IEEE P802.11
Wireless LANs

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| TGah Channel Model – Proposed Text |
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# 3.0 Channel models

The outdoor channel models for TGah are based on the SCM channel model used by 3GPP and 3GPP2. The indoor channel models are based on TGn channel models.

**3.1 Spatial Channel Model (SCM)**

The Spatial Channel Model (SCM) is fully described in [1] and a freeware Matlab implementation can be downloaded from [2].

This channel model shall be used to evaluate 11ah outdoor MIMO link and system performance.

TGah use cases involve up to pedestrian mobility. However as reported in [3] and [4], reflections from cars cause higher Doppler and can be represented by assigning one of the six channel taps a higher Doppler.

The following two simulation scenarios shall be used:

1. SCM with speed up to 3mph for all paths
2. SCM with the fourth path assigned a speed of 60mph and the rest of the paths assigned 0mph.

**Example Usage of SCM**

1. Download Matlab code from [2]. Main function is scm.m
2. Define several parameters
	1. scmpar.CenterFrequency=0.9e9;
	2. scmpar.Scenario='urban\_macro';
	3. scmpar.BsUrbanMacroAS='eight';
	4. scmpar.NumBsElements=4; (number of BS antennas)
	5. antpar.BsElementPosition=0.5; (antenna spacing)
	6. scmpar.NumMsElements=1;
	7. linkpar.MsVelocity=1kmph
	8. Call main function [H delays out]=scm(scmpar,linkpar,antpar); H is a time domain MIMO channel between all Tx and Rx antennas
3. Calculate frequency response

**3.2 Outdoor Path Loss Models**

The path loss models for TGah outdoor scenarios are based on [5] and include two options:

1. Macro deployment - antenna height is assumed 15m above rooftop and the path loss in [dB] is given by the formula PL=8+37.6log10(d) where d is in meters and the RF carrier is assumed at 900MHz. For other frequencies a correction factor of 21log10(f/900MHz) should be added.
2. Pico/Hotzone deployment – antenna height is assumed at roof top level and the path loss is given by PL=23.3+36.7log10(d) with adjustment for other frequencies as above.

The above formulas represent the average path loss. Deviation around this average to account for shadowing should be modelled by adding a random Gaussian variable with zero mean and standard deviation of 8dB for Macro deployments and 10dB for Pico deployments.

In addition, penetration loss of 10dB should be added when simulating indoor reception with outdoor access points.

**3.3 Indoor Channel Models**

Indoor channel models are based on [6] with the following modifications:

**References**

[1] 3GPP TR 25.996 - Technical Specification Group Radio Access Network; Spatial channel model for Multiple Input Multiple Output (MIMO) simulations

[2] Link to Matlab implementation of [1]

<http://radio.tkk.fi/en/research/rf_applications_in_mobile_communication/radio_channel/scm-05-07-2006.zip>

[3] 11-03-0940-04-000n-tgn-channel-models.doc – channel model F

[4] 15-09-0742-01-004g-fading-in-900mhz-smart-utility-radio-channels.pdf – Steve Shearer

[5] 3GPP TR 36.814 - Further advancements for E-UTRA physical layer aspects, Annex A.2- system simulation scenario

[6] 11-03-0940-04-000n-tgn-channel-models.doc section 2.