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)

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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 M1 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

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
<th>Comment</th>
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<tbody>
<tr>
<td><strong>Manufacturer</strong></td>
<td>Daimler AG, DE-70546 Stuttgart</td>
<td></td>
</tr>
<tr>
<td><strong>Make</strong></td>
<td>Mercedes Benz</td>
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<tr>
<td><strong>Type</strong></td>
<td>204 X</td>
<td>Complete</td>
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<tr>
<td><strong>Commercial name</strong></td>
<td>EQC</td>
<td></td>
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<tr>
<td><strong>Model year</strong></td>
<td>2020</td>
<td></td>
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<tr>
<td><strong>Engine</strong></td>
<td>Asynchronous <strong>rear and front electric engine</strong>: 300 kW</td>
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<tr>
<td><strong>Battery size</strong></td>
<td>80 kWh</td>
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<tr>
<td><strong>Charging power</strong></td>
<td>16A single-phase, 16A two-phases; Direct Current: 200A, Type 2; Combo 2 (CCS), 110kW</td>
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<td><strong>Vehicle Identification Number</strong></td>
<td>W1K2938901F005396</td>
<td>July 20 2020</td>
</tr>
<tr>
<td><strong>Global type approval number</strong></td>
<td>e1<em>2001/116</em>0480*36</td>
<td>June 12 2019</td>
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<tr>
<td><strong>R10 type approval number</strong></td>
<td>E1<em>10R05/01</em>8723*00</td>
<td>February 25 2019</td>
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<tr>
<td><strong>Testing service/laboratory</strong></td>
<td>AKKA EMC GmbH, DE-71332 Waiblingen, Germany</td>
<td>ISO 17025</td>
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<td><strong>Manufacturer</strong></td>
<td>Tesla Inc. 3500 Deer Creek Dr, Palo Alto, CA 94304, USA</td>
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<td><strong>Type</strong></td>
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<tr>
<td><strong>Commercial name</strong></td>
<td>Model 3</td>
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<td><strong>Model year</strong></td>
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<td></td>
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<tr>
<td><strong>Engine</strong></td>
<td>Dual motor: rear (88kW) and front (65kW)</td>
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<tr>
<td><strong>Battery size</strong></td>
<td>75 kWh</td>
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<td><strong>Charging power</strong></td>
<td>On-board 3-phase 48 A (AC), 250 kW (DC) with Supercharger V3</td>
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<td><strong>Global type approval number</strong></td>
<td>E4<em>2007/46</em>1293*11</td>
<td>July 1 2020</td>
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<td><strong>R10 type approval number</strong></td>
<td>E4<em>10R05/01</em>3987*04</td>
<td>July 1 2020</td>
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<td><strong>Testing service/laboratory</strong></td>
<td>Tesla EMC Chamber, Fremont, CA, USA</td>
<td>Calibrated equipment</td>
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</table>
Laboratory: JRC Vela 9

- Semi anechoic chamber with dimensions 21m x 15.6m x 8m
- Chassis dynamo by AVL
- Antenna: Schwarzbeck MESS (placement at 10 m)
- Artificial network: Rohde&Schwarz ENV 400
- Signal receiver: Rohde&Schwarz ESR 7
- Chargers: Elphi and ABB Terra
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
EQC: Regulated modalities

Charging

40 km/h

Engine OFF

Conducted
Model 3: Regulated modalities

CISPR 12 § 6.5 Surveillance (quality audit) of series production: 80% of confidence limit was applied
Other normal conditions of use: Rational

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…
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
Keep in touch

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