

IEEE 802.16m Update

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<http://www.cse.wustl.edu/~jain/wimax/16m0706.htm>



- Requirements:
 - General requirements
 - Functional Requirements
 - Performance Requirements
 - Operational requirements
- 802.16m Evaluation Methodology: ToC

TGm Technical Documents

- ❑ System requirements document (SRD)
 - Requirements to be met by 16m
 - Defines scope of SDD and TGm amendment
 - Similar to stage 1 in 3GPP
- ❑ Evaluation methodology
- ❑ System description document (SDD)
 - Describes complete 16m end system
 - Captures technical decisions
 - Similar to stage 2 in 3GPP
- ❑ TGm Amendment: Detailed specification

IEEE 802.16m Overview

- ❑ Candidate for IMT-Advanced evaluation process
- ❑ IMT-Advanced next generation mobile networks
ITU-R report M.2072
- ❑ Amendment to 802.16-2004 and 16e.
- ❑ Advanced air interface for operation in licensed bands

General Requirements

- ❑ Meet all the IMT-Advanced performance requirements.
- ❑ System requirements for a system comprising of all new MSs and BSs.
- ❑ Legacy support: Mobile System Profile, Release 1.0 (Revision 1.4.0: 2007-05-02) [1].
 - 16m MS shall be able to operate with a legacy BS
 - 16m and 16e shall be able to operate on the same RF carrier, with the same/different channel bandwidth
 - 16m BS shall support a mix of 16m and legacy MSs
 - 16m BS shall support seamless handover of a legacy MS to and from legacy BS
- ❑ Minimize complexity and number of options

General Requirements (Cont)

- ❑ Operating frequencies: less than 6 GHz
- ❑ Operating bandwidths: 5 to 20 MHz and more.
- ❑ Duplex schemes: TDD and FDD, HFDD
- ❑ Both unpaired and paired frequency allocations
- ❑ UL/DL ratio should be configurable in both TDD and FDD
- ❑ Downlink-only configurations on a given carrier.
- ❑ Advanced antenna techniques
 - Minimum 2 Xmit and 2 Rcv For BS
 - Minimum 1 Xmit and 2 Rcv for MS
 - => Minimum 2x2 downlink and 1x2 uplink

General Requirements (Cont)

- ❑ Support for government mandates and public safety first responders, military and emergency services such as call-prioritization, pre-emption, push-to-talk.
- ❑ Emergency Services (E9-1-1) [12] and Communications Assistance for Law Enforcement Act (CALEA) [13] [14]

Functional Requirements

- ❑ Peak data rate:
 - Downlink (BS->MS) > 6.5 bps/Hz,
Uplink (MS->BS) > 2.8 bps/Hz
 - After phy overhead pilots, cyclic-prefix, guard bands and guard intervals.
 - 20 MHz => 130 Mbps
- ❑ Latency : Lower than 16e in all cases - air link, state transition delay, access delay, and handover.
 - Data latency: Deliver one one MAC PDU Downlink (BS->MS) 10 ms max, Uplink (MS->BS) 10 ms max
 - State transition latency: from idle to active mode in less than 100ms
 - Max Handover interruption time: Intra-frequency 50 ms, Inter-frequency 150 ms

Functional Requirements (Cont)

- ❑ QoS: Maintained when switching between radio access technologies (RATs)
- ❑ Service continuity during handover for both inter-RAT and intra-RAT handover.
- ❑ Enhanced multicast broadcast service (E-MBS) via a dedicated carrier.
- ❑ Optimized switching between broadcast and unicast services
- ❑ Max MBS channel reselection interruption times:
Intra-frequency 1s, Inter-frequency 1.5s
- ❑ High resolution location determination.
- ❑ Reduce overhead associated with headers of higher layer protocols
- ❑ Multi-RAT operation: 802.11, 3GPP GSM/EDGE, UMTS WCDMA, LTE, CDMA2000

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Performance Requirements

- ❑ 2x user throughput related to 16e
- ❑ 2x sector throughput (bps/Hz/Sector) in DL, and 1.5x in UL
- ❑ 1.5x VOIP capacity (active users/MHz/sector)
- ❑ Min 60 active VOIP users/MHz/sector assuming a 12.2 kbps codec with a 40% activity factor
- ❑ Mobility: Optimized for 0-15 km/h, marginal degradation 15-120 km/h, maintain connection 120-350 km/h
- ❑ 3 dB improvement in link budget over 16e
- ❑ Optimized for cell sizes of up to 5km. Graceful degradation in spectral efficiency for 5-30km. Functional for 30-100 km.

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Performance Requirements (Cont)

- ❑ E-MBS services with 4 bps/Hz for inter-site distance of 0.5 km, 2 bps/Hz for 1.5km
- ❑ Both mixed unicast/multicast and dedicated MBS carriers
- ❑ Location-based services:
 - Handset-based position accuracy 50m (67% of time) 150m (95% of time)
 - Network-based position accuracy 100m (67% of the time) 300m (95% of the time)

Operational requirements

- ❑ Operate in legacy 16e spectrum
- ❑ Operate in other legacy RAT spectrums
- ❑ 16m should provide enhancements to enable multi-hop relays.
- ❑ Synchronize frame timing and frame counters with BSs of same-technology neighboring systems
- ❑ Co-deployment with other networks
 - 16m is anticipated to be deployed in the same RF bands as the legacy network.
 - Co-deployable in same or overlapping geographical areas with other RATs

802.16m Evaluation Methodology: ToC

1. Introduction
2. System Level Set-up
3. Duplex Schemes
4. Channel Models: TDL Models, TDL Models with Antenna Correlation, System Model Definition, Channel Mix, Interference Channel Modelling, Path Loss Model, Spatial Channel Model
5. Link-to-System Mapping: PHY Abstraction, Mutual Information/Capacity ESM, EESM
6. Link Adaptation: Adaptive Modulation and Coding, HARQ, Channel Quality Feedback,
7. HARQ: ACK/NACK Channel

802.16m Evaluation ToC (Cont)

8. Scheduling: DL scheduler UL scheduler
9. *Handoff: Single Mobile MS Model, Trajectories, Cell Topology, Handover Performance Metrics*
10. *Power Management (informative)*
11. Traffic Models: HTTP, FTP, VOIP, NRT Video Streaming, Gaming, Traffic Mixes
12. Simulation Procedure and Flow
13. *Simulation Outputs and Performance Metrics*
14. Template for Reporting Results

802.16m Evaluation ToC (Cont)

Appendix-A: Correlation of Angular Spread and Shadowing Factor

Appendix-B: Calculation of Circular Angular Spread

Appendix-C: Spatial Correlation Calculation

Appendix-D: Polarized Antenna

Appendix-E: LOS Option with a K-factor

Appendix-F: Antenna Gain Imbalance and Coupling

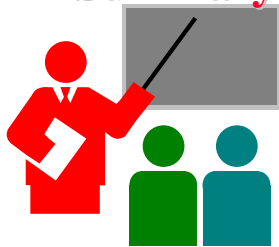
Appendix-G: 19-Cell Wrap-Around Implementation

Appendix-H: Calculation of PAPR and Cubic Metric

Appendix-I: Overhead Calculations

Appendix-J: Fixed User Locations For System Level Calibration

Summary



- Requirements document draft is almost complete
- Evaluation methodology document is being revised.
New version to be released 6/18/07.

Abbreviations and acronyms

- ❑ CALEA Communications Assistance for Law Enforcement Act
- ❑ E-MBS enhanced multicast broadcast service
- ❑ LBS location based services
- ❑ MBS multicast broadcast service
- ❑ MBSFN multicast broadcast single frequency network
- ❑ MIH media independent handover
- ❑ MS mobile station
- ❑ NCMS network control and management services
- ❑ RAN radio access network
- ❑ RAT radio access technology
- ❑ RRM radio resource management

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- [12] FCC Docket no 94-102 this includes order numbers 96-264, 99-96, 99-245.
- [13] Communications Assistance for Law Enforcement Act of 1994 (CALEA), Pub. L. No. 10323 414, 108 Stat. 4279.
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