Recommendation on Channel Propagation Model for Local Multipoint Distribution Service

Cover Sheet for Presentation to IEEE 802.16 Broadband Wireless Access Working Group (Rev. 1)

Document Number: IEEE 802.16.1pp-00/16

Date Submitted: 2000-05-04

Source:

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Venue: IEEE 802.16 Session #6 PHY Presentation

Base Document:

IEEE 802.16.1 pc-00/16 <http://grouper.ieee.org/groups/802/16/phy/contrib/802161pc-00_16.pdf>

Purpose: To provide an input to the specific area “Channel propagation model”

Notice:

Recommendation on Channel Propagation Model for Local Multipoint Distribution Service

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Outline

Introduction

Channel Propagation Model and Its Parameters

Relation Between Delay Spread and Excess Path Loss

Summary

Introduction

- Flexible channel propagation model for local multipoint distribution service (LMDS), i.e., flexible parameters: number of taps, tap gains, and tap delays

  line-of-sight (LOS) propagation

  use of highly directional antennas, at least at the receiver

- Linear relation between the delay spread and the excess path loss (in excess of free-space loss)

Channel Propagation Model and Its Parameters

- Model: $h(t) = \sum_{n=0}^{N-1\leq 2} a_n d(t - t_n)\exp(-j v_c t_n)$

  $20\log_{10} a_0 = 0$ dB and $t_0 = 0$ ns

- Parameters: $A_{\max} \geq 20\log_{10} a_1 > 20\log_{10} a_2 \geq A_{\min}$

  $t_{\min} \leq t_1 \leq t_2 \leq t_{\max}$

Table 1: Values derived from measurements

Items	A_{max} (dB)	A_{min} (dB)	t_{min} (ns)	t_{max} (ns)
Values	-2.8	-20	3	50

Table 2 : Summary of good channel

Tap index	Tap gain(dB)	Delay (ns)
0	0	0

Table 3 : Summary of moderate channel

Tap index	Tap gain (dB)	Delay (ns)
0	0	0
1	-13.7	5.3

Table 4 : Summary of bad channel

Tap index	Tap gain (dB)	Delay (ns)
0	0	0
1	-2.8	3.6
2	-16.2	15.3

Table 5 : Summary of a multipath channel

Tap index	Tap gain (dB)	Delay (ns)
0	0	0
1	-15	20
2	-20	50
-1	-15	-20
-2	-20	-50

Probably the direct LOS path is blocked: it is seen that the shortest propagation path is under non-LOS conditions.

Relation Between Delay Spread and Excess Path Loss

- Relation: $t = t_0 + t_e L_e$

  t_0 and t_e are flexible and can be determined by measurements, e.g., t_0 =0.75 ns and $t_e = 30^{-1}$ ns/dB

  derived from measurement data

  Delay spread t increases with the excess path loss L_e, in excess of free-space loss in dB.

- Excess path loss: $L_e = L_R + L_{at} + L_o + L_m$

  Rain loss L_R, may need refinements to existing models

  Loss L_{at} of atmospheric gases, models available

  Obstruction loss L_o, negligible, at least minimized, on LOS conditions

  Loss/fading L_m due to multipath, minimized by highly directional antennas

Summary

- Flexible channel propagation model: no more than 3 taps, progressive decrease tap gains, progressive increase delays

  Assumptions: (1) LOS; (2) Directional antennas at least at the receiver; (3) Heavy-rain effects not included; (4) Threshold –20 dB

- Propagation channel degrades as the excess path loss (in excess of free-space) increases. The excess loss can be minimized by installing highly directional antennas at relatively high locations.