Project	**IEEE 802.16 Broadband Wireless Access Working Group <http://ieee802.org/16>**
Title	**Channel models for 30km and 50km range**
Date Submitted	**2001-9-6**

Source(s)		
	Avi Freedman, Hexagon Ltd.	Voice: + 972 -3- 5101128 avif@hexagonltd.com
	Ali S. Sadri, BOPS Inc.	Voice: + 1(919) 433-4130 sadri@bops.com
	Amir Sarajedini, BeamReach	Voice: + 1(919) 433-4130 ASarajedini@BeamReachNetworks.com
	David Trinkwon, Transcomm	Voice: trinkwon@compuserve.com
	Eyal Verbin, Marconi	Voice: Eyal.Verbin@marconi.com
	Ofer Kelman, Marconi	Voice: Ofer.Kelman@marconi.com
	Jun Shen, Aperto Networks	Voice: jshen@apertonet.com
		wendyk@apertonet.com
		wkcheng@apertonet.com
	Marianna Goldhammer, Alvarion	Voice: mariannag@breezecom.co.il
	Marc McHenry, Shared Spectrum Co.	Voice: +1 703-761-2818 mmchenry@sharedspectrum.com
	Uzi Padan, InnoWave Wireless Systems	Voice: +972 –3- 926 3548 Uzi.Padan@innowave-ws.com
	Zion Hadad, Runcom Technologies	Voice: + 972 – 3– 9258440 zionh@runcom.co.il
	Yigal Leiba, Runcom Technologies	Voice: + 972 –3 – 9258440 yigall@runcom.co.il

Re:	
Abstract	This document suggests an additional model for TG3, for long range deployments
Purpose	Add a long-range channel model to the existing SUI models.
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Channel models for long range deployment

Introduction

The scenarios for which TG3 channel models, described in [1], were developed refer to cells of 7km size, which are considered to be typical for those types of applications. However, as mentioned in [2] and [3], super-cell configurations are also possible, especially in the initial phase of deployment. For those cases there is a need to define channel models for 30km and 50km size cells. In this document such models, based on an extrapolation of the SUI models [1], are suggested. For details refer to [4].

Extrapolation of the Values

Using the formulas, and methods suggested in [1], the following values for the delay spread, and K – factors should be expected:

$$\tau_{rms}(R) = \tau_{rms}(7km)\left(\frac{R}{7km}\right)^{\varepsilon}$$

$$K(R) = K(7km)\left(\frac{R}{7km}\right)^{\gamma}$$

Where R is the maximal cell radius, and ε between 0.5 and 1, and $\gamma = -0.5$. Those formulas also apply to the coefficients of the SUI channel models. As demonstrated in [4], the total reflection area as well as the maximal possible delay decrease as the cell range increases, so we chose the value of ε to be 0.75 for the 30km range and ε=0.6 for 50km range.

Extrapolated Models for 30km cells

The values of the taps delay and the taps K-factor for 30km cells are summarized in the following tables. Those values can be used for long range simulation, using the same procedures used for short range scenarios.

Extrapolated SUI-1 Channel Model - 30km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	1.19	2.68	µs
Power - Omni Antenna	0	-15	-20	dB
90% K-Factor (omni)	2	0	0	
75% K-Factor (omni)	7	0	0	
Power - 30 Antenna	0	-21	-32	dB
90% K-Factor (30 deg)	7	0	0	
75% K-Factor (30 deg)	26	0	0	

Extrapolated SUI-2 Channel Model- 30km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	1.2	3.3	µs
Power - Omni Antenna	0	-12	-15	dB
90% K-Factor (omni)	1	0	0	
75% K-Factor (omni)	4	0	0	
Power - 30 Antenna	0	-18	-27	dB
90% K-Factor (30 deg)	4	0	0	
75% K-Factor (30 deg)	13	0	0	

Extrapolated SUI-3 Channel Model- 30km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	1.2	2.7	µs
Power - Omni Antenna	0	-5	-10	dB
90% K-Factor (omni)	0	0	0	
75% K-Factor (omni)	2	0	0	
Power - 30 Antenna	0	-11	-22	dB
90% K-Factor (30 deg)	1	0	0	
75% K-Factor (30 deg)	5	0	0	

Extrapolated SUI-4 Channel Model- 30km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	4.5	11.9	µs
Power - Omni Antenna	0	-4	-8	dB
90% K-Factor (omni)	0	0	0	
75% K-Factor (omni)	1	0	0	
Power - 30 Antenna	0	-10	-20	dB
90% K-Factor (30 deg)	1	0	0	
75% K-Factor (30 deg)	2	0	0	

Extrapolated SUI-5 Channel Model- 30km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	11.9	29.8	µs
Power - Omni Antenna	0	-5	-10	dB
90% K-Factor (omni)	0	0	0	
75% K-Factor (omni)	0	0	0	
50% K-Factor (omni)	1	0	0	
Power - 30 Antenna	0	-11	-22	dB
90% K-Factor (30 deg)	0	0	0	
75% K-Factor (30 deg)	1	0	0	
50% K-Factor (30 deg)	3	0	0	

Extrapolated SUI-6 Channel Model-30km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	41.7	59.6	ms
Power - Omni Antenna	0	-10	-24	dB
90% K-Factor (omni)	0	0	0	
75% K-Factor (omni)	0	0	0	
50% K-Factor (omni)	1	0	0	
Power - 30 Antenna	0	-16	-36	dB
90% K-Factor (30 deg)	0	0	0	
75% K-Factor (30 deg)	1	0	0	
50% K-Factor (30 deg)	2	0	0	

Extrapolated Models for 50km cells

The values of the taps delay and the taps K-factor for 50km cells are summarized in the following tables.

Extrapolated SUI-1 Channel Model – 50km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	1.30	2.93	µs
Power - Omni Antenna	0	-15	-20	dB
90% K-Factor (omni)	1	0	0	
75% K-Factor (omni)	5	0	0	
Power - 30 Antenna	0	-21	-32	dB
90% K-Factor (30 deg)	6	0	0	
75% K-Factor (30 deg)	19	0	0	

Extrapolated SUI-2 Channel Model –50km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	1.30	3.58	µs
Power - Omni Antenna	0	-12	-15	dB
90% K-Factor (omni)	1	0	0	
75% K-Factor (omni)	3	0	0	
Power - 30 Antenna	0	-18	-27	dB
90% K-Factor (30 deg)	3	0	0	
75% K-Factor (30 deg)	10	0	0	

Extrapolated SUI-3 Channel Model-50km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	1.30	2.93	µs
Power - Omni Antenna	0	-5	-10	dB
90% K-Factor (omni)	0	0	0	
75% K-Factor (omni)	1	0	0	
Power - 30 Antenna	0	-11	-22	dB
90% K-Factor (30 deg)	1	0	0	
75% K-Factor (30 deg)	4	0	0	

Extrapolated SUI-4 Channel Model –50km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	4.88	13.01	µs
Power - Omni Antenna	0	-4	-8	dB
90% K-Factor (omni)	0	0	0	
75% K-Factor (omni)	0	0	0	
Power - 30 Antenna	0	-10	-20	dB
90% K-Factor (30 deg)	0	0	0	
75% K-Factor (30 deg)	2	0	0	

Extrapolated SUI-5 Channel Model –50km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	13.01	32.53	µs
Power - Omni Antenna	0	-5	-10	dB
90% K-Factor (omni)	0	0	0	
75% K-Factor (omni)	0	0	0	
50% K-Factor (omni)	1	0	0	
Power - 30 Antenna	0	-11	-22	dB
90% K-Factor (30 deg)	0	0	0	
75% K-Factor (30 deg)	1	0	0	
50% K-Factor (30 deg)	2	0	0	

Extrapolated SUI-6 Channel Model –50km				
	Tap 1	Tap 2	Tap 3	Units
Delay	0	45.55	65.07	ms
Power - Omni Antenna	0	-10	-24	dB
90% K-Factor (omni)	0	0	0	
75% K-Factor (omni)	0	0	0	
50% K-Factor (omni)	0	0	0	
Power - 30 Antenna	0	-16	-36	dB
90% K-Factor (30 deg)	0	0	0	
75% K-Factor (30 deg)	1	0	0	
50% K-Factor (30 deg)	2	0	0	

References

[1] IEEE 802.16.3c-01/29r2: Channel Models for Fixed Wireless Applications
[2] IEEE 802.16.3-00/02r4: Functional Requirements for the 802.16.3 Interoperability Standard
[3] IEEE 802.16.3c-01/50: An Operator's perspective
[4] IEEE 802.16.3c-01/76 Channel models for long range deployments