TÜV Rheinland InterTraffic

EMC+AD(A)S scope today and forecast (EU)

9 December 2022, Köln

Bircan Taşlica

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1. TÜV Rheinland: We are at home on all continents

Covering your needs for testing, inspection & certification (TIC) since 1872

HQ in Cologne
Germany

20.567
Employees worldwide 2021
58% outside of Germany

~2.1 bln € sales 2021
47 % generated abroad

Over 500 offices
>200 labs
In 69 countries
(incl. >10 Wireless/ IoT)

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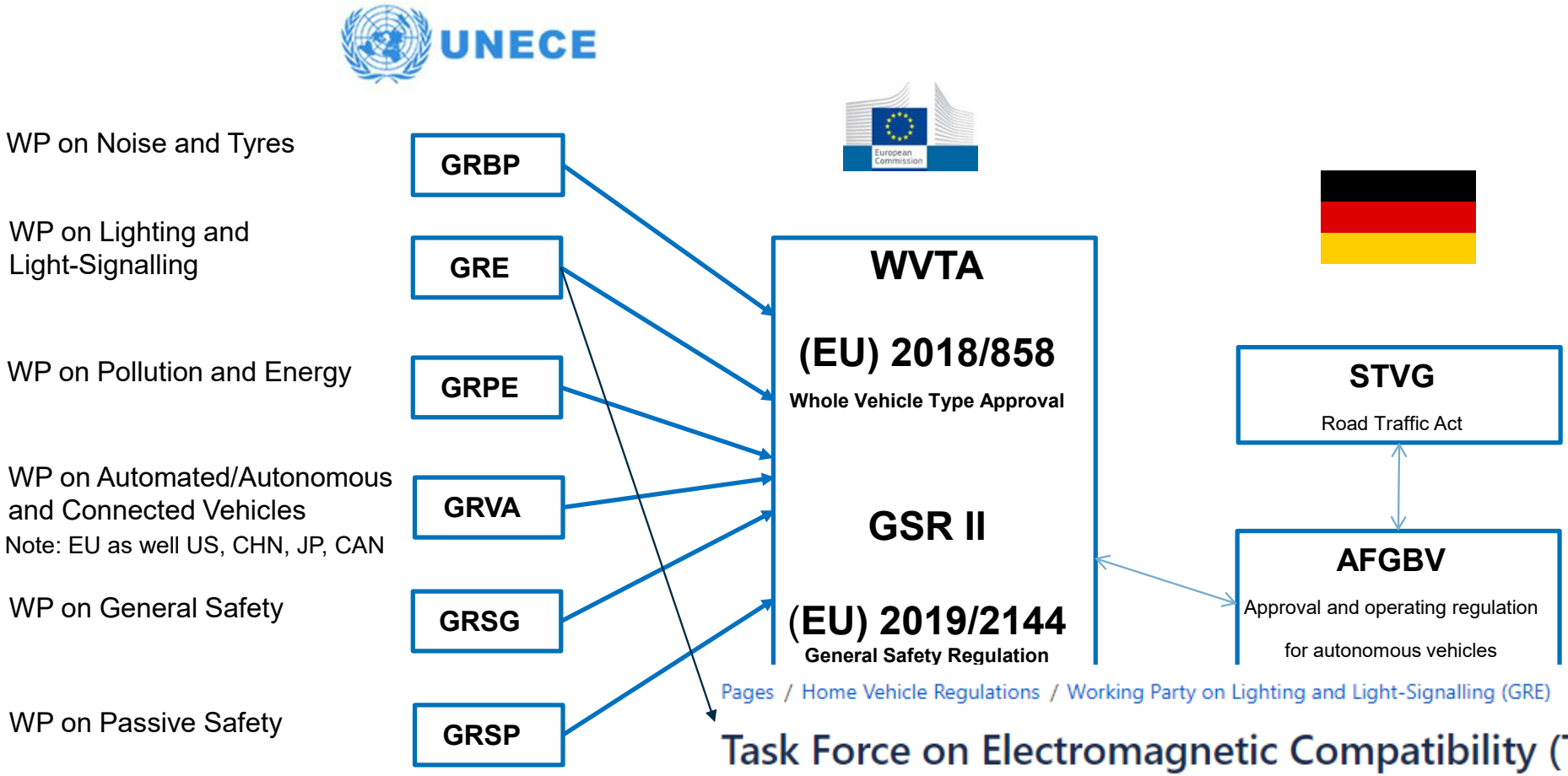
2. Legal framework for automated vehicles – World Forum Harm. of Vehicle Regul. WP29*



Pages / Home Vehicle Regulations / Working Party on Lighting and Light-Signalling (GRE)

Task Force on Electromagnetic Compatibility (TF EMC)

WP = Working Party

Pages / ... / Task Force on Electromagnetic Compatibility (TF EMC)

IWG-EMC 32nd session - 2022-11-09

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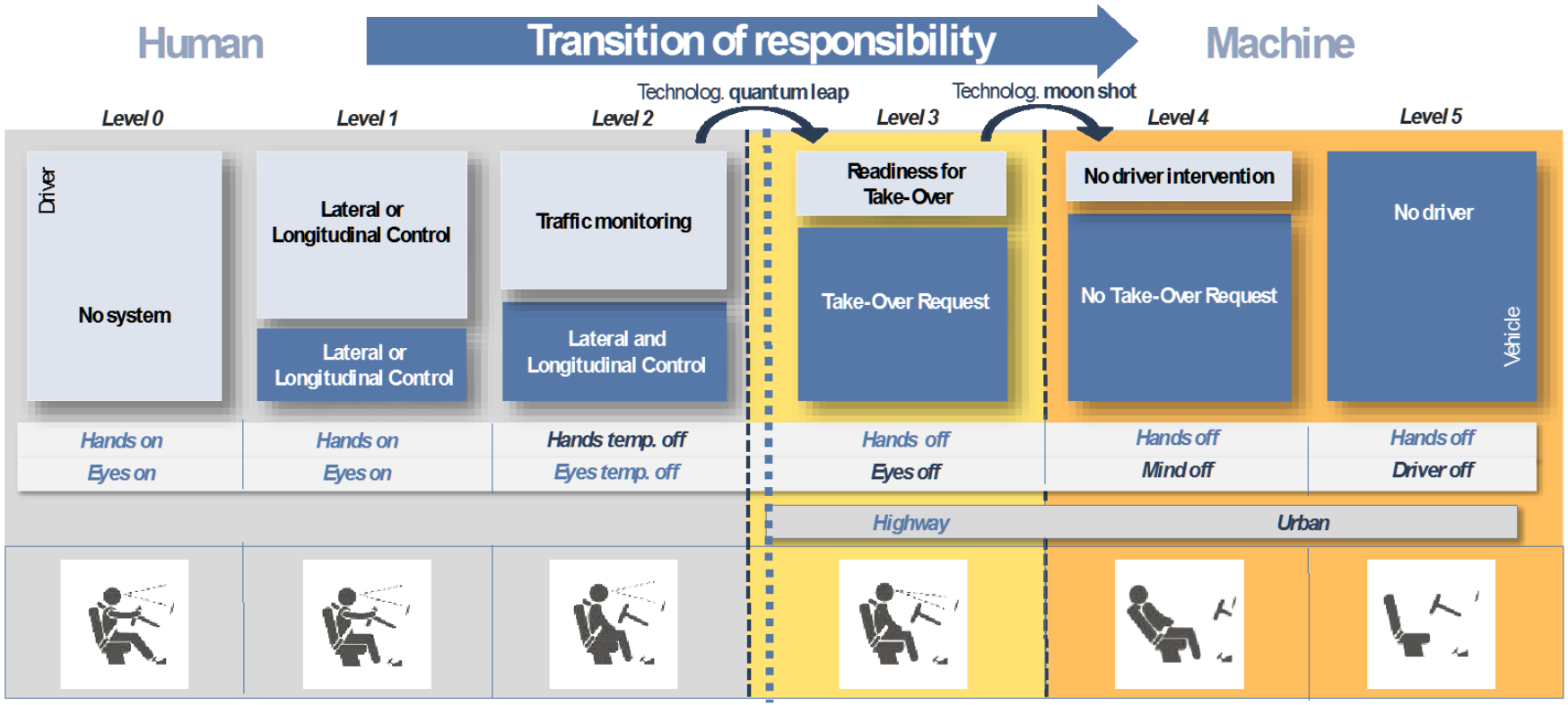
4. Legal framework for automated vehicles in Europe - AD(A)S

- **Level 2:** Lane Keeping Assistance Systems (LKAS)
- Automatically Commanded Steering Function (ACSF)
- **Level 3:** Automated Lane Keeping Systems (ALKS)
- **Level 4:** Automated Driving System (Hub to Hub, Valet Parking, ADS, Shuttle/ Goods Mover)
- **Level 5:** Autonomous vehicle (Robot Taxi)



Regulation No. 79

Regulation No. 157

Advanced Driver Assistance Systems (ADAS)

Automated Driving Systems (ADS)

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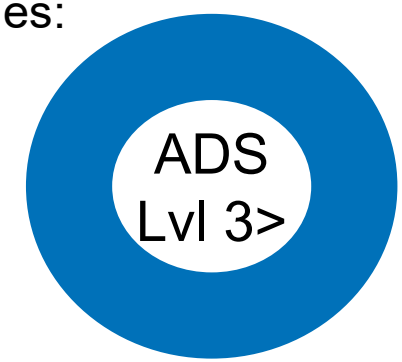
6. IWG-EMC32 session - Comments on draft of UNECE R10 V07

Chapter 2 **Definition - OICA Proposal for Definitions related to ADS (7th Oct 2022)**

2.27 "**Dynamic driving task (DDT**)" means all of the real-time operational and tactical ADS functions required to operate the ADS-equipped vehicle in on-road traffic.

-The DDT **excludes** strategic functions such as trip scheduling & selection of destinations waypoints.
-The DDT **functions** can be logically grouped under three main categories:

(a) Sensing and Perception
(b) Planning and Decision
(c) Vehicle Control



Source: IWG-EMC 32nd session - 2022-11-09 - Transport - Vehicle Regulations - UNECE Wiki

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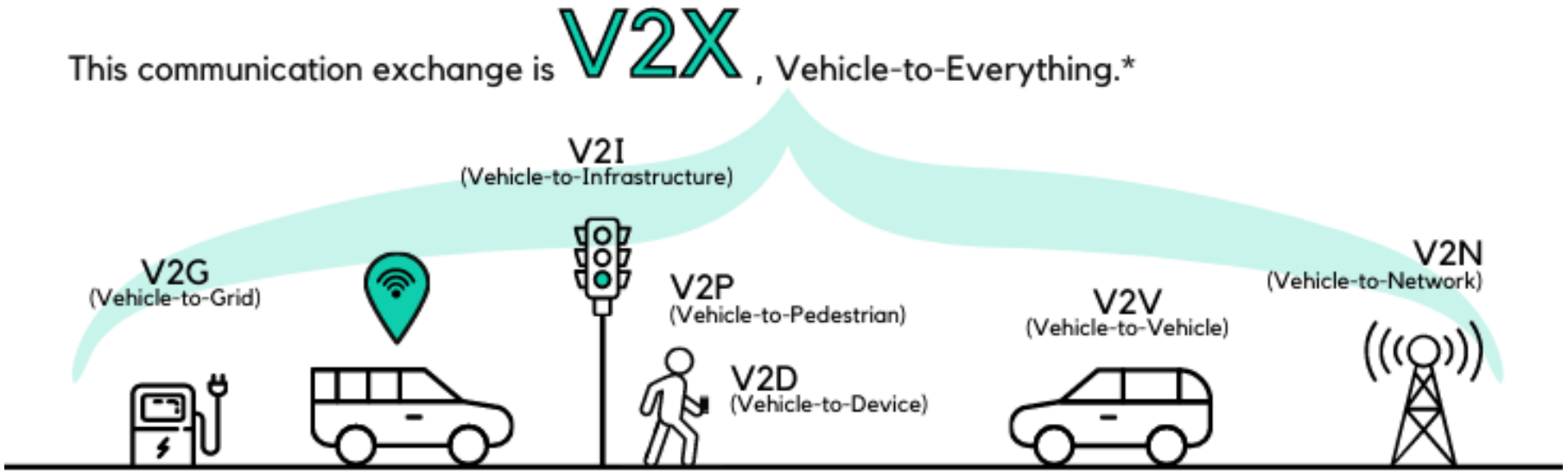
7. Autonomous Driving System vs V2X (Sensors/ RF)

Motivation - Development



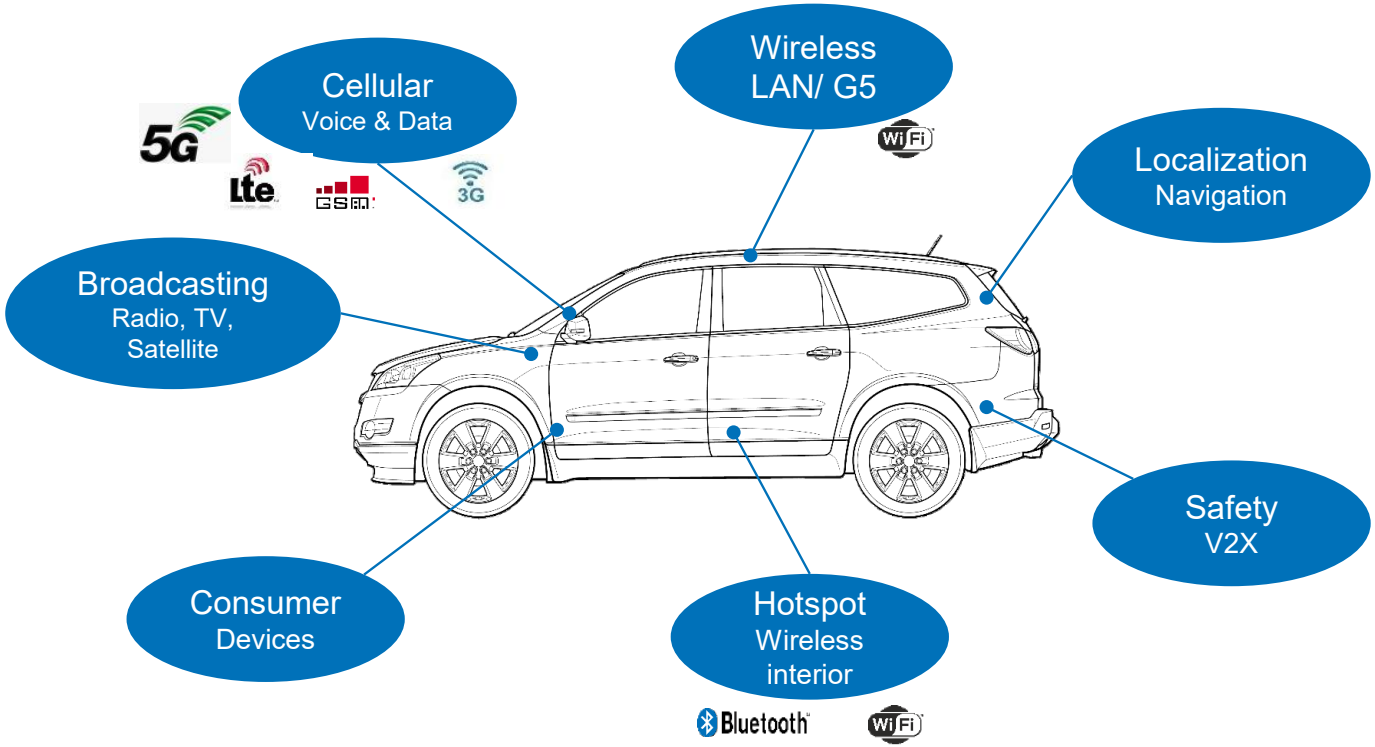
- Motivation for the ongoing ADAS and e-vehicle development
  - Occupant and pedestrian safety
  - Improved driver comfort and convenience
  - Increased traffic flow
  - Reduced impact of pollution and green house emissions

- Development of Level 4 and 5 autonomous vehicles
  - Greatly reduced accident occurrence
  - Ultimate driver comfort and convenience
  - Vehicle platooning – improved transportation efficiency
  - Potential paradigm shift in car use and ownership.

▪ Source: Autocyrpt

9.Radio Equipment's - Partly related AD(A)S

Products e.g.
Air Control Panels
Antennas
BT Units
Charger
Compenser
Distance/ Lane Control
Engine Control Unit
Handsfree Kit
Headunit
Hearing Aid Support
Incar Antenna Switches
Inglass Antenna systems



Examples Radio Regulatory Services Global
FCC / ISED (US/ CAN)
RED CE (EU)
GB CCC (CHN)
JRL/ MIC - GITEKI (JP)
MAS (177 Countries)

Products e.g.
Light Steering
Radar Sensors
Loud Speaker
NFC Sensors / Transmitters
OBU (On-Board Unit)
Radio Systems
Rear Seat Entertainment
Service Computers
Telematic Control Units / Infotainment
Traffic Sign Recognition System
Wireless Charger (Qi)
Wireless Incar Hotspot

!

Guide to the Radio Equipment Directive (RED) 2014/53/EU – BLUE GUIDE

UNECE Reg. 10 is an informative reference in EN 301 489-1 https://eur-lex.europa.eu/eli/reg/2022/2263/oj (since 22/11/2022)

ElectroMagnetic Compatibility (EMC) standard for radio equipment and services (CE & E-Marking testing should be on the same level)

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10. Introduction - EMC Scope of UNECE R10

UNECE United Nations Economic Commission for Europe

Current Status of EMC Testing of Vehicle with ADAS (Level 1-2) – **UNECE R10 V06**

For the tests of the complete vehicle, **UN-R 10 refers to**

a) CISPR 12 (2007 version) for emission testing and to

b) ISO 11451-2 (2015 version) and ISO 11451-4 (2013 version) for immunity testing.

- The **UN-R10.06** basically offers two types/ ways of approvals and electrical disturbance range:

  a) Approval for an individual ***component***, and

  b) Approval at the level of the entire ***vehicle*** with the associated tests.

  c) Test method decribed at annex 6 ex. ISO 11451 "Road vehicles - Electrical disturbances by narrowband radiated electromagnetic energy - Vehicle test methods ***up to 2 GHz (30 V/m)***

- TUVR – PPL Mover– EMC Chamber Mailand -ITA

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11. EMC Testing in an Anechoic Chamber

Challenges of performing AD(A)S tests under EMC conditions

- **Steering ability** (***Dynamic Control***) of the DUT must be maintained during tests
- **All devices needed for AD(A)S** EMC testing (stimulation, steering dyno, GNSS transmitters, etc.) are not allowed to influence the EMC measurements
- **Description of the Functionality of the ADAS needed** to develop appropriate test methods for EMC tests of Automated and Autonomous Vehicles (Valid. & Homologation)
- Incident radiation regulation of field-strength **30 V/m enough?**

- Field-strength of Microwave Oven?

- PPL Mover - TUVR – EMC Chamber Mailand -ITA

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12. Upcoming Regulation – UNR10 V07

UNECE
United Nations Economic Commission for Europe

GRVA-09-07

- Test Method for Automated Driving (NATM)*
  - Entirely inside a computer **(SiL)**
  - With a Sensor, a subsystem or interacting with a virtual environment **(HiL/ViL)**
    - In a **laboratory** (vehicle is standing still or !!moving on a chassis dynamometer or powertrain test bed and be connected to the environment model by wire or by direct simulation of its sensors)
    - On **a proving ground** where the vehicle would be connected to an environment model and would interact with virtual objects by physically moving on the test-track

- *NATM can validated by Technical Service (TUVR)

UN ECE R10-07

- ECE Regulation R10 addresses electromagnetic compatibility (EMC) issues and applies to vehicles of categories L, M, N O, T, R and S. The regulation requires manufacturers to gain type approval for all vehicles, electronic sub-assemblies, components and separate technical units.
  - **The vehicle under test of AD(A)S shall be operational. This means the AD(A)S feature must be switched on.**
  - Extended at **ISO 11451** the freqeuncy: The field strength shall be **10 volts/m** rms (root mean squared) in over 90 per cent of the **2 GHz to 6 GHz**.

! **Almost all manufacturers have higher quality standards/ claim !**
In fact, request higher requirements calls factory/ tender specifications by OEMs.

13. Why higher requirements for ex. Electromagnetic Compatibility requested OEMs?

EMC higher levels/ range ➡ Increases SAFETY

- **Standards are not up-to-date** for advanced technological equipment such as AD(A)S.

- **Incidence**: When a door opens during the drive (ADS) due to cable harness interference from active radio signal. Here “EMC + Radio” not intensively tested.
  For this AD(A)S error, product liability lies with the manufacturer

- For ex., ***to be safe OEM applies*** <1 GHz instead of 30 V/m apply for AD(A)S 120 V/m or higher*.

  Note*: At 200 V/m could interfering sources for monitoring, GNSS, C2x signals,…

- If someone is injured due to a product defect, the **manufacturer is liable** – even without proof of fault !

! Compensation can range from high to jail. In addition **IMAGE loss** !

14. Proposed Solutions (1/2)

There is no such thing as 100 percent security anywhere, but greatly reduce it w/ folllowings:

- **Interoperability** testing is **to prove that end-to-end functionality between (at least) two communicating/ sensors systems is as required by the standard(s) on which those systems are based**.

- Avoid **EMI** (Electro-Magnetic-Interference)
  Has three sources: Natural, artificial & inherent

- ***Real-World environment*** with realistic traffic for testing many unlikely events as possible at test tracks, labs (Virtual-Simulation), dedicated critical roads,….. as well corner-cases.
- **Strong weather test conditions** (rain, fog, storm, snow, high temp.…)

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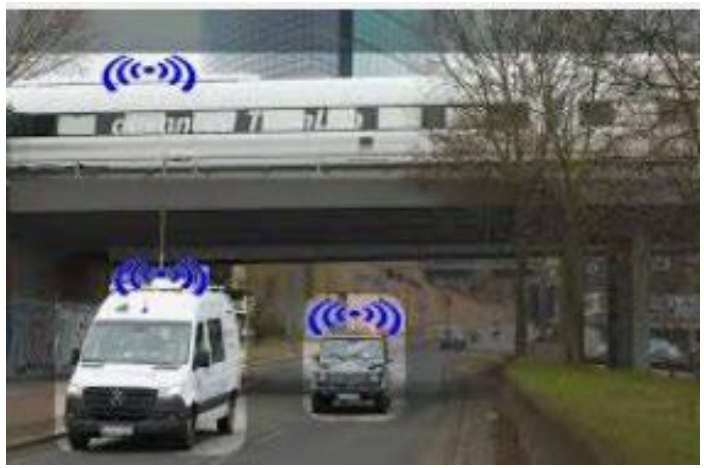
14. Proposed Solutions (2/2)

There is no such thing as 100 percent security anywhere, but greatly reduce it w/ folllowings

- A **platform AD(A)S** partly set up where e.g. the KBA (Fed. Motor Transport Auth.) should be informed of any unforeseen system errors.

  Partly exist a rule from AFGVB for Level 4 (excl. AVP, Lvl3) **each 90 days** to inform/document and main inspection **each 6 months for ADS** (PPLM, GoodsMover AGV) according **AFGBV** **(**Autonome-Fahrzeuge-Genehmigungs-und-Betriebs-Verordnung - GER) since 1.July 2022.

- **For a safe AD(A)S journey**, it will be essential in the future to use all possible technologies to give the driver and passers-by, bikers, cyclist,….SAFETY, here are the leading technologies or as back-up:
  Sensors, RF, V2x, AI, GNSS, Cyber-Security,…



- Ex. unlikey event at Traffic - Rail ‚Interference'?

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15. UNECE R10 V07 (Draft, EMC) – Potential Roadmap

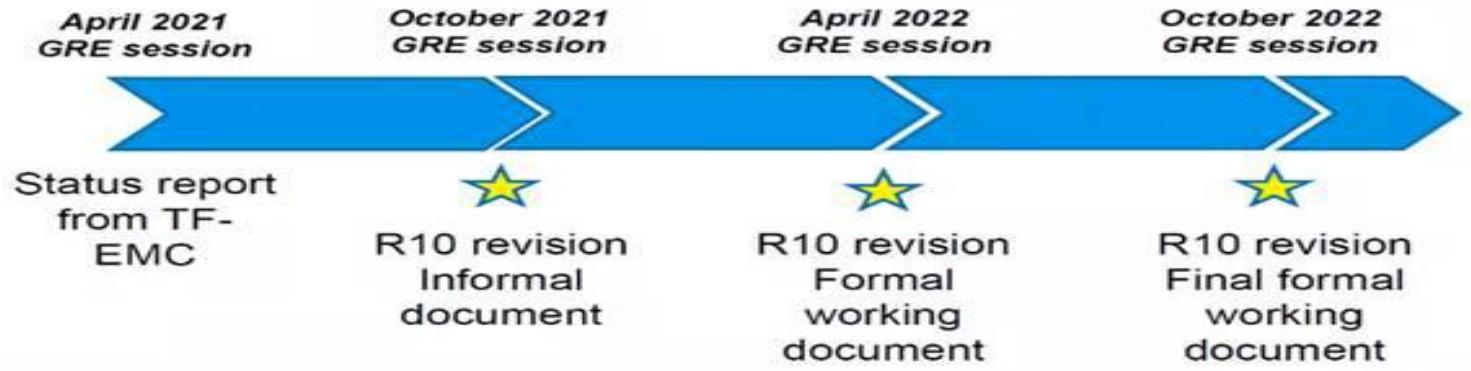
UNECE
United Nations Economic Commission for Europe

Aus dem Statusbericht für die 84. GRE Sitzung

VDA | Verband der Automobilindustrie

(Dokument: GRE-84-11)

- **Potential roadmap for R10 revision**
  - Confirmation by D.Rovers that R10 is one of the top priorities issues within the subjects under consideration by GRE (with a 2022 timeline) and also in the latest version of EU Commission program of work.
  - Proposed targets for TF-EMC



Ergänzung:
Vorlage bei WP29 im April 2023;
Best-Case für Inkrafttreten:
Oktober 2023!

- **<u>Next session:</u>** It will be prepared the final draft 07 series of amendments as a working doc for the 88th session of GRE by end of **January 2023**, expected some delay.

! Official release expected Q1‘2024 –UNR10V07 (adp. ~50 ctrs WW)

17. Facts to LiDAR vs UNECE R10

- If the LiDAR tested according UN-R10 (EMC) at the vehicle during the EMC test, an UN-R10 marking as ex. “E1” (1 for GER) is not necessary for this component!

No specific requirements on Sensors's at vehicle, the system must work from **Homologation** point of view!

- A new Uniform provisions concerning the approval of vehicles with regard to **Driver Control Assistance Systems (DCAS)** *under development at UNECE*, part of it:

▪ 3.3.5. Identification of units

▪ Each unit shall be clearly and unambiguously identifiable (e.g. by marking for hardware and marking or software output for software content) to provide corresponding hardware and documentation association.

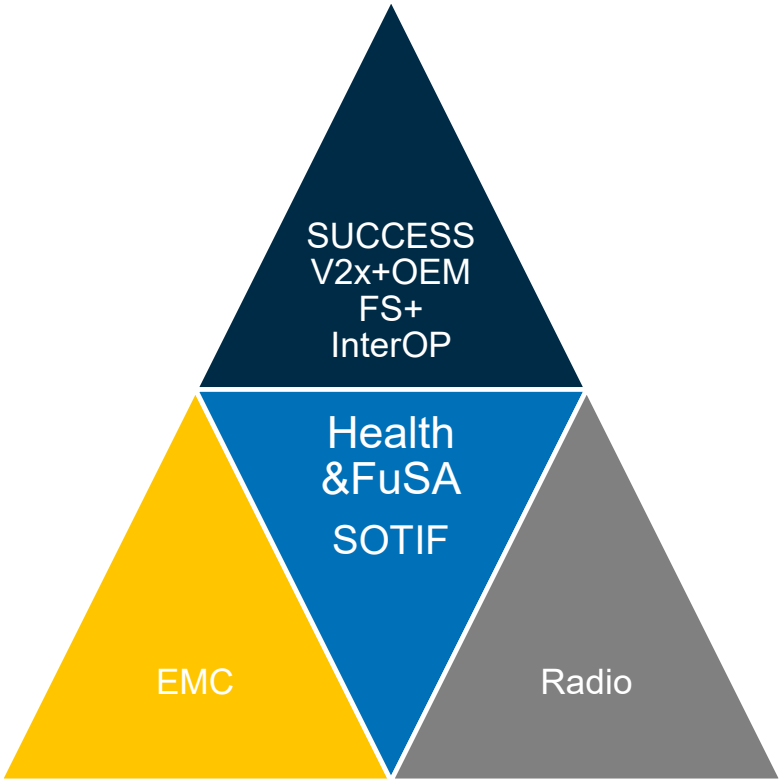
Even this regulation is not approved as a LiDAR as a component but at DCAS in which a LiDAR is present!

- At least as **product & quality claim the LiDAR** must be marked/tested as ex. in GER and mostly adopted International as an essential **SAFETY** requirement:

"Laser Klasse 1 nach EN 60825-1:2014 + A11:2021“ upcoming ***IEC 68025-19 (DTF)*** for moving platform.

18. Beside EMC + Essential Requirements for AD(A)S

Basic as essentials Requirements required - QISSustainbility



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19. Possible Future AD(A)S VIL-Test Concepts in an (EMC) Anechoic Cham.

OTA (Over-the-air) - ADAS Functionality and Safety aspects ex. Test Report 5GAA VATM (TUVR active²)

Full-sized Chamber for **EMC + Connectivity (2G…5G)**

AI learning phase and gap analyse for simulated driving, camera detection with screen (OBU)

Real- vs SIM-World!
Video Game Driving Mode. Mapping of real roads & TR proving grounds, IoT scenarios, Traffic sign detection

RADAR Target Wall – Target Simulation

Steerable Dyno to Simulate Driving – **AEB, ACC, FCW, V2V, V2I, V2P**

Sensor-Fusion
LIDAR in combination of Camera + Radar + GNSS

Note:1https://www.unece.org/trans/main/wp29/wp29wgs/wp29grva/grvainf2020-3.html
Informal document GRVA-07-38, 7th GRVA, 21-25 September'20
2 https://5gaa.org/wp-content/uploads/2021/08/5GAA_TR_Vehicular_Antenna_Test_Methodology.pdf (rel. Aug'2021)

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20.Beside EMC – Designation/ Experience/ References - “ONE-STOP” Service

UN Regulation No. 155, 156, 157, German Shuttle/ Goods Mover, Hub to Hub, Valet Parking, Level 3

- Since spring 2021 TÜV Rheinland is designated as Technical Service (TS) by KBA and SNCH for UN-R 155 CyberSecurtiy-Management-System (CSMS), UN-R 156 (SW-Update-MS) and for UN-R 157 (ALKS).

- Since 2019 TÜV Rheinland is working on several AD(A)S customer projects, some examples:

  - Granted worldwide the 1st approvals acc. to UN-R 155, UN-R 156 and UNR-157 on base
  - Partly autonomous shuttles (Level 2+) have been operating regular services (Linienkonze
    This is the 1st project of its kind operating in Germany at public road verified & approved b

We are working on Goodsmover (AGV-4G) projects and Autom.-Valet Parking Systems & SAE Level 3 as

Autonome E-Shuttles in Monheim: "Die überfahren wirklich niemanden"

Die größte Herausforderung beim Pilotprojekt der Bahnen Monheim mit den selbstfahrenden "Altstadtstromern" ist das ganze Thema Software inklusive Updates.

Lesezeit: 5 Min. In Pocket speichern 161

Autonom fahrende, elektrische Busse am Busbahnhof in Monheim

- Sources: [First AGV at BASF Ludwigshafen - YouTube](#)
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[Receives World's First Internationally Valid System Approval for Automated Driving (mrglitterati.com)](#)

[www.heise.de/news/Autonome-E-Shuttles.html](#)

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Welcome to…

Plan "In… …TSI and … …y (20…23)

We need YOU!

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Mission : "TUVR ensure safety on digital road and their network"

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Thank you for your mobility attention!

Bircan Taslica

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FMS (Future Mobility Solution)

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