Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**Draft IEEE 802.16m Requirements: Section 6: Functional Requirements**	
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Re:	Response to call for contributions on requirements for P802.16m – Advanced Air Interface	
Abstract	This document proposes text for Section 6.0	
Purpose	For consideration of 802.16 TGm Requirements drafting group	
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6.0Functional Requirements

This section contains system level functional requirements targeting higher peak rates, lower latency, lower system overhead as well as PHY/MAC features enabling improved service security, QoS and Radio Resource Management.

6.1 Peak Data Rate

State of the art modulation, coding, scheduling and multiplexing should be employed to achieve higher spectral efficiency at a reasonable complexity.

The IEEE 802.16m should include enhancements relative to the 802.16e reference system MIMO and AAS modes within the scope of the project for the explicit purpose of increasing the capacity, aggregate link data rates and spectral efficiency.

The requirements for peak data rates in the downlink and uplink are captured in the following table. For These requirements shall be met with the Baseline Antenna Configuration as defined earlier in this document. TDD systems, these requirements shall be calculated for the DL and UL based on 1:0 and 0:1 DL:UL ratios, respectively.

Requirements for peak data rate

Key Performance Characteristic	Required Value	Comments
DL Peak Data Rates		
Peak (stationary/indoor)	> 64 Mbps	Assuming a 10 MHz operating bandwidth (unpaired) consistent with the IEEE 802.16e reference system This requirement shall be met with the baseline antenna configuration. Average Instantaneous Data Rate DL > 20 Mbps, where average instantaneous implies average over the cell area.
Peak (pedestrian)	> 64 Mbps	
Peak (vehicular)	> 40 Mbps	
Peak (stationary/indoor)	> 128 Mbps	Assumes a 20 MHz operating bandwidth This requirement shall be met with the baseline antenna configuration. Average Instantaneous Data Rate DL > 40 Mbps, where average instantaneous implies average over the cell area.
Peak (pedestrian)	> 128 Mbps	
Peak (vehicular)	> 80 Mbps	
UL Peak Data Rates		

Peak (stationary/indoor)	> 28 Mbps	Assuming a 10 MHz operating bandwidth (unpaired) consistent with the IEEE 802.16e reference system This requirement shall be met with the baseline antenna configuration. Average Instantaneous Data Rate UL > 10 Mbps, where average instantaneous implies average over the cell area.
Peak (pedestrian)	> 28 Mbps	
Peak (vehicular)	> 18 Mbps	
Peak (stationary/indoor)	> 56 Mbps	Assuming a 20 MHz operating bandwidth. This requirement shall be met with the baseline antenna configuration. Average Instantaneous Data Rate UL > 20 Mbps, where average instantaneous implies average over the cell area.
Peak (pedestrian)	> 56 Mbps	
Peak (vehicular)	> 36 Mbps	

6.2 Latency

Latency should be further reduced as compared to the 802.16e reference system for all aspects of the system including the air link, state transition delay, access delay, and handover.

The following latency requirements shall be met by the system, under light loading assuming no signaling/MAC message retransmission.

Latency requirements for the system

Latency Metric	Requirement	Comments
IDLE_STATE to ACTIVE_STATE	< 100 ms	The time it takes for a device to go from an idle state (fully authenticated/registered and monitoring the control channel) to when it begins exchanging data with the network on a traffic channel or timeslot measured from the paging indication (i.e. not including the paging period).
SLEEP_STATE to ACTIVE_STATE	< 10 ms	
Transmission Latency – Uplink	< 10 ms	The one-way transit time between the start of a small IP data packet transmission from the MS MAC layer and its arrival at the BS MAC layer for a high priority service assuming all radio resources have been previously assigned.
Transmission Latency – Downlink	< 10 ms	The one-way transit time between the start of a small IP data packet transmission from the BS MAC layer and its arrival at the MS MAC layer for a high priority service assuming all radio resources have been previously assigned.
Scheduling Latency – Uplink	< 15 ms	The time between the arrival of a data packet at the MS and the start of its transmission for a high priority service assuming all radio resources have been previously assigned.
Handoff interruption time (intra FA)	< 50 ms	The time between the point when an MS makes connection with a target handoff channel and when it breaks connection with its previous operating channel (Handoff between two sectors operating in the same frequency assignment).
Handoff interruption time (inter FA)	< 150 ms	The time between the point when an MS makes connection with a target handoff channel and when it breaks connection with its previous operating channel (Handoff between two sectors operating in different frequency

		assignments).
Initial System Entry Time	(a) < 5 s (b) < 60 s	The time for a new device to complete network entry with probability > 0.9, including scanning, receiving DL signal and required management messages, and performing system entry for (a) when the device is powered on in the same network it was operating last time (including neighboring cells), and (b) when the device is powered on in a new network.

6.3 QoS

IEEE 802.16m shall support QoS classes, enabling an optimal matching of service, application and protocol requirements (including higher layer signaling) to RAN resources and radio characteristics. This includes enabling new applications such as interactive gaming [5]. The 802.16m amendment shall provide

simultaneous support for a wide range of multimedia services,

enhanced management of different quality of service levels

6.4 Radio Resource Management

While Radio Resource Management (RRM) is outside the scope of IEEE 802.16m standard necessary messages and parameters to enable RRM at the network layer shall be supported.

Functions such as priority and preemption shall be supported.

Regional regulatory needs including CALEA shall be supported to extent it impacts the air interface.

6.5 Security

The following are the requirements for Secrecy and Privacy:

Confidentiality and integrity protection (encryption) for traffic transmission, MAC management messages, and control information;

Robust user/device authentication scheme; Location privacy scheme; and Reliable and flexible service availability protection scheme.

The following are the requirements for Service Security

Authentication and authorization of subscribers to each service shall be provided

All signaling and user traffic related to services shall be confidentiality- and integrity-protected

It shall be possible to apply different levels of security to different sessions after some negotiation during the signaling setup

A single sign-on solution that minimizes the number of times that protection is applied when a user is accessing a service, without reducing the security level, is highly desirable.

The following are the requirements for Interworking Security:

Delay constrained handover and roaming support without changing the security level (Especially, seamless mobility across heterogeneous networks with the negotiation of security mechanisms/algorithms); and Minimum performance/capacity degradation due to the security feature provisioning.

6.6 Improved Location Determination and Broadcast-Multicast Efficiency

The IEEE 802.16m system shall support PHY and MAC measurements and reporting mechanisms needed to enable high resolution location determination.

The 802.16m system should provide optimizations for efficiently delivery of broadcast and multicast services.

The performance requirements for location determination and broadcast and multicast services are captured under performance requirements.