Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Proposed Revision to Section B.3.2 (SC2 PHY Link Budget Analysis)**
Date Submitted	**2002-05-02**
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Re:	Proposal to revise Section B.3.2 of document IEEE P802.16a/D3-2002 with provided text.
Abstract	The Link budget analysis given in Tables 286 and 288 are being revised in Section B.3.2 of docume IEEE P802.16a/D3-2002. This contribution provides more link budget results for various channel models introduced to IEEE802.16a as SUI model with Categories A, B, and C.
Purpose	Incorporate provided text as revision of Section B.3.2 of document IEEE P802.16a/D3-2002.
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Revision of SC2 PHY Link Budget Analysis

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Introduction:

The objective of this contribution is to present a typical link budget for single carrier systems with parameters close to a feasible scenarios for Uplink and Downlink. In the existing Appendix B.3.2, there are link budget tables given for only Category C type of terrian [B48]. Here, we have included the link budget analysis for various terrian environment that are classified as Category A, B, and C. In addition, we have made recommendation on how to use this link analysis for possible system level design purposes. Therefore, we propose to replace Section B.3.2 of the existing document with the following section.

B.2.4 SC2 PHY LINK Budget Analysis

A link budget analysis was performed by combining various channel bandwidths and QAM constellations with the channel models found in [B48]. Figure 242 and Figure 243 provide two examples of the path loss versus propagation radius, using the NLOS Categoies A, B, and C propagation models of [B48], and assuming 3.5 GHz band operation, a 6.5 m SS antenna height, and for a 30 m and 80 m BTS antennas height, respectively. For reference, an example set of parameters that fully specify channel model Categories A, B, and C in [B48] are listed in Table 286.
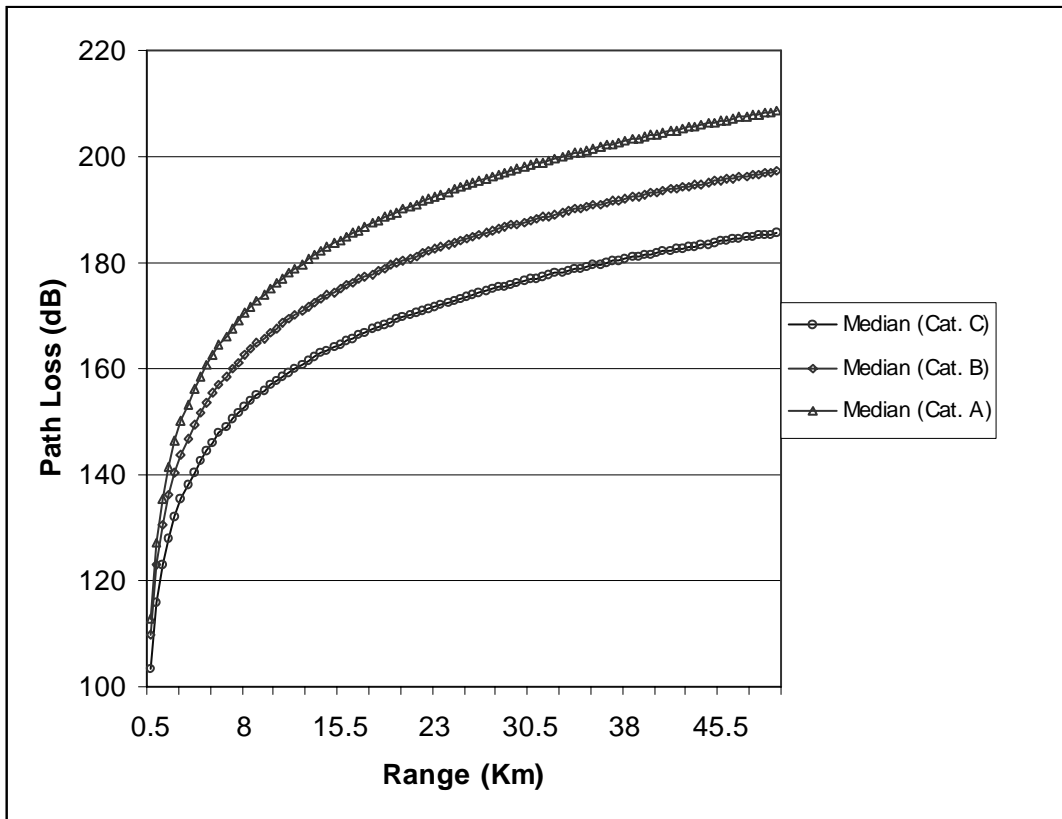
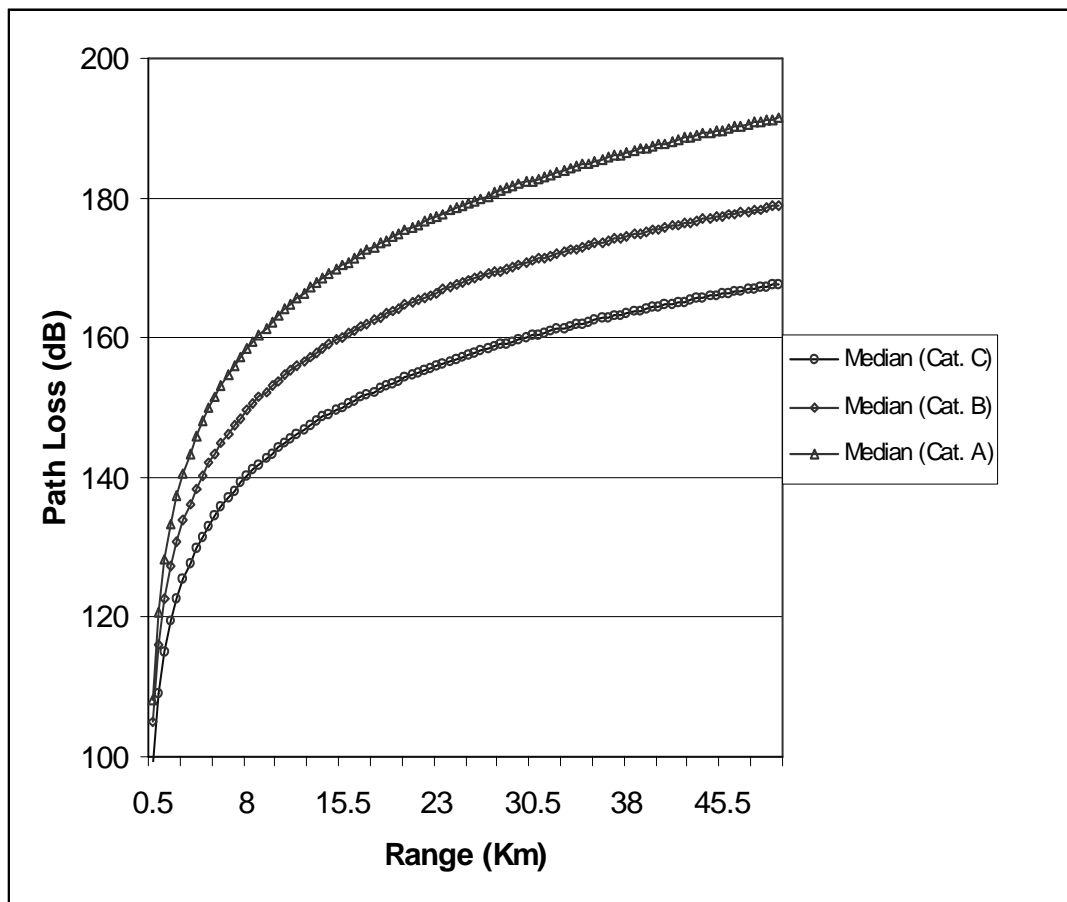**Figure 242—Path loss model for 30 m BTS antenna height (Categories A, B, & C)**

Figure 243—Path loss model for 80 m BTS antenna height (Categories A, B, & C)

Table 286—Sample set of parameters for A, B, and C channel model Categories

Parameters	Category		
	C	**B**	**A**
	Flat Few trees	**Intermediate**	**Hilly Heavy trees**
a	3.6	4	4.6
b	0.005	0.0065	0.0075
c	20	17.1	12.6
Channel frequency (GHz)	3.5		
Wavelength λ (m)	0.085714		
SS antenna height h(m)	6.5		
BTS antenna height h_b(m)	30 or 80		
$\gamma = a - b \cdot h_b + c/h_b$	4.117	4.375	4.795
$A = 20\log10(4\pi d_o/\lambda)$	83.32		
s(dB)	9.4		
$P_L = A + 10\gamma \cdot \log10(d/d_0) + DPI + DPh + s$			
4/3 Earth LOS (km)	32.5		

Evaluating, for example, median path loss figures as a function of distance, the minimum path length necessary to reliably deliver QPSK and 16QAM, on both UL (1.75 MHz) channel and DL (7 MHz) channels may be computed by including **s** shadowing factor into path loss P_L calculation.

An alternate approach is to assume a cell radius, calculate link budgets, and then assess link margins. Table 287 to Table 290 provide link budget calculations for a NLOS SC2 system with '**median**' path loss for downlink and uplink and, for 30 m and 80 m BTS antenna heights, respectively. A 7 MHz DL using 16-QAM and a 1.75 MHz UL using QPSK are assumed in these calculations. Table 291 and Table 292 provide similar analysis for the SC2 system with 30 m BTS antenna height and for a 3.5 Km coverage. For comparison purposes, corresponding link budget results for LOS scenarios are also provided in these tables.

Table 287—Typical SC2 Downlink link budget: example I

Parameter	SC2(NLOS) Category C	SC2(NLOS) Category B	SC2(NLOS) Category A	SC2(LOS)
Bandwidth	7 MHz			
Modulation	16 QAM			
Target SNR with FEC	14 dB			
P_{1dB}	40 dBm			
Tx Antenna gain	15 dB			
Backoff	8 dB			
EIRP	47 dBm			
Cell radius for target SNR	7 km			
Pathloss [48]	-150.5 dB	-160.0 dB	-167.7 dB	-120.2 dB
Rx Antenna gain	18 dB			
Power at input to receiver	-85.5 dBm	-94.0 dBm	-102.7 dBm	-55.2 dBm
Receiver NF	5 dB			
Equivalent Noise Power in channel BW	-100.5 dBm			
SNR, calculated	15.0 dB	5.5 dB	-2.2 dB	45.3 dB
Fade Margin	+1 dB	-8.5 dB	-16.2 dB	31.3 dB
BTS antenna height = 30 m				
SS antenna height = 6.5 m				

Table 288—Typical SC2 Uplink link budget: example II

Parameter	SC2(NLOS) Category C	SC2(NLOS) Category B	SC2(NLOS) Category A	SC2(LOS)
Bandwidth	1.75 MHz			
Modulation	QPSK			
Target SNR with FEC	12 dB			
P_{1dB}	30 dBm			
Tx Antenna gain	18 dB			
Backoff	5 dB			
EIRP	43 dBm			
Cell radius for target SNR	7 km			
Pathloss [48]	-150.5 dB	-160.0 dB	-167.7 dB	-120.2 dB
Rx Antenna gain	15 dB			
Power at input to receiver	-92.5 dBm	-102.0 dBm	-109.7 dBm	-62.2 dBm
Receiver NF	4 dB			
Equivalent Noise Power in channel BW	-107.6 dBm			
SNR, Calculated	15.1 dB	5.6 dB	-2.1 dB	45.3 dB
Fade Margin	3.1 dB	-6.4 dB	-14.1 dB	33.3 dB
BTS antenna height = 30 m				
SS antenna height = 6.5 m				

Table 289—Typical SC2 Downlink link budget: example III

Parameter	SC2(NLOS) Category C	SC2(NLOS) Category B	SC2(NLOS) Category A	SC2(LOS)
Bandwidth	7 MHz			
Modulation	16 QAM			
Target SNR with FEC	14 dB			
P_{1dB}	40 dBm			
Tx Antenna gain	15 dB			
Backoff	8 dB			
EIRP	47 dBm			
Cell radius for target SNR	7 km			
Pathloss [48]	-138.2 dB	-147.4 dB	-156.0 dB	-120.2 dB
Rx Antenna gain	18 dB			
Power at input to receiver	-73.2 dBm	-82.4 dBm	-91.0 dBm	-55.2 dBm
Receiver NF	5 dB			
Equivalent Noise Power in channel BW	-100.5 dBm			
SNR, calculated	27.3 dB	20.1 dB	9.5 dB	45.3 dB
Fade Margin	13.3 dB	6.1 dB	-4.5 dB	31.3 dB
BTS antenna height = 80 m				
SS antenna height = 6.5 m				

Table 290—Typical SC2 Uplink link budget: example IV

Parameter	SC2(NLOS) Category C	SC2(NLOS) Category B	SC2(NLOS) Category A	SC2(LOS)
Bandwidth	1.75 MHz			
Modulation	QPSK			
Target SNR with FEC	12 dB			
P_{1dB}	30 dBm			
Tx Antenna gain	18 dB			
Backoff	5 dB			
EIRP	43 dBm			
Cell radius for target SNR	7 km			
Pathloss [48]	-138.2 dB	-147.4 dB	-156.0 dB	-120.2 dB
Rx Antenna gain	15 dB			
Power at input to receiver	-80.2 dBm	-89.4 dBm	-98.0 dBm	-62.2 dBm
Receiver NF	4 dB			
Equivalent Noise Power in channel BW	-107.6 dBm			
SNR, Calculated	27.4 dB	18.2 dB	10.4 dB	45.3 dB
Fade Margin	15.4 dB	7.8 dB	-2.4 dB	33.3 dB
BTS antenna height = 80 m				
SS antenna height = 6.5 m				

Table 291—Typical SC2 Downlink link budget: example V

Parameter	SC2(NLOS) Category C	SC2(NLOS) Category B	SC2(NLOS) Category A	SC2(LOS)
Bandwidth	7 MHz			
Modulation	16 QAM			
Target SNR with FEC	14 dB			
P_{1dB}	40 dBm			
Tx Antenna gain	15 dB			
Backoff	8 dB			
EIRP	47 dBm			
Cell radius for target SNR	3.5 km			
Pathloss [48]	-138.1 dB	-146.8 dB	-153.3 dB	-114.2 dB
Rx Antenna gain	18 dB			
Power at input to receiver	-73.1 dBm	-81.8 dBm	-88.3 dBm	-49.2 dBm
Receiver NF	5 dB			
Equivalent Noise Power in channel BW	-100.5 dBm			
SNR, Calculated	27.4 dB	18.7 dB	12.2 dB	51.3 dB
Fade Margin	13.4 dB	4.7 dB	-1.8 dB	37.3 dB
BTS antenna height = 30 m				
SS antenna height = 6.5 m				

Table 292—Typical SC2 Uplink link budget: example VI

Parameter	SC2(NLOS) Category C	SC2(NLOS) Category B	SC2(NLOS) Category A	SC2(LOS)
Bandwidth	1.75 MHz			
Modulation	QPSK			
Target SNR with FEC	12 dB			
P_{1dB}	30 dBm			
Tx Antenna gain	18 dB			
Backoff	5 dB			
EIRP	43 dBm			
Cell radius for target SNR	3.5 km			
Pathloss [48]	-138.1 dB	-146.8 dB	-153.3 dB	-114.2 dB
Rx Antenna gain	15 dB			
Power at input to receiver	-80.1 dBm	-88.8 dBm	-95.3 dBm	-56.2 dBm
Receiver NF	4 dB			
Equivalent Noise Power in channel BW	-107.6 dBm			
SNR, Calculated	27.5 dB	18.8 dB	12.3 dB	51.4 dB
Fade Margin	15.5 dB	7.2 dB	1.7 dB	39.4 dB
BTS antenna height = 30 m				
SS antenna height = 6.5 m				

Note that:

Target SNRs assume Concatenated RS-CC or turbo FEC delivers a BER of 10 [-6] with 6 dB coding gain.

Tx Antenna gain in all above Tables **include -1.5 dB** RF loss.

Link budget evaluations provided in Table 286 to Table 292 are for Median path loss cases. That is, the effect of Shadow Fading (e.g., S = 9.4 dB) is NOT included.