Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**IEEE 802.16-2004 and IEEE 802.16e RF Characteristics**
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Source(s)	Reza Arefi reza.arefi@intel.com Intel Corporation On behalf of WiMAX Forum www.wimaxforum.org
Re:	In response to ITU-R activities related to coexistence studies between IMT-2000 and OFDM-based broadband wireless access systems in the 2.5-2.69 GHz band.
Abstract	This document provides a recommended list of RF characteristics for IEEE 802.16-2004 and 802.16e developed in WiMAX Forum to be used in performing spectrum sharing studies including in ITU-R Working Party 8F.
Purpose	For approval and submission to the next ITU-R WP 8F meeting to be held June 7-15.
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IEEE 802.16-2004 and 802.16e RF Characteristics

WiMAX Forum

Introduction

In its 15th meeting, ITU-R Working Party 8F (WP8F) continued its discussion on the proposal from the US administration to produce a Report on the issue of adjacent frequency sharing of the 2.5-2.69 GHz between IMT-2000 systems and OFDM-based Broadband Wireless Access (BWA) systems in the same geographical area. As a result of these discussions, WP8F agreed to "…conduct sharing studies initially between IMT-2000 and fixed broadband wireless access systems including nomadic applications. Therefore, a liaison statement to WPs 8A, 9B and 9D asking for technical information regarding non-IMT-2000 broadband wireless access systems and material relevant to these sharing studies was approved." [1]

IEEE 802.16-2004 and its mobile evolution 802.16e are certainly among those OFDM-based BWA systems that are being considered for deployment in the 2.5-2.69 GHz band and are, therefore, likely to share this band with IMT-2000 systems. IEEE 802.16-2004, supporting nomadic BWA applications has been published in 2004. IEEE 802.16e, supporting mobile applications, is in its final stages and is expected to be approved later this year. Since none of the ITU-R Working Parties that received the liaison letter from WP8F have official approved technical documentation on 802.16 systems, and also since such information is not included in any approved ITU-R Recommendation, it is hereby recommended that IEEE 802.16 send such information directly to the next WP8F meeting, to be held June 7-15, 2005 in Quebec City, Canada, with copies to Working parties 8A, 9B, and 9D, to facilitate commencement of spectrum sharing studies as soon as possible.

RF characteristics

Below in Table 1 are listed some key parameters, and their suggested values, recommended for performing a spectrum sharing study between 802.16 systems and IMT-2000 systems in adjacent bands and in the same geographical area. It is also suggested that IEEE 802.16 ask WP8F that any future inquires on additional information be sent directly to IEEE 802.16.

It should be noted that the values in the below table are best considered as typical numbers in the context of performing sharing studies and are not based on any specific implementation of the standard.

[1] Document 8F/427 Chairman's Report on the 15th meeting of WP 8F (Geneva, 1-8 February 2005)

Table 1 – IEEE 802.16 RF parameters to be used in coexistence studies for the band 2500-2690 MHz

Parameter	802.16-2004		802.16e	
	BS	SS	BS	MSS
System-wide				
Carrier Bandwidth (MHz) [1]	5		5	
No. of Sectors [2]	3		3	
Reuse factor	1:1, 1:3		1:1, 1:3	
Co-locating antenna Minimum Coupling Loss, MCL (dB) [3]	60	n/a	60	n/a
TX				
Average Power (dBm) [4]	36	24	36	20
TDD activity factor (dB) [5]	3		3	
Antenna gain (dBi) [6]	18	8	18	0/6
Antenna height AGL (m) [7]	15/45	<6	15/30	1.5
Loss of gain due to downtilt (dB)	0	n/a	0	n/a
Misc. losses (dB) [8]	2	0	2	0
Adjacent Channel Leakage Ratio, ACLR (dB) [9]				
ACLR_1 (dB)	53.5	37	53.5	33
ACLR_2 (dB)	66	51	66	51
RX				
Antenna gain (dBi) [6]	18	8	18	0/6
Antenna height AGL (m) [7]	15/45	<6	15/30	1.5
Misc. losses (dB) [8]	0	0	0	0
Loss of gain due to downtilt (dB)	0	n/a	0	n/a
Noise Figure (dB) [10]	3	5	3	5
Thermal Noise Density (dBm/Hz)	-174			
Adjacent Channel Selectivity, ACS (dB) [11]				
ACS_1 (dB)	70	40	70	40
ACS_2 (dB)	70	59	70	59
Interference criteria, I/N (dB) [12]	-6/-10	-6/-10	-6/-10	-6/-10
Max. tolerable interference power (dBm) [13]	-114	-112	-114	-112

Notes

[1] While other carrier bandwidths are allowed in the standard, 5 MHz is chosen as a typical configuration for the frequency band of interest.

[2] No. of sectors ranges from 1 (omnidirectional) to higher numbers such as 6. For the sake of sharing studies three-sectored sites are being considered.

[3] For co-locating base stations, this parameter captures the coupling between the two systems. ITU-R Report IMT.MITIGATE suggests that MCL of up to 70 dB is achievable with a few meters of antenna separation.

[4] TX power reported is typical and higher values may be available based on region.

[5] A function of UL/DL ratio of the TDD mode, this parameter is not applicable to FDD operation.

[6] Base station antenna gains are typical of wide area terrestrial cellular deployments and very much consistent with ETSI BRAN document BRAN40d048r2, “Liaison Letter to ITU-R”. Mobile Subscriber Station antenna gain ranges from 0, for PDA and other handheld terminals, to 6, for laptops.
[7] Previous ITU-R studies on sharing of IMT-2000 systems (M.2030, and IMT.MITIGATE) use 30 meters as base station antenna heights. Assuming the same height of 30 meters for 802.16 systems would create the worst case situation for coexistence with IMT-2000 by creating the possibility of main-beam coupling of interfering systems. It should be, however, noted that base station height of 15 meters is considered a more typical number for 802.16 systems. The numbers for SS antenna height are typical for urban/suburban/rural environments. It should be noted, however, that SS heights could exceed the numbers in the table in some situations such as high-rise buildings.
[8]: Miscellaneous losses account for cable/connector losses in the TX path. These losses could be avoided by using tower-top LNA on the RX path.
[9] Defined as the ratio of the on-channel transmitted power to the power transmitted in the adjacent channel, ACLR represents out-of-band emission of the transmitter. ACLR_*n* in the table are ACLR values at *n* 5-MHz carriers away. The values suggested in the table do not include any mitigatory factors such as the ones included in the ITU-R Report IMT.MITIGATE which reports that better values are achievable using cost-effective power amplifier linearization techniques. It should be noted that for compliance with FCC mask imposed for situations where interference is a problem and/or distance between the stations is less than 1.5 km, ACLR values suggested in IMT.MITIGATE would be required.
[10] Suggested values are based on general industry-accepted numbers.
[11] Suggested ACS numbers are based on expected performance in the industry achievable with reasonable cost. ITU-R Report IMT.MITIGATE also confirms that similar numbers are achievable with adequate receiver filtering.
[12] The I/N of -10 dB, corresponding to about half a dB impact on the receiver sensitivity, is a stringent criterion which is recommended in certain cases including in some ITU-R Recommendations. The number of -6 dB, corresponding to 1 dB impact on the receiver sensitivity, however, is also recommended in ITU-R Recommendation F.758-3.
[13] Numbers are based on I/N of -10 dB.