Measurement and Analysis of ITS-G5 in Railway Environments

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Outline

- Motivation
- Measurement setup
- Environment and scenarios
- Measurement results and analysis
- Conclusion and Outlook
Motivation (1)

Future wireless railway communications

- Reliable
- Low latency
- High throughput

- Safety critical
- Interoperable
Motivation (2)

Intelligent Transportation System ITS-G5

- Vehicle-to-Vehicle (V2V)
- Vehicle-to-Infrastructure (V2I)

- ITS frequency allocation
  - Service Channel (Ch) 3,4
    ITS- non-safety applications
  - Control Ch + Service Ch 1,2
    ITS road safety
  - Service Ch 5,6
    Future ITS applications
Measurements Setup

Cohda ITS-G5
• Transmitter (Tx) - Train
• Receiver (Rx) - Car

Dual channel operation:
• Control channel: **Ch 180 - 6 Mbps**
• Service channel 1: **Ch 176 - 3 Mbps**
• 10 MHz bandwidth
• 21 or 24 dBm output power
• 100 Hz message repetition rate
• Message length 150 and 400 Byte
BOB – Route network
Environments

- Urban area
- Rural area
- Tunnel
- Cross bridge
- Open field
- Forest
Scenarios

Video see attachment
Passing manoeuver
Overtaking manoeuver
Opposing manoeuver
Coverage

Transmit power $P_{Tx} = 21$ dBm

- Avg(Ch 180)
- Avg(Ch 176)
- Path loss model (21 dBm)
- Receiver sensitivity
- Avg(Ch 176) 150
- Avg(Ch 180) 150
- Avg(Ch 176) 400
- Avg(Ch 180) 400

$P_{Tx} = 24$ dBm

- Avg(Ch 180)
- Avg(Ch 176)
- Path loss model (24 dBm)
- Receiver sensitivity
- Avg(Ch 176) 150
- Avg(Ch 180) 150
- Avg(Ch 176) 400
- Avg(Ch 180) 400
Conclusion and Outlook

• ITS-G5 can handle different railway environments

• Coverage
  • $P_{Tx} = 21$ dBm $\sim 400$ m
  • $P_{Tx} = 24$ dBm $\sim 600$ m
  $$P_{Tx} = 33$$ dBm $\sim 1200$ m

• Update Delay of ITS-G5 is sufficient for railway applications

• Further measurements on High Speed Trains
Thank you for your attention!

Questions?

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Knowledge for Tomorrow
References