Status of 802.20 Channel Models

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Qiang Guo
Editor, Channel Modeling Correspondence Group

Current Status of 802.20 Channel Models

- A conference call has been held since July plenary
- Consensus reached on a few channel model issues:
  - Inclusion of outdoor-to-indoor model into channel model set
  - Unifying MIMO/SIMO/MISO/SISO channel models
- Open issue
  - Two discrepant views on the maximum delay spread in MBWA channel models and the frequency of occurrence of such channels in the real world
- Two more conference calls scheduled
  - October 14, 2003,2:00 - 3:00pm EDT
  - October 29, 2003, 2:00 - 3:00pm EDT

Outdoor-to-Indoor Model

- Decided to examine the ITU pedestrian model as starting point and then look into how to extrapolate it to the outdoor-to-indoor model
- There was also a consensus that very little is known about the MIMO nature of outdoor-indoor model

ITU Outdoor-to-Indoor and Pedestrian Model [1]

- BS with low antenna heights, located outdoor
- Small cell size
- Low transmit power
- Pedestrian users located on streets and inside building
- Doppler rate set by walking speeds, with occasional higher rates due to vehicular reflections
- Geometrical path loss rule of R^{-4} is appropriate, but R^{-6} may be encountered due to trees and other obstructions
- Building penetration loss averages 12 dB with a standard deviation of 8 dB

MIMO/SIMO/MISO/SISO Models

- Decided to specify MIMO channel model first, and then tweak the parameters so that it will approximate the characteristics of SIMO/MISO/SISO models
- Need to specify guidelines for setting the key parameters of model based on a selected set of test environments, such as micro/macro, typical urban/suburban/rural, outdoor-to-indoor, etc
- Making sure the model have appropriate delay spread, Doppler spread, and spatial characteristics that are typical of licensed bands below 3.5 GHz

MIMO/SIMO/MISO/SISO Models (Cont)

- Considering separate SISO models would confuse the process of comparing SISO techniques to MIMO/MISO/SIMO techniques, because it would be difficult to guarantee a fair comparison between the two

- The spatial characteristics of MIMO model will heavily influence the Doppler characteristics, which would make it difficult to compare a Jakes-faded SISO model to a spatial MIMO model

Maximum Delay Spread

- Two different opinions on the maximum delay spread in MBWA channel models and the frequency of occurrence of such channels in the real world
  - Need to define a vehicular channel model for MBWA, which would have power delay profile less than ITU Vehicular B
  - Satisfy ourselves with the ITU Vehicular B model
- In order to accurately evaluate candidate physical-layer technologies, it is desirable to model the variety of delay spreads, which is justifiable based on real world channel measurements.
- Information regarding delay spread measurement campaign would help 802.20 Channel Modeling CG understand the issue and reach group consensus

Delay Spread Measurements on a Mobile Broadband Channel at 3.6 GHz [2,3]

- As reported in [2,3], an experimental mobile broadband communication system developed for the purpose of evaluating candidate physical-layer technologies
- Data collected by this experimental system also used to characterize the 2x2 MIMO channel impulse responses
- The delay spread characteristics of a 20MHz channel at 3.675 GHz is summarized here, based on a series of field experiments conducted in a suburban area
- As described in [3], outdoor measurements were performed on various driving routes around the base
- Vehicle speed varies from 0 to 60 mph

Delay Spread Measurements on a Mobile Broadband Channel at 3.6 GHz [Cont]

- Delay spread measurements are calculated from power delay profiles given by the magnitude squared of the estimated channel impulse response
- The channel impulse response is determined with a frequency-domain channel estimator designed using the fact that all the transmitted data is known
- A correlator operating in the time-domain was also designed to detect multi-path components with delays of up to 25 μS
- With this correlator, it was observed that the maximum delay spread beyond 10 μS is statistically insignificant
  - A total of 5474 profiles, including 2142 profiles captured at LOS locations and 3332 profiles captured at NLOS locations

Statistics of RMS and MAX Delay Spread

(in micro-second)

	ALL	LOS	NLOS
RMS Delay Spread in 95%	1.75	0.90	2.0
Max Delay Spread in 95%	5.3	2.3	6.1

References

1. Recommendation ITU-R M.1225, “Guideline for Evaluation of Radio Transmission Technologies for IMT-2000,” 1997.
2. C802.20-03/12, “Antenna Arrays for MBWA: Overview and Field Experiments”.
3. C802.20-03/19, “Frequency-Domain-Oriented Approaches for MBWA: Overview and Field Experiments”.