U.S. DOT LTE-V2X Testing:
Simulation Model

August 2022

U.S. Department of Transportation

ITS / V2X Communications Summit

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Simulation Parameters

Description	Parameter Value
Bandwidth	20 MHz (2 subchannels)
Pathloss model	Two ray
Effective Antenna Height (Tx & Rx)	1.5 m & 1.5 m
Antenna Gain (Tx & Rx)	0 dBi & 0 dBi
Center frequency	5.9 GHz
Transmit power	20 dBm
TBS & NPRB	1480 & 17 (MCS-5)
HARQ	On - Smart
Channel Model	Extended Vehicular-A
Noise Figure	6 dB

TBS: Transport block size
NPRB: Number of Allocated Physical Resource Blocks
LOS: Line of sight
RSU: Road-side unit
MCS: Modulation and coding scheme
SPS: Semi-persistent scheduling
TTI: Transmit time interval
PER: Packet error rate
CPD: Consecutive packet drop
OST: One shot transmission
OSC: One-shot counter
RC: Reselection counter
RKP: Resource keeping probability

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Resource Selection Procedure for HARQ

▶ The LTE-V2X can enable retransmission to increase the reliability and communication range by transmitting a package twice.

▶ To search for the required candidate subframe resource (CSR) for retransmission purposes, the SPS constitutes a third list, L3 of CSRs from L2 (i.e., at least 20% of resources in selection window), which falls within SF ±15 ms interval, where SF refers to the scheduled sub-frame for the packet transmission.

▶ The transmitter reserves a random CSR from L3 for redundant transmission and maintains it for the following ResourceReselectionCtr retransmissions.
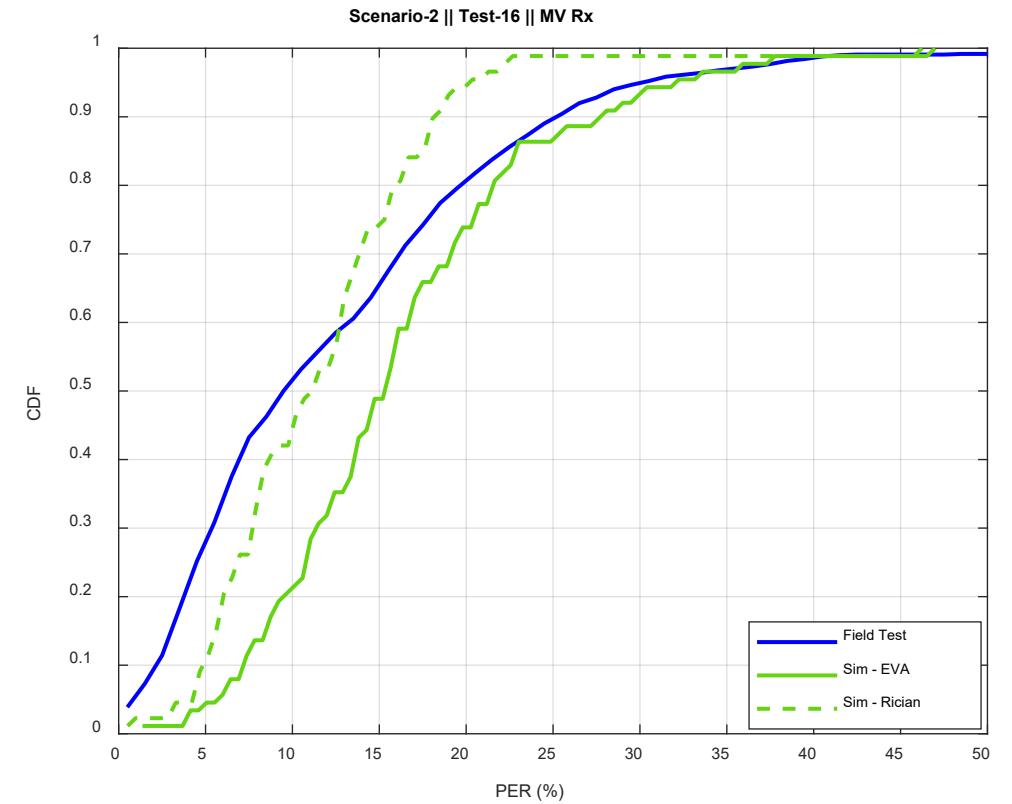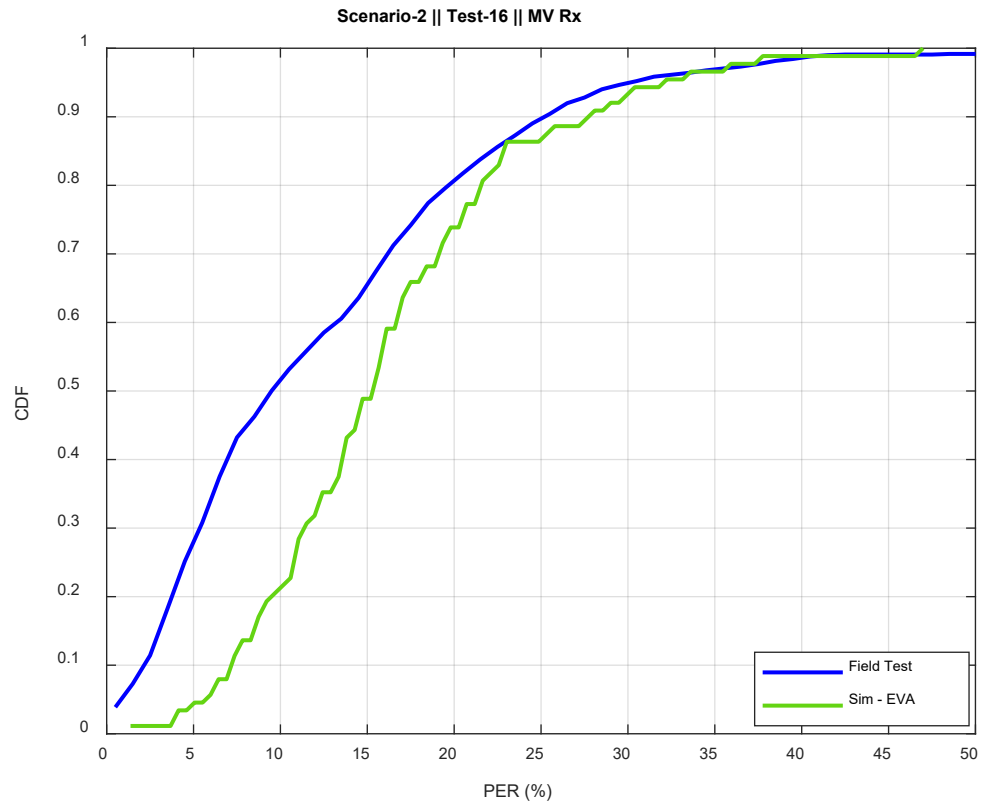
▶ SAE J3161, p.28

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Heavily Congested Scenario – 1500 Static Devices
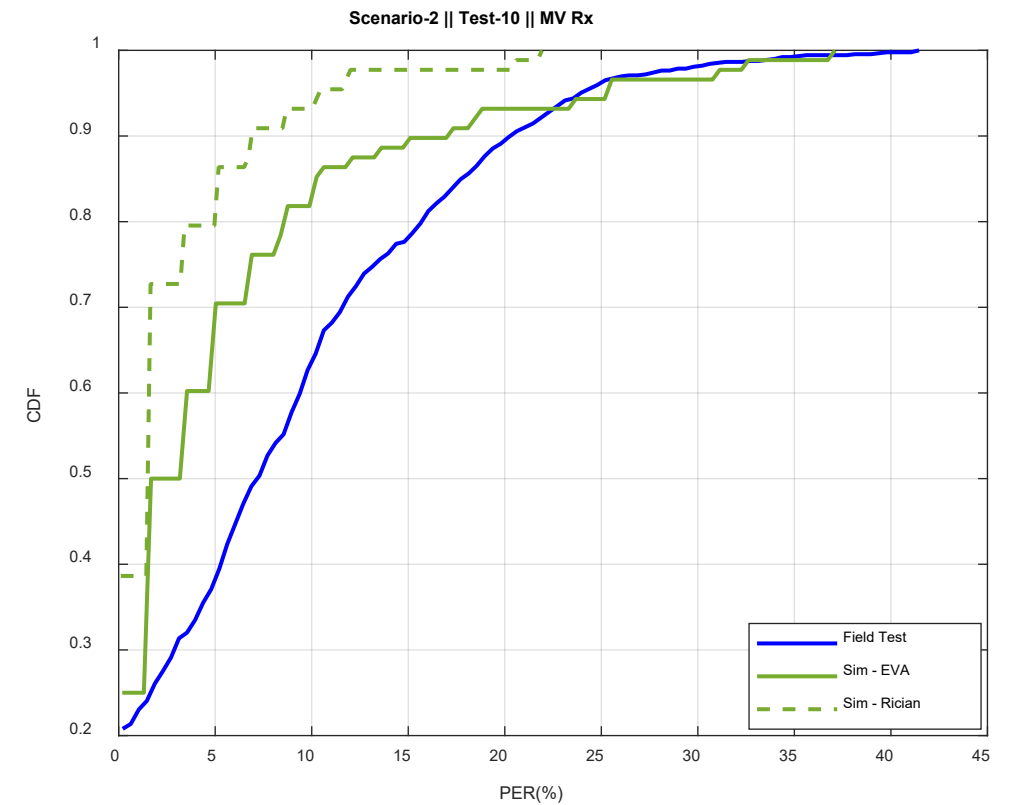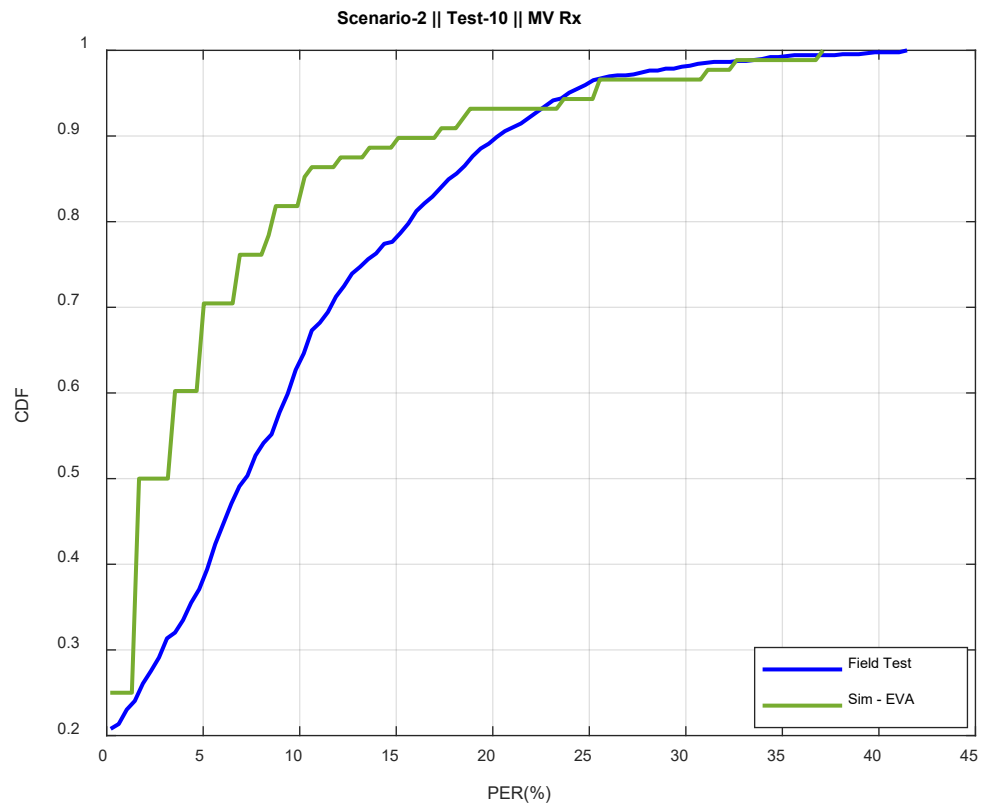
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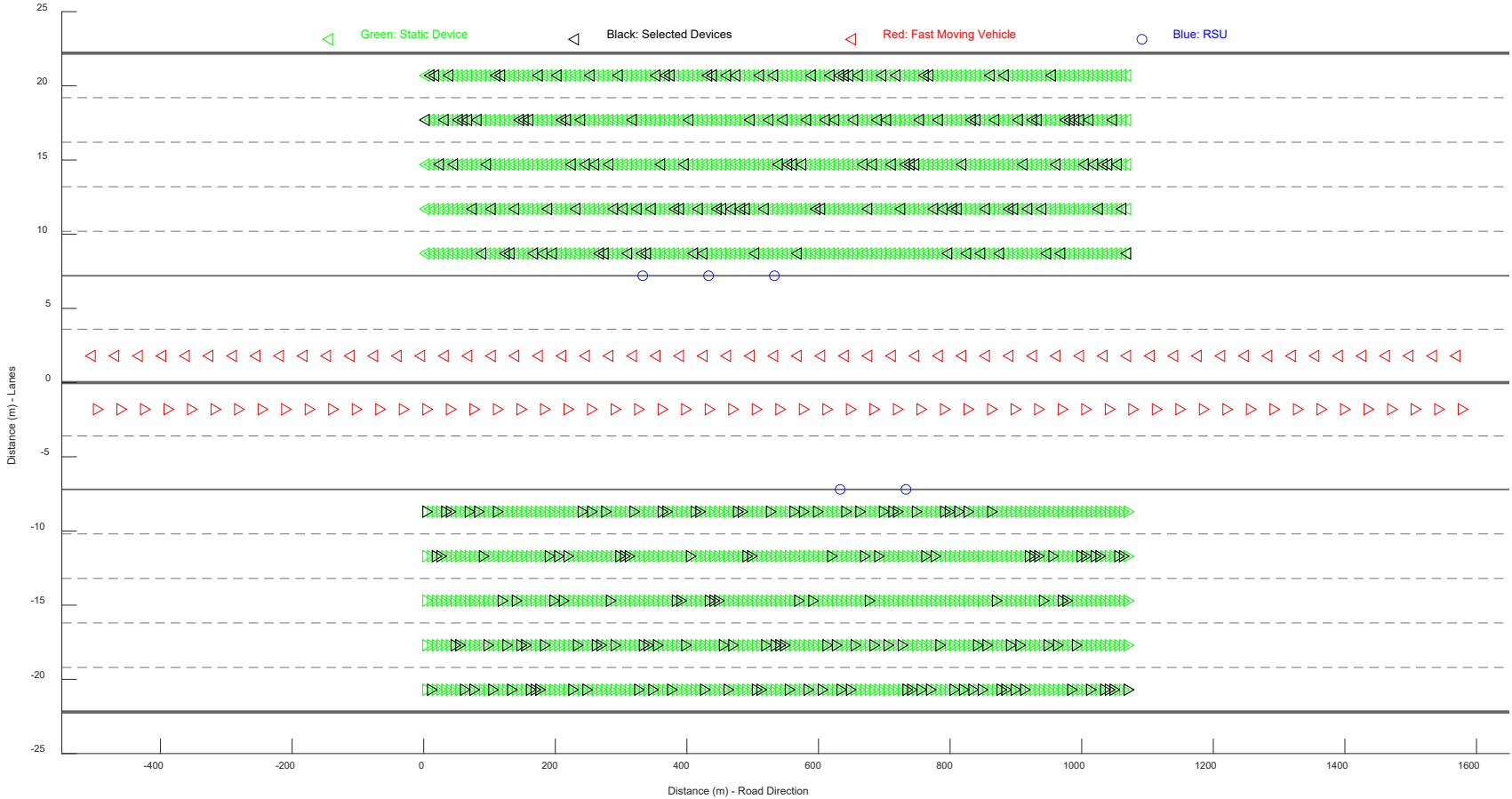
Comments on Results

▶ Simulation results almost match the field test results on 100ms. In new version of SAE J3161 standards, the resources for HARQ needed to be selected among the ones whose RSSIs are the lowest.

▶ Compared heavily congested scenario with emulation performed by fixing TTI to 100ms. The aim in emulation is to be able to mimic a scenario with 1500 devices. In emulation, fixing TTIs to 100ms helps emulating six devices with a single device.

▶ Results with emulation and 1500 devices deployment scenario show that emulation performs better. This is expected because in emulation six devices emulated by a single device cannot interfere with each other. However, in real deployment, any devices can interfere with any device

▶ Since the simulation results with CM on IMA test match with field test results, if another field test were to be performed with 1500 devices, the result would be similar to what simulation provides
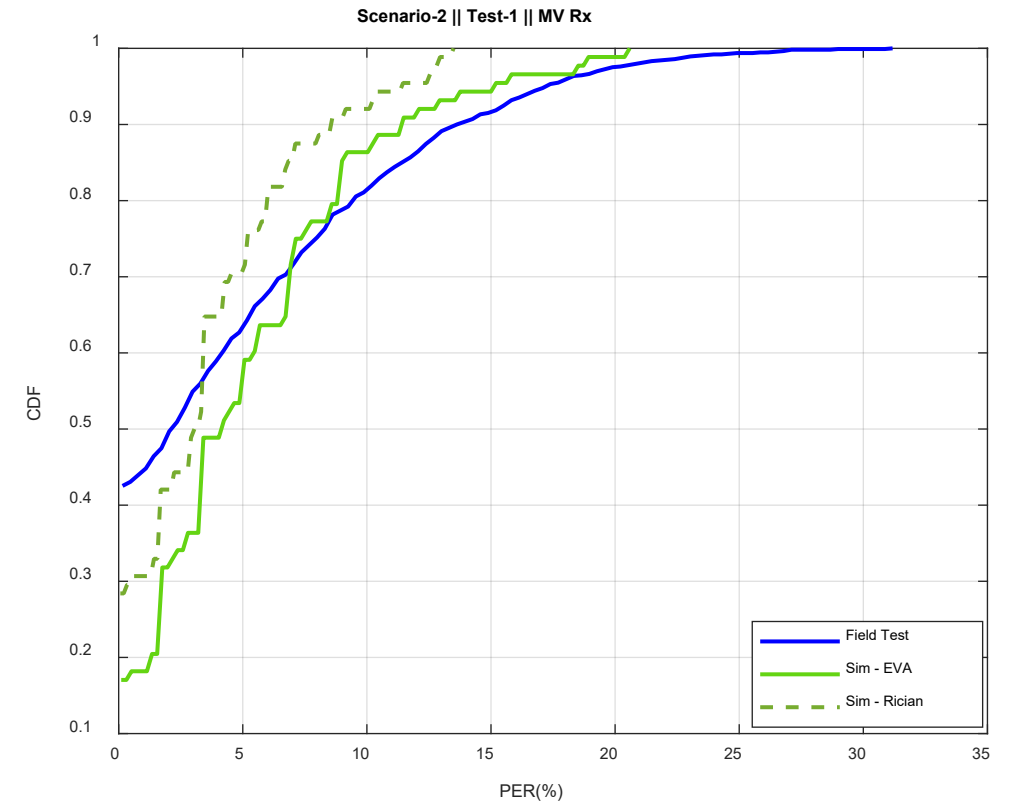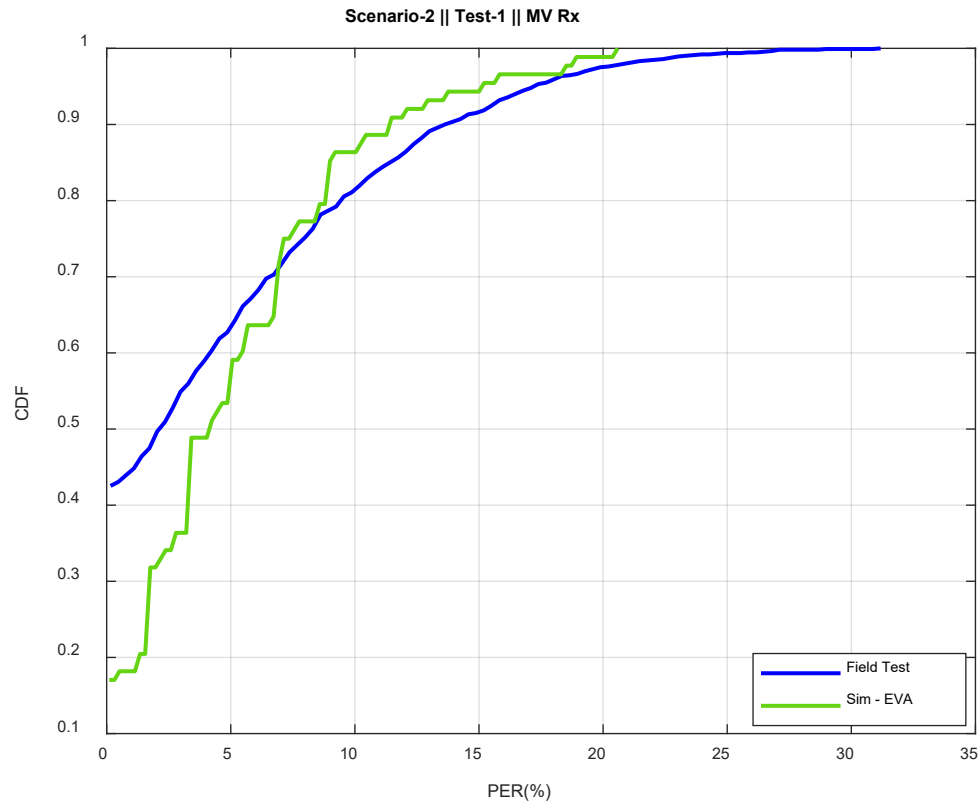
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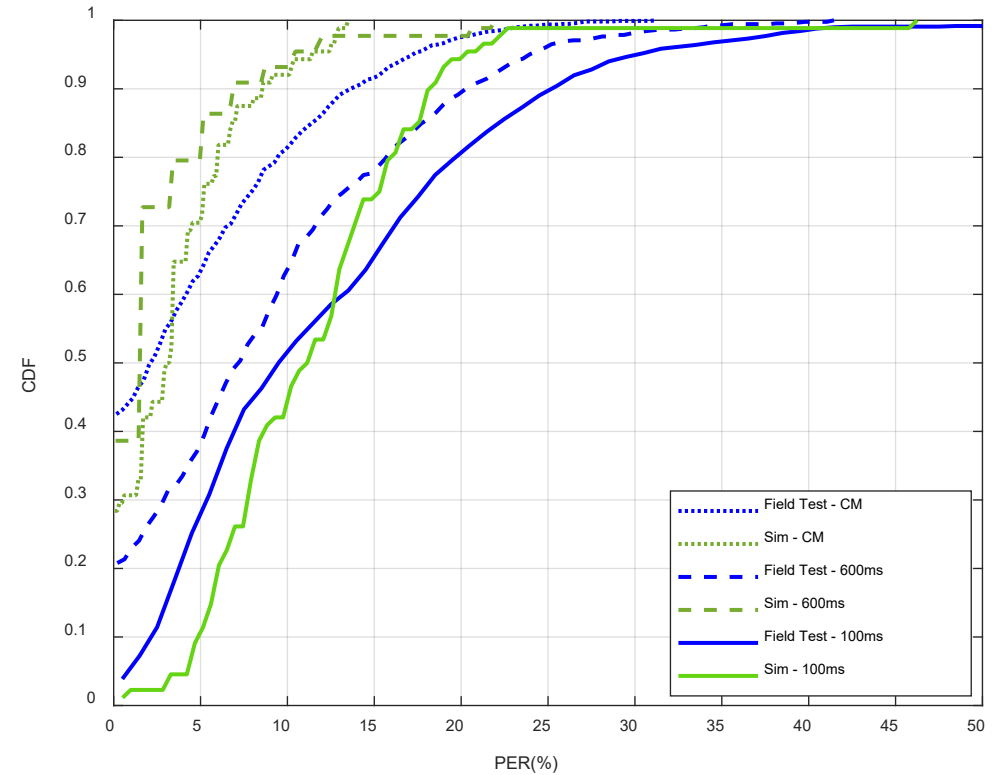
Results – 100ms

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Results – 600ms

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Results – Congestion Mitigation

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Result - All

with EVA

with Rician

Results – 50ms

Scenario-2 || Test-15 || MV Rx