

# Safety Market Surveillance

Verifying the compliance of Mercedes-Benz EQC and Tesla Model 3 against UN ECE R10: Radiated and conducted electromagnetic emission (ANNEX 4, 5 and 13)

*Akos Kriston, Marco Zanni and Fabrizio Minarini*  
*European Commission, DG Joint Research Centre*

# Topics

- Scope of testing
- Laboratory and test articles
- Test result of regulated modalities
- Test results of modalities beyond regulated conditions
- Conclusions
- Verification of compliance for market surveillance

# Scope of testing

2 vehicles of category M<sub>1</sub> have been tested regarding to radiated and conducted electromagnetic emission (UNECE Regulation 10) as part of the Vehicle Safety Market Surveillance activities as per Regulation (EC) 2018/858.

- Broadband radiated emission in driving and charging mode according to Annex 4
- Narrowband radiated emission according to Annex 5
- Conducted emission according to Annex 13

Immunity of the vehicle was not tested in this testing campaign.

# Test articles

Parameter	Value	Comment
Manufacturer	Daimler AG, DE-70546 Stuttgart	
Make	Mercedes Benz	
Type	204 X	Complete
Commercial name	EQC	
Model year	2020	
Engine	Asynchronous <b>rear and front electric engine</b> : 300 kW	
Battery size	80 kWh	
Charging power	16A single-phase, 16A two-phases; Direct Current: 200A, Type 2; Combo 2 (CCS), 110kW	
Vehicle Identification Number	W1K2938901F005396	July 20 2020
Global type approval number	e1*2001/116*0480*36	June 12 2019
R10 type approval number	E1*10R05/01*8723*00	February 25 2019
Testing service/laboratory	AKKA EMC GmbH, DE-71332 Waiblingen, Germany	ISO 17025



Parameter	Value	Comment
Manufacturer	Tesla Inc. 3500 Deer Creek Dr, Palo Alto, CA 94304, USA	
Make	Tesla	
Type	003	Complete
Commercial name	Model 3	
Model year	2020	
Engine	<b>Dual motor: rear (88kW) and front (65kW)</b>	
Battery size	75 kWh	
Charging power	On-board 3-phase 48 A (AC), 250 kW (DC) with Supercharger V3	
Vehicle Identification Number	5YJ3E7EB9LF759768	
Global type approval number	E4*2007/46*1293*11	July 1 2020
R10 type approval number	E4*10R05/01*3987*04	July 1 2020
Testing service/laboratory	Tesla EMC Chamber, Fremont, CA, USA	Calibrated equipment



# Laboratory: JRC Vela 9

- Semi anechoic chamber with dimension 21m x 15.6m x 8m
- Chassis dynamo by AVL
- Antenna: Schwarzbeck MESS (placement at 10 m)
- Artificial network: Rohde&Schwarz ENV 40
- Signal receiver: Rohde&Schwarz ESR 7
- Chargers: Elphi and ABB Terra



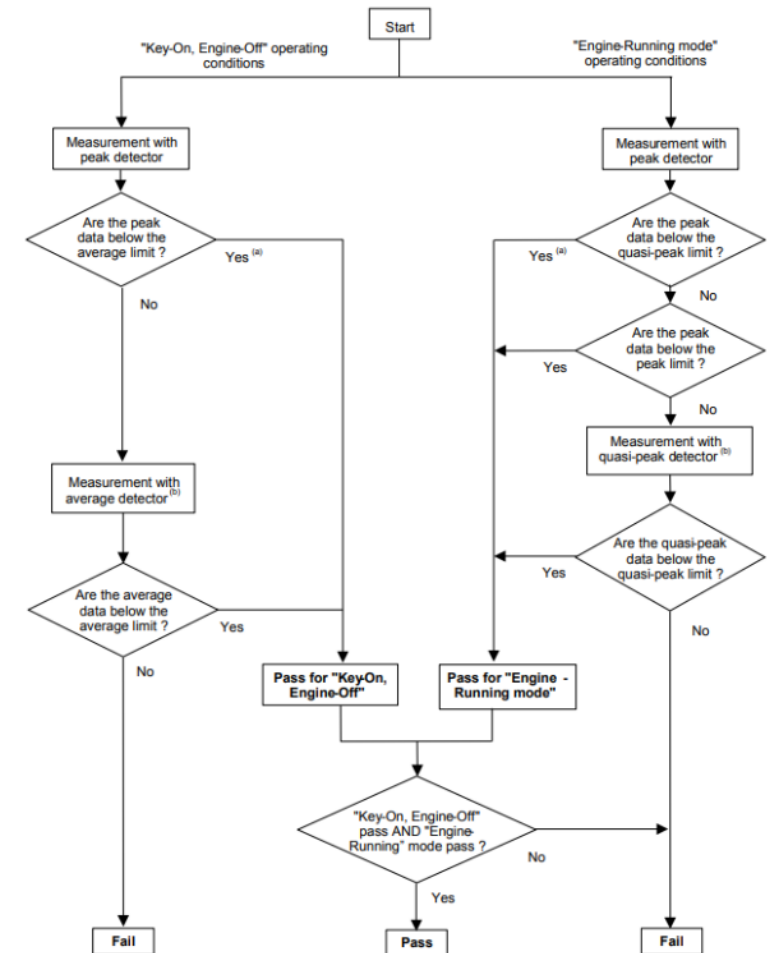
with  
W 2-

# Test conditions of regulated modalities

- Broadband radiated emission: ANNEX 4 + CISPR 12
  - Charging mode: 1-2-3 phase at different power
  - Other than charging mode: Driving at 40 km/h constant speed
- Narrowband radiated emission: ANNEX 5 + CISPR 12
  - Key-on engine off
- Conducted emission to AC network: ANNEX 13
  - Charging mode: Different power: 1-phase 12 A and 16 A

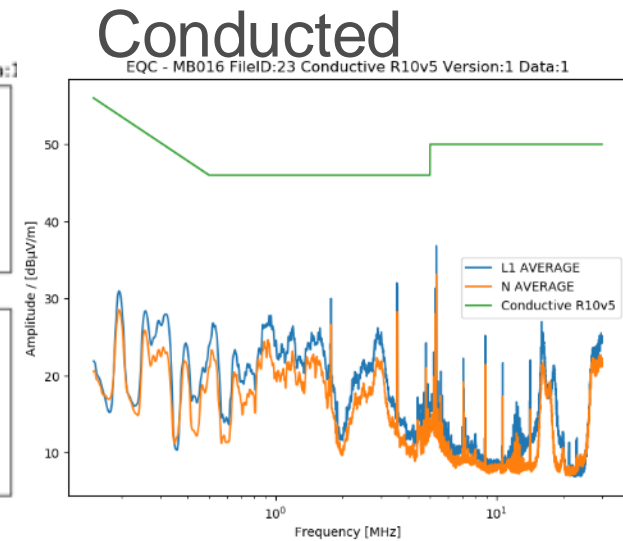
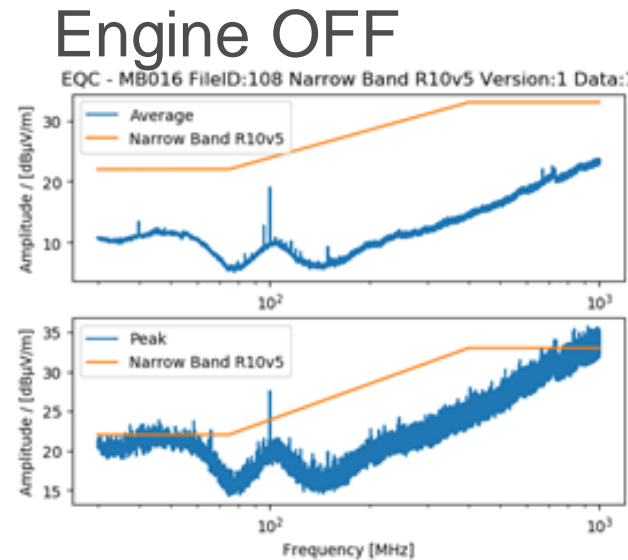
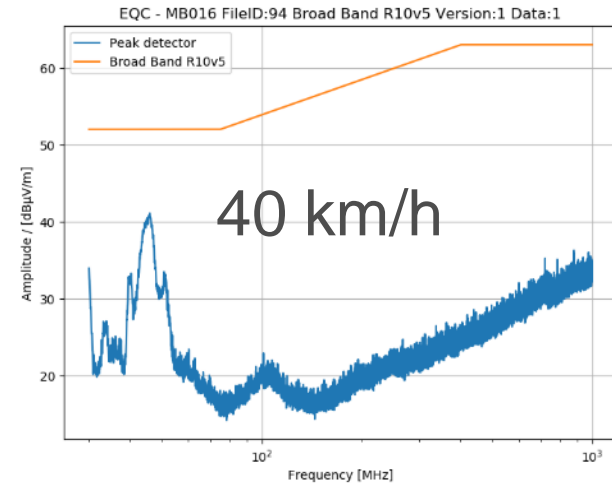
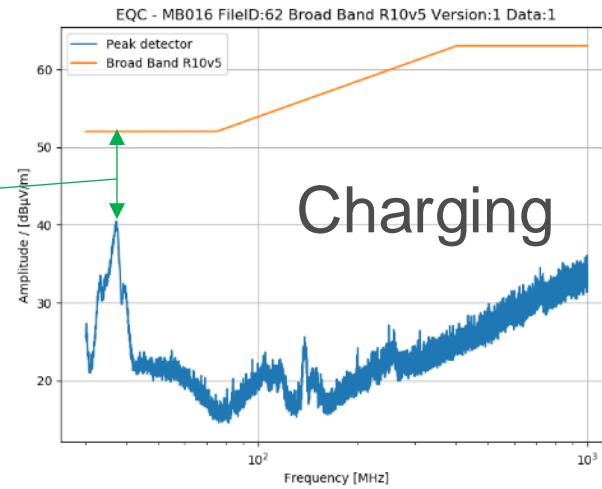
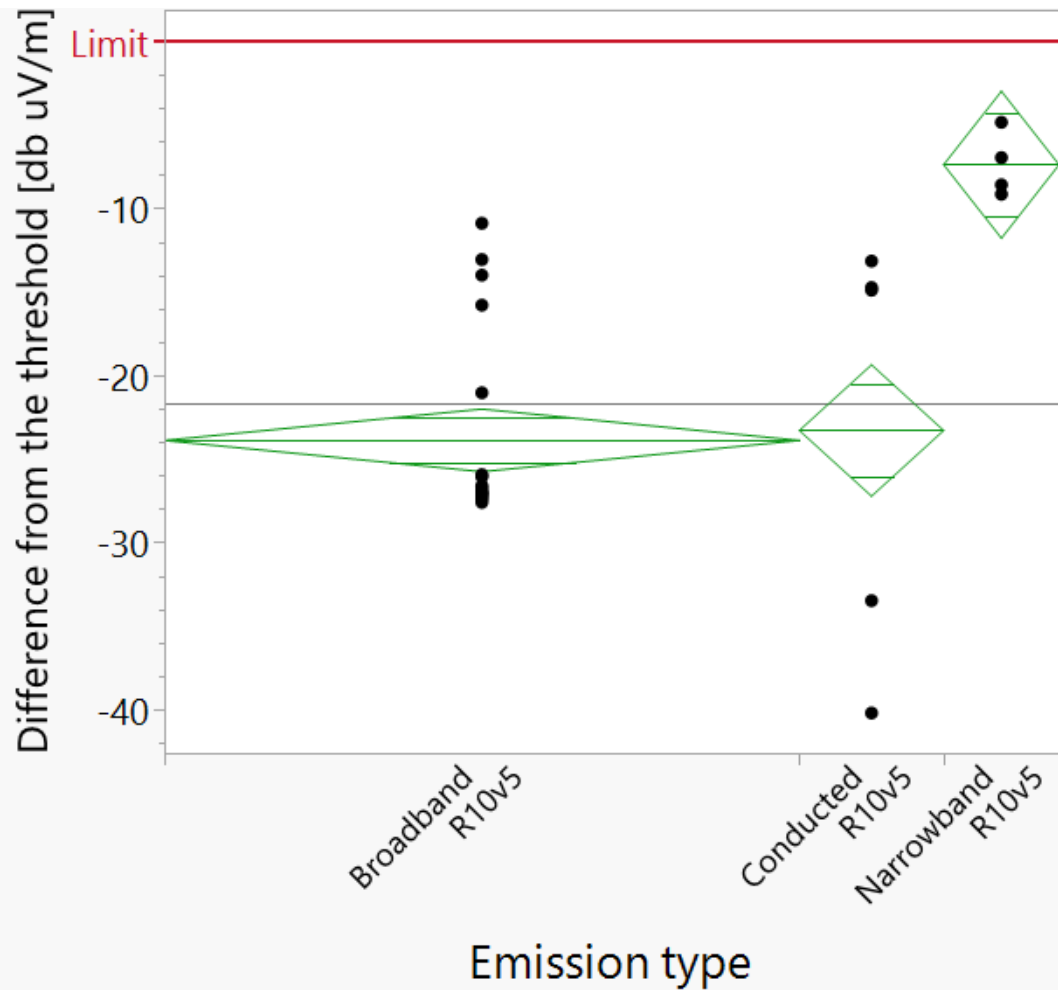
- 12 -

CISPR 12 © IEC:2007+A1:2009

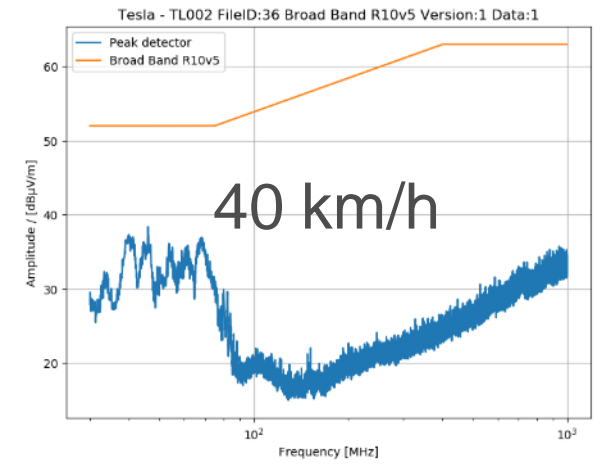
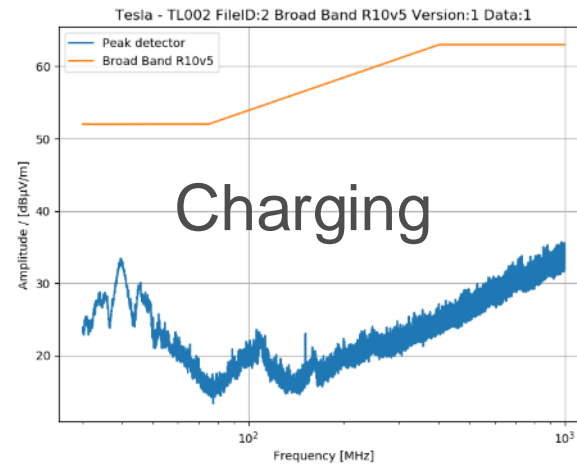
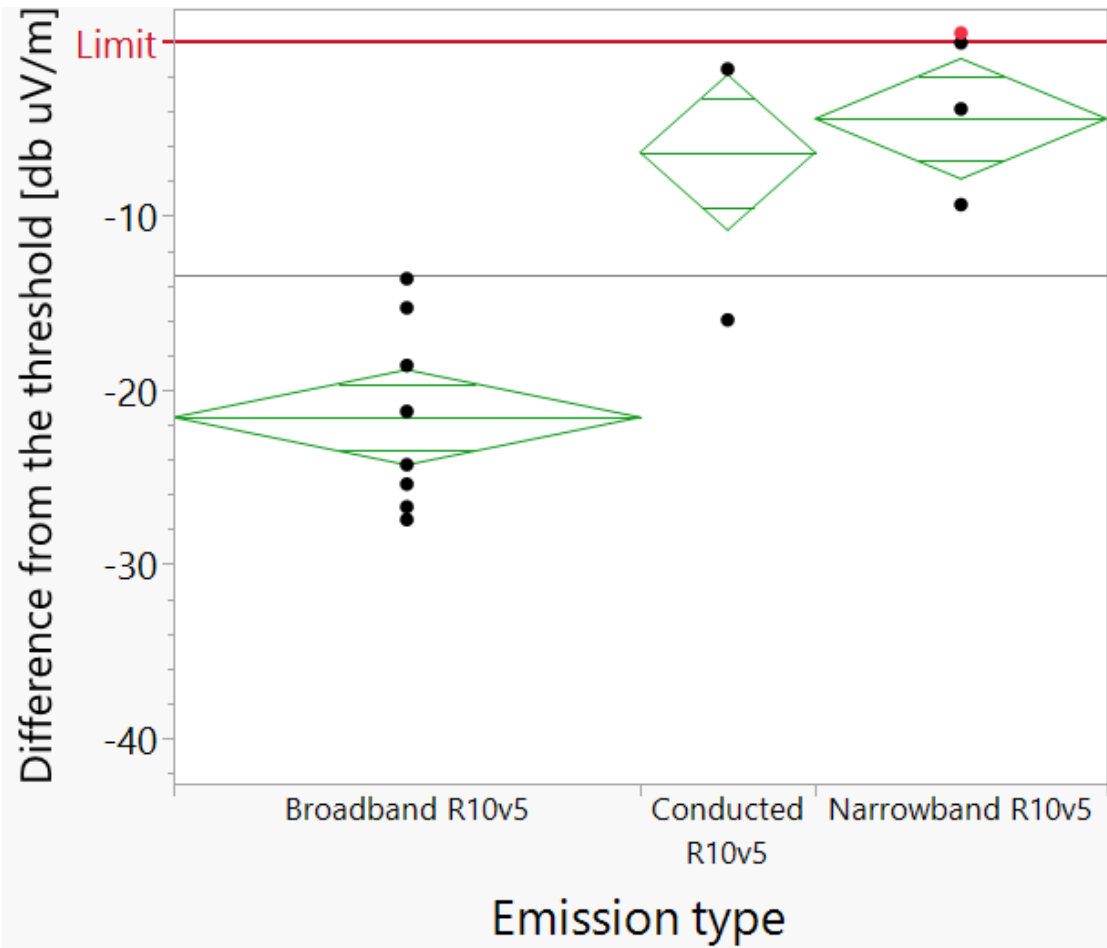


IEC 706/07

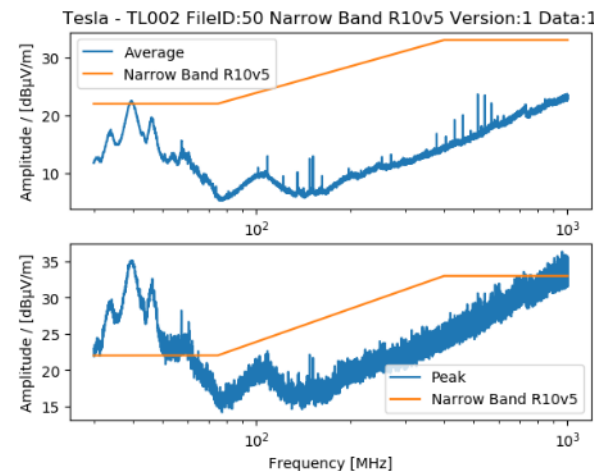
# EQC: Regulated modalities



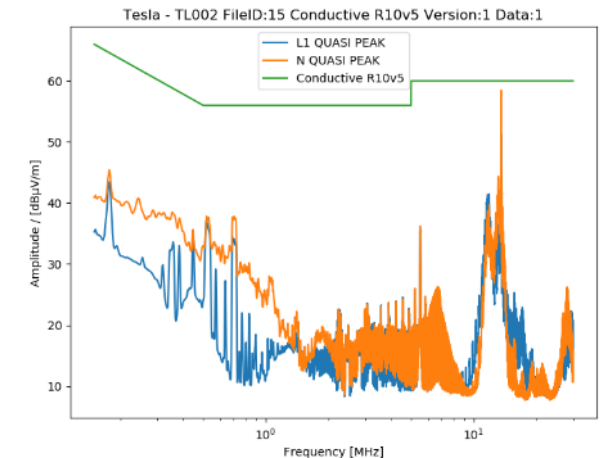
# Model 3: Regulated modalities



## Engine OFF



## Conducted



CISPR 12 § 6.5 Surveillance (quality audit) of series production: 80% of confidence limit was applied



# Other normal conditions of use: Rational



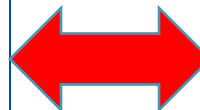
Front engine works at 40 km/h

Both engines works at higher speed and during acceleration

Both engines recuperates energy during deceleration

## UN ECE Regulation R10

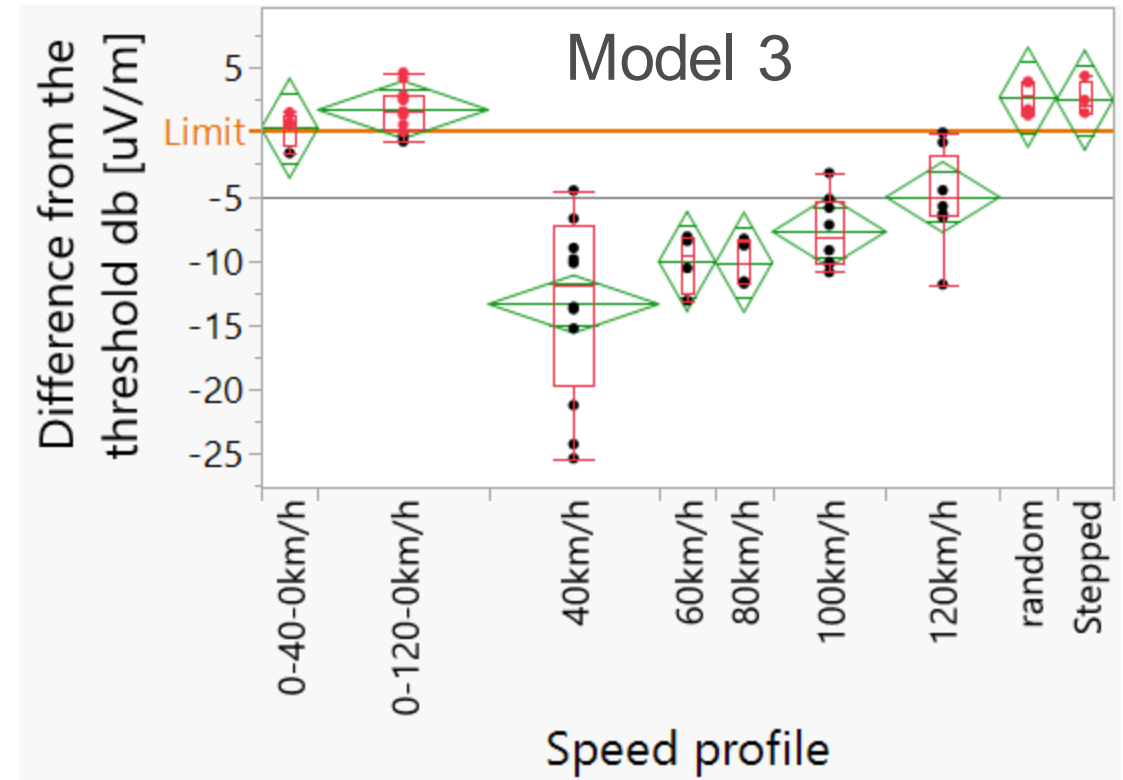
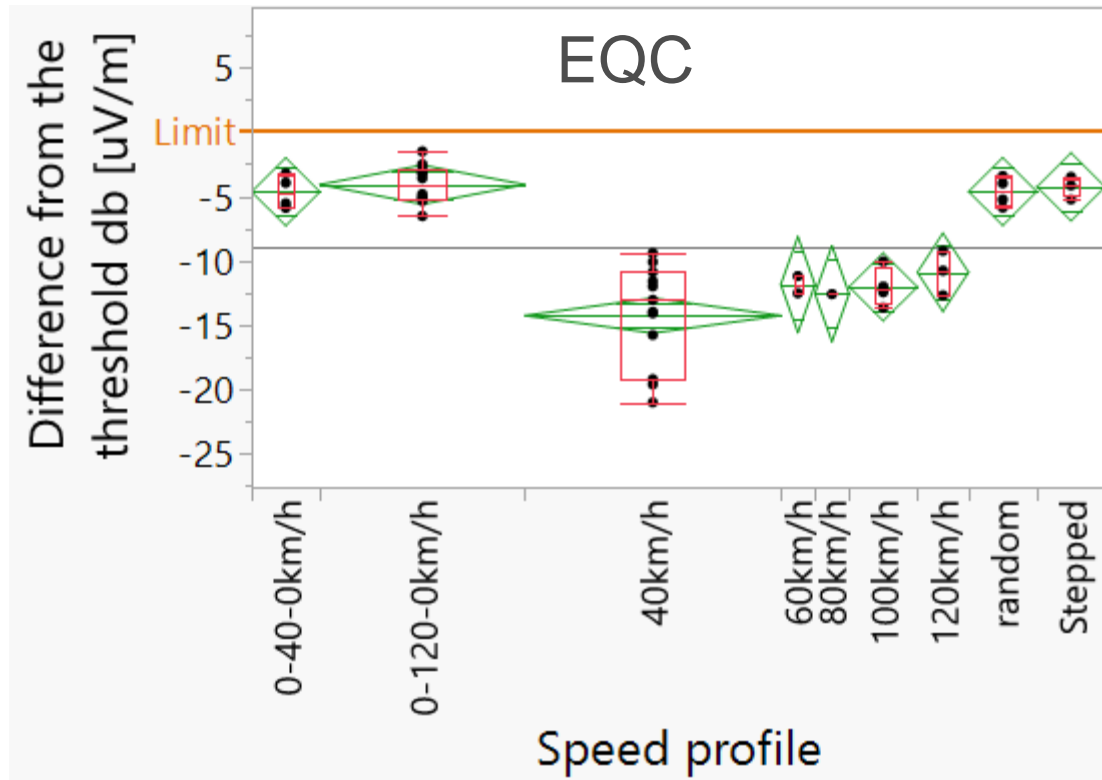
- 6.1.1. “A vehicle and its electrical/electronic system(s) or ESA(s) shall be so designed, constructed and fitted as to enable the vehicle, **in normal conditions of use**, to comply with the requirements of this Regulation.”
- 2.1.1. (ANNEX 4) **All equipment** capable of generating broadband emissions 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...**

# Other normal conditions of use: Results



- Continuous scan was applied for non-constant speeds
- Narrower frequency range is applied than required by the regulation
- The broadband emission threshold is used for comparison only

# Conclusion

- Both vehicles are compliant with the investigated functions: radiated and conducted emissions
- The propulsion electric engine operation strategy highly depends on the speed and acceleration/deceleration
- Other normal conditions of driving can lead to different radiated broadband emission than that described in IEC CISPR 12.

# Verification of compliance for market surveillance

- According to the measurement description of CISPR 12 the vehicle shall be driven at 40 km/h at which speed only one engine operates. This condition covers only a part of the normal driving conditions therefore the § 6.1.1. of R10 cannot be verified comprehensively.

## **What does normal conditions of use mean for market surveillance?**

- In market surveillance testing we assess all normal conditions of use of the propulsion engine(s), i.e. all propulsion engines both in charge consuming and in recuperation modes.

# Thank you



© European Union 2022

Unless otherwise noted the reuse of this presentation is authorised under the [CC BY 4.0](https://creativecommons.org/licenses/by/4.0/) license. For any use or reproduction of elements that are not owned by the EU, permission may need to be sought directly from the respective right holders.<sup>2</sup>

# Keep in touch



EU Science Hub: [ec.europa.eu/jrc](https://ec.europa.eu/jrc)



@EU\_ScienceHub



EU Science Hub – Joint Research Centre

EU Science, Research and Innovation



Eu Science Hub



# Acknowledgement

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

# Technical slides



