

E3-E4 (CM MODULE)

WiMAX OVERVIEW & BSNL WiMAX PROJECT

WELCOME

- This is a presentation for the E3-E4 Technical (CM-Module) for the Topic: WiMAX Overview & BSNL WiMAX Project
- Eligibility: Those who have got the upgradation from E3 to E4.
- This presentation is last updated on 14-3-2011.
- You can also visit the Digital library of BSNL to see this topic.

Agenda

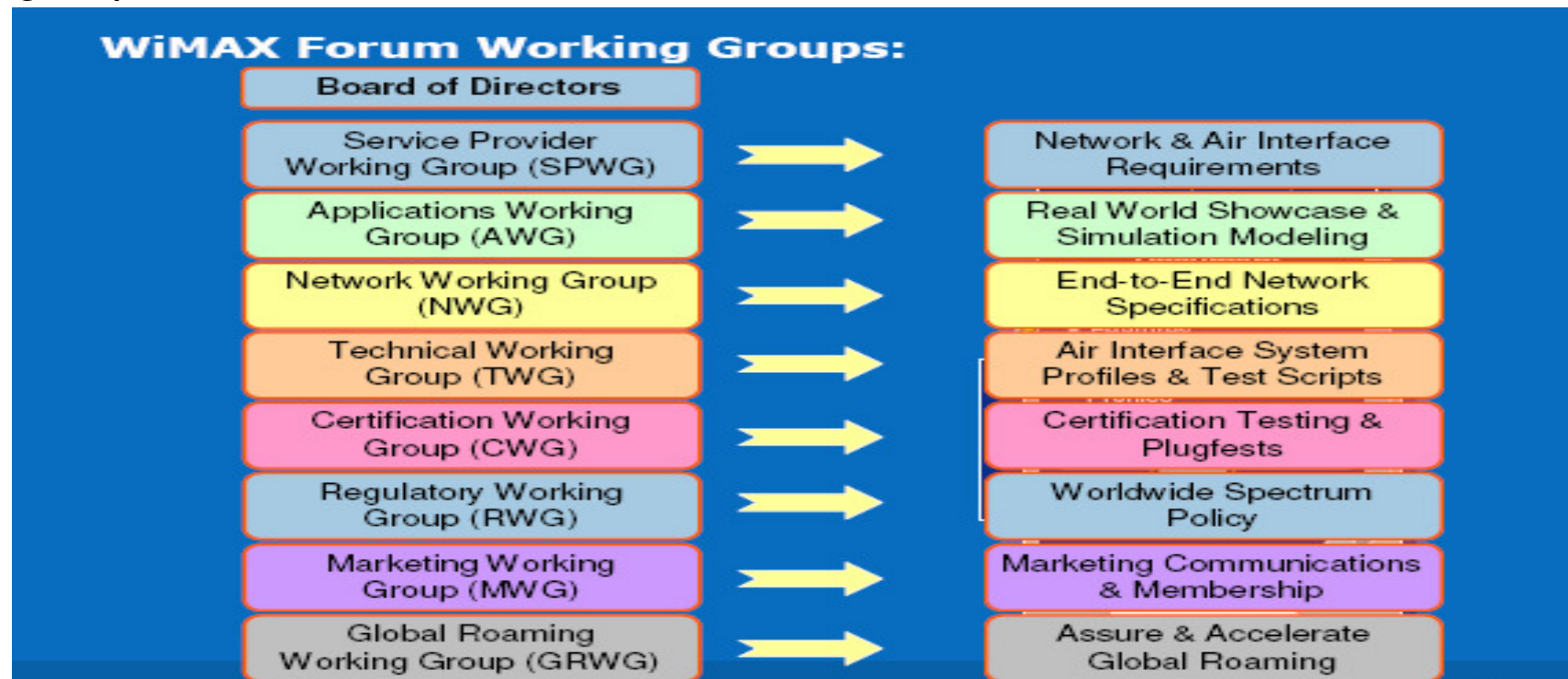
- Wi-MAX: Introduction
- WiMAX Forum
- WiMAX: Salient Features
- WiMAX: Network Architecture
- WiMAX Technical Aspects
- BSNL Plans

WiMAX: Introduction

The **WiMAX (Worldwide Interoperability for Microwave Access)** technology, based on the IEEE 802.16-2004 Air Interface Standard is rapidly proving itself as a technology that will play a key role in fixed broadband wireless metropolitan area networks. In December, 2005 the IEEE introduced the 802.16e which adds the features and attributes to the standard necessary to support mobility. WiMAX has become a “hot topic” in the wireless industry, with visible and aggressive backing from INTEL, among others. WiMAX is designed to provide “last-mile” or “backhaul” connectivity using wireless.

WiMAX Forum

The **WiMAX Forum** brings together leaders in the communication and computing industries to drive a common platform for global deployment of IP based wireless broadband services. The WiMAX forum certifies products for conformance and interoperability based upon IEEE 802.16 standards. WiMAX forum has various working groups as follows.



WiMAX Forum Profiles

WiMAX forum Profiles are defined by the following parameters:

- Spectrum band
- Duplexing-TDD/FDD
- Channel bandwidth

IEEE 802.16-2004 profile uses OFDM with 256 subcarriers and 802.16e profiles are based on Scalable OFDMA and supports mobility.

WiMAX: Salient Features

Some of the salient features supported by Mobile WiMAX are:

- **High Data Rates:** Mobile WiMAX technology supports peak DL data rates up to 63 Mbps per sector and peak UL data rates up to 28 Mbps per sector in a 10 MHz channel.
- **Quality of Service (QoS):** WiMAX defines Service Flows which can provide end-to-end IP based QoS.
- **Scalability:** Mobile WiMAX technology is designed to be able to scale to work in different channelization from 1.25 to 20 MHz to comply with varied worldwide requirements.

WiMAX: Salient Features

Security: The features provided for Mobile WiMAX security aspects are best in class with EAP (Extensible Authentication Protocol) based authentication, Support for a diverse set of user credentials exists including Digital Certificates, and Username/Password schemes.

Mobility: Mobile WiMAX supports full mobility for all types of CPE.

WiMAX: Network Architecture

The IEEE only defined the Physical (PHY) and Media Access Control (MAC) layers in 802.16. WiMAX Forum's Network Working Group, which is focused on creating higher-level networking specifications for fixed, nomadic, portable and mobile WiMAX systems beyond what is defined in the IEEE 802.16 standard.

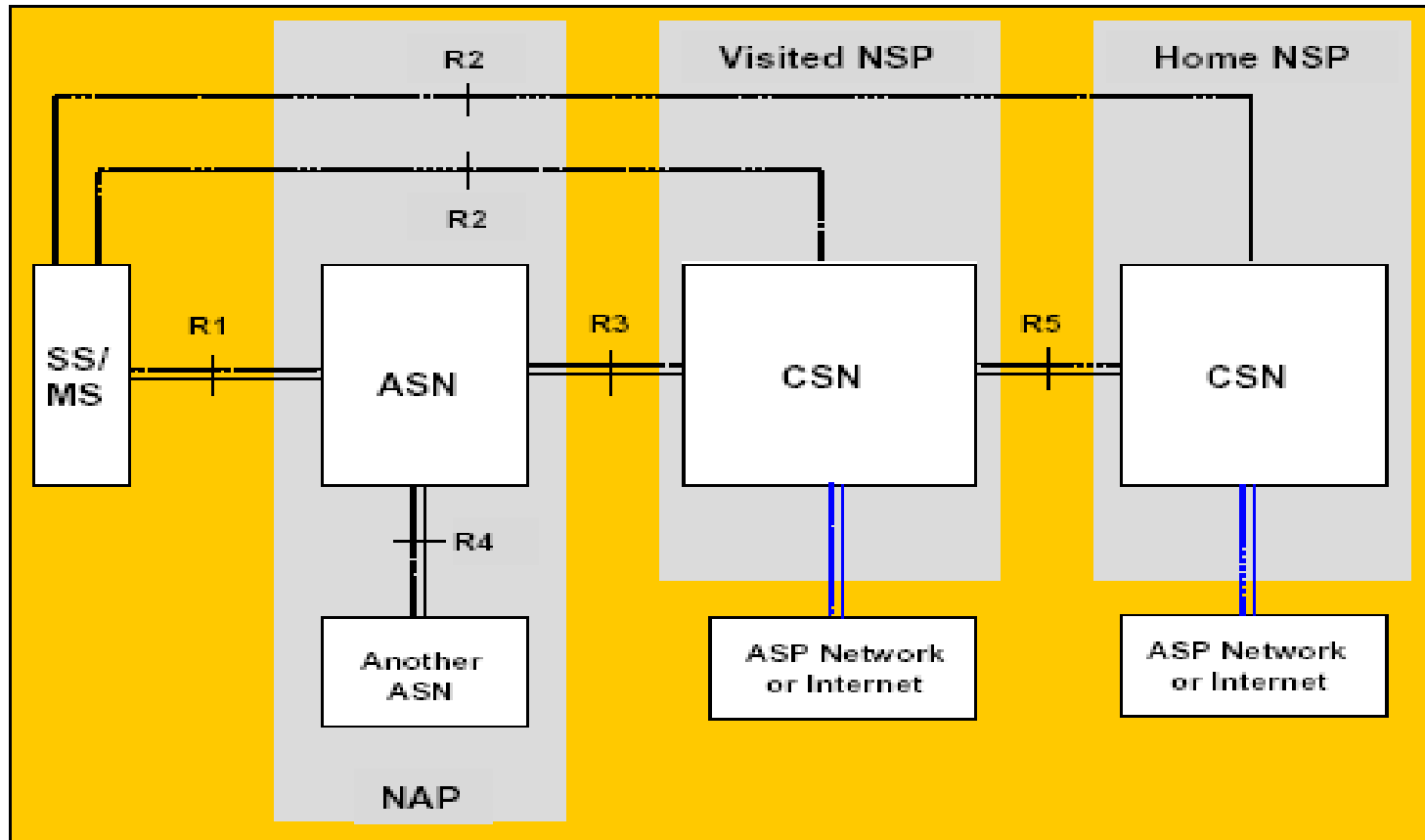
The Mobile WiMAX End-to-End Network Architecture is based on an All-IP platform. The use of All-IP means that a common network core can be used.

WiMAX: Network Architecture

WiMAX Forum has identified a WiMAX Network Reference Model (NRM) that is a logical representation of the network architecture. The NRM identifies functional entities and reference points over which interoperability is achieved between functional entities. NRM, consisting of the following logical entities:

- MS (Mobile Station)
- Access Service Network (ASN)
- Connectivity Service Network (CSN)

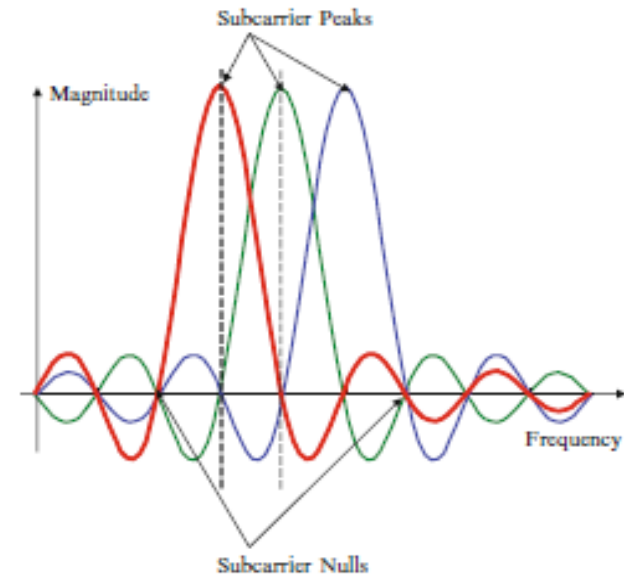
WiMAX: Network Architecture



WiMAX Network Reference Model

WiMAX Technical Aspects: OFDMA

Orthogonal Frequency Division Multiplexing (OFDM) is a multiplexing technique that subdivides the bandwidth into multiple frequency sub-carriers. In an OFDM system, the input data stream is divided into several parallel sub-streams and each sub-stream is modulated and transmitted on a separate orthogonal sub-carrier. It enables a large number of sub-carriers (up to 2048).



WiMAX Technical Aspects: TDD

The 802.16e supports Time Division Duplexing (TDD) operation. TDD is the preferred duplexing mode over FDD for the following reasons:

- ✓ **TDD enables** adjustment of the downlink/uplink ratio to efficiently support asymmetric downlink/ uplink traffic, while with FDD, downlink and uplink always have fixed and generally, equal DL and UL bandwidths.
- ✓ **TDD assures** channel reciprocity for better support of link adaptation, MIMO and other closed loop advanced antenna technologies.

WiMAX Technical Aspects: TDD

- ✓ **Unlike FDD**, which requires a pair of channels, TDD only requires a single channel for both downlink and uplink providing greater flexibility for adaptation to varied global spectrum allocations.
- ✓ **Transceiver** designs for TDD implementations are less complex and therefore less expensive.

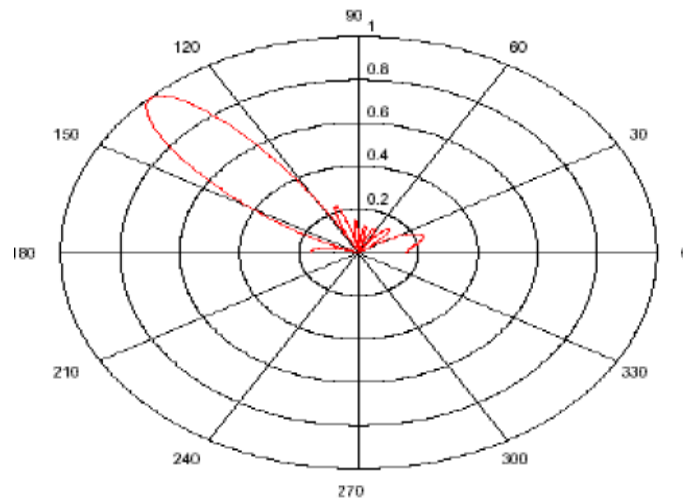
WiMAX Technical Aspects: AMC

- WiMAX supports for QPSK, 16QAM & 64QAM modulation in DL.
- In the UL, 64QAM is optional.
- Both Convolution Code (CC) and Convolution Turbo Code (CTC) with variable code rate and repetition coding are supported.

WiMAX: Smart Antenna Technologies

Mobile WiMAX supports smart antenna technologies to enhance system performance. The smart antenna technologies supported include

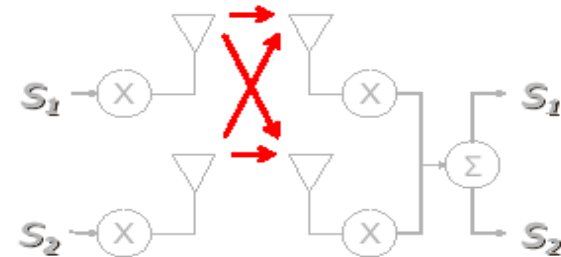
Beam-forming: With beam-forming, the system uses multiple-antennas to transmit weighted signals to improve coverage and capacity of the system and reduce outage probability.



WiMAX: Smart Antenna Technologies

Multiple Input Multiple Output (MIMO): MIMO is supported to take advantage of higher peak rates and increased throughput. In MIMO multiple streams are transmitted over multiple antennas. If the receiver also has multiple antennas, it can separate the different streams to achieve higher throughput compared to single antenna systems. 2x2 MIMO (Multiple Input Multiple Output), increases the peak data rate two-fold by transmitting two data streams.

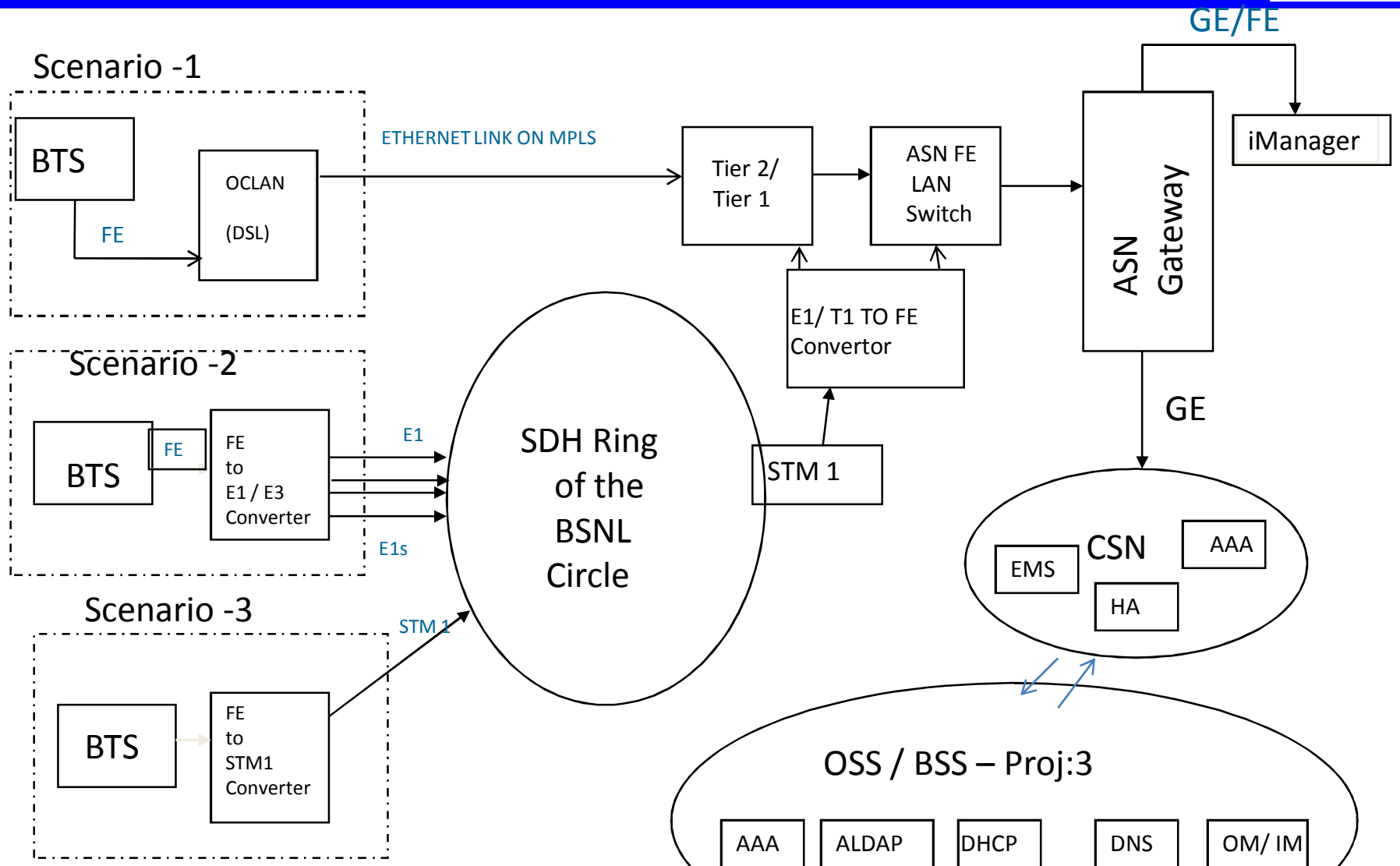
MIMO A / MIMO B



Matrix-A: Space Time Block Coding-TX
diversity, benefiting link margin
Matrix-B: Spatial multiplexing, benefiting throughput

BSNL PLANS

BSNL: Proposed WiMAX Network



BSNL: WiMAX Spectrum

20 MHz spectrum has been allocated to BSNL in July 2008.

- Gujarat, Maharashtra & Andhra Pradesh in FDD Mode
2540 & 2640 MHz with 10 MHz in each band
- Rest of India 20 Mhz with TDD Mode
carrier frequency of 2645 Mhz.

BSNL: WiMAX Models

BSNL has adopted different models for deployment of WiMAX Services:

- GJ, MH & AP Circle- deployment by M/s Soma Network in revenue sharing agreement.
- PB & KL Circle – Own deployment about 1600 WiMAX BTS of 802.16e-2005 standard.
- DIT Bharat Nirman Project- About 1000 BTS to cover 16000 blocks of rural areas and provide access to wireless broadband.
- In remaining 16 LSA deployments through franchise on revenue sharing agreement basis.

BSNL: WiMAX Rural Project

Department of Information Technology (DIT) Project for wireless Broadband connectivity to Community Service Centres (CSC's). STP is the in-charge for Execution of the Project.

Rural Phase-I

- Approximately 11,666 CSC's for 1000 Blocks.
- PO to M/s HCL Infosystems Ltd. for North and East. PO to M/s Gemini Communications Ltd. for South and West.

Rural Phase-II

- Approximately 51000 CSC's to be covered.
- Total 6863 BTS to be installed.

BSNL: WiMAX Urban Project

- WiMAX Urban Project is for Kerala & Punjab Circle.
- BSNL will deploy its own WiMAX Network.
- In Kerala the PO for supply of 450 BTS was awarded to M/s ICOMM.
In Punjab the PO for supply of 350 BTS was awarded to M/s Huawei
WiMAX urban service has been launched on 31.03.2010 in 22 cities
/towns of Punjab Circle.

Customer Premises Equipment (CPE)

CPE types:

- Indoor USB Type CPE (integrated antennas)
- Integrated outdoor CPE
- PC Card
- Laptop integrated

CPE benefits:

- Interoperability and multiple vendor Support



Self Install



Outdoor



PC Card



Laptop

Planned WiMAX Coverage

RF Environment	CPE Type	Coverage (Approx. Cell Radius - Kms)
Urban	Laptop with USB Dongle	1.5
Urban	Indoor CPE	2.5
Urban	Outdoor CPE	8
Rural	Outdoor CPE	15

Thank You