1.0 Introduction

1.1 WiMAX Customer Premises Equipment (CPE) supports Ethernet and VoIP connections to deliver Broadband Wireless Access (BWA) services. Outdoor CPEs are used for fixed applications and in line-of-sight (LOS) environment and Tilt Mounting Kits suitable for different environments. CPEs can be remotely configured.

1.2 Scope

1.2.1 This document specifies Generic Requirements (GR) of OUTDOOR WiMAX Customer Premises Equipment (Subscriber Station (SS, MS), used for accessing Broadband Wireless services provided by WiMAX networks, in line-of-sight (LOS) scenarios.

1.2.2 This GR covers requirements for interoperability, Quality, Electromagnetic Compatibility, Safety and Security. It does not cover software applications/features of CPE.

1.2.3 This document covers Two Categories of OUTDOOR WiMAX CPE based on architecture and support of Data/ Voice services.

1.2.4 Functional Requirements

2.1 Services

2.1.1 i) The CPE shall provide Fixed Broadband Wireless Access (BWA) as per IEEE 802.16e standard.

ii) The CPE shall support services i.e. Data, Video and Voice.

iii) Prevailing National Regulations shall apply in case of VoIP.

2.1.2 Usage models:

- Fixed: Usage with a fixed CPE at a single location.

2.2 CPE shall be fully Plug & Play. There shall not be any requirement of driver installation by the customer.

2.3 The CPE shall be capable of working with any of the WiMAX certified base station with corresponding certification profile.

2.4 CPE shall have a Visual/ audio indications on the unit indicating receive signal strength for facilitating proper orientation and quick alignment and easy installation.

3.0 Technical Requirements

3.1 Conformance to Standards

The equipment shall conform to WiMAX Forum Air interface Specifications: Mobile System Profile – Release 1.0 (based on IEEE 802.16e standard) and shall be certified against WiMAX Forum Wave 2 (for applicable profile) or Open Retail 1(a) or its any higher release.

3.2 (i) The CPE shall be able to work in anyone of the frequency bands as defined below and Channel bandwidths shall be supported as defined in table below:

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Frequency Band</th>
<th>Channel Bandwidth</th>
<th>FFT – Size</th>
<th>Duplexing</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>3.4 GHz to 3.6GHz</td>
<td>5MHz &amp; 10MHz</td>
<td>512 &amp; 1024</td>
<td>TDD</td>
</tr>
<tr>
<td>2.</td>
<td>2.5GHz to 2.69GHz</td>
<td>5MHz &amp; 10MHz</td>
<td>512 &amp; 1024</td>
<td>TDD</td>
</tr>
<tr>
<td>3.</td>
<td>2.3GHz to 2.4GHz</td>
<td>5MHz &amp; 10MHz</td>
<td>512 &amp; 1024</td>
<td>TDD</td>
</tr>
</tbody>
</table>

(ii) Both Bandwidths shall be supported by the equipment.

(iii) Multiband support shall be supported if required by operator (optional).

(iv) Frequency band in operation will be as per allocation by WPC/ DoT.

3.3 MIMO CONFIGURATION:

i) CPE shall support 2Tx, 2Rx MIMO
ii) CPE may support 1Tx, 2Rx MIMO (Optional).
iii) CPE shall support both modes of MIMO, i.e. MIMO Matrix-A (STC) and MIIMO Matrix-B.

3.4 OUTDOOR CPE shall comply with specifications listed in the following table:

3.5 Minimum receiver sensitivity in dBm of all categories of CPEs shall be as per table below:

<table>
<thead>
<tr>
<th>Band Width</th>
<th>Modulation/Coding Rate</th>
<th>Modulation/Coding Rate</th>
<th>Modulation/Coding Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>QPSK</td>
<td>16QAM</td>
<td>64QAM</td>
</tr>
<tr>
<td></td>
<td>1/2 3/4</td>
<td>1/2 3/4</td>
<td>1/2 3/4</td>
</tr>
<tr>
<td>5MHz</td>
<td>-96 -93</td>
<td>-90 -86</td>
<td>-83 -81</td>
</tr>
<tr>
<td>10MHz</td>
<td>-93 -90</td>
<td>-87 -83</td>
<td>-80 -78</td>
</tr>
</tbody>
</table>

3.6 Interconnecting Cable

It shall be possible to connect Outdoor Unit to Indoor unit through Ethernet Cable. Suitable connector, low loss connecting cable and other accessories, mounting pole/ arrangement shall be provided as per requirement of the purchaser.

3.7 DL/UL Configurations

The CPE shall support different configurations of DL/UL distribution (ratio) e.g. 1:1, 2:1, 3:1 etc. on the air-interface.

3.8 Spectrum Mask: It shall be as per applicable IEEE or WiMAX Forum standards.

3.9 Maximum Transmit Power: An SS shall not produce an EIRP spectral density exceeding either +39.5 dBmi/MHz or as per National regulatory requirements as modified time to time.

3.10 Power Class Profile:

Limits shall be as per applicable Power Class of CPE.

<table>
<thead>
<tr>
<th>Class Identifier</th>
<th>Transmit Power(dBm) for 16-QAM</th>
<th>Transmit Power (dBm) for QPSK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Class 1</td>
<td>18 &lt;= PTx,max &lt; 21</td>
<td>20 &lt;= PTx,max &lt; 23</td>
</tr>
<tr>
<td>Power Class 2</td>
<td>21 &lt;= PTx,max &lt; 25</td>
<td>23 &lt;= PTx,max &lt; 27</td>
</tr>
<tr>
<td>Power Class 3</td>
<td>25 &lt;= PTx,max &lt; 30</td>
<td>27 &lt;= PTx,max &lt; 30</td>
</tr>
<tr>
<td>Power Class 4</td>
<td>30 &lt;= PTx,max</td>
<td>30 &lt;= PTx,max</td>
</tr>
</tbody>
</table>

3.11 The CPE shall allow voice (or circuit data service) and packet data service to operate concurrently (within the limits of the air interface system capacity).

3.12 Quality of Service

IP services with IP classifiers, QoS Bandwidth allocation as per IEEE 802.16e standard shall be supported.

3.12.1 The
3.12.4 Intra-user and inter-user QoS shall be supported.

3.13 Other Technical Specifications

3.13.1 Sub-Channelling

The CPE shall support sub-channeling mode in uplink transmission as per IEEE 802.16e standard.
3.13.2 Channel Coding

The CPE shall support 1/2, 2/3 & 3/4 channel rate coding. Turbo coding to be supported as defined in IEEE 802.16e standards.

3.13.3 Modulation

i) and available transmit power.

3.13.4 Physical Ranging

The CPE shall support four different uplink Ranging channels (initial ranging, periodic ranging, bandwidth request and handover) as defined in IEEE 802.16e standard.

3.13.5 PHY Feedback Channels

The CPE shall support ACK channel, and 6 bit CQICH (Channel Quality Indication Channel).

3.13.6 Embedded Wi-Fi Access Point

CPE with embedded Wi-Fi Access Point shall be compliant to IEEE 802.11 b/g/n and have 64/128bits WEP, WPS, WPA/WPA2 and MAC address filtering capability. The antenna type used shall be 1 x internal 2dBi.

4.0 Interconnectivity and Interoperability

The CPE shall be WiMAX Forum Certified or WiMAX Certified against WiMAX Forum Wave 2 or OR 1a (Open Retail 1a) or any higher certification release (for the applicable profile).
5.0 Quality Requirements

The System shall meet the following qualitative requirements.

a) The manufacturer shall have a valid ISO 9001:2008 certificate. The quality plan describing the quality assurance system followed by the manufacturer shall be submitted.

b) The equipment shall meet the environmental requirements as per category - D (for Outdoor Unit) and Category ï B (for Indoor Unit) of TEC standard for Environmental Testing of Telecommunication Equipment (No. SD: QM-333 March 2010).

c) The MTBF (Mean Time between Failure) and MTTR (Mean Time To Restore) predicted shall be provided and the manufacturer shall furnish observed values.
6.1 General Electromagnetic Compatibility (EMC) Requirements:

The equipment shall conform to the EMC requirements as per the following standards and limits indicated therein. A test certificate and test report shall be furnished from a test agency.

a) Conducted and radiated emission (applicable to telecom equipment):

   Limits:-
   ii) The values of limits shall be as per TEC Standard No. TEC/EMI/TEL-001/01/FEB-09

b) Immunity to Electrostatic discharge:

   Limits:-
   i) Contact discharge level 2 \( \pm 4 \text{ kV} \) or higher voltage;
   ii) Air discharge level 3 \( \pm 8 \text{ kV} \) or higher voltage;

c) Immunity to radiated RF:

   Limits:-
   i) Under Test level 2 \( \{ \text{Test field strength of 3 V/m} \} \) for general purposes in frequency range 80 MHz to 1000 MHz and
   ii) Under test level 3 \( \{ 10 \text{ V/m} \} \) for protection against digital radio telephones and other RF devices in frequency ranges 800 MHz to 960 MHz and 1.4 GHz to 6.0 GHz.

d) Immunity to fast transients (burst):

   Limits:-
   Test Level 2 i.e. a) 1 kV for AC/DC power lines; b) 0.5 kV for signal / control / data / telecom lines;

e) Immunity to surges:

   Limits:-
   i) For mains power input ports : (a) 1.0 kV peak open circuit voltage for line to ground coupling (b) 0.5 kV peak open circuit voltage for line to line coupling
   ii) For telecom ports : (a) 0.5 kV peak open circuit voltage for line to ground (b) 0.5 kV peak open circuit voltage for line to line coupling

f) Immunity to conducted disturbance induced by Radio frequency fields:

   Limits:-
   Under the test level 2 \( \{ 3 \text{ V r.m.s.} \} \) in the frequency range 150 kHz - 80 MHz for AC / DC lines and Signal / Control / telecom lines.

g) Immunity to voltage dips & short interruptions (applicable to only ac mains power input ports, if any):

   Limits:-
   i) a voltage dips corresponding to a reduction of the supply voltage of 30% for 500ms (i.e. 70% supply voltage for 500 ms)
   ii) a voltage dips corresponding to a reduction of the supply voltage of 60% for 200ms (i.e. 40% supply voltage for 200 ms)
   iii) a voltage interruption corresponding to a reduction of supply voltage of > 95% for 5s.

   Note 1: The test agency for EMC tests shall be an accredited agency and details of accreditation shall be submitted.

Alternatively EMC test report from a non-accredited test lab, which is audited by an accredited lab / accrediting authority for the availability of all the essential facilities (test equipment, test chamber, calibrations in order, test instructions, skilled personnel etc.), required for performing the tests according to the EMC test methods audited, may be acceptable.
7.0 Safety Requirements

7.1 The equipment shall comply with applicable requirements specified in UL60950-1 and EN 60950/60950-1.

7.2 The CPE shall comply with the prevailing national standard for SAR (Specific Absorption Rate). SAR (Specific Absorption rate) measurement system shall as per the TEC GR No. TEC/GR/SAR/001/01.
8.0 Security Requirements

8.1 User Security Requirements:

8.1.1 Security management based on key exchange and encryption shall be supported.

8.1.2 The CPE shall support the Privacy Key Management version 2 (PKMv2) authentications and confidentiality protocol on the RF interface.

8.1.3 Device authentication based on X.509 certification management shall be supported as defined in the clause 8.3.2.3.9 of the 802.16e-2005 standards.

8.1.4 The Equipment shall support a mechanism through which only allowed cipher suites are enabled to provide the strongest cipher algorithms permissible under regional or global export regulations.

8.1.5 The Equipment shall support PKMv2 authorization utilizing EAP as the authentication protocol for the 802.16 network.

8.1.6 The Equipment shall support traffic encryption utilizing the AES-CCM mode of the Advanced Encryption Standard (AES) to encrypt MAC PDUs.

8.1.7 The AES Key Wrap algorithm shall be used for the encryption of keys sent by BS to the CPE.

8.1.8 The Equipment shall support CMAC for MAC message authentication.

8.1.9 The Equipment shall expire key materials based on time and/or volume of exchanged data.

8.1.10 The system shall provide accordance with IEEE 802.16e standard for primary, static and dynamic security associations to be utilized to specify the security profiles for different kinds of service flows per CPE.

8.1.11 Lawful Interception

The CPE shall not pose any restriction w.r.t. Lawful Interception and Monitoring using the LIS/LIM equipment deployed in the Service Provider’s Network.

8.3 General Security Requirements:

8.3.1 The following general security requirements are intended to protect hosts from various threats where the host itself is the intended target:

i) Operating system hardening shall be required on all equipment utilising commercial operating systems.

ii) Anti-virus software shall be utilized on all Microsoft Windows based platforms in the network.

9.0 Other Requirements

9.1 Identification of Equipment

i) CPE shall be marked with supplier’s or manufacturer’s logo/name as per purchaser’s requirements.

ii) The Model No., serial No., Month and year of manufacture shall be screen printed at the bottom of the CPE body.

9.2 Documentation

Detailed documentation in English and Hindi/Indian Local Language shall be provided, including:

i) Self explanatory user manual giving details of all functions, facilities and procedures

ii) Set- Optional Requirements

10.1 Following features may be supported:-

i) Support for SIM

ii) VoIP Features

a. Caller ID
b. Directory (Contact Information)
c. Voice Quality - VAD (Voice Activity Detection), CNG (Comfort Noise Generation), Echo Cancellation G.165/G.168,
d. DTMF Detection and Generation,
e. Conferencing
f. Call Features
g. SMS (Short Messaging Services)
h. Ring tones

10.2 Firewall Features

(i) IP Based Packet Filtering for incoming/outgoing packets for the following:
(ii)
   a. Source IP address
   b. Destination IP address
   c. Source layer 4 port
   d. Destination layer 4 port
   e. Source MAC address filtering
(iii) Stateful packet inspection (SPI)

Tendering Information

11.1 Required category of CPE as per Clause 3.4 to be specified.
11.2 As per requirements, purchaser, may specify:-
   a) MIMO Configuration (Clause No. 3.3)
   b) Embedded WiFi Access point (Clause No. 3.14)
11.3 For procurement purposes, purchaser may consider to include any/all of the clauses given below:
   a) Optional features in clause No 3.4 -12 (ii), 3.4 -17 (for DES only), 8.3.1(III).
   b) Features, Menus, Application, Interfaces on CPE
   c) Display Specifications.
   d) Embossing/screen printing of service provider’s logo shall be as per purchaser’s requirement.
   e) Colour and aesthetics shall also be as per purchaser’s requirements.
   f) List of all components for which second source is not available should be provided.