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Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**	
Title	**Text and Table for Draft 802.16m Evaluation Methodology: Link Budget Template**	
Date Submitted	2007-11-13	
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Re:	IEEE 802.16m-07/039r1– Call for Comments on Draft 802.16m Evaluation Methodology Document	
Abstract	This document contains proposed text for the draft evaluation methodology for IEEE 802.16m technical proposals.	
Purpose	For discussion and approval by TGm	
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Text and Table for Draft 802.16m Evaluation Methodology:

Link Budget Template

Text Proposal

----------*Start of the text*----------

[Add the following references after the line#13 of the page 15 in C802.16m-07/037]

[1]. ITU-R recommendation M.1225, 'Guidelines for evaluation of radio transmission technologies for IMT-2000' (1997)

[2]. IEEE 802.16 Evaluation Methodology Document, IEEE C802.16m-07/080r3, August 28, 2007, IEEE 802.16 Broadband Wireless Access Working Group.

[3]. Mobile WiMAX – Part 1: A Technical Overview and Performance Evaluation, WiMAX Forum , February 21, 2006

[4]. ITU-R 'Additional technical details supporting IP-OFDMA as an IMT-2000 terrestrial radio interface', Revision 1 to Document 8F/1079-E, Radiocommunication Study Groups, January 10,2007.

[5]. http://www.wimaxforum.org/technology/WiMAX_IMT_2000/

[6]. 8F/1079r1: Section 2.3.4 on Link Budget

[7]. 8F/1347: Clarifications Regarding OFDMA TDD WMAN Link Budget

----------*End of the text*----------

----------*Start of the text*----------

[Add text and Table: after line 32 of the page #116 in C802.16m-07/037]

13.1.1.1.1. Link Budget Template

The link budget template, as shown in **Table 1**, is adopted from ITU-R recommendation M 1225 [1] with additions and modifications of some entries in the table to reflect different system operation and characteristics that may be exploited or considered in 802.16m but are not accounted for in the M.1225 document [2-7]. It needs to evaluate link budget for each type of control and data channels.

Table 1 Link Budget Template

Item	Downlink	Uplink
System Configuration		
Carrier frequency/Total channel bandwidth	GHz/MHz	GHz/MHz
BS/MS heights	m	m
Test environment	Indoor, outdoor vehicular, etc.	Indoor, outdoor vehicular, etc.
Channel type	Control channel/ Traffic channel	Control channel/ Traffic channel
Area coverage	%	%
Test service	Data (rate)/ VoIP (rate)	Data (rate)/ VoIP (rate)
Chosen modulation and coding scheme (explicitly state the use of repetition coding)	-	-
Total channel bandwidth	MHz	MHz
Multipath channel class (characterization of both temporal and spatial properties, e.g., ITU VehA with fixed spatial correlation)	-	-
Mobile speed	km/h	km/h
Transmitter		
(a) Number of transmit antennas	-	-
(b) Maximum transmitter power per antenna	dBm	dBm
(c) Transmit Backoff	dB	dB
(d) **Transmit power per antenna = (b) - (c)**	dBm	dBm
(d1) **Total transmit power per sector = function (a) & (d)**	dBm	dBm
(e) Transmitter antenna gain	dBi	dBi
(e1) Transmitter array gain (depends on transmitter array configurations and technologies such as adaptive beam forming, CDD (Cyclic delay diversity), etc.)	dB	dB
(e2) Control channel power boosting gain	dB	dB
(e3) Data carrier power loss due to pilot/control boosting	dB	dB
(f) Cable, connector, combiner, body losses (enumerate sources)	dB	dB
(g) **Transmitter control EIRP = (d1) + (e) + (e1) +(e2) - (f)** **Data EIRP = (d1) + (e) + (e1) -(e3) - (f)**	dBm	dBm
Receiver		
(h) Number of receive antennas	-	-
(i) Receiver antenna gain	dBi	dBi
(j) Cable, connector, body losses	dB	dB
(k) Receiver noise figure	dB	dB
(l) Thermal noise density	–174 dBm/Hz	–174 dBm/Hz
(m) Receiver interference density	dBm/Hz	dBm/Hz

(n)	**Total noise plus interference density = 10 log ($10^{((l)/10)}$ + $10^{((m)/10)}$)**	dBm/Hz	dBm/Hz
(o)	Occupied channel bandwidth (for meeting the requirements of the test service)	Hz	Hz
(p)	**Effective noise power = (n) + (k) + 10log((o))**	dBm	dBm
(q)	Required SNR (AWGN 1-branch sensitivity)	dB	dB
(r)	Receiver implementation margin	dB	dB
(r1)	Fast fading margin (include scheduler gain)	dB	dB
(r2)	HARQ gain	dB	dB
(r3)	Handover gain	dB	dB
(r4)	BS/MS diversity gain	dB	dB
(s)	**Receiver sensitivity = (p) + (q) + (j) + (r) + (r1) + (r2) + (r3) + (r4)**	dBm	dBm
(t)	**Hardware link budget = (g) + (i) - (s)**	dB	dB
Calculation of Available Pathloss			
(u)	Lognormal shadow fading std deviation	dB	dB
(v)	Shadow fading margin (function of the area coverage and (u))	dB	dB
(w)	Penetration margin	dB	dB
(w1)	Other gains	dB	dB
(x)	**Available path loss = (t) – (v) – (w) + (w1)**	dB	dB
Range/coverage Efficiency Calculation			
(y)	Maximum range (according to the selected carrier frequency, BS/MS antenna heights, and test environment – see System Configuration section of the link budget)	m	m
(z)	Coverage Efficiency (π $(v)^2$)	sq m/site	sq m/site

---*End of the text*---