

Experimental Evaluation of 5.9 GHz Link Asymmetry using Standards-Compliant Implementation

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Second International Workshop on Vehicular Communications and Applications 2013 (VCA'13)
October 7th, 2013

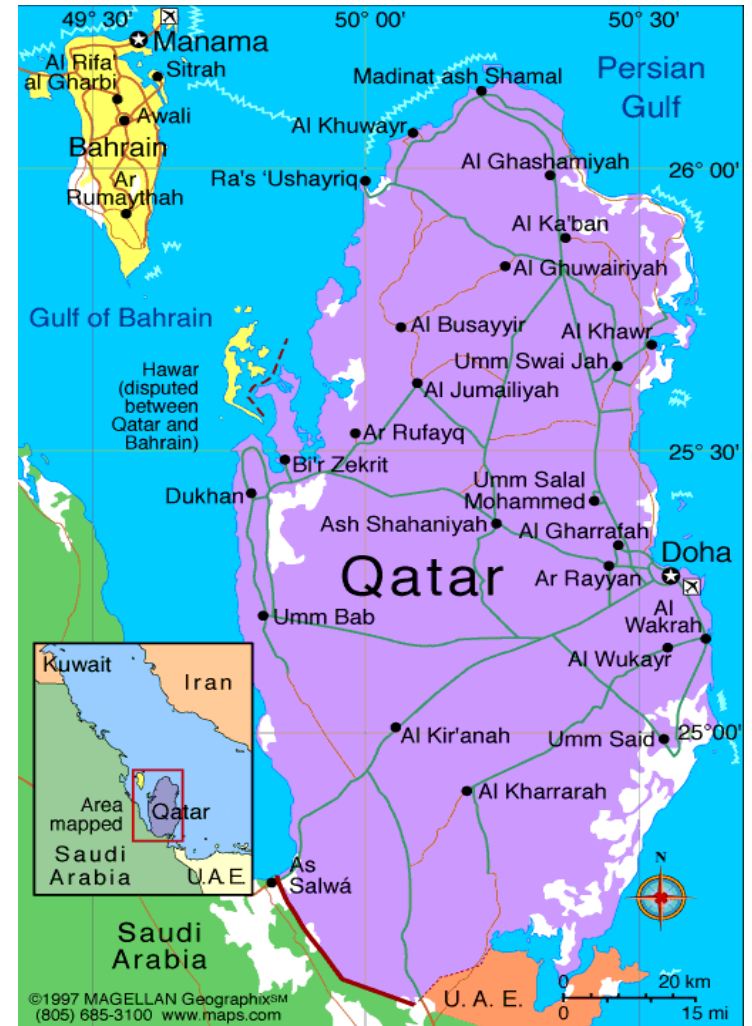
About QMIC

QATAR SCIENCE & TECHNOLOGY PARK



Regional first innovations center focused on mobility applications, services and solutions.

Emerging as the regional leader in Intelligent Transport Systems



Outlines

- Introduction
- Motivations
- Experiments and Outcomes
- Conclusions

Our Cars will talk



Introduction

- Many stakeholders already interested in

Car Makers



Public Authorities



SDOs



R&D Projects

Universities

Tech. Suppliers



Introduction

CopITS project

Title: **Cooperative Cars and Roads for Safer and Intelligent Transportation Systems**

NPRP Project funded by QNRF

Duration: **3 years (Dec. 2010 to Nov. 2013)**

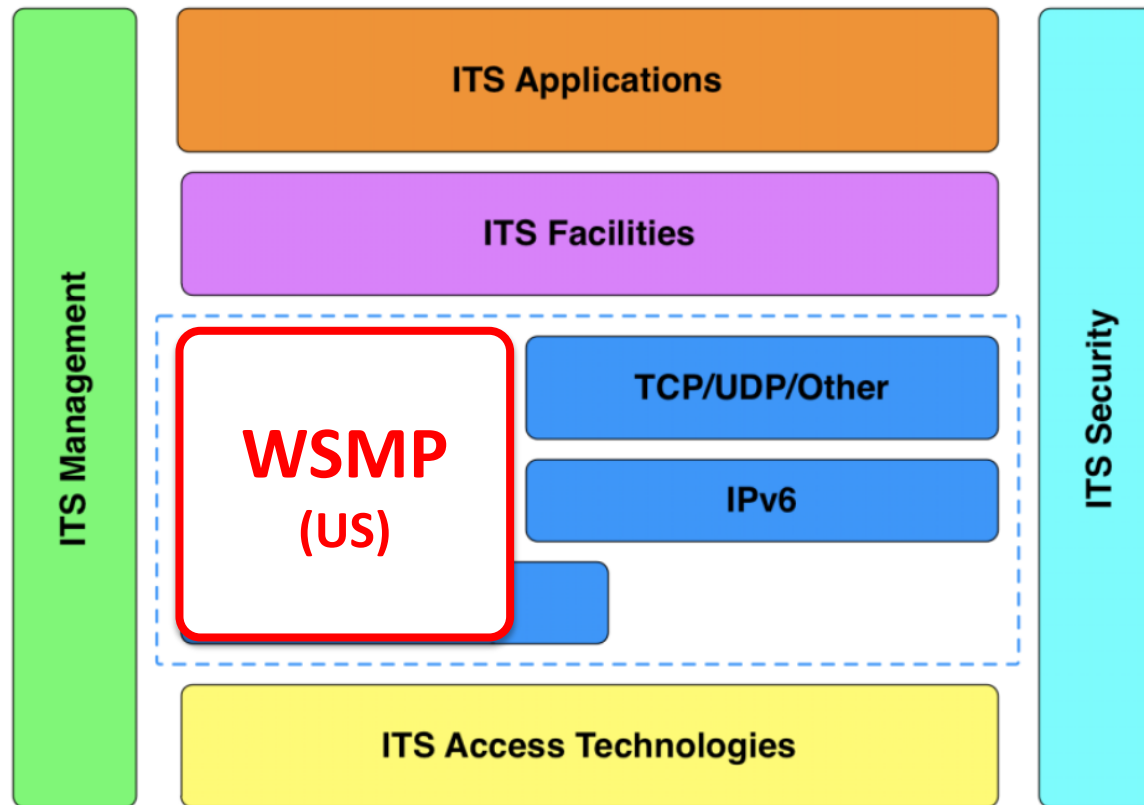
Website: www.copits.org

Lead-PI: **Dr. Fethi Filali, QUWIC**



Introduction

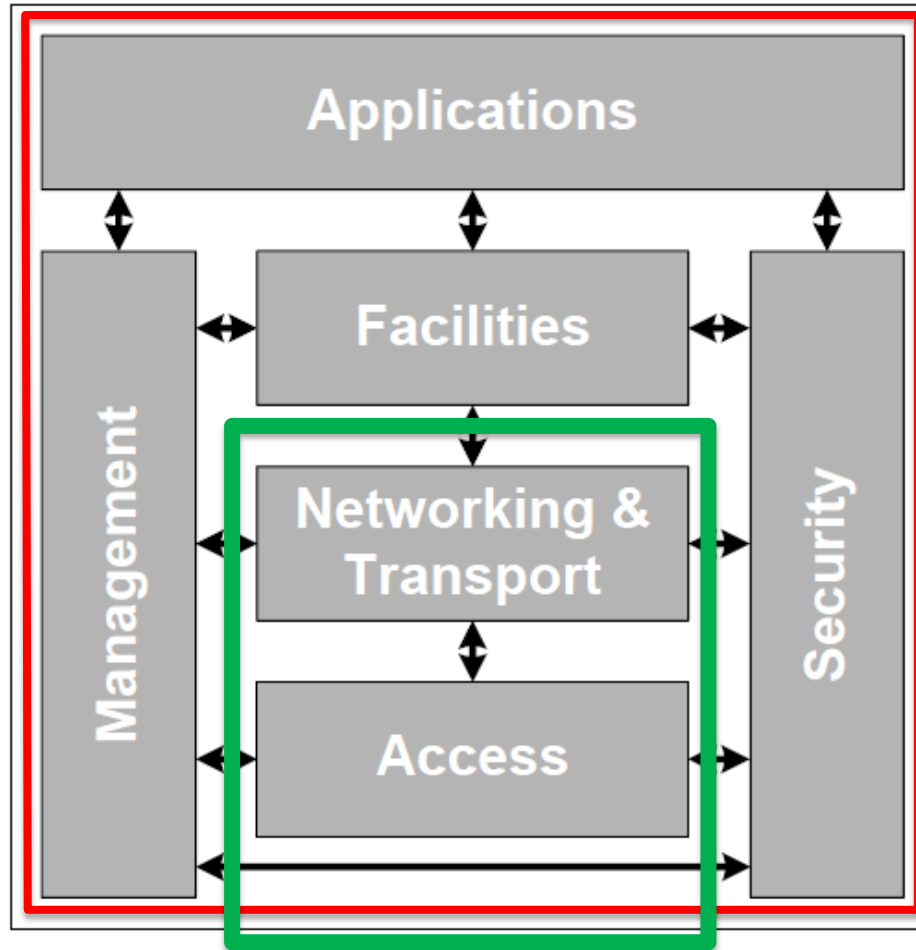
ETSI TC ITS Architecture (Europe)



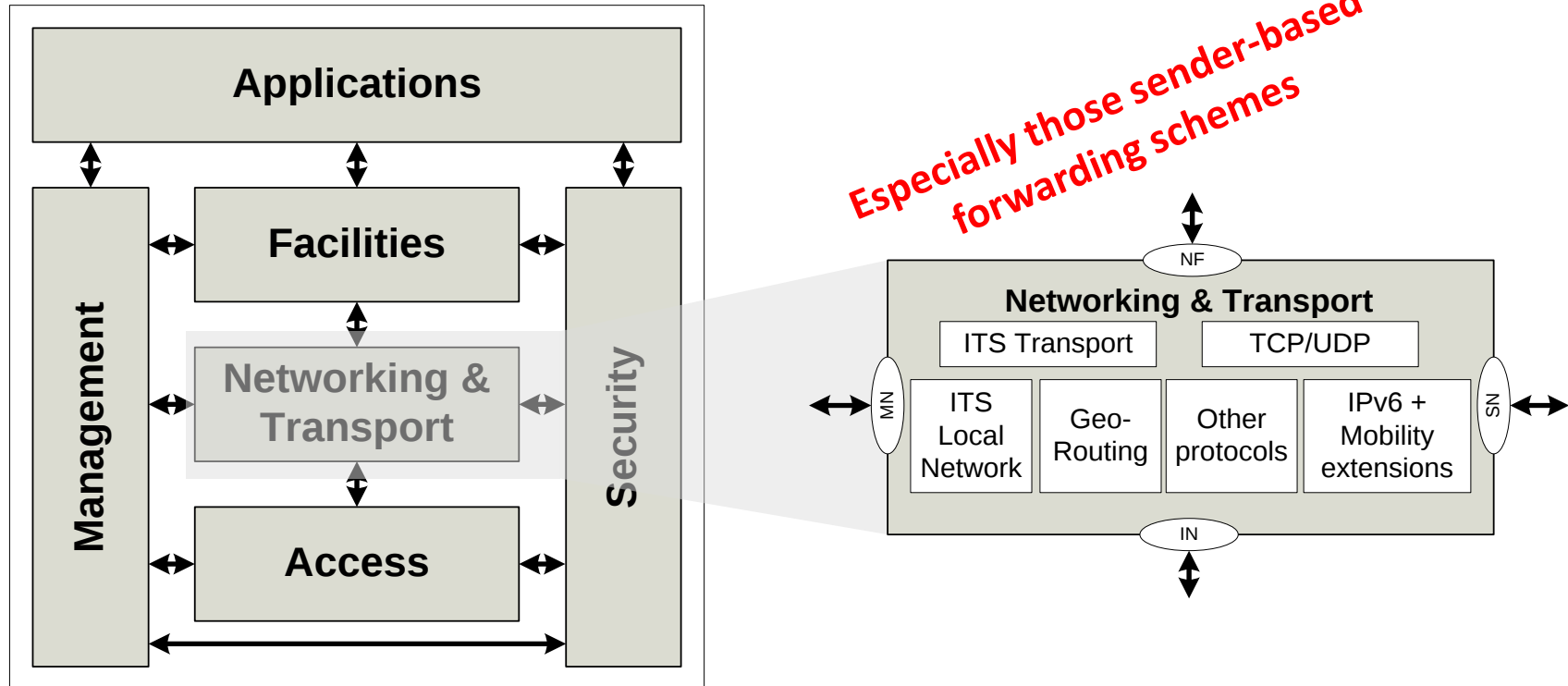
Motivations

ETSI TC ITS Architecture

CopITS Scoop and Contribution



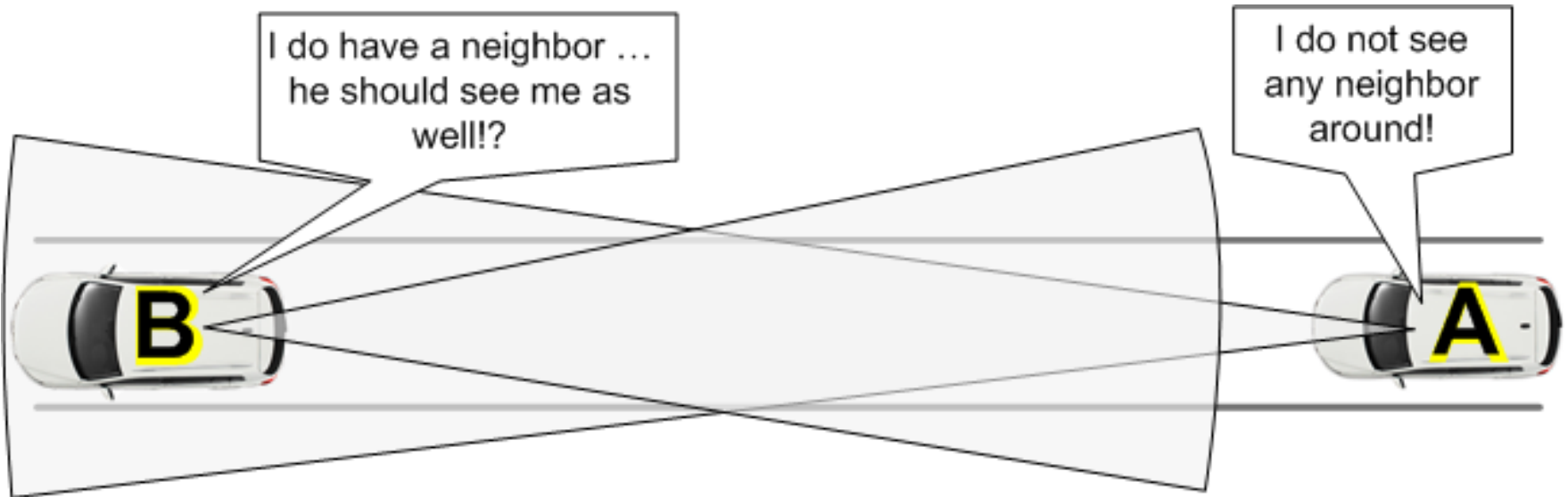
Motivations



Key components at Network layer rely on link symmetry

Motivations

5.9 GHz link asymmetry may impact on network and upper layers performances?



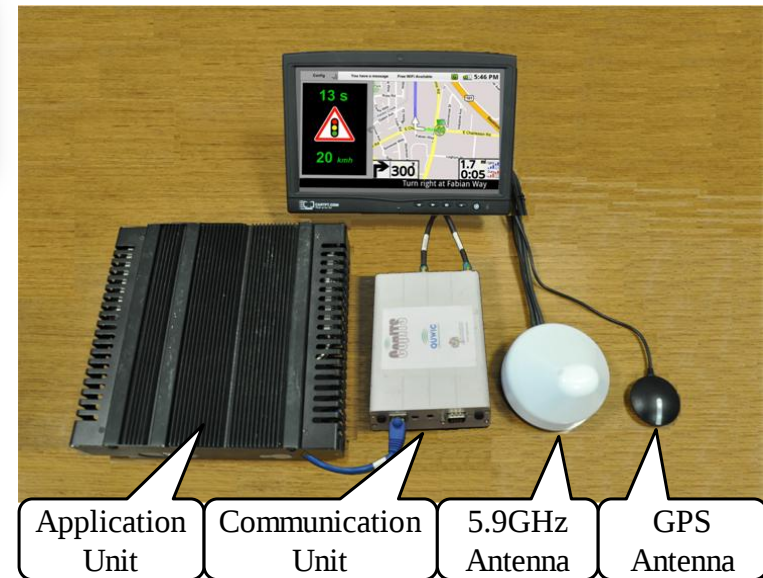
STOP! Danger from left

I am turning to green in 12 seconds!

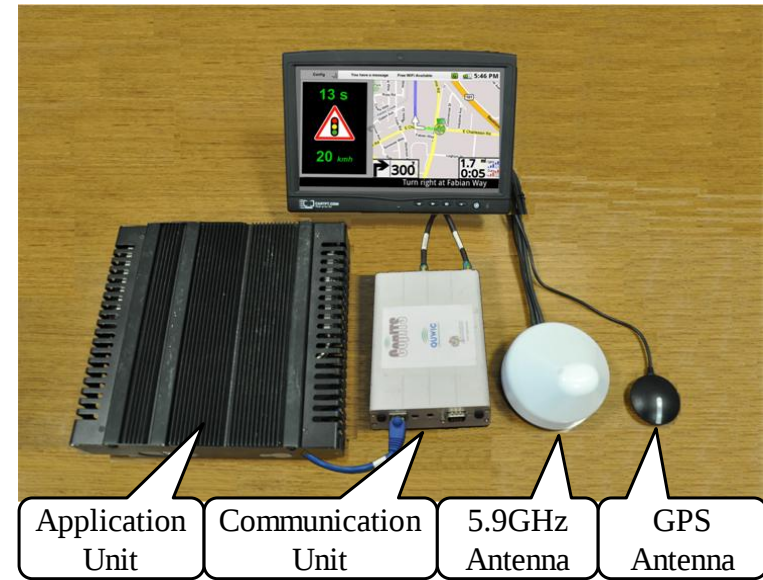
Road Work ahead

©QMIC

Experiments/Outcomes

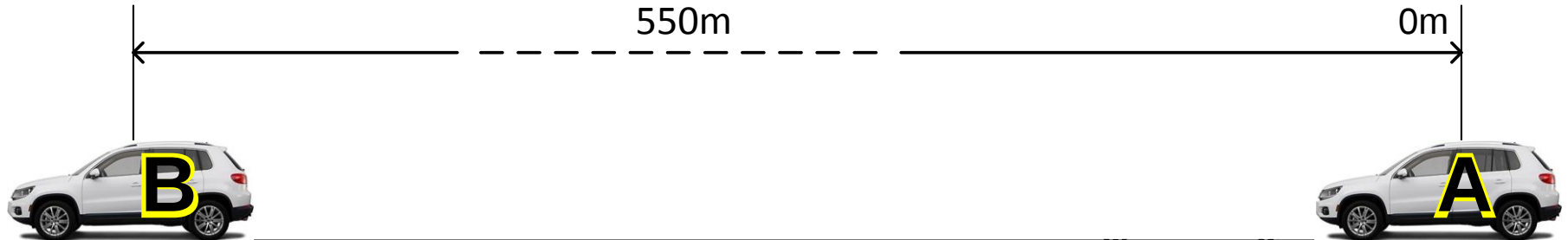


Experiments/Outcomes

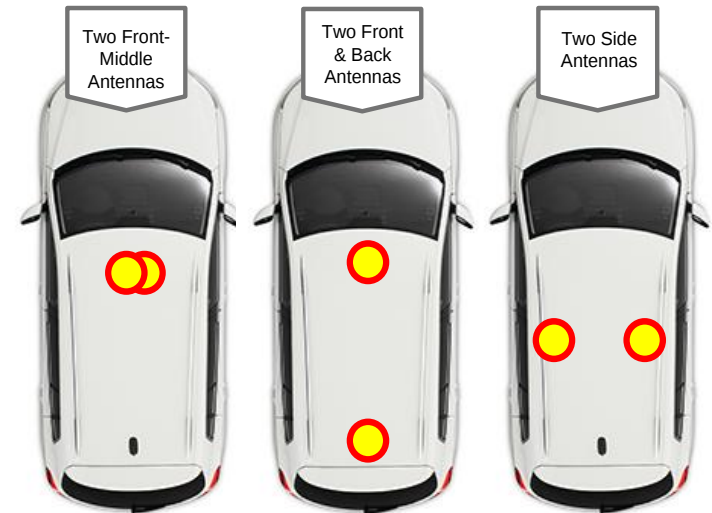


**Standard compliant implementation of the related
ETSI TC ITS Standards**

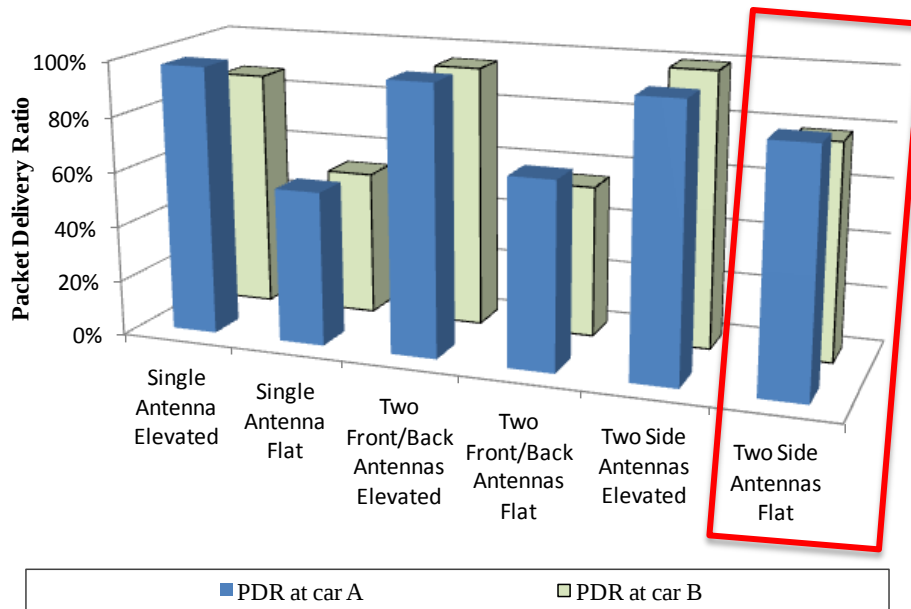
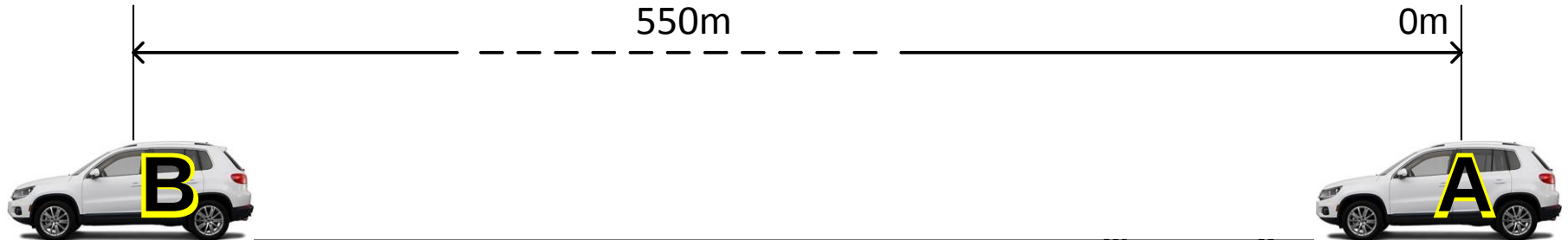
Experiments/Outcomes



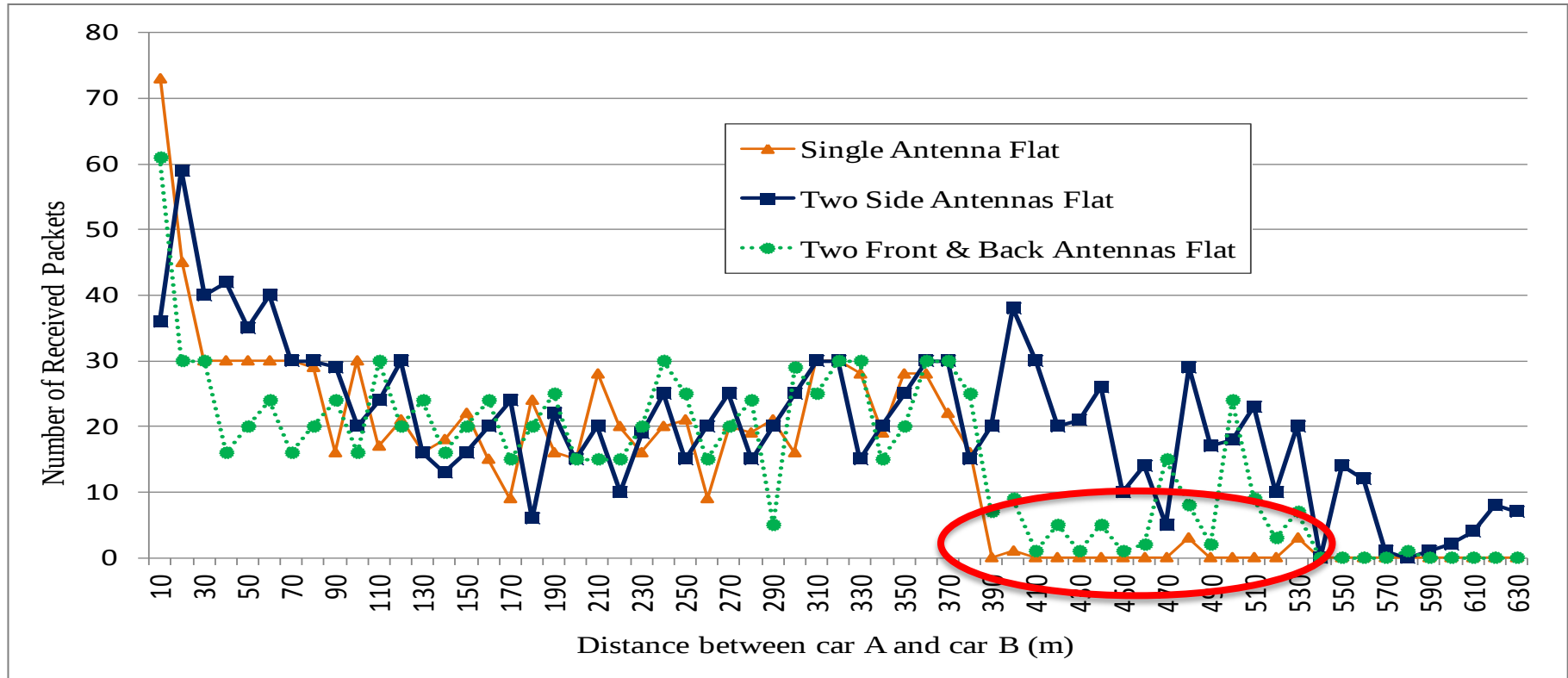
Parameter	Value
Car A height	1,686 mm (66.4 in)
Car B height	1,847 mm (72.7 in)
Communication channel	5 895 MHz to 5 905 MHz (CH180)
Communication channel size	10MHz
TxPower at both cars	21 dBm
Antenna gain	5 dBi
Network beacon size	36 bytes



Experiments/Outcomes

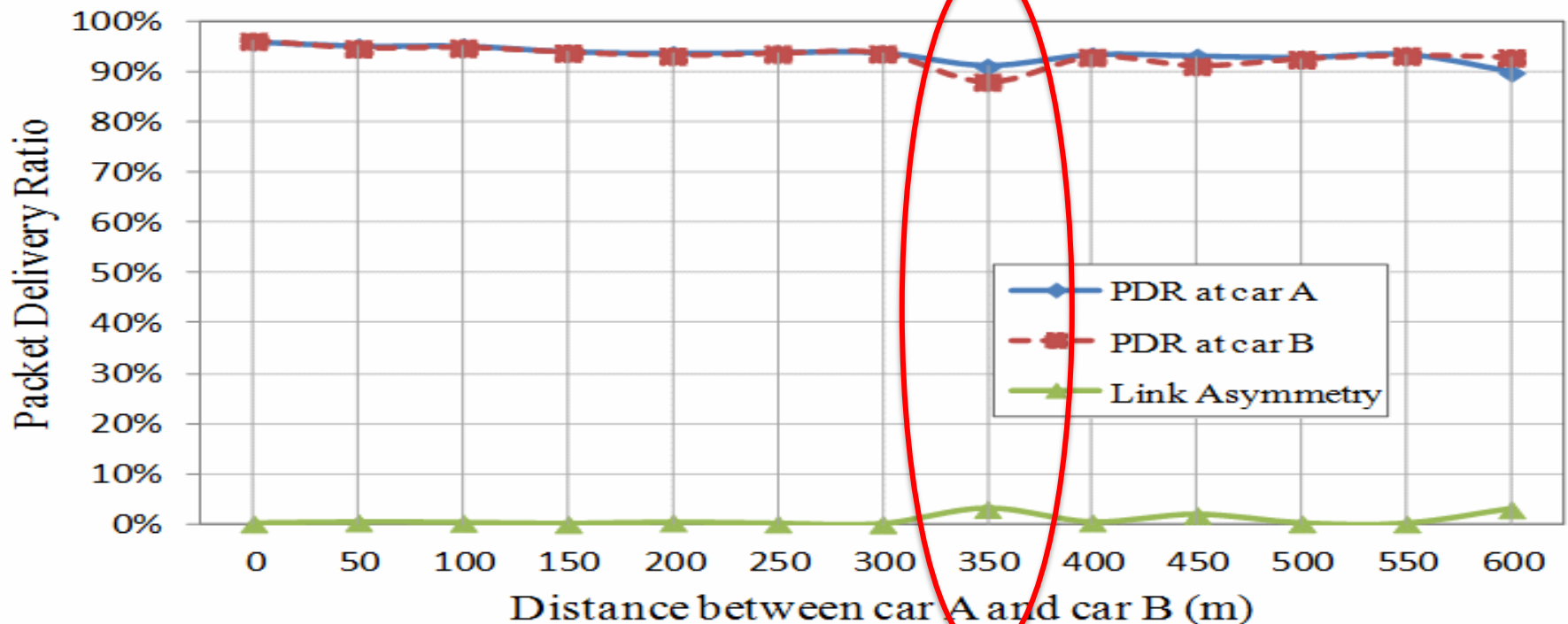
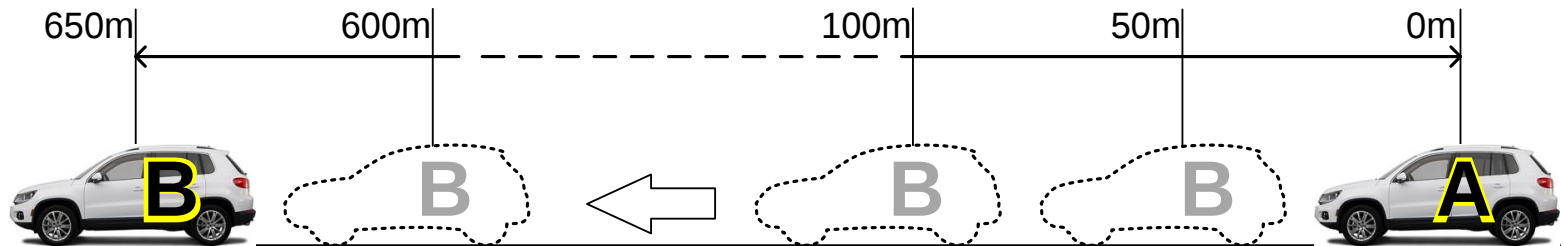


Experiments/Outcomes

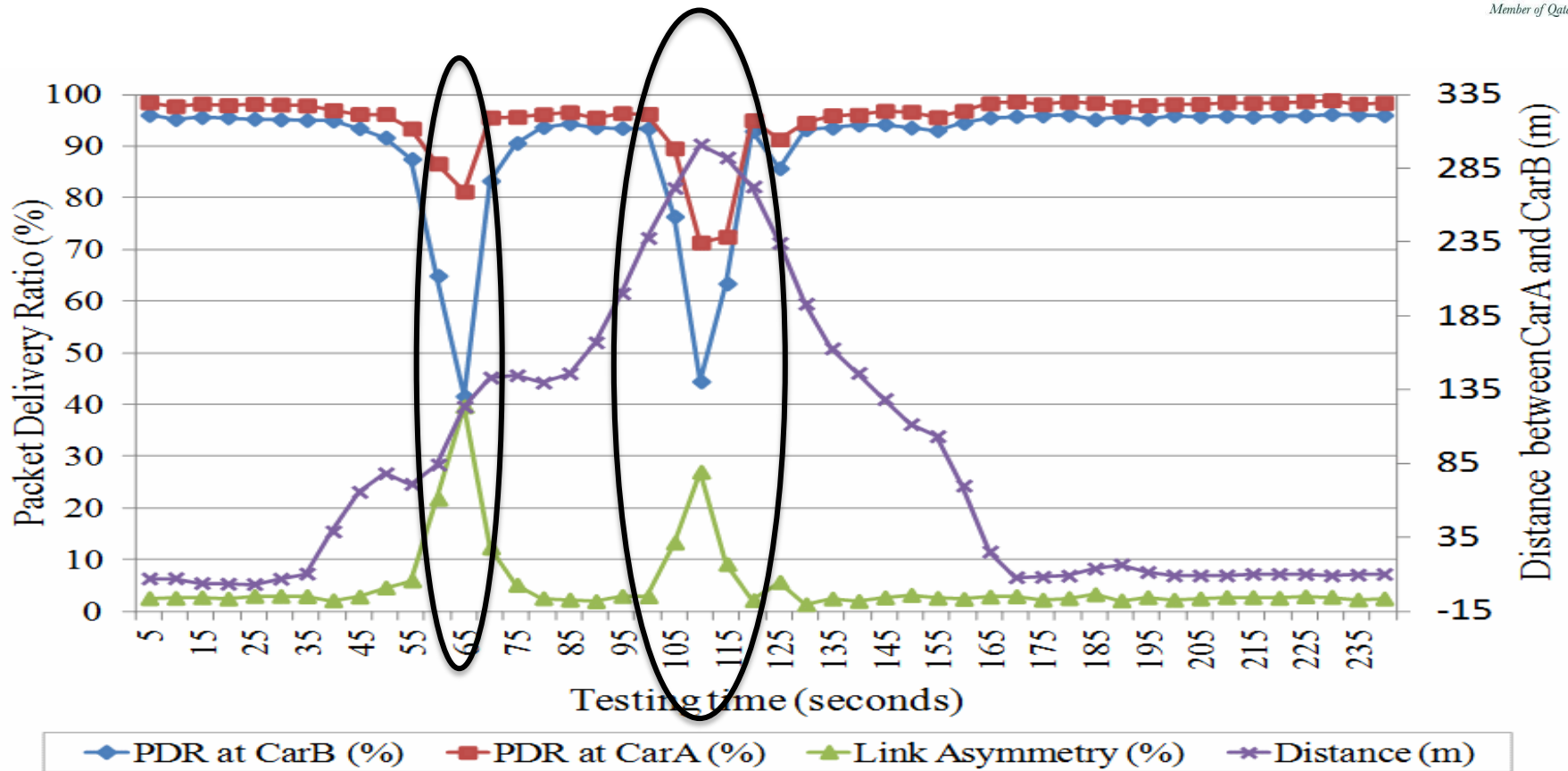


Number of received packet at sender side at different distances from the sender i.e. from 10 to 630 meters. Communication **antennas are stuck to cars' roof**. The sender keeps moving away from the sender with a static speed of 20kmh.

Experiments/Outcomes



Experiments/Outcomes



PDR measured when driving on public road, to show the impact of other vehicles (obstacles) on the link symmetry.

Conclusions

- Conducted real experimentations to evaluate the link asymmetry of 5.9 GHz wireless link and its impact on upper layers.
- Wireless antennas installation location on the car's roof may have a considerable impact on the quality of the wireless communication link
- Link symmetry can be considerably impacted by sensitivity of 5.9 GHz, but not by distance.
- More extensive experiments needs to be conducted, and a higher number of involved vehicles should be considered



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MENA Region

Time for
Connected Vehicles



***Thank you
for your Attention.***

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CopITS project: www.copits.org