

Informal document GRE-87-12-Rev.1
(87th GRE, 25-28 October 2022, agenda item 8)

Safety Market Surveillance

Comparison of radiated electromagnetic emission in different normal conditions of use

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Topics

- Scope of testing
- Laboratory and test articles
- Test result of regulated modalities
- Test results of other normal driving conditions
- Conclusions

Scope of testing

2 vehicles of category M₁ have been tested regarding electromagnetic emission (UNECE Regulation 10) as part of the Vehicle Safety Market Surveillance activities (Regulation (EC) 2018/858.)

- Broadband radiated emission other than charging modes
 - Regulated modalities (constant 40 km/h)
 - Other normal driving conditions upto 120 km/h
- Narrowband radiated emission – engine off

Test articles

Vehicle 1

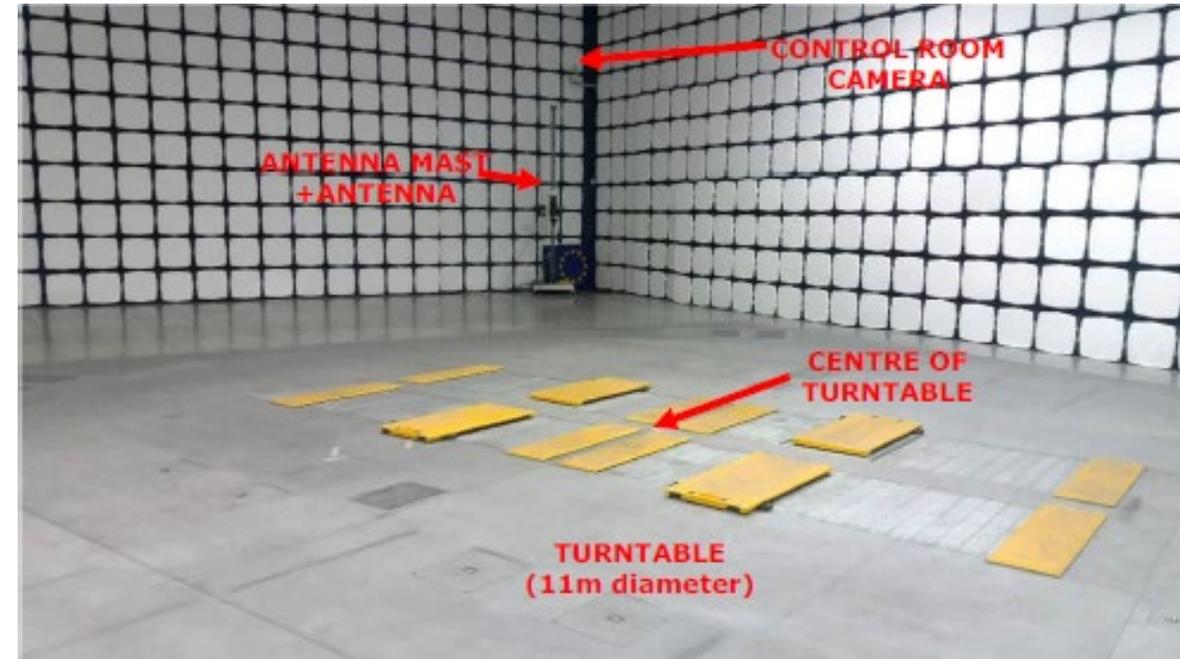
Parameter	Value
Model year	2020
Engine	Asynchronous rear and front electric engine : 300 kW
Battery size	80 kWh
Charging power	16A single-phase, 16A two-phases; Direct Current: 200A, Type 2; Combo 2 (CCS), 110kW

Vehicle 2

Parameter	Value
Model year	2020
Engine	Dual motor: rear (88kW) and front (65kW)
Battery size	75 kWh
Charging power	On-board 3-phase 48 A (AC), 250 kW (DC) with Supercharger V3

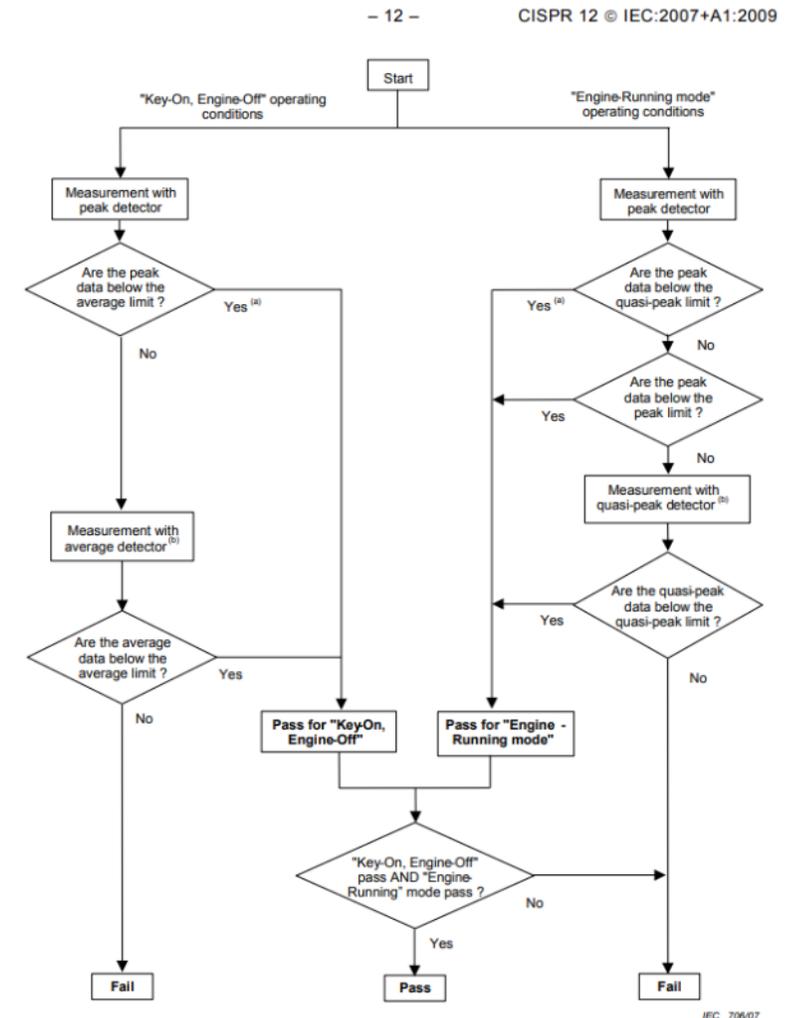
Laboratory: JRC Vela 9

- Semi anechoic chamber with dimension 21m x 15.6m x 8m
- Chassis dynamo by AVL
- Antenna: Schwarzbeck MESS VULB 9162 (placement at 10 m)
- Signal receiver: Rohde&Schwarz ESR 7

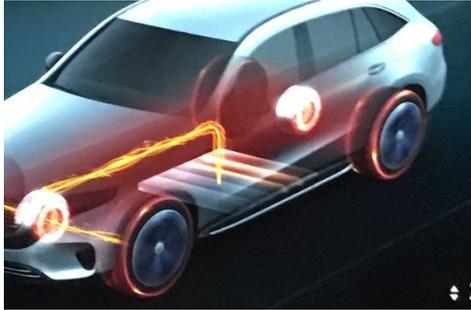


Test conditions

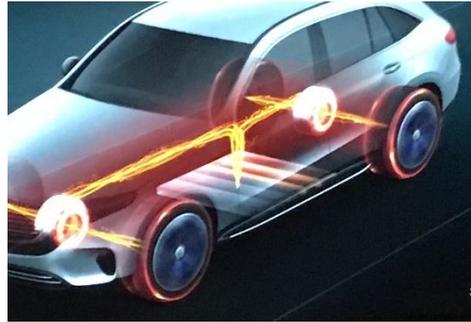
- Narrowband radiated emission: ANNEX 5 + CISPR 12: Key-on engine off
- Regulated broadband radiated emission: ANNEX 4 + CISPR 12
 - Driving at 40 km/h constant speed
- Other normal condition of use:
 - constant driving: 40, 60 60, 100 and 120 km/h
 - 0-40-0 km/h acceleration in 10 s and highest regenerative braking power
 - 0-120-0 km/h acceleration in 30 s highest regenerative braking power
 - Stepped driving 40, 60 60, 100 and 120 km/h and highest braking
 - Random driving profile upto 120 km/h



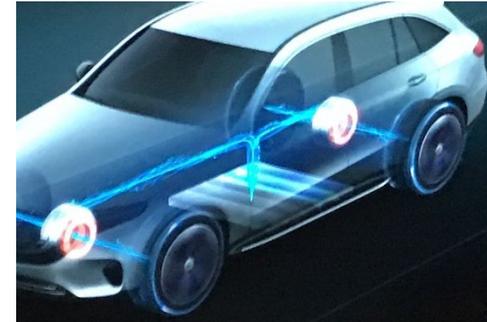
Other normal conditions of use: Rational



Front engines works at 40 km/h



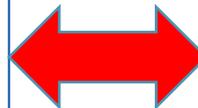
Both engines works at 120 km/h or during acceleration



Both engines works during recuperation

UN ECE Regulation R10 (v5)

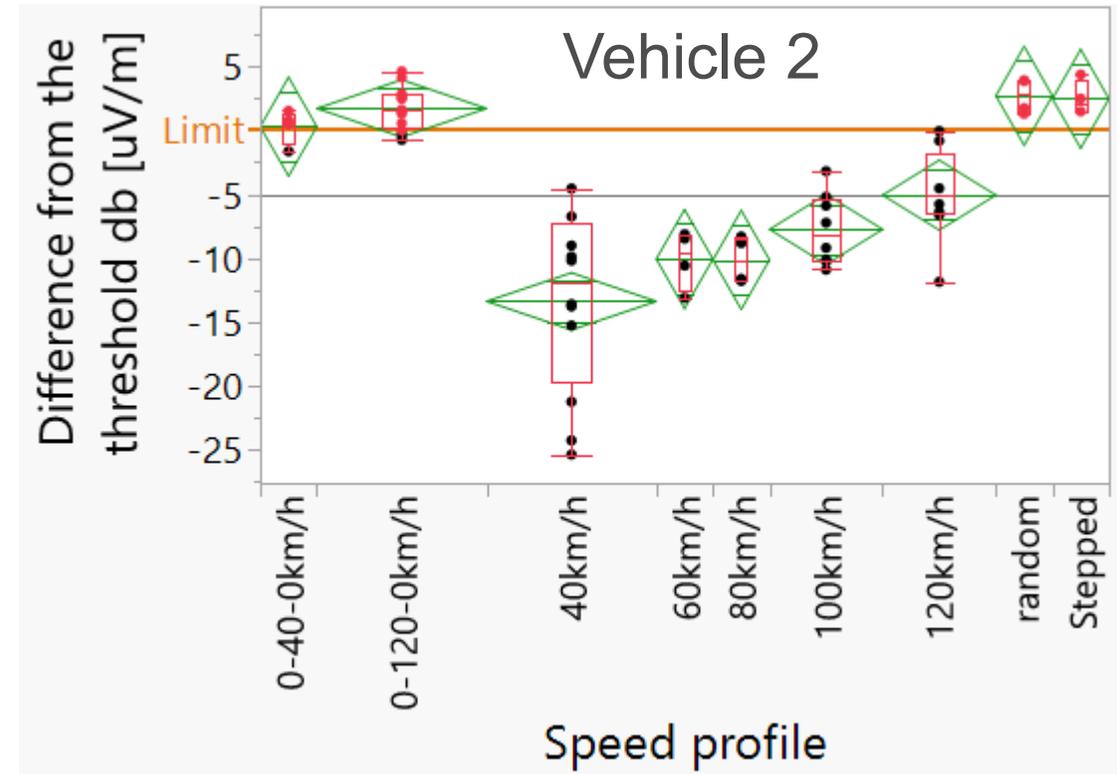
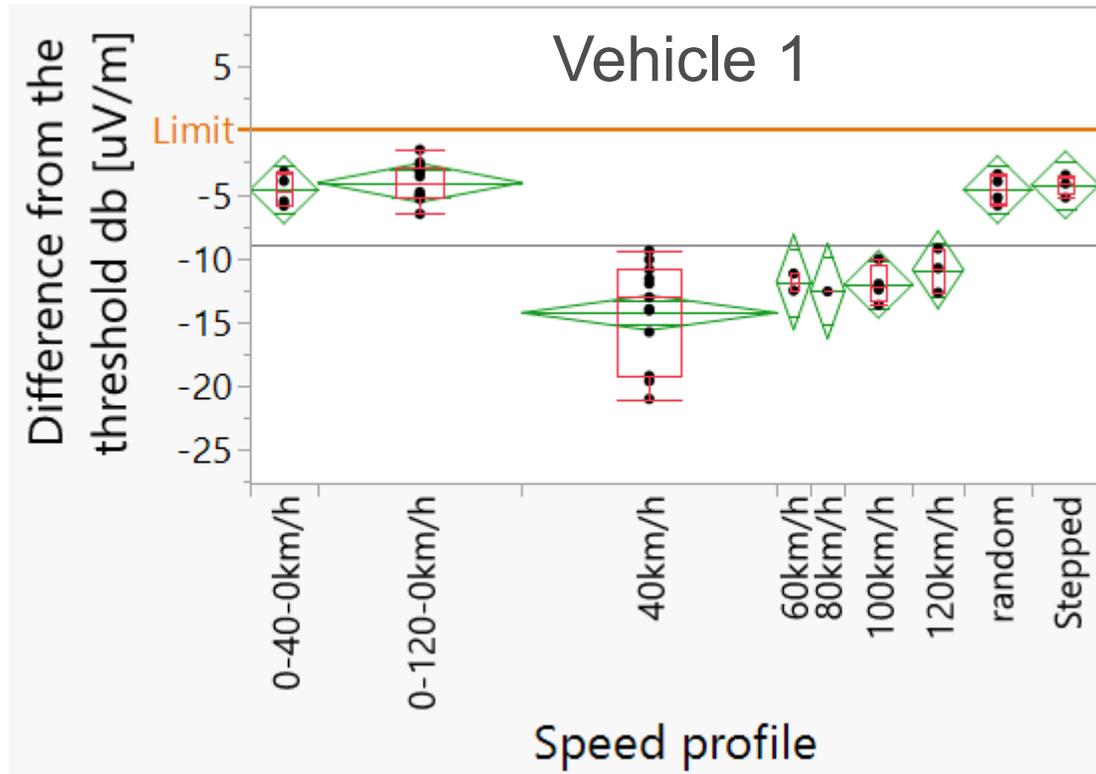
- 6.1.1. “A vehicle and its electrical/electronic system(s) or ESA(s) shall be so designed, constructed and fitted as to enable the vehicle, **in normal conditions of use**, to comply with the requirements of this Regulation.”
- 2.1.1. (ANNEX 4) **All equipment** capable of generating broadband emissions which can be switched on permanently by the driver or passenger should be in operation in maximum load, e.g. wiper motors or fans.



IEC CISPR 12

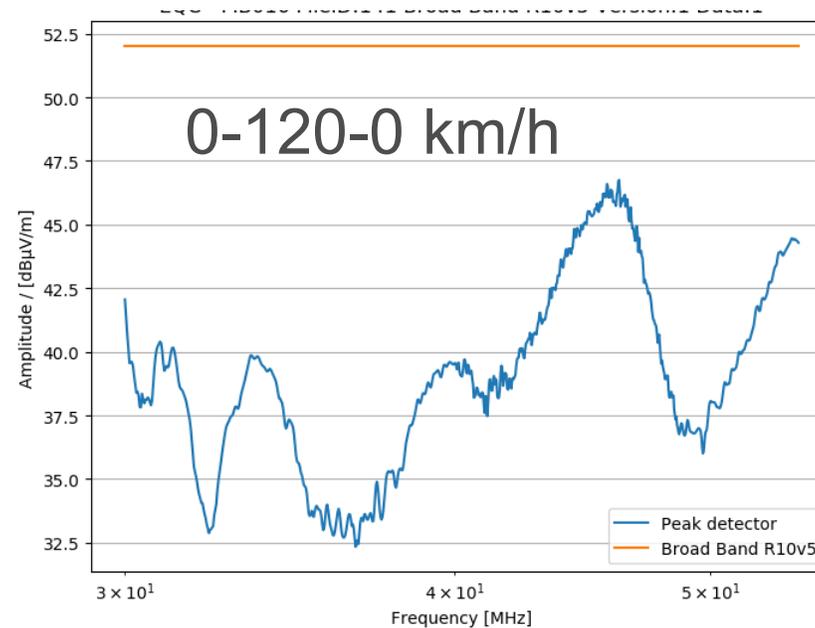
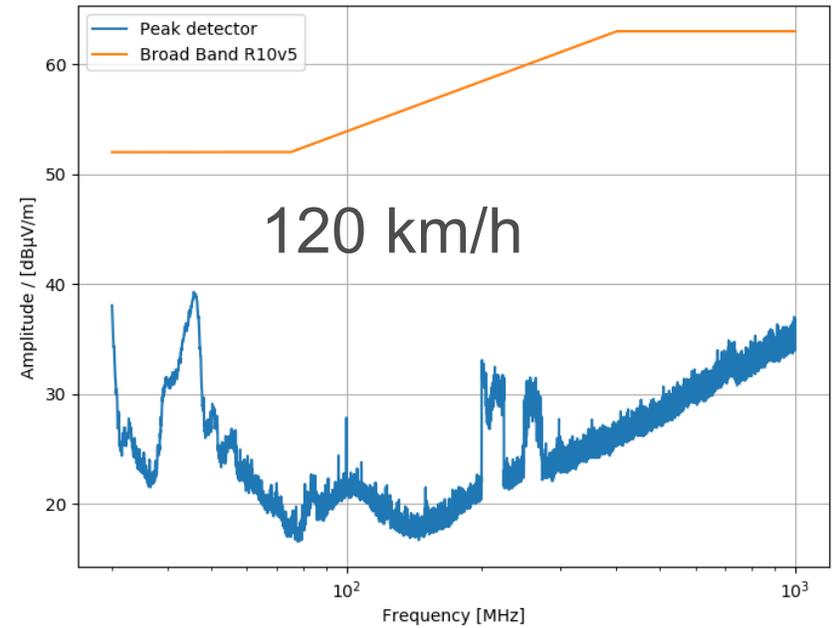
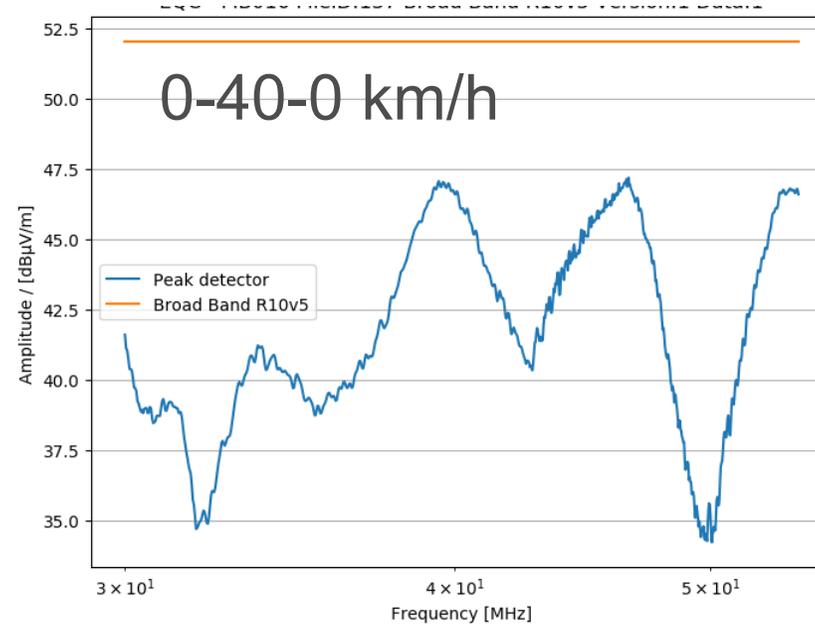
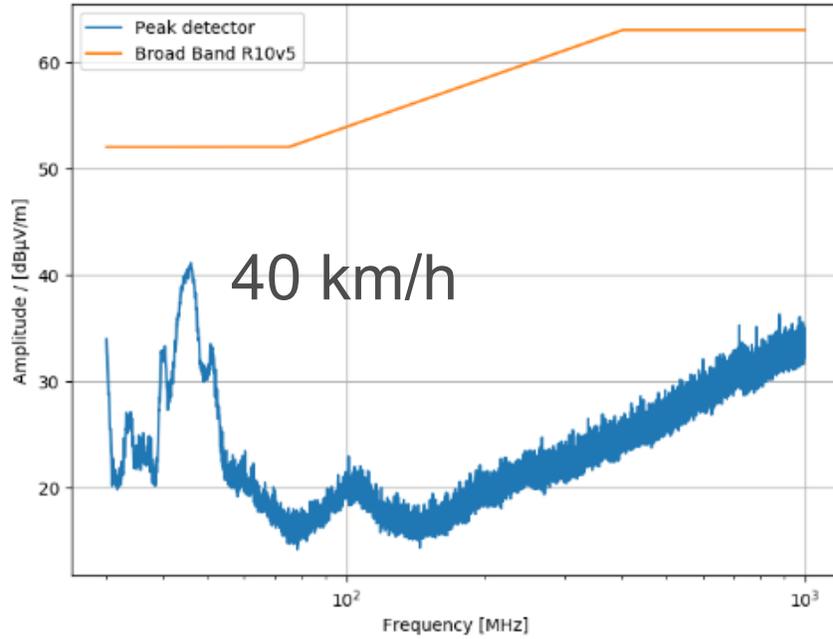
- 5.3.2.2. Vehicles/boats equipped with an electronic propulsion motor shall be test with the vehicle driven on a dynamometer without a load, or on non-conductive axle stands, with **constant speed of 40 km/h...**

Results - summary

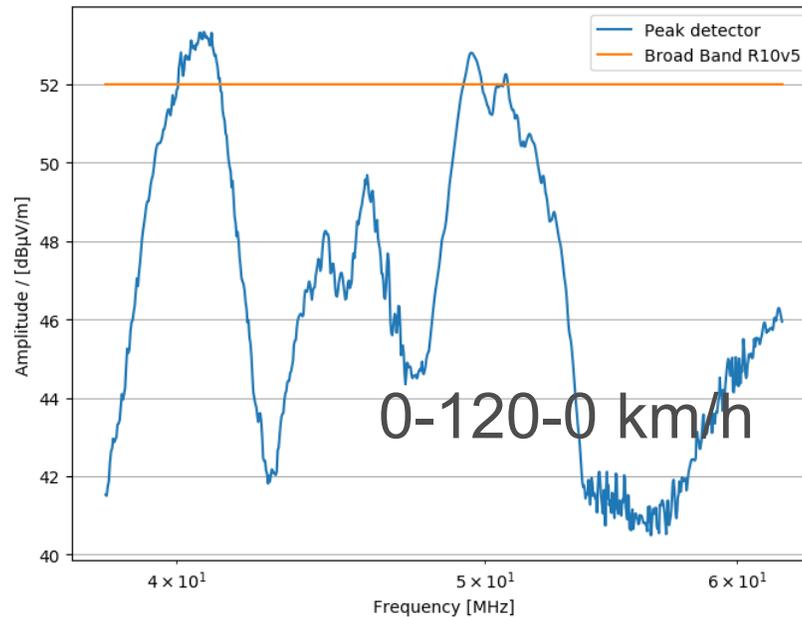
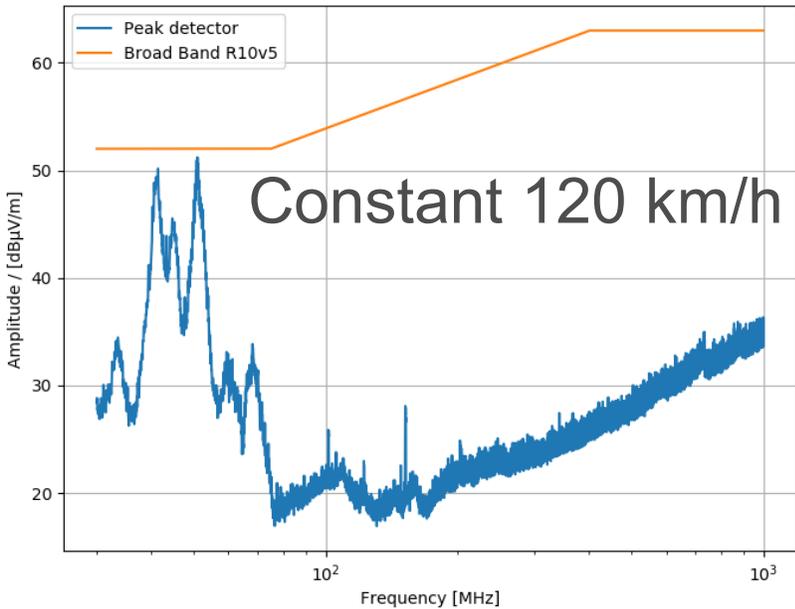
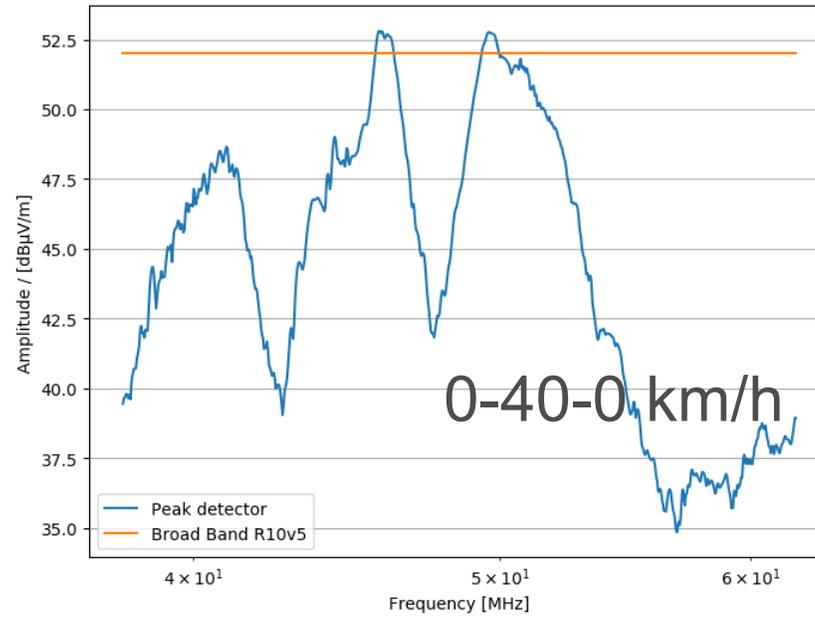
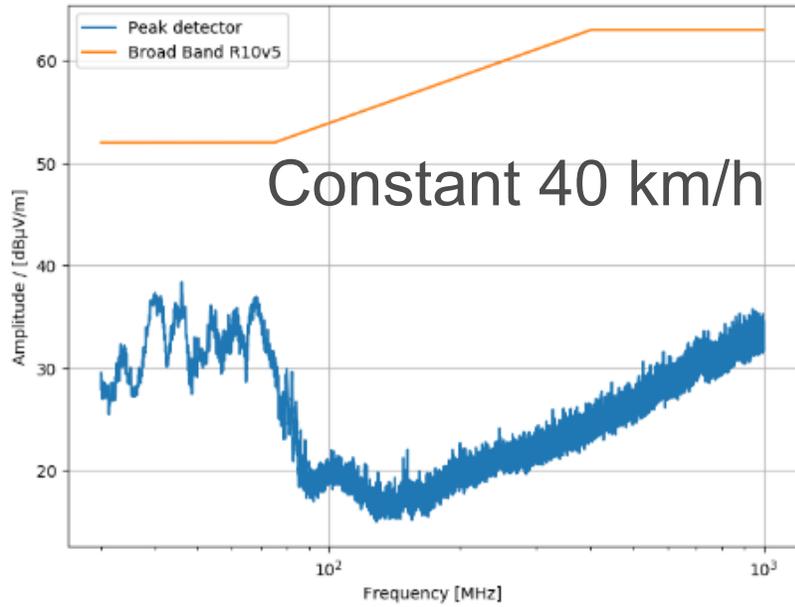


- Both left, right and horizontal and vertical antenna orientation are included
- Continuous scan was applied for non-constant speeds
- More accurate measuring time is applied than required by regulation for data acquisition
- The broadband emission threshold (R10v5) is used for comparison

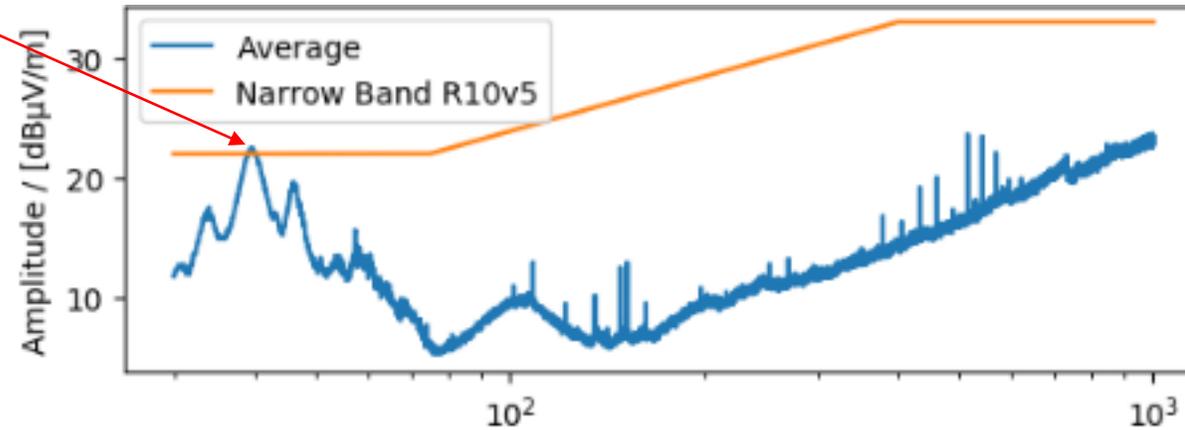
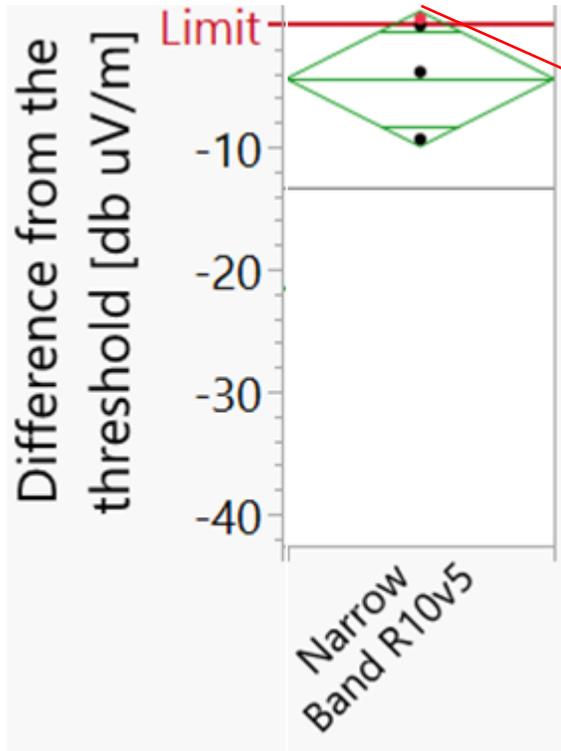
Vehicle 1



Vehicle 2



Vehicle 2 – Narrow band - Engine OFF



- Ambiguous assessment of compliance
- Maybe cooling system turns on
- Any auxiliary equipment irrespective who turns them on (i.e. driver or other systems)

Key findings

- The propulsion electric engine(s) operation strategy highly depends on the speed and acceleration/deceleration modes.
- Other than constant 40 km/h normal driving conditions can lead to non-compliant radiated broadband emission (for some vehicles) for 2 out of 5 vehicles
- Narrowband emission can be also influenced by some systems (cooling, heating of the battery) that are frequently on and can lead to ambiguous results
- Different result can be obtained measuring EMC radiated emission not only positioning vehicle in left side and right side but also in front and rear sides

Concluding remarks

- Testing at only constant 40 km/h is an issue since it covers a part of the normal conditions of use therefore the § 6.1.1. of R10 cannot be verified comprehensively.



- Proposal for the revision of current testing methods to better reflect reality during IWG meetings
 - New propulsion technologies
 - All propulsion engines
 - Other modes of normal use: both during acceleration and in recuperation modes
 - Include of on-board devices which are switched on by other systems
 - Realistic load conditions

Thank you



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Acknowledgement

- We thank Harald Scholz for his advices and hands-on assistance during testing.

Technical slides

