

**IEEE EMC MEETING 2024-06-11**

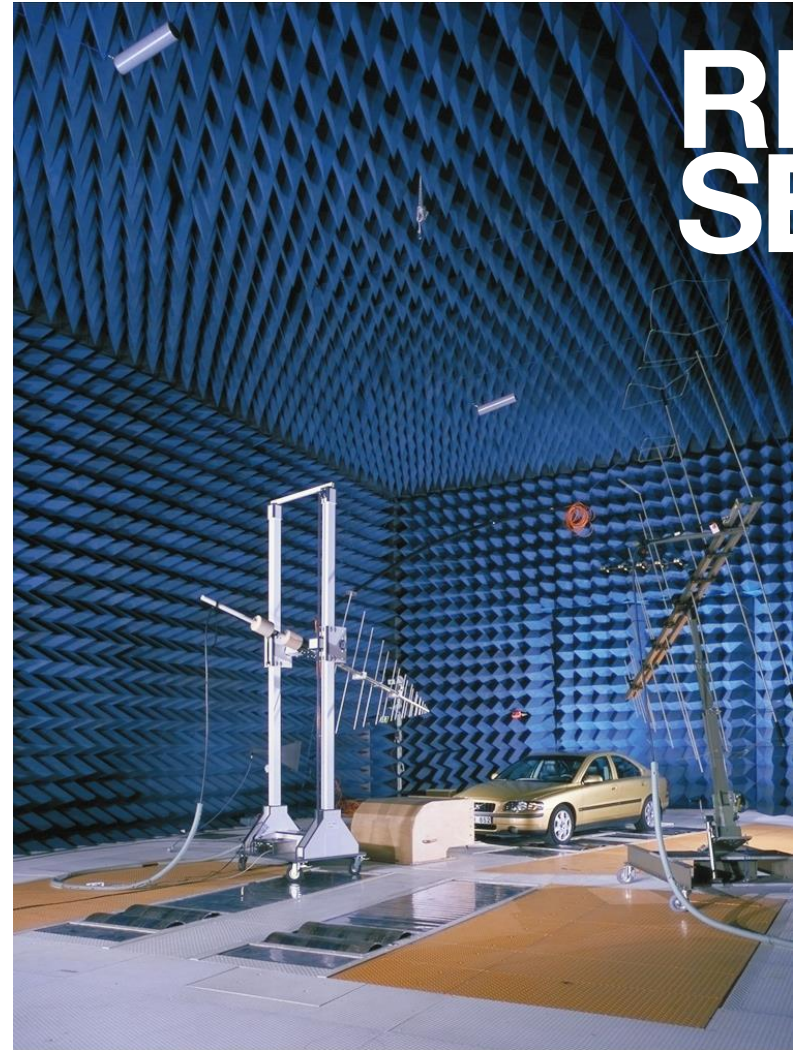
# **EMC testing - trends and news**

**Automotive - Krister Kilbrandt - Director EMC - vehicles**

**ICT & Radio - Daniel Lundgren - Director - ICT&Radio**

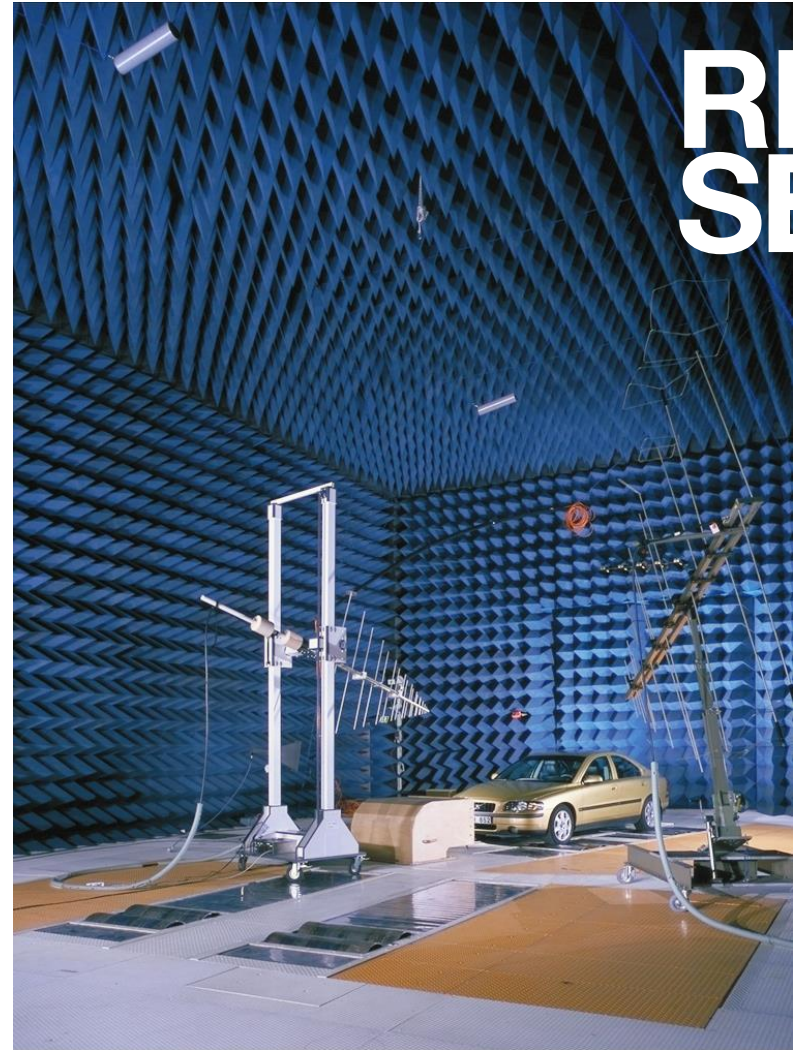
# 2 parts

1. Automotive-trends & news
2. ICT & Radio-trends & news



## **Automotive-trends & news**

- 1. Automotive EMC-past-present-future**
- 2. Highlights changes for Automotive EMC - UN ECE R10-ISO-IEC**
- 3. Global trends for Automotive EMC - chosen by the presenter**



**RI  
SE**

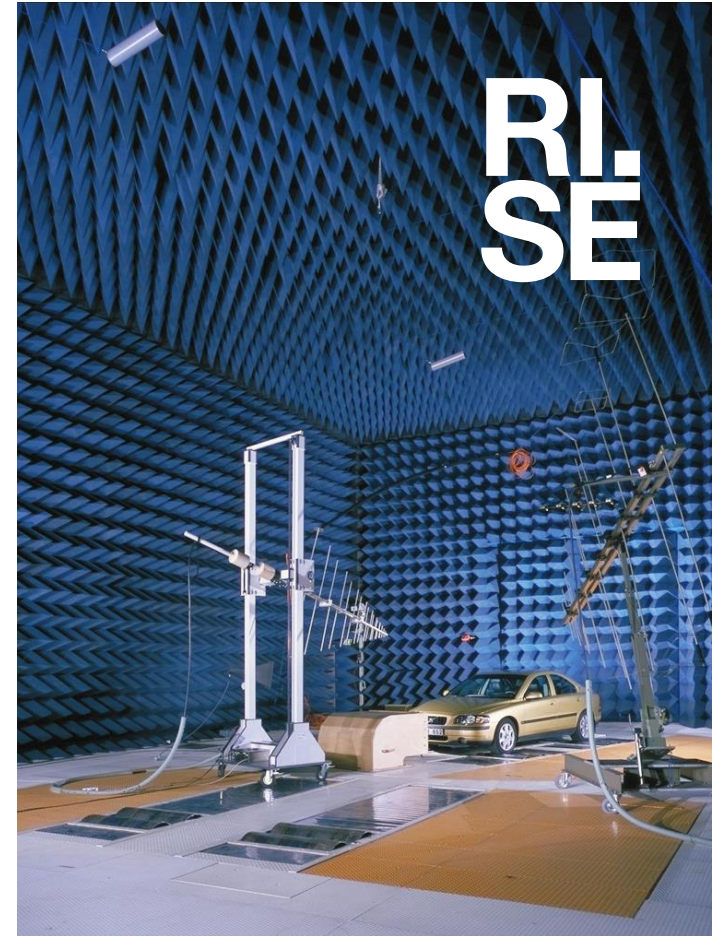
# Automotive-trends & news

**Automotive EMC-past  
1991-1995: 2 EMC chambers**

**Immunity - ISO - Three complex electronic system to test for ISO immunity:**

- 1. ECU-Engine control unit-fuel and ignition control system**
- 2. ABS- Automated Braking system- anti lock system**
- 3. Airbag - ECU (Electronic control system) with squibs**

**Emission - IEC- CISPR 12 and CISPR 25:  
Mainly spark ignition disturbances from the ignition system**



# Automotive-trends & news

## Automotive EMC-present

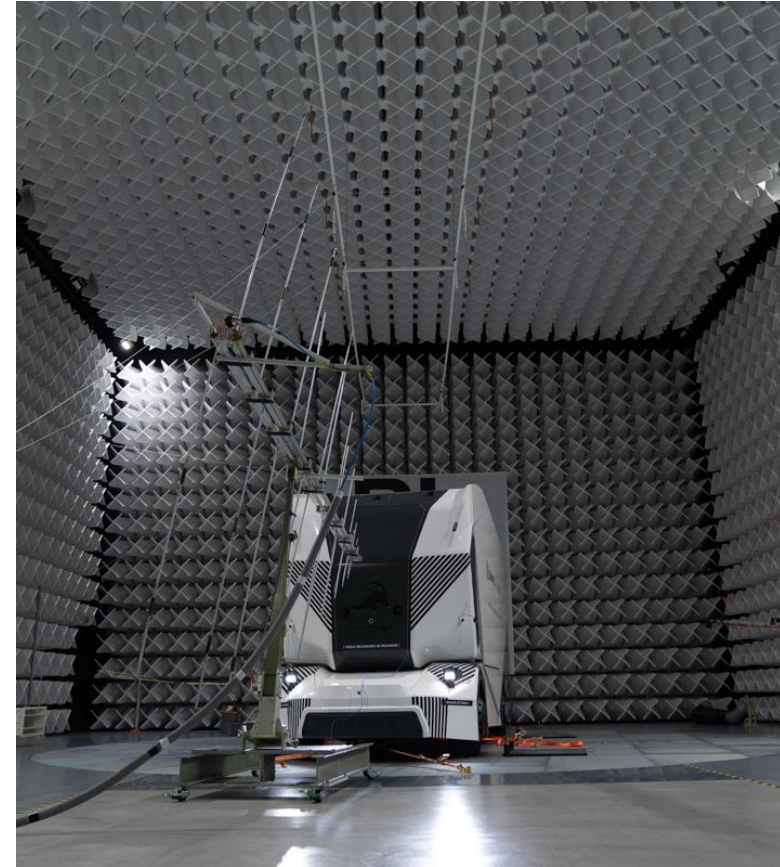
**2018 - 2024: 10 EMC chambers - 1 more 2026**

**Immunity - ISO - Three areas has increased the need for more EMC testing:**

- 1. The electrification of the powertrain and the charging mode**
- 2. Autonomous driving and ADAS (Advanced Driver Assistance Systems) support system**
- 3. Connectivity - the vehicle is now a connected computer on wheels- with pros and cons- Over the air updates-e-call-cybersecurity and so on**

**Emission - IEC- CISPR 12 and CISPR 25:**

**Emission from the electrified powertrain with charging mode and all new fast bus system are a huge EMC challenge**



# Automotive-trends & news

## Automotive EMC-future

2026 - 2030- some future EMC changes:

1. **Reverb testing - both component and vehicles- why?- this will be explained on later slides**
2. **Charging-decharging - V2G-the vehicle is a integrated part of the energy system**
3. **Connectivity - OTA-antenna-Cybersecurity**
4. **Higher frequencies**
5. **More defense testing**
6. **Real time spectrum analyzers and dynamic drive cycles - dynamic charging?-prefer fixed**



# Automotive-trends & news

## 1. Highlights changes for Automotive EMC - UN ECE R10-Ver 7 - 2024-06- part 1

Precisions for trolley-buses,

- Requirement for minimum number of operating conditions in driving and charging mode (6.1.2, 7.1.2),

- Suppression of 800 mm Stripline method for ESA immunity testing,

- Addition of reverberation chamber method for ESA immunity testing (ISO 11452-11),

- Extension of the frequency range for radiated immunity test up to 6 GHz,

- Update of reference for pulses 1 to 3; pulse 4 only applicable to ICE vehicles,

- Suppression of FM band CISPR 25 measurements as alternative to vehicle CISPR 12 measurements for narrowband radiated emission (6.3.2.4 to be deleted),

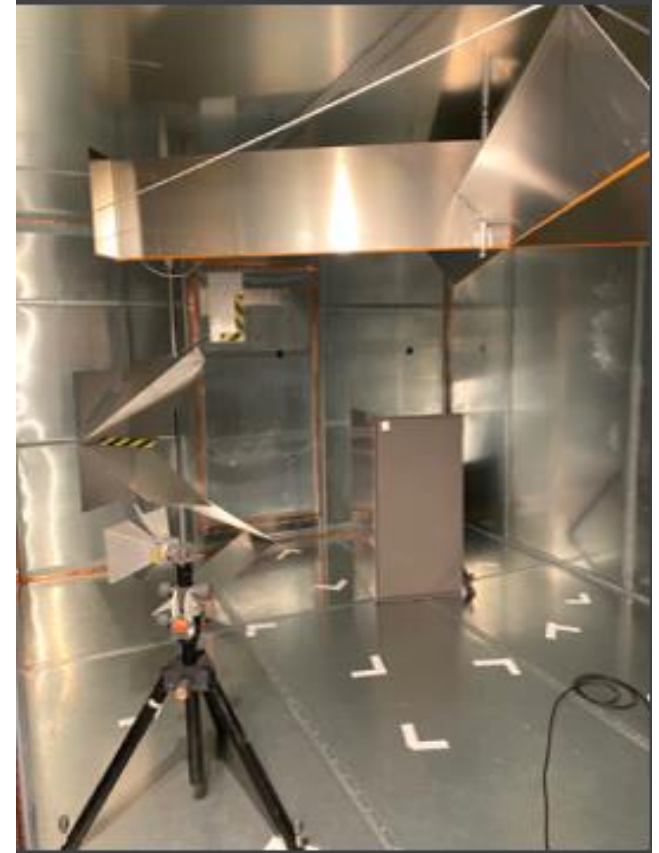
- Introduction of flow charts for charging modes to be tested for each Annex (7.1.3),

- Introduction of limits for vehicles charged in non-residential environments (7.5.3),

- Suppression of Annexes 14 and 20,

- Draft of Transitional provisions for vehicle and ESA (13.3),

- Introduction of a non-conductive insulating support for two-wheeled vehicles



# Automotive-trends & news

## 1. Highlights changes for Automotive EMC - UN ECE R10-Ver 7 - 2024-06- part 2

Precision for minimum charging current for vehicle and ESA in AC and DC charging mode emission test,

• Alignment of charging setup (“Z-folding” of cable) with ISO/CISPR standardization,

• Emission measurement (conducted and radiated) instrumentation – Potential use of FFT (Fast Fourier Transform),

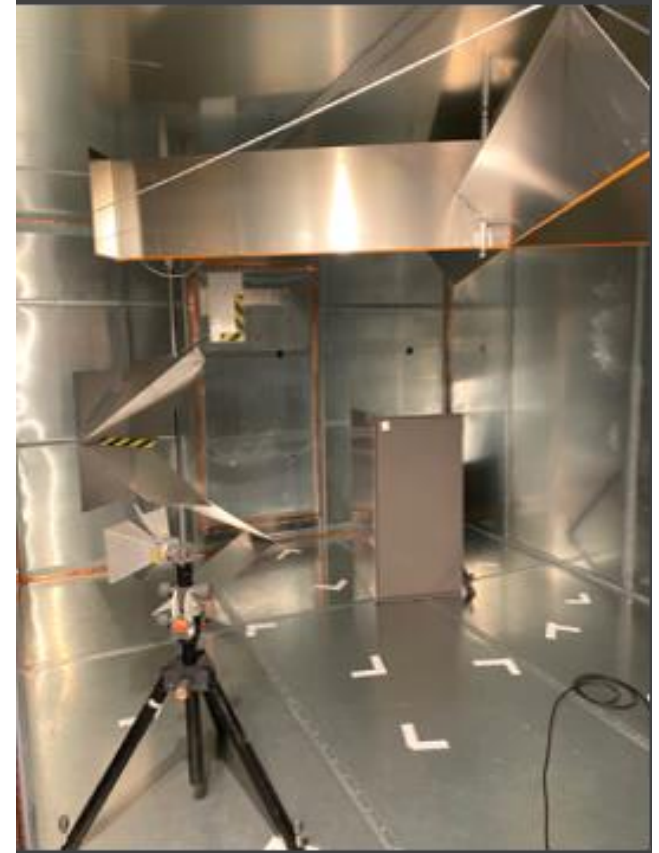
• Extension of possible use of simplified measurement for test performed by technical services to vehicle in charging mode test,

• Precision of alternative methods for large vehicle immunity tests (Annex 6),

• New failure criteria for vehicle immunity tests: ADS, AVAS, AECS,

• Precision on ESA transient immunity test for charging mode configuration,

• Replacement of PM by PM2 and PM3





# **Automotive-trends & news - ISO**

- 1. ISO 11452-11- new edition is coming 2024-06-18- important - testing with groundplane-without groundplane or on the floor- all acceptable-same-same**
- 2. ISO 11451-3- new version is coming- adding 4G and 5G frequencies- up to 7.125 GHz**
- 3. ISO 11451-2- new version is coming- news TLS only vertical polarization, SE- Rise - comment - distance to antenna can differ-allowing different distance from side or front-rear of vehicle**
- 4. ISO 11451-1 and 11452-1- new head version is under work**

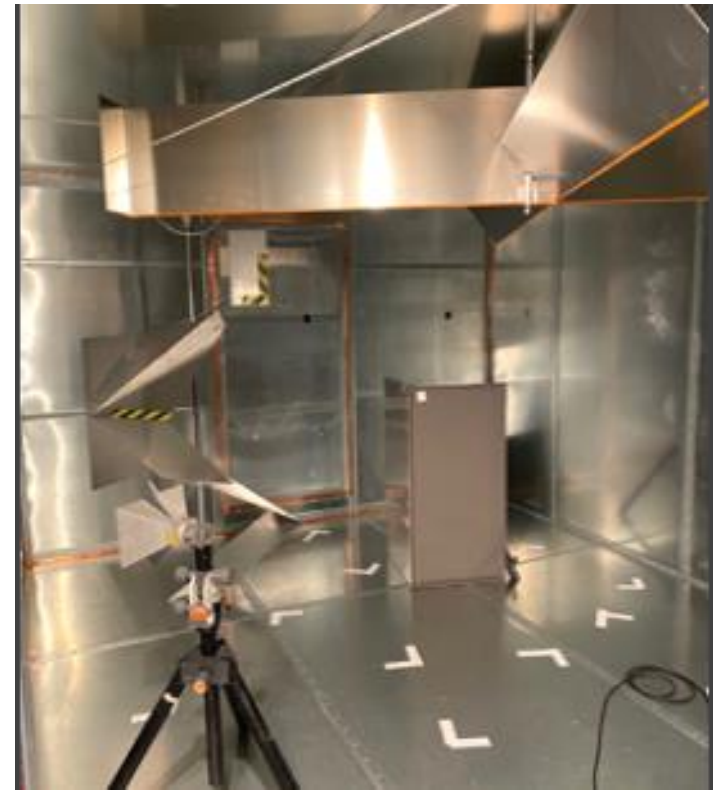
# Automotive-trends & news - IEC

## 1. IEC-CISRP 12- ed 7 is still under rework after two negative votes.

-

WG1:

- CISPR 12 7th edition project has been cancelled in July 2023. A Q doc has been circulated which recommend to re-initiate the project based on last draft document with small editorial modification as new CDV. The eV limits in the document are the following ones:
  - while driving: Peak Limit is CISPR 12 QP limit +13dB,
  - while charging: CISPR 12 QP Limit (no peak limit);
  -
- CISPR 36 no evolution.



# Automotive-trends & news - IEC

## 1. IEC-CISRP 25.

-WG2:

- During last Malaga meeting WG experts changed their mind and decided to go back to a single document for 6th edition of CISPR25 (no split similar to CISPR16);

- 6th edition modification 25 could include the following changes:

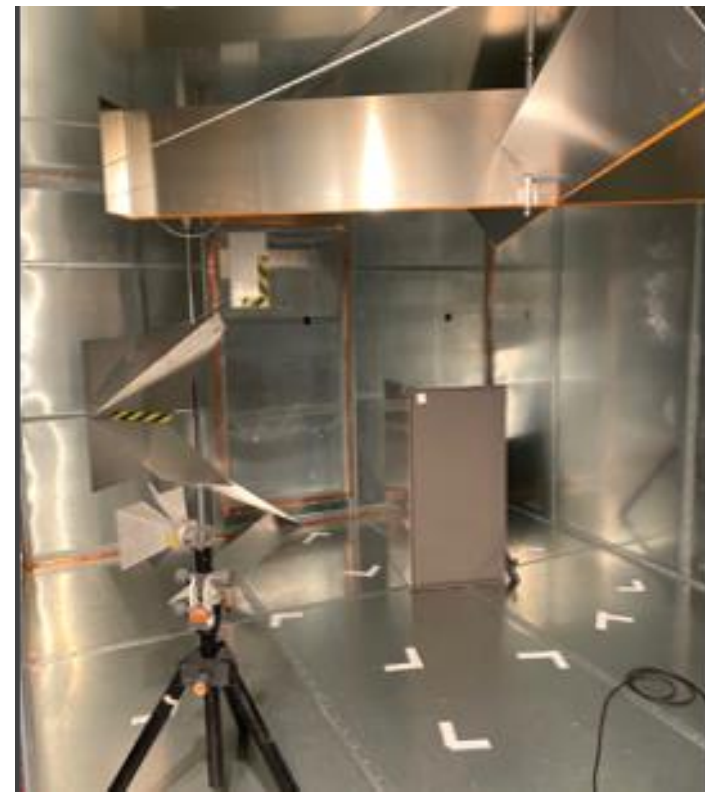
- Extending the ALSE Validation process to 6GHz,

- German Experts have requested we keep Stripline Emissions in CISPR 25,

- Possibly including ALSE site influences in uncertainty budgets,

- Possibly an annex on limiting the upper frequency to be tested based upon highest intentionally

- generated frequencies of the DUT (similar to other CISPR standards);



# Automotive-trends & news - Global interesting trends

## 1. Reverb testing for complete vehicles- Why?

1. **ISO 11451-5- For higher freq. - the antenna beamwidth is very narrow. In an ALSE the full vehicle is not covered without testing many additional test directions.**
2. **Rise - Andreas Lundberg has done a Msc thesis on this:**

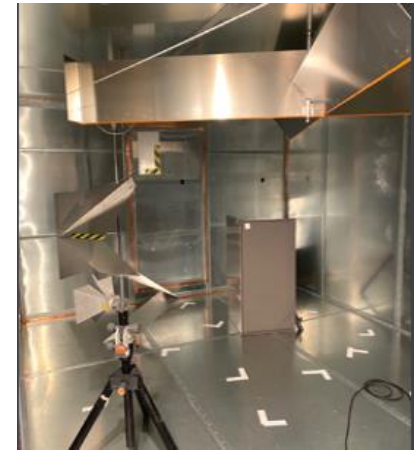
### Analysis of RISE's VIRC for Automotive EMC Immunity Testing

**With reverb testing you discover “all” susceptibility problems, compared to standard ALSE testing with a few angles or even one angle and polarization**

**Future Autonomous and ADAS system can not be launched without the statistical security - Reverb testing provides**

**Systems testing in reverb is allowed in UN ECE R10.07-which is approved.**

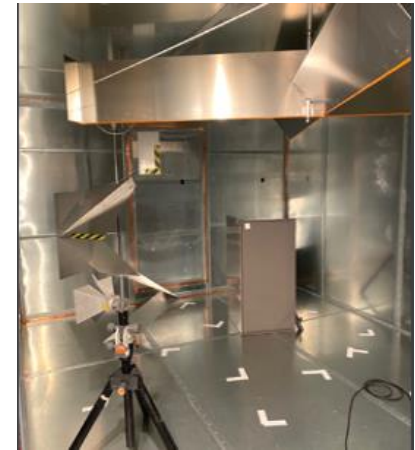
**New large complete vehicle reverb chambers are being built in China, Japan, Germany**



# Automotive-trends & news - Global interesting trends

## 1. Reverb emission testing for large complex systems and complete vehicles Why?

1. **Trying to measure emission on large driveline systems and huge battery packs on a CISPR 25 bench is insufficient.**
2. CISPR requested CISPR/D to extend the frequency range to at least 6 GHz ( For the future 40 GHz). Conventional EMI measurements would require rotation - height scan and floor absorbers. We see a benefit to change the method to reverb also for EMI.
3. **Several countries - including SE are supporting this new IEC working item.**
4. **My personal thoughts- standard ALSE will still be used for many many years up to 1-2 Ghz, but reverb chambers will increase rapidly as a necessary complement measurement method- both for immunity and emission.**



# Automotive-trends & news - Global interesting trends

## Q+A

Please take the chance to ask us questions during the tour

Thank You

