

Automotive

AUTOMOTIVE

Presenter: Daniel Loo
System Engineer | EMC

ROHDE & SCHWARZ

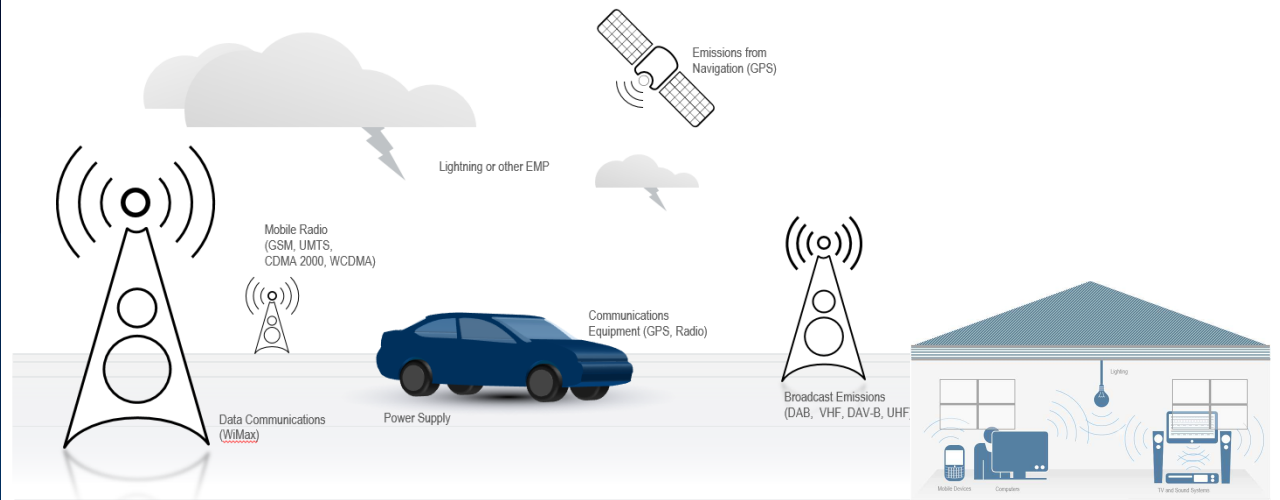
Make ideas real



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AGENDA

- Traditional EMC Testing (Requirement)
- Future?



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STANDARDS OVERVIEW

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EMC STANDARDS BASED ON EUT

▶ Different Electronic Equipment require compliance to different Standards

Commercial Equipment:

- ISM Equipment
- Consumer Electronics Equipment
- IT / Household Equipment
- Lighting Equipment



Automotive Equipment:

- Control Equipment
- Infotainment Equipment
- Communication Equipment



Military Equipment:

- Aircraft Equipment
- Ship & Submarine Equipment
- Land Based Equipment



Space Equipment:

- Space Vehicle Equipment
- Launch Vehicle Equipment
- Ground Based Equipment



Automotive EMC

STANDARD OVERVIEW

International	Manufacturer	Europe	India
CISPR 12 VEHICLE EMI	GM 3097 ESA EMC	2004/104/EEC VEHICLE & ESA EMC	AS004 VEHICLE & ESA EMC
ISO 11451 VEHICLE EMS	BMW GS95002 VEHICLE & ESA EMC	ECE R10 VEHICLE & ESA EMC	
ISO 10605 VEHICLE & ESA ESD	VW-TL ESA EMC		
CISPR 25 ESA EMI	FORD EMC ESA EMC		
ISO 11452 ESA EMS	⋮		
ISO 7637 Conducted Pulse	FLAT 9.90110 VEHICLE & ESA EMC		

EMC STANDARDS BASED ON EUT

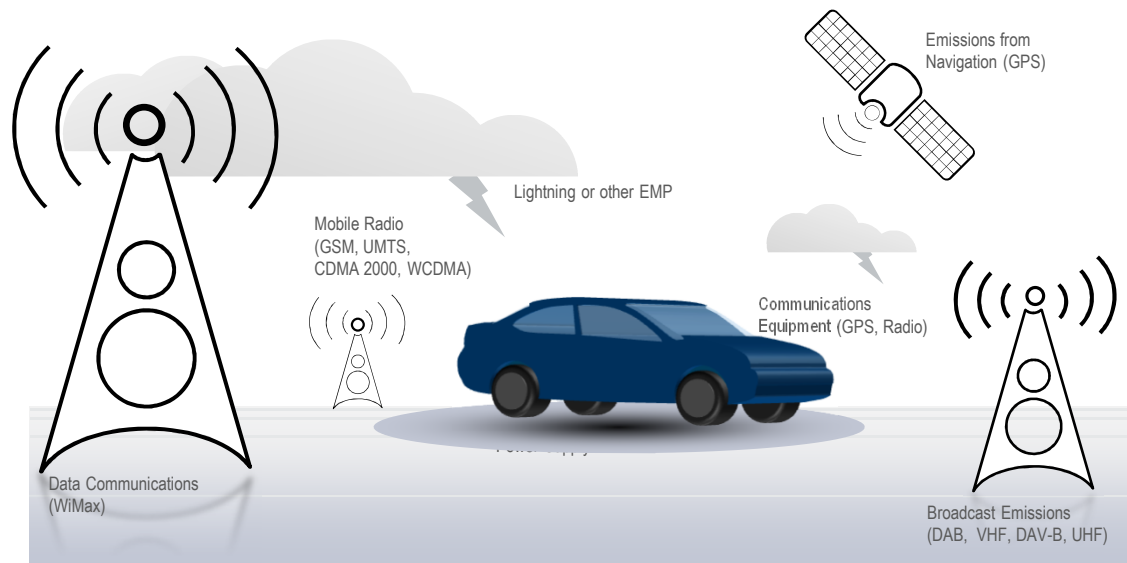
► Different Electronic Equipment require compliance to different Standards

Automotive Equipment:

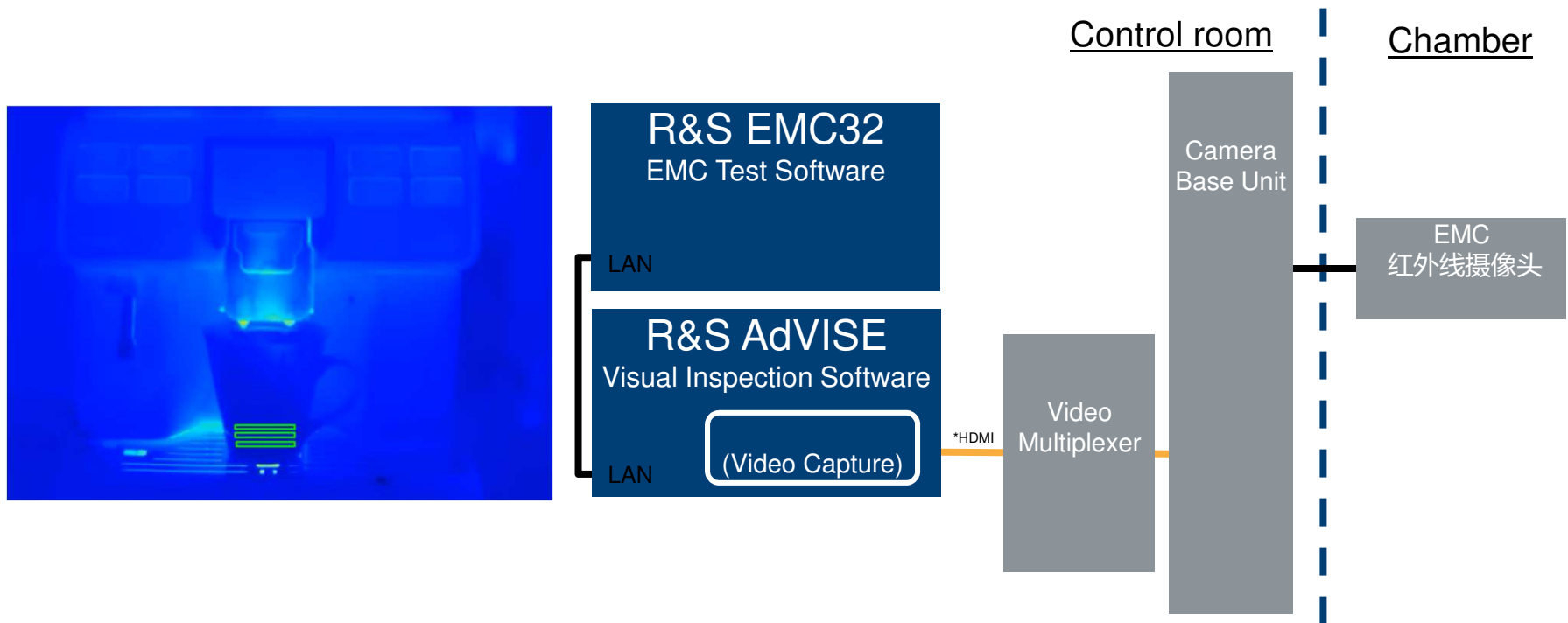
- I Control Equipment
- I Infotainment Equipment
- I Communication Equipment

Applicable Standards:

- I CISPR 12, 25
- I ISO11451, ISO11452
- I Product Specific Standards



R&S ADVISE ® - MONITORING SYSTEM



Automotive EMC

AUTOMOTIVE SYSTEM (汽車系統)



Automotive Test Solutions

- Radar
- Connectivity
- 4G / 5G Network; Quality Analysis
- Infotainment
- Ethernet & other Bus
- ECU Testing
- Power Supplies
- EMC / Antenna Testing

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AUTOMOTIVE STANDARD UPDATES

VISUALIZATION IN AUTOMOTIVE SENSOR FUSION TEST

ELECTROMAGNETIC SAFETY IN AUTOMOTIVE

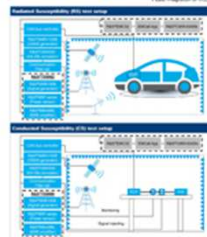


ROHDE & SCHWARZ
White Paper 04

EMCall App

AT A GLANCE

Following the activation of the eCall system in a crash, the eCall system provides an automated message with the MSISDN to emergency services with the aim of bringing rapid assistance to subscribers. eCall reduces the emergency services response time and the quicker response will lower the severity of injuries and number of fatalities. Still, the eCall system participation in the subscription market. It is crucial to ensure their stability and reliability by meeting specific test requirements in a complex electromagnetic environment.



TA-EME ELECTROMAGNETIC ENVIRONMENT TEST SYSTEM

ELECTROMAGNETIC SAFETY IN AUTOMOTIVE



ROHDE & SCHWARZ
White Paper 04

TA-ACE ADAS WITH COMPREHENSIVE ELECTROMAGNETIC ENVIRONMENT TEST

ELECTROMAGNETIC SAFETY IN AUTOMOTIVE



ROHDE & SCHWARZ
White Paper 04

AUTOMOTIVE RADAR TESTING

High precision test solutions for radar and tomorrow's ADAS radar



Test it. Trust it.

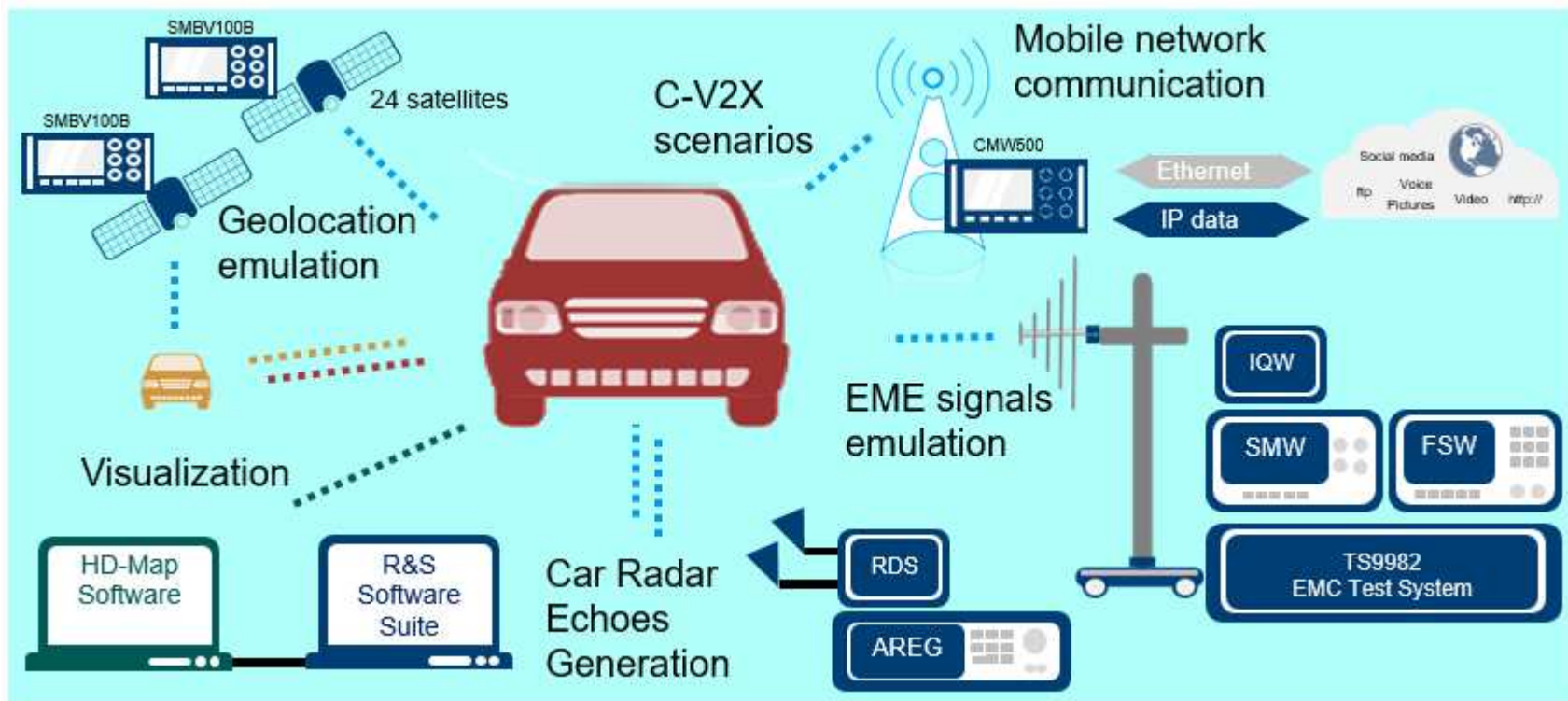
ISO and road
Great things happen when the world

1. T/CSAE 150 2020 (official release)
 1. Requirements and test methods for road vehicle's adaptability to complex electromagnetic environment
2. GB34660 (drafting new version)
 1. Failure Judgment Criteria of Active Safety System
 2. Failure Judgment Criteria of ADAS
3. ISO11451 1 /2 (drafting new)
 1. V2X test proposals for ISO11451/2
 2. Faster immunity test method
 3. E2.2.3 Pseudo noise sequence
4. ISO11452 1/2 (drafting new)
 1. Pseudo noise sequence - Broadband
 2. Replay of recorded signals
5. ECE R10 (V 7) —(drafting new)
 1. AECS(Accident emergency calling system)
 2. EMS Freq from 2Ghz to 6Ghz
 3. FFT sweep, measurement time

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SMART VEHICLE EMC SAFETY AND RELIABILITY TEST

Comprehensive signals and visualization simulation in test chamber



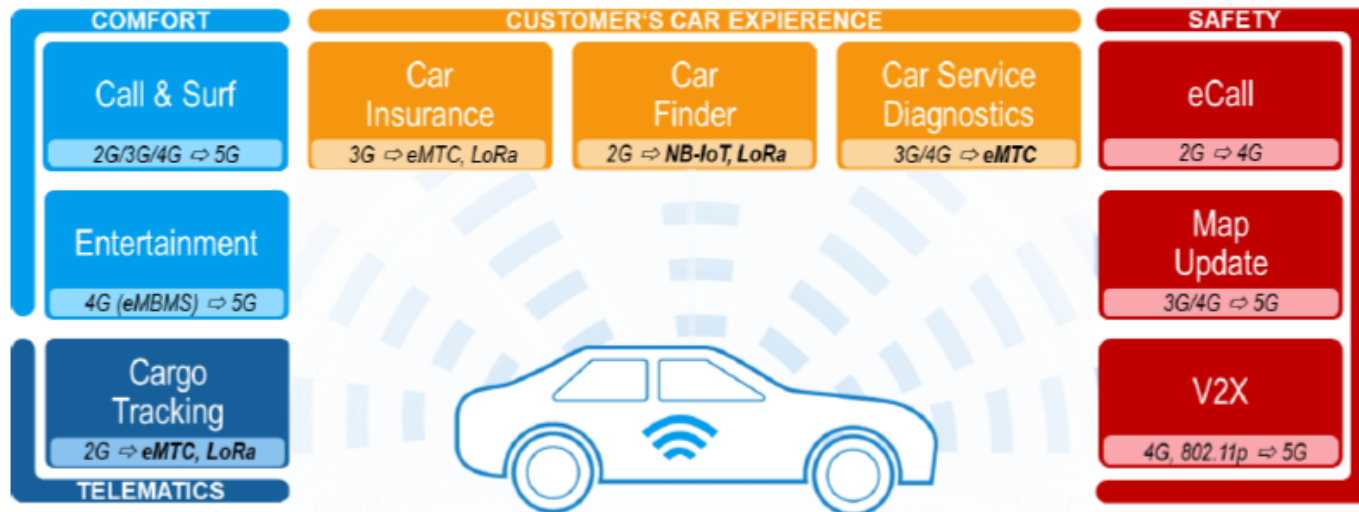


ELECTROMAGNETIC ENVIRONMENT TESTING

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INSIDE THE CONNECTED CARS

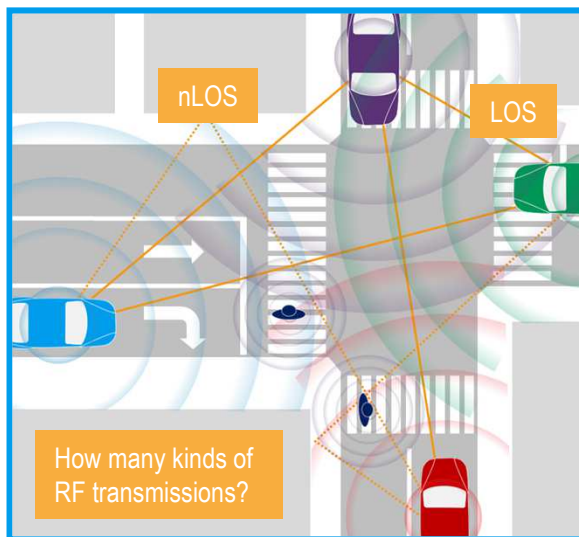
SMART APP SERVICES WITH WIRELESS AND TELECOMMUNICATION TECHNOLOGIES



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WHAT IS ALARMING IN ROAD SAFETY FOR ICV ON THE ROAD?

A VERY CHALLENGING ELECTROMAGNETIC ENVIRONMENT (EME)



Electromagnetic Environment (EME) :

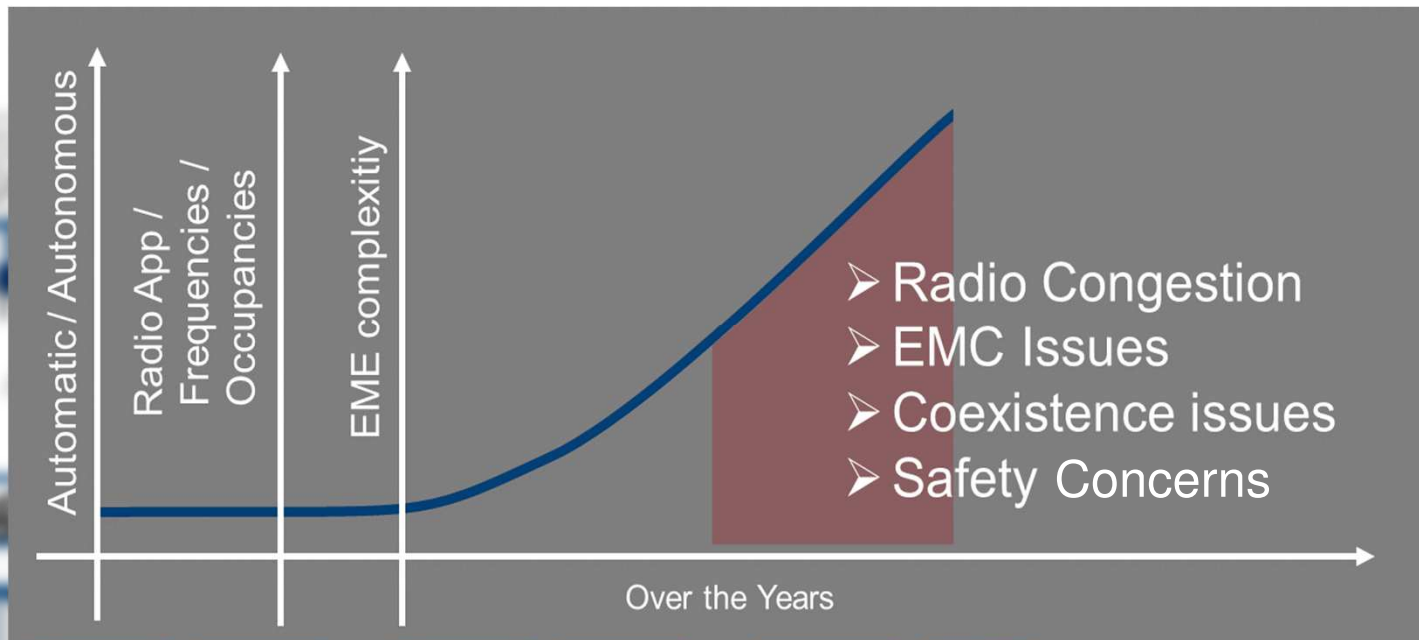
- ▮ Intentional and Unintentional Transmissions
- ▮ RADAR signals
- ▮ Cellular and Wireless signals
- ▮ TV/Radio Broadcasting Transmissions
- ▮ Other EMI Signals (ESD / Inter-modulation signals)
- ▮ Jamming

- ▮ In-Vehicle Receiver Desensitization & Coexistence
- ▮ Transient Signals Effects
- ▮ Radar Pulse Interferences
- ▮ Receiver Sensitivity
- ▮ Road EME Effects (Multipath, Fading, Interferences)
- ▮ Overcrowding Effects

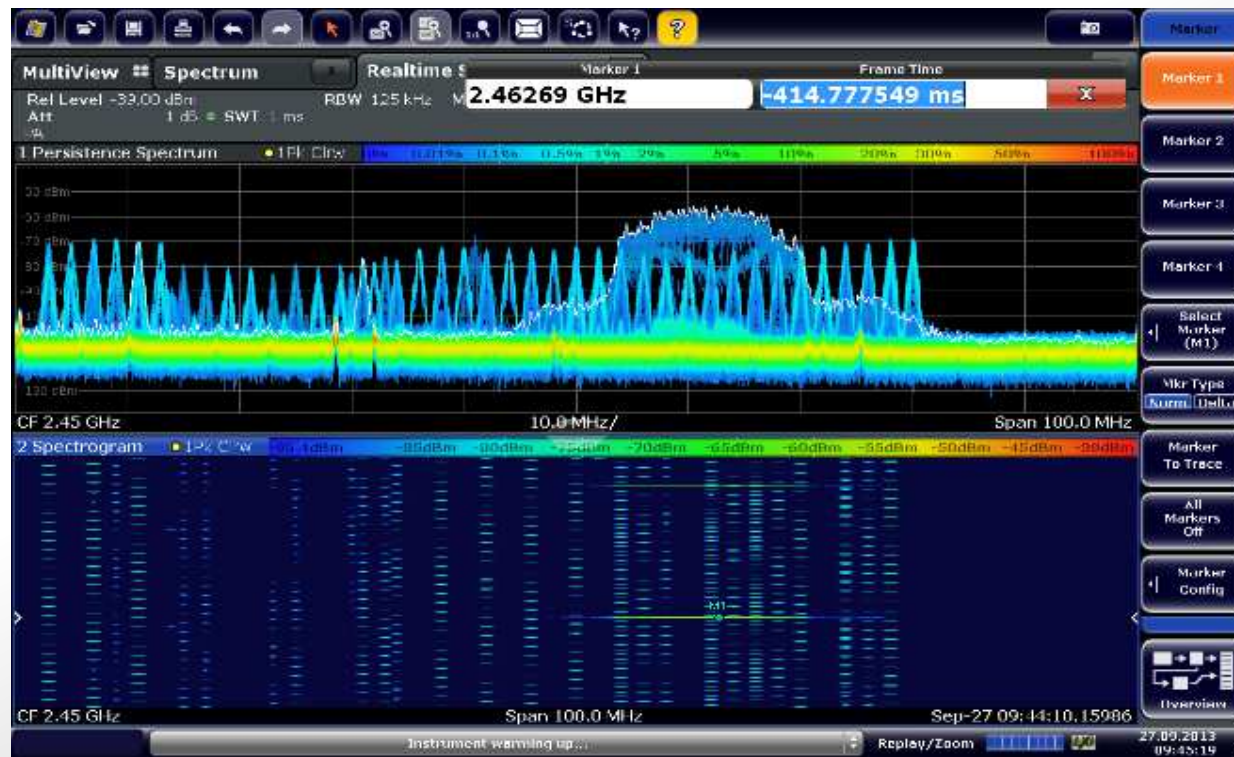
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ELECTROMAGNETIC ENVIRONMENT IN THE FUTURE

How is the smart networking era affecting us in future?



EME SIGNAL COLLECTION AND RECORDING ON ROAD





ELECTROMAGNETIC WINDOW SCANNING

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RELATED STANDARDS

► IEC 61000-4-3 Ed.4



The EUT is initially placed with one face coincident with the UFA plane. The EUT face being illuminated shall be contained within the UFA unless partial illumination is being applied. See 6.3 regarding field level setting and use of partial illumination.

The frequency ranges to be considered are swept with the signal modulated in accordance with 5.1, pausing to adjust the RF signal level or to switch oscillators and antennas as necessary. Where the frequency range is swept incrementally, see 8.4 about the step size requirements.

The dwell time of the modulated carrier at each frequency shall not be less than the time necessary for the EUT to be exercised and to respond, but shall in no case be less than 0,5 s.

NOTE 1 The dwell time starts when the test condition has stabilized at each frequency.

In order to reduce test time, more than one frequency may be applied simultaneously (multiple signal testing) during a single dwell time, provided the linearity requirements of 6.3.2 step 5) or 6.3.3 step 7) are met on the aggregate signal. At each of the signal frequencies, the test levels shall be the ones resulting from the level setting procedure for testing with one frequency at a time. The same modulation is applied simultaneously to each signal. Intermodulation signals shall be treated like harmonics and checked to ensure they are not causing a significant effect (see Annex I regarding modulation effects and Clause 9 regarding the evaluation of the test result).

► ISO 11451-2/202X



ISO/TC22/SC32/WG3 N xxx:
Date: 2021-12-1

ISO 11451-2 / 202x

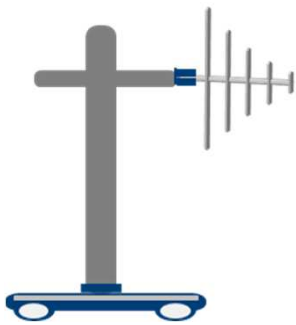
Road vehicles — Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy — Part 2: Off-vehicle radiation sources

SUBJECT: Proposal of **multiple signals testing** as a new annex.

REFERENCE DOCUMENTS: IEC 61000-4-3 Edition 4.0 Electromagnetic compatibility (EMC) – Part 4-3: Testing and measurement techniques – Radiated, radio-frequency electromagnetic field immunity test

EMS WINDOWING SCAN TEST

Standard EMS test signals generation



EMS WINDOWING SCAN TEST

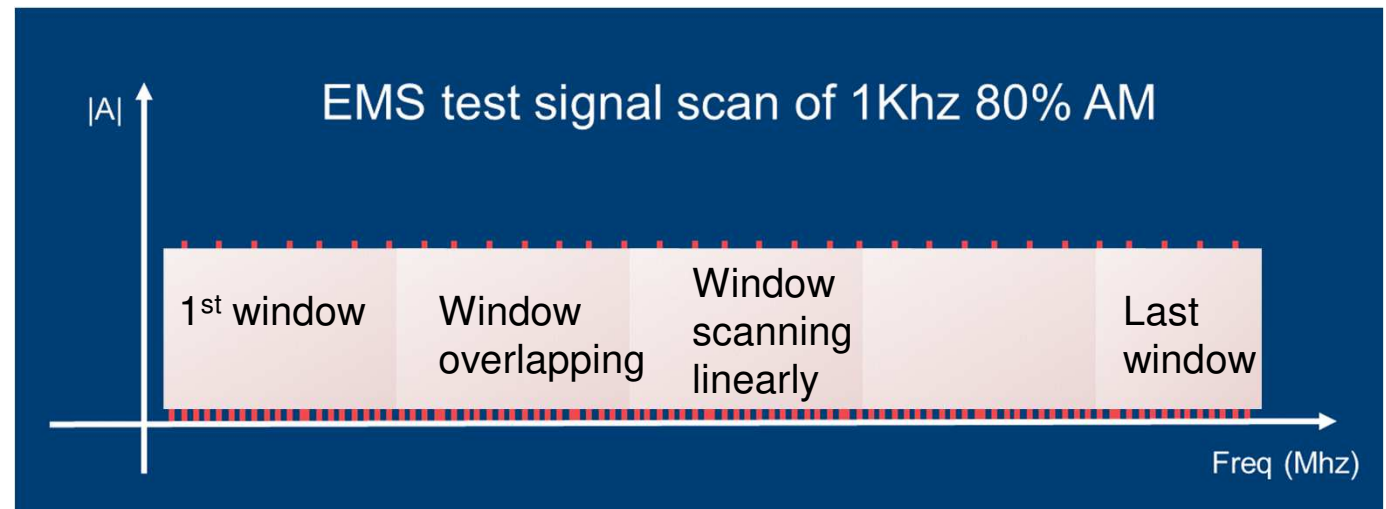
Windowing scan concept

User define windows for test

User define window overlapping size (%)

User define 1khz 80% AM signals spacing (linear)

1khz 80% AM signals grouping waveform



Software calculate and adjust appropriate immunity level

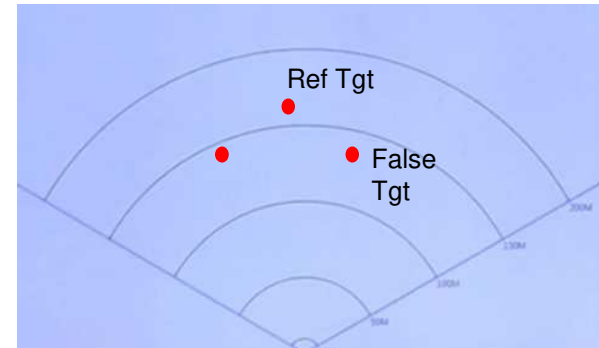
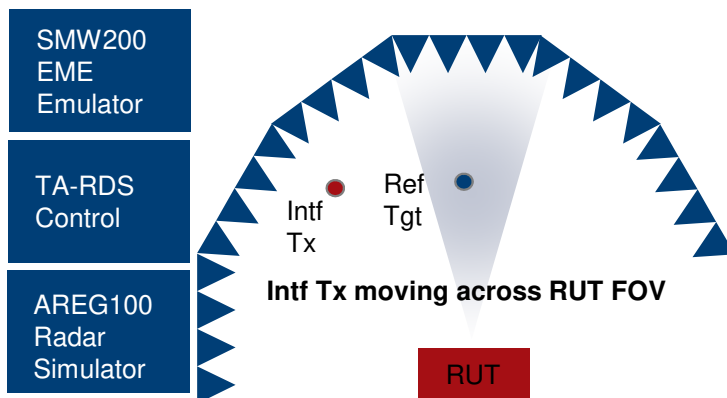


RADAR / LIDAR

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REFERENCE TGT + MOVING COEXISTENCE INTERFERENCES

ELECTROMAGNETIC INTERFERENCES CAN COME FROM ANY DIRECTIONS



- Interference transmission moving across RUT's FOV
- Interference signals (FMCW, CW) for eg: according to ETSI
- Similar performance evaluation as ISO11451/2-2



COEXISTENCE

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WHEN CARS BECOME HIGHLY AUTONOMOUS...

...which is not far in the future, EME testing will be in demand to ensure road safety

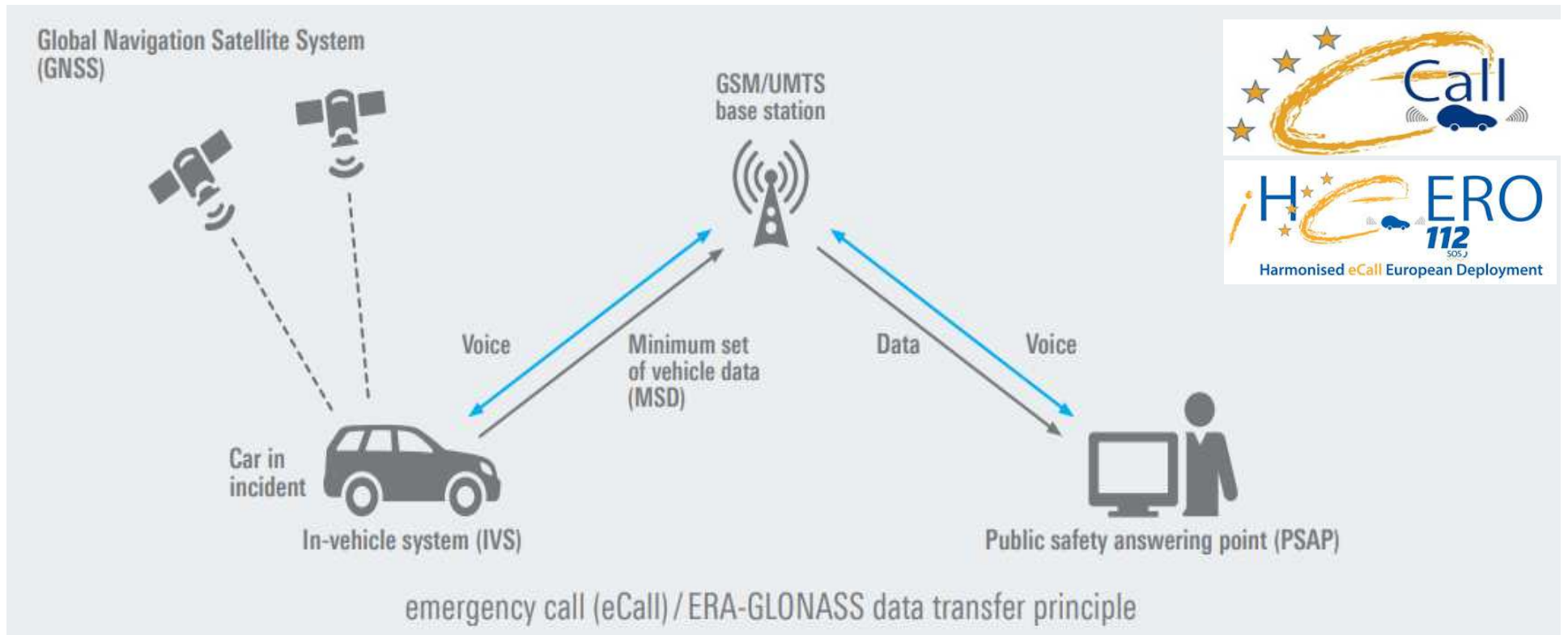




E-CALL

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HOW ECALL WORKS



Current situation

25,700 road traffic deaths
in 2014 in Europe

57% 
of all accidents take
place in rural areas

European objectives
for traffic fatalities:

 **2001** 54,900
2020 <16,000

10% 
lives saved in 2016
with eCall solutions

EU 
eCall Mandatory
by March 31, 2018

RUS 
ERA-GLONASS mandated
since January 1, 2015

460,000 cars equipped with
ERA-GLONASS solutions

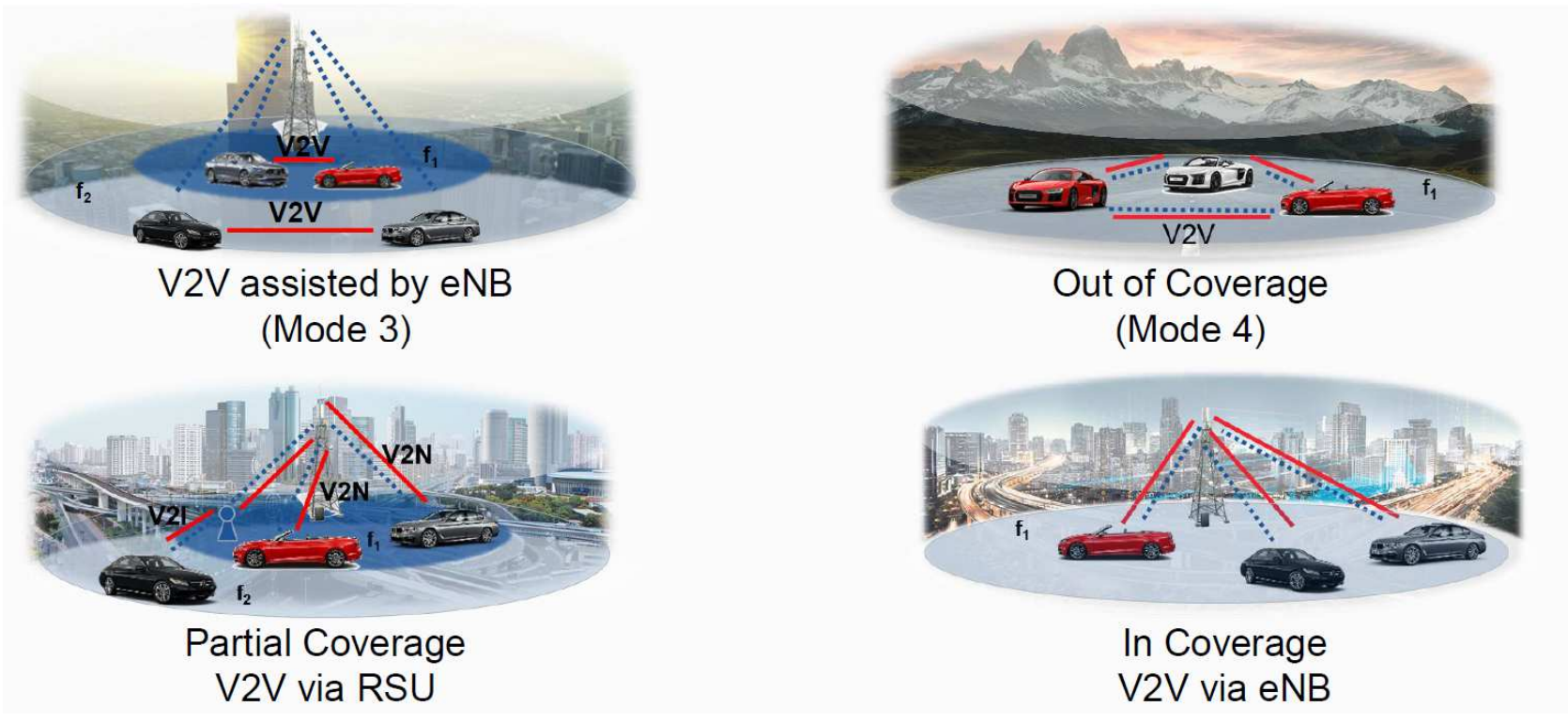
+30% 
faster accident



CV2X

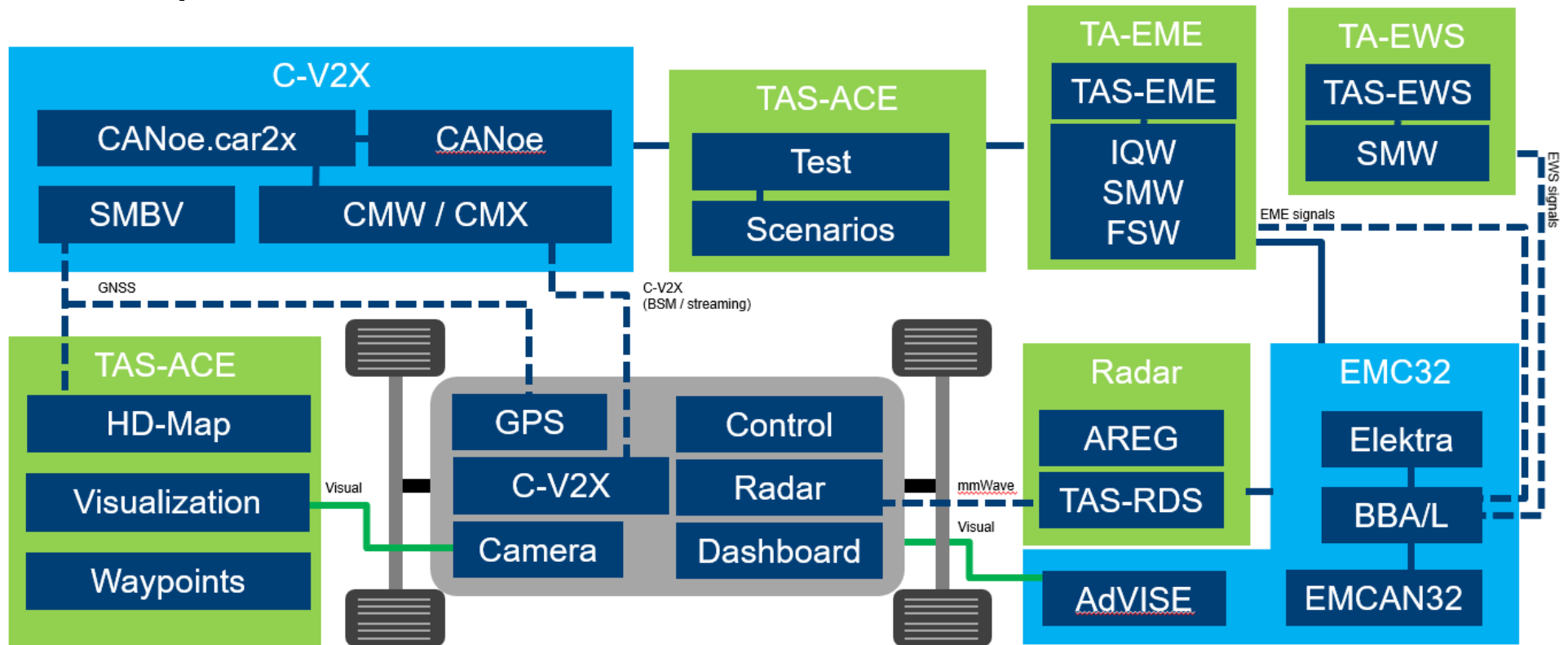
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C-V2X CONNECTIVITY EVERYWHERE



TA-ACE SOLUTION FOR AUTOMOTIVE

Developed for future





Rohde & Schwarz

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