Virtual Drive Verification Rural Car - Car

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Freeway LOS Scenario

- trees
- crash barrier
- transmitter
- moving vehicles
- receiver
Comparison Measurement – Simulation (Freeway, LOS)

Measurement

Simulation

trees

transmitter

receiver

trees

transmitter
Measurement Freeway, LOS

- **norm. receive power in dB**
  - Fast fading: -74 to -86 dB
  - Slow fading: -78 to -82 dB

- **deviation from mean in dB**
  - Fast fading: -2 to 4 dB

The chart displays the comparison between fast fading and slow fading over time. The green line represents the fast fading, while the black line represents the slow fading. The graphs show the normalized receive power and the deviation from the mean over time.
Short Term Fading Analysis Criteria

- **CDF**: Cumulative Distribution Function
- **LCR**: Level Crossing Rate
- **AFD**: Average Fade Duration

threshold for LCR, AFD

deviation from mean in dB

time t in s

short term fading freeway LOS
CDF Comp. Freeway Meas. / Simulation (LOS)

Cumulative distribution function (CDF) of fast fading (narrow-band analysis)

- CDF
- Fast fading amplitude in dB
- Measurement
- Simulation
Level crossing rate (LCR) of fast fading (narrow band analysis)

- Measurement
- Simulation

LCR in 1/s

Fast fading amplitude in dB

-10 -8 -6 -4 -2 0 2 4

-10 -8 -6 -4 -2 0 2 4

0.1

0.01

10

100

Simulation and Measurement Comparison of Level Crossing Rate (LCR) for Fast Fading with Narrow Band Analysis.
Average fade duration (AFD) of fast fading (narrow band analysis)

- Simulation
- Measurement

AFD in s

Fast fading amplitude in dB
Comp. Motorway Measurement / Simulation (LOS)

Characteristic power delay spectra PDP
(wide-band analysis, qualitative)

Simulation reflects narrow-band and wide-band characteristics of the real channel very well.
Comp. Motorway Measurement / Simulation (LOS)

Characteristic power delay spectra PDP (wide-band analysis, qualitative)

Simulation reflects narrow-band and wide-band characteristics of the real channel very well.
Mean Power Delay Profile (Freeway, LOS)

-80
-90
-100
-110
-120
-123
-130
-140
0 0.1 0.2 0.3 0.4 0.5

Received power $P_{Rx}$ in dBm

Relative excess delay time in µs

- measurement
- simulation
Freeway NLOS Scenario

trees

crash barrier

traffic sign

transmitter

truck

moving vehicles

receiver
Freeway Measurement Scenario (NLOS)

Measurement

Simulation

trees

truck

trees

receiver

transmitter

truck
CDF Comp. Freeway Meas. / Simulation (NLOS)

Cumulative distribution function (CDF)
(fast fading)

- CDF
- Measurement
- Simulation

fast fading amplitude in dB

CDF
Level crossing rate (LCR) (fast fading)

- LCR in 1/s
- Fast fading amplitude in dB
Conclusion

Ray tracing channel simulations represent the fading quite well.

This is the basis for:
- Diversity
- MIMO
antenna system design.