defined 3 profiles for the distribution of the functions between the ASN-GW and the ASN-BS.

The CBS5000 supports profiles A and C, both suitable for large cellular deployments. By supporting both protocols, the CBS5000 ensures that operators can choose from a range of ASN-GW suppliers.

Fixed service and nomadicity

Nomadic users can power down their terminal and set-up in a new location serviced by the same operator, and then turn on the terminal to set-up a new link. In addition, when the signal from the base station is lost, the CPE automatically establishes a link with another BS without interrupting communications.

Fixed services often focus on business applications and backhaul. For these applications, **symmetryMXe** implements features that are optional in the mobile WiMAX 802.16e standard, as well as specific enhancements for fixed network applications.

■ Layer 2 convergence sublayer:

The Layer 2CS allows the network to operate as an Ethernet bridge. This ensures transparency to tunneling protocols such as PPP and offers VLAN support, which is necessary for deployments where multiple ISPs share a common infrastructure.

■ 64QAM uplink modulation:

Optional in the WiMAX forum 802.16e profiles, 64QAM uplink modulation permits more spectrumefficient, higher-rate uplink services, such as those required by business subscribers and backhaul applications.

Product Highlights

Services

- Integrates with ASN-Gateway (Profile A or C) to create a complete ASN solution that enables IMS/Diffserv support and IMS back office sharing.
- Enables core network functions—including network traffic switching, services provisioning and billing—with complete 3GPP/3GPP2 convergence.
- Economical deployment of IP applications, including: VoIP, multimedia conferencing, instant messaging, Web browsing, media content download and eMail, interactive gaming, streaming media, managed VPN and FTP.
- Supports Metro Area Network VLAN Services. Provides a low-cost QoS-enabled backhaul.
- Delivers IMS, multicast and broadcast services.

symmetryMXe features

Airlink profiles

- 2.5 GHz and 3.5 GHz, TDD duplexing with dynamic uplink and downlink ratio control.
- 2.5, 5 and 10 MHz channels.
- Smart antenna systems: STC, 2X2 MIMO, 4X4 MIMO or AAS that optimize spectrum usage, improve link budget, mitigate interference and improve NLOS in-building penetration.

WiMAX ASN architecture compliance

- Full support of ASN architecture for mobile IP services, including: dynamic QoS, with Policy Server function interface.
- Simultaneous support of mobile and nomadic subscriber stations within the same cell using client and proxy MIP.
- Radio resource management including service flow authorization and airlink admission control with two possible models (ASN-GW RRM or BS RRM) to support various ASN-GW profiles and handover models.
- Supports ASN-BS functions and standard R6 interface (ASN-GW, ASN-BS).
- Roaming from home and visited networks using GRE tunnels to support Mobile IP, and inter-BS and inter-Gateway handoff for low total-handover latency.
- Security: including mobile SS and end-user authentication

Intra-ASN mobility (profiles A and C)

- Data Path Function: Manages the BS DP connections, i.e. connecting GRE tunnel to 802.16e connection
- Context Client: Provides MS/SS context for intra-ASN mobility
- Radio Resource Management (RRM) (profiles A and C)
 - Radio resource agent
 - Collection and measurement of radio resource indicators from the BS
 - Collection and measurement of Radio Resource indicators MS registered with the BS using MAC management procedures as per IEEE 802.16 specifications and other measurement reporting for upper layers
 - Communicating RRM control information over the air interface to MS
 - Signaling procedure exchange with RRC for radio resource management function
 - Controlling the radio resources of the respective BS
 - Radio resource controller
 - Collection of radio resource indicators from associated RRA(s)
 - Communication between/across RRCs
 - Handover
 - Handover function
 - Communication between serving and target BSs to perform controlled handover
 - Handover control (in profile C mode only)

- Gathering MS and BS metric information (link metrics, radio resource usage, etc) and issuing BS-initiated handovers. Performing BS-initiated handovers.
- Paging agent
 - Responsible for handling the interaction between the ASN-GW paging controller (PC) and 802.16e paging-related functionality implemented in the Base Station
- Service Flow Manager (SFM)
 - The SFM entity is responsible for the creation, admission, activation, modification and deletion of 802.16 service flows on the base station.

Layer 3 operation (IP routing)

Layer 3 operation is based on IP (either IPv4 or IPv6) links between the MS/SS and external data networks which is the default WiMAX Forum NWG architecture model.

Layer 2 operation

Layer 2 operation is based on Ethernet (IEEE 802.3) bridged links between the MS/SS and external data networks.

AAA

Support of the WiMAX NWG specification for AAA interface with support for both L2 (e.g. PPPoE) and L3 (IPoE) services.

Services

Convergence Sub-layer Service	Ethernet/802.3 and IP over Ethernet
Network Segmentation and Network Prioritization	VLAN: IEEE 802.1Q; Q-in-Q [802.1ad]; 802.1D [802.1p]
Packet Switching	Low-latency Layer-2 switching and policy switching that enables easy inter-working with Routers, Gateways, Firewall/NAT, IP PBX, Media Gateway, Demilitarized Zone (DMZ) Host, Multicast Routers, Diffserv networks and MPLS switches.
User Traffic Protocol	IPv4, PPPoE, L2TP, IPSec, PPTP, MPLS
IP Configuration	Dynamic Host Configuration Protocol (DHCP) support or static configuration
Grade of Service (GoS)	Configurable and predefined GoS profiles SLA Protection: Admission Control and Maximum Over Subscription Ratio protection
Backhaul network port	100/1000Base-SX/LX [SFP] 100/1000Base-T
WBRU interfaces (IDU-ODU Interconnect)	Open Base Station Architecture Initiative (OBSAI), <ul style="list-style-type: none"> • Delay compensated for long range support to 5 Km • Single I/F multi-sector multiplexing ready. • Multi-rate, small form factor pluggable (SFP) fibre optic transceivers
RF ports on ODU	N-type
Synchronization source	GPS antenna port; Internal synchronization source: Stratum 3; Accuracy +/- 4.7ppm; Capture range +/- 4.7ppm; Stability 0.37ppm/24 hours
Synchronization cascade interface	Cascade Input: LVDS [RJ-45 Shielded] Cascade Output: LVDS [RJ-45 Shielded]
Typical Applications	Fixed and nomadic applications; including: IP (interactive gaming, VoIP and multimedia conferencing, streaming media, instant messaging, Web browsing, media content download, managed VPN, FTP, and E-mail) Metro Area Network VLAN services Low-cost QoS-enabled backhaul

MAC layer features

Convergence Sub-layer Packet Classification	Extensive Packet Classification Layer 2: IEEE 802.3, IEEE 802.1Q, IEEE 802.1D (802.1p) Layer 3: IP, Differentiated Services Code Point / TOS Layer 4: Port number and/or range
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Convergence Sub-layer Traffic Conditioning	Traffic priority marking Per flow, Multimedia queuing, Traffic conformance metering Token Bucket Traffic shaping, Congestion control (WRED) Latency and jitter control
Filters	Source and Destination Mac filters; Broadcast, Multicast filters, Broadcast Strom Filters Access control list defined through classifier rules.
QoS Scheduler Options	Advanced Scheduling Algorithm with full WiMAX QoS support. Airlink Optimization Automatic Retransmission reQuest (ARQ), Uplink power control Payload Header Suppression, Dynamic Bandwidth Admission Control Maximum Over Subscription Ratio Control, Multicast group polling
Security Options	Encryption: DES and AES (future) Authentication based on X.509 certificate

Physical layer

Air Interface	802.16-2004 Software upgradeable to specific 802.16e profiles
Frequency Ranges	2.5 GHz TDD (2500 - 2695 MHz) 3.5 GHz TDD (3300 - 3800 MHz) 3.5 GHz FDD (3300 - 3800 MHz) 10.5 GHz FDD (10.15 GHz - 10.65 GHz)
Channel Bandwidths	2.5 GHz TDD – 3.5, 5.0, 7.0 MHz 3.5 GHz TDD – 3.5, 5.0, 7.0 MHz 3.5 GHz FDD – 1.75, 3.5, 7.0 MHz 10.5 GHz FDD – 3.5, 7.0 MHz
Duplexing	FDD (with H-FDD SS support), TDD (DL:UL ratio configurable)
Adaptive Modulation	64 QAM (3/4, 2/3), 16 QAM (3/4, 1/2), QPSK (3/4, 1/2), and BPSK (1/2)
Frame Size	5ms, 10ms
Maximum RF Transmit Power	31 dBm
Transceivers	2 WBRU per sector for STC, up to 3 sectors
Antenna type (typical)	Sectoral Polarization: Vertical or dual slant +/- 45° Antenna Gain: 17.5 dBi (typical)
Cyclic Prefix	1/4, 1/8, 1/16, and 1/32 (configurable)
Diversity	Polarization Diversity: Two-branch Tx/Rx, with MRC and STC
Sub-channeling	2, 4, 8, and 16 channels ATPC (Automatic Power Control) Uplink closed loop power control with adaptive modulation
Sectors	Up to 3 sectors with diversity

Services

ASN-BS functions	ASN Profile C functions, services and interface: <ul style="list-style-type: none"> • Data Path Function • Handover Function R6 control • Context Function • Radio Resources Agent • Radio Resources Control • Authentication relay • Key receiver • Service. Flow management • Paging Agent in the BS • R6 support • 802.16e-2005 MAC common part support
Low-latency Layer-2 switching and Layer-3 routing with QoS class support:	<ul style="list-style-type: none"> • GRE Tunnel for Mobile IP • PMIP and Client MIPS over R6
Backhaul network port	100/1000Base-SX/LX [SFP] 100/1000Base-T
WBRU interfaces (IDU-ODU Interconnect)	Open Base Station Architecture Initiative (OBSAI), <ul style="list-style-type: none"> • Delay compensated for long range support to 5 Km • Single I/F multi-sector multiplexing ready. • Multi-rate, small form factor pluggable (SFP) fibre optic transceivers
RF ports on ODU	N-type
Synchronization source	GPS antenna port; Internal synchronization source: Stratum 3; Accuracy +/- 4.7ppm; Capture range +/- 4.7ppm; Stability 0.37ppm/24 hours
Synchronization cascade interface	Cascade Input: LVDS [RJ-45 Shielded] Cascade Output: LVDS [RJ-45 Shielded]
ASN-GW interface	R6 to ASN-GW (signaling and data plane) CID Update R6 HO control trigger R6 tunnel management
Network segmentation and prioritization	VLAN: IEEE 802.1Q; Q-in-Q [802.3ad]; 802.1D [802.1p]
Typical Applications	Mobile, nomadic and fixed applications; including: IP (interactive gaming, VoIP and multimedia conferencing, streaming media, instant messaging, Web browsing, media content download, managed VPN, FTP, and E-mail) Metro Area Network VLAN services Low-cost QoS-enabled backhaul IMS, multicast, and broadcast services
User traffic protocol	MIP GRE tunneling. (IPv4 initially, IPv6 future)
Grade of service (GoS) SLA protection	<ul style="list-style-type: none"> • Configurable and predefined GoS profiles • Dynamic provision via R6 interface (future) • Static provision via NMS • Admission Control • Maximum Over-Subscription Radio protection

MAC layer features

QoS scheduler options	<ul style="list-style-type: none"> • Advanced Fast Scheduling Algorithm implements per flow queuing and complies fully with all IEEE 802.16 QoS options.
Airlink optimization and radio resources management	<ul style="list-style-type: none"> • Automatic Retransmission reQuest (ARQ) and HARQ • Uplink and downlink power control • Radio Resource Agent • Radio Resource Controller • Dynamic Bandwidth • Air Link Admission Control (Network admission control in the ASN-GW) • Maximum Over Subscription Ratio Control with static provisioning or recommended ASN-GW models. • Multicast group polling
Policy management	<ul style="list-style-type: none"> • Service flow management • Multiple classes of service for each SS
Security options	<ul style="list-style-type: none"> • AK Receiver • TEK and SA management • Authentication relay/ EAP Proxy • Authentication based on X.509 certificate

Physical layer

Air interface	802.16e-2005 (IEEE 802.16-2004 as amended by IEEE 802.16-2005) Frequency range 2.5 GHz [2500MHz - 2695MHz] 3.5 GHz [3300 – 3800 MHz] Channel bandwidth 2.5 GHz: Scalable 2.5, 5.00, 10.00 MHz 3.5 GHz: 5.0, 7.0, 10.0 MHz Duplexing TDD (dynamic partitioning)
RF access scheme	SOFDMA (512, 1024 point FFT)
Adaptive modulation	64-QAM ⁵ / ₆ , ³ / ₄ , ² / ₃ , ¹ / ₂ 16-QAM ³ / ₄ , ¹ / ₂ QPSK ³ / ₄ , ¹ / ₂
Frame size	5 ms (TDD)
Maximum RF transmit power	31 dBm per transceiver
Transceivers	2 WBRU per sectors for STC up to 3 sectors 4 WBRU per sector for MIMO and AAS for 1 sector support.
Antenna type	Omni, sectoral, or panel Polarization: Vertical (with STC)
Cyclic prefix	¹ / ₈
Smart antenna system / RF path diversity	MIMO, AAS, STC Alamouti coding
Channel coding	Convolutional coding with tail biting Convolutional Turbo Coding
ATPC (Automatic Power Control)	Closed loop power control with adaptive modulation
Sub-carrier allocation	PUSC, FUSC, AMC 2x3
Sectors	1 RF carrier per sector using 4 transceivers
DL: UL ratio	Configurable

CBS5000

electrical, mechanical,
environmental features

Mechanical (W x H x D)

Indoor: 440 x 44.5 x 323.85 mm
(17.3" x 1.75" x 12.75")

Outdoor: 280 x 510 x 110 mm
(11" x 20" x 4.5")

Operating temperature

Indoor digital shelf: -5 to +45° C (23 to 113° F)

Outdoor WBRU: -45 to +60° C (-49 to +140° F)

Humidity

5% to 95% non-condensing

Weight

Indoor digital shelf: 3 sectors = 3 kg (6 lbs)

Outdoor WBRU: 7 kg (15 lbs)

Power supply

-48 Vdc nominal (-40 to -60 Vdc)

DC ON/OFF Switch with integrated
circuit breakers

Power LED indication

Power consumption

Indoor digital shelf: 3 sectors = 90W

Outdoor TDD: 55W/sector; 110W/sector with diversity
(2x WBRU)

WiMAX.

Clearly here and now

SR Telecom is a pioneer and acknowledged leader in the broadband wireless access (BWA) industry. With 26 years of experience in designing, developing and deploying wireless access networks for top-tier carriers around the world, SR Telecom's BWA solutions have been installed in over 110 countries, serving more than two million people.

The first company to commercially deploy an OFDM-based broadband solution, SR Telecom is the only BWA vendor with a decade of experience deploying advanced WiMAX technologies in end-to-end solutions. We provide top-tier carriers with the industry's highest link budget and verifiable performance metrics, not just predictions on how a product will perform based on lab testing. With this real-world experience driving our product innovation, SR Telecom focuses on delivering premium broadband technology, and business-driven services that exceed operators' expectations and drive their business forward. Our solutions and support strategies are key enablers for large-scale WiMAX rollouts by top-tier carriers.