

Simulation Results for 8Tx Codebook for 802.16m

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Venue:

Re: 802.16m amendment working document - Chapter 15.3.7 (DL-MIMO)

Abstract:

Proposal for modification to 16m 8Tx codebook

Purpose:

Adoption of proposed text/content for 802.16m AWD

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<http://standards.ieee.org/guides/bylaws/sect6-7.html#6>> and <http://standards.ieee.org/guides/opman/sect6.html#6.3>>.

Further information is located at <http://standards.ieee.org/board/pat/pat-material.html>> and <http://standards.ieee.org/board/pat>>.

System Level Results (16m EMD)

Relative sector throughput – 16m EMD

UL Model	ULA		XPOL	
Feedback method	CB-AWD	CB-381r1	CB-AWD	CB-381r1
SU-MIMO	100	104	100	102
MU-MIMO	100	113	100	109

Note: The sector throughput with CB-AWD codebook is normalized to 100 for ULA and XPOLs separately. It is also normalized for SU and MU-MIMO with CB-AWD separately.

System Simulation Setup (1/3)

- **System Layout:**
 - 19 cell (57 sector) classical layout; statistics in the center cell;
 - Cell radius = 866 m
 - 10 MS per sector; final statistics on about ~600 MS in the center cell
 - 10 MHz, full frequency reuse across cells/sectors
- **Channel:**
 - Pathloss model: $130.19 + 37.6 \cdot \log_{10}(R)$, where R in km + 10dB penetration loss + 2 dB cable loss
 - SCM channel details: PedB multipath profile, AS = 15 degrees, $v = 3\text{km/h}$, $f = 2.5\text{GHz}$;
 - Dominant interferers (path loss within 20dB of desired) are modeled as frequency and spatially selective
- **BS:**
 - 4 Transmit antennas, 4 Receive antennas (power fair TX power allocation per antenna)
 - TX power = 46 dBm;
 - ULA with 0.7λ spacing;
 - Sector antenna: parabolic (70 degrees 3 dB beamwidth), 17 dBi gain, 20 dB front-to-back ratio
- **MS:**
 - 2 receive antenna
 - MMSE receiver at the MS

System Simulation Setup (2/3)

- **Downlink:**
 - Permutation: distributed CRUs (48 randomly permuted PRUs; subband allocation count = 0).
 - Full buffer
 - Equal bandwidth scheduler: $N_{\text{PRU}} = \text{floor}(48/N_{\text{USERS}})$; for MU-MIMO this applies per MU-MIMO group
 - 24 symbols per 5 ms frame; 12 pilots per PRU assumed
- **Feedback methods**
 - A) CB-AWD: 8Tx codebook as in 16m 80216m-09_0010r1a.pdf
 - B) CB-381r1: 8Tx codebook as in C80216m-09_0381r1_Samsung.doc
- **DL TX methods**
 - SU-MIMO (realistic rank adaptation and PMI selection based on wideband broadcast interference estimate at the MS on midamble)
 - MU-MIMO (realistic user grouping at the BS based on wideband PMI & CQI feedback or eigenvector & CQI feedback, both based on midamble)
- **Wideband feedback**
 - Rank, CQI, PMI calculation based on wideband midamble
 - Ideal DL channel estimation for Rank adaptation, CQI, PMI selection, and eigenvector calculation
 - Rank-one feedback for MU-MIMO (for both PMI and eigenvector)

System Simulation Setup (3/3)

- UL models for PMI & AFB:
 - Ideal (PMI known at BS)
- UL Models for Rank and CQI feedback
 - Rank feedback for SU-MIMO is Ideal
 - CQI feedback is ideal
- Link adaptation
 - Realistic: based on wideband CQI feedback from the MS; 1 frame delay
 - Chase HARQ is modeled (max 3 attempts)
- Feedback delays:
 - 5 ms (1 frame) delay for PMI
- Link-to-system mapping: EESM
- The effect of precoded interference seen on the DL data versus the midamble-only interference seen during CQI and PMI calculations is captured

Comments

- CB-381r1 has better performance than CB-AWD
 - Also has better distance properties
- CB-381r1 maintains a unitary structure (CB-AWD rank1 is non-unitary)
 - Enables CQI computation for MU-MIMO (as described in section 15.3.7.2.6.1 of AWD)
 - CB-AWD disables unitary MU-MIMO (CB-381r1 enables PU2RC MU-MIMO especially for uncorrelated scenarios)
- CB-381r1 enables low complexity search for MS due to 8-PSK alphabet and rank nesting
 - Search complexity is especially a concern for 8Tx due to more channel coefficients