SkyMAX™

Siemens WiMAX Solution

SIEMENS

First in the WiMAX Arena

SkyMAX is the Siemens WiMAX solution that provides cost-efficient last mile broadband wireless access for residential users, Small Office-Home Office (SOHO) and Small-Medium size Enterprises (SME).

SkyMAX employs non-line-of-sight OFDM technology according to IEEE802.16, ETSI HiperMAN standard and WiMAX baseline profiles for delivering voice, video and data services at a rate of multiple Mbps with guaranteed quality of service (QoS) and grade of service (GoS).

SkyMAX provides a standard-based mean for offering new forms of voice, video and data services to end-users staying at home, in the office, outside or on the move.
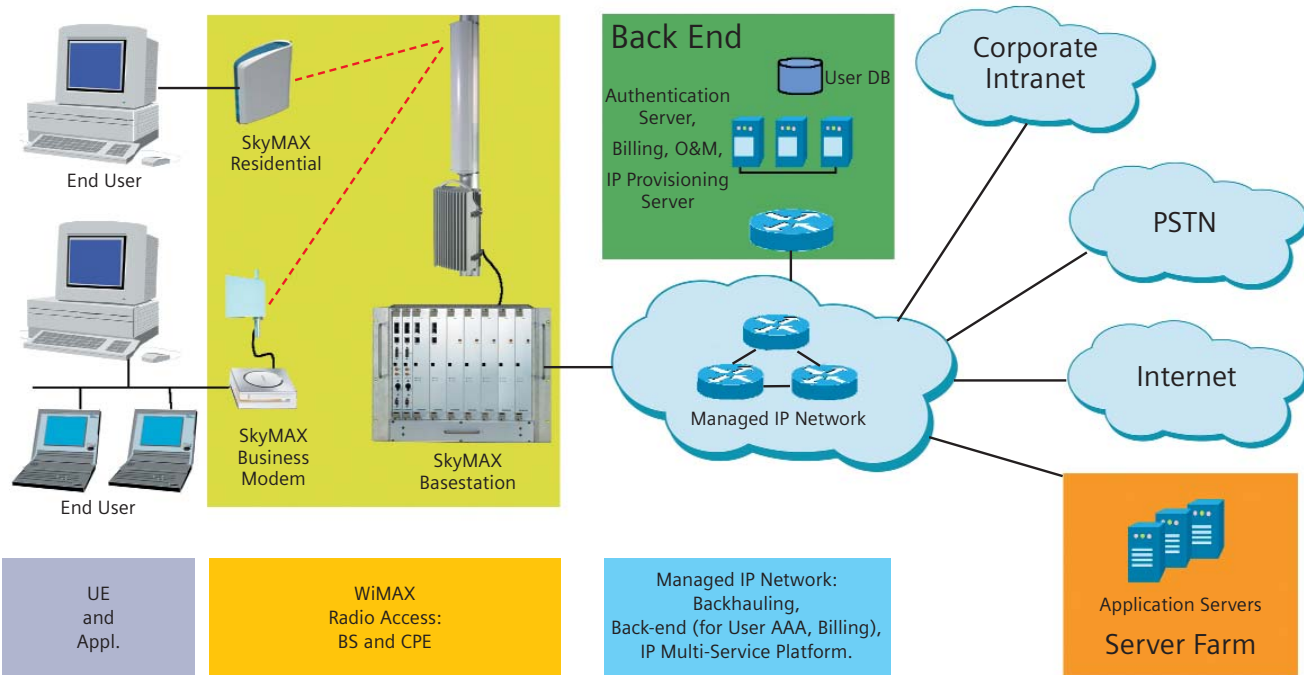
SkyMAX is the IEEE802.16e SOFDMA-ready platform for operators offering broadband fixed and nomadic services of today IEEE802.16d standard who wish to seamlessly evolve their network with lowest risk towards portable services of tomorrow IEEE802.16e standard.

SkyMAX system enables the operator to offer a variety of broadband real-time and non-real-time nomadic/portable services such as:
- data services like HSIA (High Speed Internet Access), e-mail, file download, office extension, music downloads, streaming audio;
- good quality Video services like Video on Demand, Broadcast video, video streaming;
- real Time Packetized Voice (VoIP, live streaming audio);
- real Time Video such as videoconference, video communication, networked/internet gaming, live streaming video;
- TDM services.

SkyMAX system includes the SkyMAX Basestation product line, the SkyMAX CPE portfolio for residential and business users and is part of an end-to-end network solution that provides fixed and portable services.

SkyMAX Basestation's high power solution and the cost-effective, complete SkyMAX CPE portfolio provide the highest range and top-in-class performance to residential users, small-office and small-to-medium size enterprises.

End User

SkyMAX Residential

SkyMAX Business Modem

End User

SkyMAX Basestation

Back End

Authentication Server, Billing, O&M, IP Provisioning Server

User DB

Managed IP Network

Corporate Intranet

PSTN

Internet

Application Servers

Server Farm

UE and Appl.	WiMAX Radio Access: BS and CPE	Managed IP Network: Backhauling, Back-end (for User AAA, Billing), IP Multi-Service Platform.	

SkyMAX Basestation

SkyMAX Basestation is the Siemens WiMAX equipment that provides voice, video and high-capacity data services to stationary and portable users.

SkyMAX Basestation is a carrier-grade shelf that fits into standard racks, supports up to four sectors and is connected to one or more remote Outdoor Units (ODU). The chassis hosts a Controller and Switching Unit (CSU), a Connector Unit (CU) and multiple Sector and Modem Units (SMU). All modules are hot-swappable.

Indoor shelf

- The Controller and Switching Unit (CSU) manages all Basestation components and aggregates traffic from the air-interface to the backbone. The CSU transparently interfaces the IP networking gear through standard IP and Ethernet protocols via 100/1000 BaseT network interface. The CSU could be made 1:1 redundant for protection purpose.

- The Connector Unit (CU) hosts DC filters and connectors for power supply, alarms and external synchronisation signals like GPS. The CU and the power supply line could be made 1:1 redundant for protection purpose.

- The Sector and Modem Unit (SMU) manages the radio resources of one sector and includes the physical, the DLC and the MAC layer functionalities. Its OFDM modem is capable of providing up to 1024FFT for seamless evolution towards IEEE802.16e standard. The RF channel is software configurable from 1.75MHz up to 14MHz as required to migrate towards IEEE802.16e SOFDMA.

Outdoor Unit

- Each SMU is connected via one single IF cable to a top-in-class high-power remote Outdoor Unit (ODU) that performs the RF processing. The ODU integrates two receivers in order to provide cost-effective polarisation or spatial RX diversity. The high power 35dBm ODU is installed close to the antenna to minimise the feeder loss and ensures the highest range. Booster or Tower Mounted Amplifiers are not required.

Cost-effective equipment reliability is ensured through N:1 redundancy of SMU plus ODU units.

Frequency Division Duplex (FDD) and Time Division Duplex (TDD) are both supported.

Technical Benefits

Highest cell range

SkyMAX solution achieves the highest range and cell capacity through the combined use of high-power solution, advanced diversity techniques and sub-channelisation.

SkyMAX Basestation and CPE portfolio support the sub-channelised transmission in order to recover from a lower uplink vs. downlink output power (up to 35dBm SkyMAX Basestation, up to 27dBm for CPE).

Sub-channelling increases the uplink budget (up to 12dB) for those users that are located close to the cell border but decreases the uplink user throughput accordingly.

SkyMAX Basestation also employs advanced cost-effective receive-diversity technique integrated in its RF unit (ODU), which efficiently combines the signals received from different antennas for enhanced uplink budget. The usage of RX diversity is therefore highly recommended.

Highest data rate every time

SkyMAX supports BPSK, QPSK,16QAM and 64QAM modulations and provides per-allocation adaptive modulation and coding scheme. SkyMAX ensures the most robust link conditions with the highest data rate by optimally selects the best physical mode in downlink and by optimally assigns modulation, coding schemes, transmit power and sub-channels to the attached CPE's in uplink.

More Capacity over the Air

SkyMAX offers industry-leading Spectral Efficiency for highest data rate provision. The excellent multi-path resistance capabilities of OFDM technology enables operation in Non-Line-Of-Sight (NLOS) conditions, which allows reaching optimal spectrum usage and a net peak data rate of 25Mbps over a single 7 MHz channel.

Moreover, SkyMAX employs Payload Header Suppression (PHS) and packets concatenation, fragmentation and packing. Those functionalities, together with support of ARQ (Automatic Repeat Request) protocol makes voice and data transmission even more reliable and efficient.

No waste of Bandwidth

The amount of spectrum and duplex scheme allocated for Broadband Wireless Access (BWA) applications vary on a country-basis depending on local regulatory decisions. In order to offer the highest flexibility, the RF channel size of each sector is made configurable between 1.75MHz and 14 MHz (in steps of 250 KHz). SkyMAX optimally manages the radio resources by assigning dynamically the available on-air capacity to the active CPE's with guaranteed QoS according to stipulated Service Level Agreement.

Easy integration into existing network

SkyMAX is conceived to be an integral part of an IP-based network thanks to its comprehensive set of IP and Ethernet services and applications. SkyMAX supports VLAN, Ethernet, IP over Ethernet traffic transport. It lets service provider implementing Virtual Private Network (VPN) for corporate intranet access, Trivial File Transfer Protocol (TFTP) and any other IP-based applications. The service provider can optimise the assignment of IP addresses and offers secure services by implementing DHCP (Dynamic Host Configuration Protocol) that SkyMAX supports acting as server or relay agent.

Guaranteed quality of service (QoS)

QoS service in the IEEE802.16 standard is accomplished through four different type of scheduling services: unsolicited (or continuous) grant, real time polling, non-real-time polling, and best effort service. SkyMAX supports all above mentioned scheduling services. Service flows QoS parameters like Peak Data Rate (PDR), Guaranteed Data Rate (GDR), User Priority (for grade of service) can be configured on a service-basis and separately for uplink and downlink.

A signalling function for dynamically establishing QoS-enabled service flows and traffic parameters is supported. The QoS parameters of the service flow can be also dynamically varied on a connection-basis by mean of Dynamic Services signalling messages.

Overbooking of On-air resources is also supported by SkyMAX.

MultiService support

The upper layer incoming packets are classified based on IP/Ethernet traffic flow differentiators like ToS field of IP header (DiffServ aware IP-based network) and Traffic Priority field (IEEE802.1p) of VLAN frame e.g.. So SkyMAX is able to differentiate the services like Web browsing, Voice over IP (VoIP), Video streaming,... with the ability to map each of them into a different service over the air interface. The advanced scheduling mechanism and queues-visit algorithms of SkyMAX enforce the assigned QoS metric of the service flows by giving the traffic of each queue different delay and buffer preference.

Grade of Service (GoS) Management

Several user groups can be defined (Platinum, Gold, Silver, Bronze,...) according to the different Service Level Agreement (SLA) stipulated between the service provider and the end-user. SkyMAX provides the appropriate GoS by assigning each user profile a different "User Priority" level. Up to four User Priority levels can be assigned to each service. Given two services identical in all other QoS parameters, the higher priority service is given lower delay and higher buffering preference. Priority management is supported in Up and Down link directions separately.

Boundless deployment

International carrier which operates in a number of countries where different bands are allocated for broadband wireless access applications needs a unique platform that can be easily adapted to various local regulatory environments. The hardware architecture of SkyMAX foresees an indoor shelf that is frequency-agnostic and is able to inter-operate with multiple remote outdoor units (ODU) of the SkyMAX family (3.5GHz, 2.5GHz i.e.).

"Pay as you grow"

SkyMAX is designed to be scalable in terms of number of sectors, capacity per sector and services per CPE. Up to four sectors, more than 16 thousands active services per Basestation makes SkyMAX Basestation a future-proof solution to meet future traffic volume expectation. Moreover the support of up to 16 different services per CPE with different QoS level enables the service provider to offer multi-tiered services and maximize the revenue opportunities. Activation licenses enable operators to smoothly increase the network investments as the customer base grows.

Minimal backhauling cost

The SkyMAX Basestation aims to minimise operator's backhauling costs by offering a wide variety of backhaul interfaces and solutions. The CSU slot can host Ethernet, PDH or SDH based physical interface to fit at the best into the already existing transmission environment.

Secure Services

SkyMAX has a privacy sub-layer than performs authentication, key exchange and encryption of packets according to IEEE802.16 standard. Device authentication is based on X.509 for certification and validation whilst encryption employs IEEE standard compliant protocols. Universal Access Method (UAM) and IEEE-compliant Personal Key Management (PKM) user authentication protocols are also supported.

SkyMAX Basestation Main Features

- IEEE802.16- 2004 and WiMAX Compliant

- Seamless Upgrade towards IEEE802.16e SOFDMA

- SW Configurable RF Channel (1.75 ÷ 14MHz)

- Flexible Architecture (split indoor-outdoor part)

- Highest Range (35dBm High Power downlink, RX Div. and Sub-chann. uplink)

- Cost-effective RX Diversity solution (integrated in one ODU)

- Carrier-grade redundancy concept (all units are protected)

- Cost-effective Radio Chain redundancy concept (N:1)

- Always the best Radio Conditions and highest Data Rate (Adaptive PHY Mode and Power Control)

- Guaranteed QoS and Multi-service support based on SLA on a per-user basis (standard compliant Service Classes and IP/Ethernet-traffic classification schemes)

- Carrier-grade Synchronisation concept (GPS, external synch)

- Seamless Integration into existing network (Simple networking concept)

- Seamless Integration into existing AAA Platform (User Authentication)

End User

Office

End User

Internet Cafè

Wi-Fi
Access Point
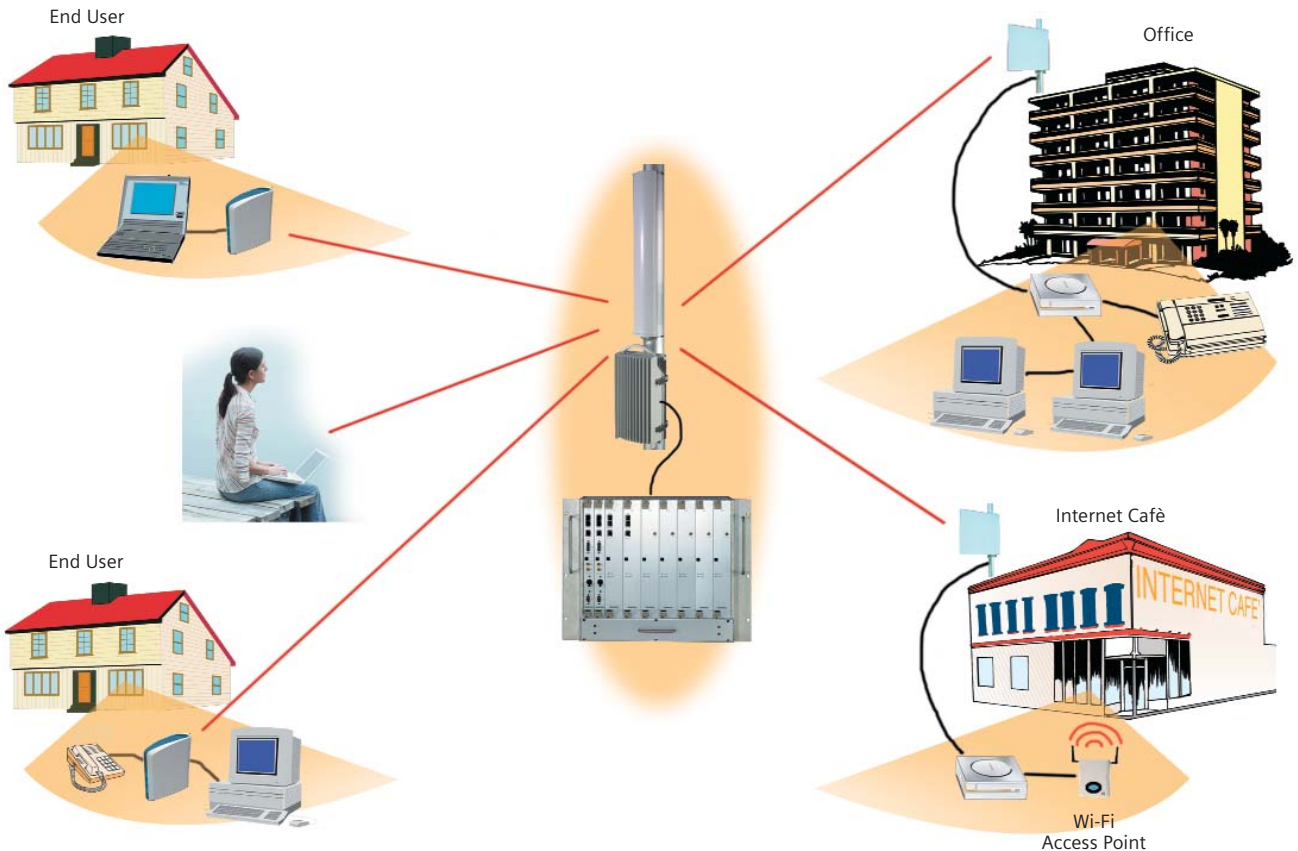
Customer Premises Equipment

The need for anytime, anywhere access to voice, video and high-speed data services is becoming more and more important. SkyMAX fulfils this need by empowering residential and business users with a variety of CPE models that address the need of the different market segments:

- SkyMAX Residential (fully indoor, self-installing) designed for Residential users and SOHO

- SkyMAX Business (fully outdoor) designed for Business customers and Gold residential users

All models are remotely operated and maintained by Siemens NetViewer O&M system.

SkyMAX Residential

SkyMAX Residential is the ideal solution for every access need. It is a fully-indoor, self-installing device that provides broadband wireless access services to residential users and small/home offices (SOHO). SkyMAX Residential operates in Non-Line-Of-Sight (NLOS), below the roof line. SkyMAX Residential provides the interface to the user's equipment and the RF processing on a single main board. It is powered from the mains via its power supply unit. The RF connector of SkyMAX Residential can be connected to multiple types of antenna (omni directional, desktop, window, external antenna) depending on use cases and radio conditions.

Technical Benefits

High Speed Performance
The SkyMAX Residential provides an efficient platform for high speed Internet/Intranet services and for any type of voice and real-time services. The system provides its subscribers with fast access to IP based services, a typical user experience of multiple Mbps and a peak data rate of 30Mbps (uplink and downlink).

Self-Installation
The SkyMAX Residential connects end-user devices that run the most widely used operating systems, applications and contents without any modifications.

Variety of types for every need
SkyMAX Residential comprises three different versions that differ from number and type of interfaces:

- SkyMAX Residential Modem: provides the wireless termination point for the SkyMAX system at the subscriber's location. It connects to the user owned equipment by standard Ethernet 10/100 BaseT.
- SkyMAX Residential Multi-User: is the ideal solution for multi-user access where there is a need to share the bandwidth among different users. It is equipped with multiple Ethernet 10/100 BaseT ports, POTS interfaces and optionally Wi-Fi (IEEE802.11) access point for indoor coverage of subscriber household. SkyMAX Residential Multi-User has the same housing and design of the SkyMAX Residential Modem.
- SkyMAX Residential Portable Modem: is a low-power slim version of SkyMAX Residential Modem with battery and optional SIM cardholder suitable for nomadic/portable usage.

SkyMAX Residential Main Features

- Fully indoor, self-installing, small-form-factor

- Non-Line-Of-Sight operation (NLOS)

- Several antenna options (omnidirectional, desktop, outdoor high gain antenna)

- Networking features

- Ethernet, POTS, Wi-Fi connectivity

- Multi-level QoS via traffic classification and SLA enforcement

- Remote configuration, management and software upgrades
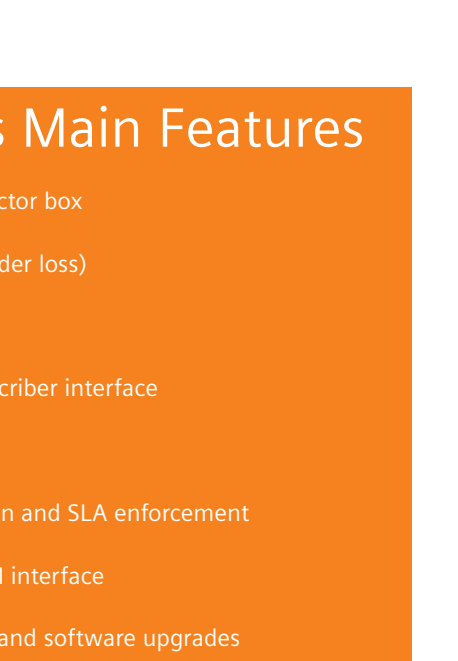
SkyMAX Business

SkyMAX Business is the optimal solution for SME, SOHO and Gold residential users.
Conceived as a fully outdoor device, SkyMAX Business is equipped with a integrated high gain antenna in order to maximise cell range and improve quality of service in challenging propagation environments. The outdoor unit provides for simple, fast, low cost installations and high operational reliability. It is connected to a indoor connector box via a thin multi-wire cable. Ethernet connectivity available in the connector box makes it compatible with all types of subscriber LAN equipment.

Technical Benefits

Premium Services
The SkyMAX Business provides a reliable platform for any type of real-time and non-real-time services and TDM services. The system provides its subscribers with advanced networking suite of functionalities and security capabilities.

Best QoS in every radio condition
Due to its split indoor-outdoor architecture, the outdoor part of the SkyMAX Business can be easily installed at or even above the roof line where the radio signal is much stronger. The high gain antenna ensures a 18dBi link budget increase. Furthermore, building penetration losses are not to be accounted. As a result, SkyMAX Business ensures the highest data rate and best QoS.

SkyMAX Business Main Features

• Fully outdoor unit with indoor connector box

• Integrated high gain antenna (no feeder loss)

• Advanced routing functionalities

• Single drop cable for power and subscriber interface

• Non-Line-Of-Sight operation (NLOS)

• Multi-level QoS via traffic classification and SLA enforcement

• Ethernet user interface, optional TDM interface

• Remote configuration, management and software upgrades

Business Benefits of SkyMAX Solution

SkyMAX solution enables operators to rapidly address multiple market segments and build out their networks with minimal Capital and Operational Expenses (Capex and Opex).

- SkyMAX is the WiMAX solution in the market that provides all savings and economies of scale made possible by standards-based, interoperable products. WiMAX products will drive down price and performance to levels unachievable by proprietary approaches.

- SkyMAX allows operators to minimise the number of required Basestations, sites and associated expenses needed for deployment thanks to:
  - highest range achieved through High-Power solution, dynamic usage of sub-channelisation and cost-effective antenna diversity techniques;
  - highest flexibility during site search, site acquisition and deployment while minimising installation and power consumption costs through distributed Basestation architecture with remote Outdoor Unit (ODU) close to the antenna.

- SkyMAX CPE family minimises installation time and operational costs:
  - SkyMAX Residential is the family of self-installing, fully indoor devices with zero-installation cost and maintenance specifically designed for residential users and small/home offices.
  - SkyMAX Business comprises fully-outdoor, one-piece units that require a low-cost installation with simple cabling in NLOS conditions. Configuration, fault management and software upgrades over the air interface reduce the operational costs.

- SkyMAX offers operators reliability, flexibility, and compelling economics while migrating their networks from today IEEE802.16d-based network (OFDM 256) to tomorrow IEEE802.16e-based network (SOFDMA) without the worry of costly forklift upgrades.

- SkyMAX offers operators nearly unlimited scalability, upgradeability and "Pay as you Grow" investment strategy: more than 16 thousands services simultaneously handled by the SkyMAX Basestation, up to 16 simultaneous services per SkyMAX CPE. "Pay as you Grow" concept is realised through activation licenses.

- Boost of operator revenues from fixed line replacement services and business customers thanks to:
  - voice, video and data services with guaranteed QoS (Quality of Service);
  - highest data rates even at cell border;
  - outstanding service availability due to cost-effective N:1 Basestation redundancy concept.

- Additional revenues from Nomadic/Portable add-on services through support of Personal Key Management protocols and user authentication mechanism according to IEEE802.16 standard.

- SkyMAX solution achieves break-even typically within 18/24 months of operations.

- SkyMAX solution is complemented by Siemens unique end-to-end portfolio, which increases operators revenues thanks to:
  - application platforms;
  - content based charging.
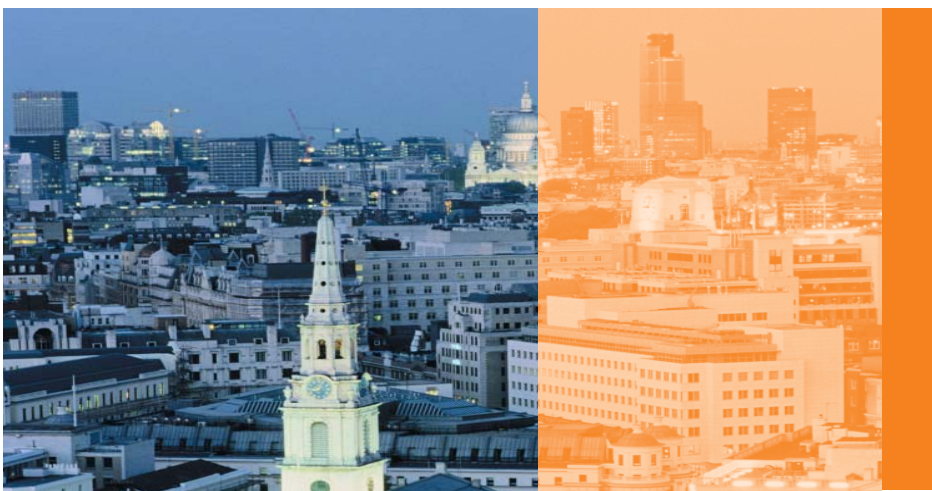
Technical Data

Standard Compliance

Air Interface	IEEE802.16-2004 OFDM 256FFT
Seamless upgrade towards	IEEE802.16e SOFDMA (Scalable OFDMA) OFDM 1024FFT

QoS

Service Classes	Best Effort, Non-Real-Time/Real-Time Polling, Continuous Grant
Peak Data Rate	Configurable per Service, separately in Up/Down-link
Guaranteed Data Rate	Configurable per Service, separately in Up/Down-link
User Priority	Configurable per Service, separately in Up/Down-link

Radio Frequency Section

Frequency band	3.4÷3.8 GHz
Duplex Mode SkyMAX Basestation	FDD, TDD
Duplex Mode SkyMAX Residential and Business	half-FDD (H-FDD), TDD
Sub-carriers Modulation	BPSK, QPSK, 16QAM, 64QAM adaptive
RF Channel size	1.75 ÷ 14 MHz SW configurable
Output power at antenna connector SkyMAX Basestation	up to 35 dBm
Output power at antenna connector SkyMAX Residential and Business	up to 27 dBm
Receiver Sensitivity @ 1.75 MHz/3.5 MHz	-103/-100 dBm ÷ -85/-82 dBm

SkyMAX Basestation

Networking

Network Interface	10/100/1000 BaseT
Packets classification	Layer2 IEEE802.1p; Layer3 IP DSCP

Performance

Sectors	up to 4 (4+1 protection)
Max net capacity (UL+DL)	320Mbps
Max # of Simultaneous Services	16384

Quality Aspects

Environmental	ETSI EN 300 019
Acoustic Noise Emission	ETSI EN 300 753(6) class 3.1 Business
Radio	ETSI EN 301 021
EMC	ETSI EN 301 489
Safety	ETSI EN 60950
Power Supply	ETSI EN 300-132

Mechanical & Electrical

Dimensions Shelf (HxWxD)	405x435x258 mm
Max Power Consumption 3 sectors Basestation	470 W
Operation Temperature indoor part	0 °C ÷ +45 °C
Operation Temperature outdoor part	-33 °C ÷ +55 °C

SkyMAX Customer Premises Equipment

Networking

Data Interface SkyMAX Residential Modem	10/100 BaseT
Data Interface SkyMAX Business	10/100 BaseT; E1/T1 (Optional)
Packets classification	Layer2 IEEE802.1p; Layer3 IP DSCP
Networking functionalities	NAPT; DHCP; PPPoE

Performance

Max # of simultaneous Services	Up to 16
Max Sustained Data Rate (UL+DL)	30 Mbps

Quality Aspects

Environmental	ETSI EN 300 019
Acoustic Noise Emission	ETSI EN 300 753(6) class 3.1 Office
Radio	ETSI EN 301 021
EMC	ETSI EN 301 489
Safety	ETSI EN 60950
CE Marking	EU 1999/5/EC
Environmental Protection	WEEE Eco directive; 2002/95/EC (RoHS)

Mechanical & Electrical

Dimensions SkyMAX Residential (HxWxD)	150x140x50 mm
Dimensions SkyMAX Business Outdoor Part (HxWxD)	160x160x60 mm
Max Power Consumption	25 W
Operation Temperature SkyMAX Residential	0 °C ÷ +40 °C
Operation Temperature SkyMAX Business	-33 °C ÷ +55 °C
Power supply	100-240 VAC; 50-60Hz

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