



Volkswagen



Adding 2Rx antennas as a baseline for NR-V2X simulations

Introduction

- During the course of the “Study on evaluation for 2 RX exception in Rel-15 vehicle mounted UE for NR” in RAN4 the automotive industry explained the difficulties of implementing more and more antennas onto vehicles.
- Based on the study, vehicular UE with 2Rx antennas were allowed for the communication over Uu.
- It was observed that during the RAN1 study on NR Vehicle-to-Everything (V2X) only 4Rx antennas were part of the simulation assumption (see Annex A.1 in TR38.885).
- Vehicle manufactures understand that with the introduction of 5G there may be a shift toward more Rx antennas for some use cases.
- Nevertheless, automotive companies would like to highlight that the deployment of a technology depends on the complexity of implementation.
- Business decisions determine what level of complexity is realized.

Complexity of vehicle mounted antennas

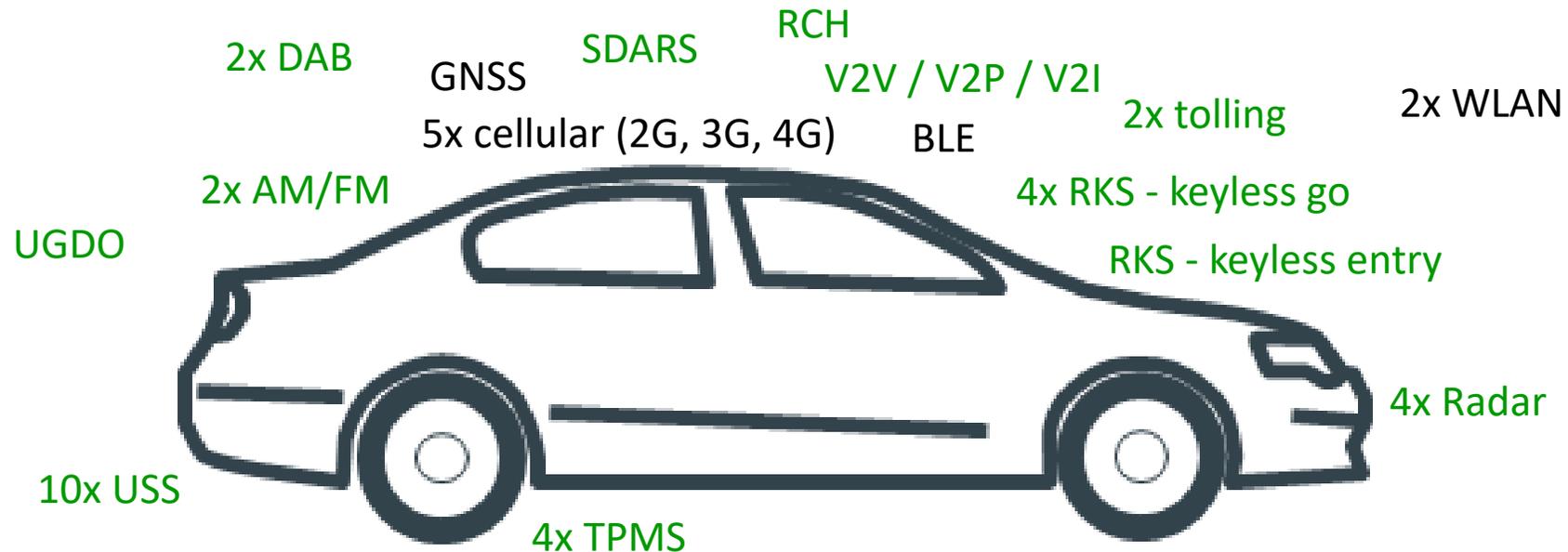
- Automotive production requires antennas to be realized as a separate module.
 - > Modules need to be equipped with automotive graded RF components and connectors
 - > Adds design, assembly and reliability complexity.
- Chassis made of metal require antennas to be mounted ideally outside of the body sheet in prime locations to achieve the best coverage.
- Design constraints of brands and for certain models require conformal / concealed antennas
 - > Alternative antenna concepts need to be used which require more space and are less effective.
 - > Adds complexity because of limited mounting space.
- As the next slide shows, antennas used for cellular communication are only one type of antennas.
- Prime locations for antennas to achieve a desired radiation pattern are usually limited and some vehicle outlines (e.g. heavy goods vehicle, transporters, convertibles) never give such locations.
 - > Alternative antenna positions might contribute only minorly to MIMO transmissions and to diversity gain if at all.

Radio technologies of current car models

(feature list affects amount of antennas)

More than 15 different technologies require antennas

-> Antenna mounting space is valuable



Technologies special to automotive industry

RCH: remote controlled heating

UGDO: universal garage door opener

TPMS: tire pressure monitoring

USS: ultrasonic sensors

RKS: remote keyless system

Summary

- 3GPP RAN is asked to offer a limited implementation complexity of NR V2X by considering also 2Rx antennas.
- To avoid unforeseen behaviors of 2Rx implementations simulations need to be conducted during the NR V2X WI phase.
 - > The simulation assumptions used during the WI phase need to be updated to also include a 2Tx/2Rx combination.
 - > Simulations need to be conducted using such a combination during the WI phase.