|  |  |  |  |
| --- | --- | --- | --- |
|  | United Nations | ECE/TRANS/WP.29/2025/110 | |
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**Economic Commission for Europe**

Inland Transport Committee

**World Forum for Harmonization of Vehicle Regulations**

**197th session**

Geneva, 11–14 November 2025

Item 4.8.1 of the provisional agenda

**1958 Agreement:**

**Consideration of draft amendments to existing**

**UN Regulations submitted by GRE**

Proposal for Supplement 1 to the 07 series of amendments to UN Regulation No. 10 (Electromagnetic Compatibility)

Submitted by the Working Party on Lighting and Light-Signalling[[1]](#footnote-2)\*

The text reproduced below was adopted by the Working Party on Lighting and Light-Signalling (GRE) at its ninety-second session (ECE/TRANS/WP.29/GRE/92, para. 26). It is based on ECE/TRANS/WP.29/GRE/2025/3 as amended by GRE-92-24. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee (AC.1) for consideration at their November 2025 sessions.

*Paragraph 6.1.2., first line,* replace “has to” with “shall”*.*

*Paragraph 6.7.1.,* *ISO reference,* amend to read “ISO 7637-2:2011”.

*Paragraph 7.1.2., first line,* replace “has to” with “shall”*.*

*Paragraph 7.17.1.,* *ISO reference,* amend to read “ISO 7637-2:2011”.

*Paragraph 7.18.2.1., Tables 19a and 19b,* amend to read:

"7.18.2.1. …

Table 19a

|  |  |  |
| --- | --- | --- |
|  | *Test Level in over 90 per cent of the 20 to 6,000 MHz frequency band* | |
| *Frequency range* | *BCI* | *ALSE* |
| 20 to 2,000 MHz | 60 mA | 30 V/m |
| 2,000 to 6,000 MHz | Not applicable | 10 V/m |

Table 19b

|  |  |  |
| --- | --- | --- |
|  | *Minimum Test Level over the whole 20 to 6,000 MHz frequency band* | |
| *Frequency range* | *BCI* | *ALSE* |
| 20 to 2,000 MHz | 50 mA | 25 V/m |
| 2,000 to 6,000 MHz | Not applicable | 8 V/m |

"

*Paragraph 7.19.1.,* amend to read:

"7.19.1 Method of testing

The immunity of ESA representative of its type shall be tested by the method(s) according to ISO 7637-2:2011, as described in Annex 10 with the test levels given in Table 20.

# Table 20

# **Immunity of ESA**

| *Test pulse number* | *Immunity test level* | | *Test duration /*  *Number of pulses* | *FPSC for ESA* | |
| --- | --- | --- | --- | --- | --- |
| *12V system* | *24V system* | *Related to immunity related functions* | *Not related to immunity related functions* |
| 1 | -75 V | -450V | 500 pulses | III | III |
| 2a | +37 V | +37 V | 500 pulses | I | III |
| 2b | +10 V | + 20 V | 10 pulses | II | III |
| 3a | -112 V | -150 V | 1 h | I | III |
| 3b | + 75 V | +150 V | 1 h | I | III |

"

*Appendix 1,* amend to read:

"**List of standards referred to in this Regulation**

1. CISPR 12 "Vehicles,boats, and internal combustion engine driven devices - Radio disturbance characteristics - Limits and methods of measurement for the protection of receivers except those installed in the vehicle/boat/device itself or in adjacent vehicles/boats/devices", Edition 5.1 - 2001 and AMD1:2005.

2. CISPR 16-1-4 "Specifications for radio disturbance and immunity measuring apparatus and methods - Part 1-4: Radio disturbance and immunity measuring apparatus, antennas and test sites for radiated disturbances measurements", Edition 4.2 - 2019, AMD1:2020 and AMD2:2023.

3. CISPR 25 "Radio disturbance characteristics for the protection of receivers used on board vehicles, boats, and on devices - Limits and methods of measurement", Edition 2.0 - 2002 and corrigendum 2004.

4. ISO 7637-1 "Road vehicles - Electrical disturbance from conduction and coupling - Part 1: Definitions and general considerations", Third edition 2015.

ISO 7637-2 "Road vehicles - Electrical disturbance from conduction and coupling - Part 2: Electrical transient conduction along supply lines only", Second edition 2004.

ISO 7637-2 "Road vehicles - Electrical disturbance from conduction and coupling - Part 2: Electrical transient conduction along supply lines only", Third edition 2011.

5. ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories", Third edition 2017.

6. ISO 11451 "Road vehicles – Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy":

Part 1: General principles and terminology (ISO 11451-1, Fourth edition 2015);

Part 2: Off-vehicle radiation sources (ISO 11451-2, Fourth edition 2015);

Part 4: Harness excitation methods (ISO 11451-4, fourth edition 2022).

7. ISO 11452 "Road vehicles - Component test methods for electrical disturbances from narrowband radiated electromagnetic energy":

Part 1: General principles and terminology (ISO 11452-1, Fourth edition 2015);

Part 2: Absorber-lined shielded enclosure (ISO 11452-2, Third edition 2019);

Part 3: Transverse electromagnetic (TEM) cell (ISO 11452-3,

Fourth edition 2024);

Part 4: Harness excitation methods (ISO 11452-4, Fifth edition 2020);

Part 5: Stripline (ISO 11452-5, Second edition 2002);

Part 11: Reverberation chamber (ISO 11452-11, First edition 2010).

9. IEC 61000-3-2 "Electromagnetic Compatibility (EMC) - Part 3-2: Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)", Edition 5.2 - 2018, AMD1:2020 and AMD2:2024.

10. IEC 61000-3-3 "Electromagnetic Compatibility (EMC) - Part 3-3: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with rated current ≤ 16 A per phase and not subject to conditional connection", Edition 3.2 - 2013, AMD1:2017, AMD2:2021 and COR1:2022.

11. IEC 61000-3-11 "Electromagnetic Compatibility (EMC) - Part 3-11: Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems - Equipment with rated current ≤ 75 A and subject to conditional connection", Edition 2.0 - 2017.

12. IEC 61000-3-12 "Electromagnetic Compatibility (EMC) - Part 3-12: Limits - Limits for harmonic currents produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase", Edition 1.0 - 2004.

13. IEC 61000-4-4 "Electromagnetic Compatibility (EMC) - Part 4-4: Testing and measurement techniques - Electrical fast transients/burst immunity test", Edition 3.0 - 2012.

14. IEC 61000-4-5 "Electromagnetic Compatibility (EMC) - Part 4-5: Testing and measurement techniques - Surge immunity test", Edition 3.1 - 2014 and AMD1:2017.

15. IEC 61000-6-3 "Electromagnetic Compatibility (EMC) - Part 6-3: Generic standards - Emission standard for equipment in residential environments", Edition 3.0 - 2020.

16. IEC 61000-6-4 “Electromagnetic compatibility (EMC) - Part 6-4: Generic standards - Emission standard for industrial environments”, Edition 3.0 - 2018.

17. CISPR 16-2-1 "Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-1: ~~-~~ Methods of measurement of disturbances and immunity - Conducted disturbance~~s~~ measurements", Edition 3.1 - 2014, AMD1:2017 and COR1:2020.

18. CISPR 16-1-2 "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-2: Radio disturbance and immunity measuring apparatus, coupling devices for conducted disturbance measurements", Edition 2.1 - 2014 and AMD1:2017.

19. IEC 61851-1 "Electric vehicle conductive charging system - Part 1: General requirements", Edition 3.0 - 2017.

20. IEC 61851-21-2 "Electric vehicle conductive charging system - Part 21-2: Electric vehicle requirements for conductive connection to an AC/DC supply - EMC requirements for off board electric vehicle charging systems", Edition 1.0 - 2018.

21. CISPR 32 "Electromagnetic compatibility of multimedia equipment - Emission requirements”, Edition 2.1 - 2015 and AMD1:2019.

22. CISPR 16-1-1 “Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus", Edition 5.0: 2019.

"

*Appendix 8,*

*Paragraph 1.,* for“ZPB”read “ZPB”.

*Figure 1,* amend to read

"Figure 1

**Example of 5 μH AN schematic**



Key

L1 5 μH A port to power supply

C1 0,1 μF P port to ESA

C2 1 μF (default value) B ground

R1 1 kΩ MEP measuring port”

"

*Paragraph 2., fourth indent,* amend to read:

" …

The HV-AN impedance ZPB (tolerance ± 20 %) in the measurement frequency range of 0,1 MHz to 100 MHz is shown in Figure 2. It is measured between the “ESA HV” and “GND” terminals (of Figure 3) with a 50 Ω load on the measurement port and with the “HV supply” and “GND” terminals short circuited."

*Figure 3,* amend to read:

"Figure 3

**Example of 5 μH / HV-AN schematic**

Une image contenant diagramme, ligne, Dessin technique, Plan

Description générée automatiquement

Key

L1 5 μH HV supply high voltage power supply

C1 0,1 μF ESA HV high voltage of ESA

C2 0,1 μF (default value) MEP measuring port

R1 1 kΩ GND ground

R2 1 MΩ (discharging C2 to > 50 Vdc within 60 s)

If unshielded HV**-**ANs are used in a single shielded box, then there shall be an inner shield between the HV-ANs as described in Figure 4."

*Figure 4,* amend to read:

"Figure 4

**Example of 5 μH HV**-**AN combination in a single shielded box**

Une image contenant diagramme, texte, Dessin technique, Plan

Description générée automatiquement

Key

L1 5 μH HV supply high voltage power supply (positive and negative)

C1 0,1 μF ESA HV high voltage of ESA (positive and negative)

C2 0,1 μF (default value) MEP measuring port

R1 1 kΩ GND ground

R2 1 MΩ (discharging C2 to > 50 Vdc within 60 s)"

*Figure 5,* amend to read:

"Figure 5

**Impedance matching network attached between HV**-**ANs and ESA**

Une image contenant texte, diagramme, Plan, Dessin technique

Description générée automatiquement

Key

L1 5 μH HV supply high voltage power supply (positive and negative)

C1 0,1 μF ESA HV high voltage of ESA (positive and negative)

C2 0,1 μF (default value) MEP measuring port

R1 1 kΩ GND ground

R2 1 MΩ (discharging C2 to > 50 Vdc within 60 s) ZDI-CM differential and common-mode impedance”

*Paragraph 3., third indent,* for“ZPB”read “ZPB”.

*Figure 6,* amend to read:

"Figure 6

**Example of 5 μH DC-charging-AN schematic**



Key

L1 5 µH HV supply high voltage power supply

C1 0,1 µF vehicle / ESA HV high voltage vehicle or ESA

C2 1 µF (default value, if another value is used, MEP measuring port

it shall be justified)

R1 1 kΩ GND ground

R2 1 MΩ (discharging C2 to > 50 Vdc within 60 s)"

*Paragraph 5.1., second indent,* for“Zcat**”** read “Zcat**”.**

*Figure 8,* amend to read:

"Figure 8

**Example of an AAN for Signal/Control port with symmetric lines (e.g. CAN)**



Key

1 AAN

2 vehicle Zcat symmetric adjustment impedance

3 charging station A symmetrical line 1 (in vehicle)

L1 2 x 38 mH B symmetrical line 2 (in vehicle)

L2 2 x 38 mH C symmetrical line 1 (charging station side)

R 200 Ω D symmetrical line 2 (charging station side)

C 4,7 µF E measuring port with 50 Ω load"

*Paragraph 5.2., third indent,* amend to read:

" …

The circuit in Figure 9 provides a common mode termination by the AMN / DC-charging-AN **/** HV-AN. In order to minimize emission from the PLC modem of the vehicle, an attenuator is located between the powerline and the PLC modem at the AE side in the circuit for emission tests. This attenuator consists of two resistors in combination with the input/output impedance of the PLC modem. The value of the resistors depends on the design impedance of the PLC modems and the allowed attenuation for the PLC system."

*Figure 9,* amend to read:

"Figure 9

**Example of AAN with Signal/Control port with PLC on AC or DC power lines**



Key

1 AAN C1 4,7 nF

2 vehicle A PLC on AC or DC power line (vehicle side)

3 charging station / power supply B PLC on AC or DC power line (vehicle side)

4 HV-AN or AMN or DC-charging-AN C PLC line (charging station or AE side)

5 AE D PLC line (charging station or AE side)

R1 2,5 kΩ"

*Figure 10,* amend to read:

"Figure 10

**Example of AAN circuit for Signal/Control port with PLC on control pilot**



Key

1 AAN

2 vehicle R2 270 Ω

3 charging station C1 2,2 nF

4 control pilot (in vehicle) L1100 µH

5 PLC (in vehicle) A control pilot line (vehicle side)

6 AE B/D protective earth

R1 39 Ω C control pilot line (charging station side)"

*Figure 11,* amend to read:

"Figure 11

**Example of AAN circuit for pilot line**



|  |  |
| --- | --- |
| Key |  |
| 1 AAN | C11,1 nF |
| 2 Vehicle | L1100 µH |
| 3 Charging station | A Control pilot line (vehicle side) |
| 4 Control pilot (in vehicle) | B/D Protective earth |
| R1 150 Ω | C Control pilot line (charging station side) |

"

*Annex 1,* amend to read:

"Model B

(See paragraph 5.2. of this Regulation)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Une image contenant Police, blanc, symbole, diagramme  Description générée automatiquement | |  | | --- | | 10 07 2439 | | 33 00 1628 | | Une image contenant ligne, diagramme, origami, Police  Description générée automatiquement |

a = 6 mm min

The above approval mark affixed to a vehicle or ESA shows that the vehicle type concerned has, with regard to electromagnetic compatibility, been approved in the Netherlands (E 4) pursuant to UN Regulations Nos. 10 and 33. The approval numbers indicate that, at the date when the respective approvals were given, UN Regulation No. 10 included the 07series of amendments and UN Regulation No. 33 was still in its original form."

*Annex 4,*

*Paragraph 2.2., Figure 1*, amend to read:

"**Charging mode configuration for Annex 4**

N

N

N

Y

Y

Y

N

N

Y

Y

N

Y

N

Y

Key

Y yes

N no

Mode 4 test with cable from the test facility

Mode 4 available?

End of test REESS coupled to the power grid.

Mode 3 test in one configuration (single or 3-phase) to be selected based on the maximum total nominal charge current.

Mode 3 available?

Mode 2 test with one representative cable provided by the vehicle manufacturer.

Mode 2 test with one representative cable delivered with the vehicle to the customer~~1~~.

Mode 2 test with all ICCPD variants delivered with the vehicle to the customer which do not comply with IEC 61851-21-2~~1~~.

Cables delivered with the vehicle?

Mode 2 available?

Mode 1 test with cable provided by the vehicle manufacturer.

Mode 1 available?

Mode 2 or 3 available?

**Annex 4:** test modes to be selected for REESS coupled to the power grid.

ICCPD

compliant with

IEC 61851-21-2**1**?

1 IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

"

*Paragraphs 4.3.*, *tables 1 and 2,* amend to read:

"4.3. …

Table 1

**Spectrum analyser parameters**

| *Frequency range MHz* | *Peak detector* | | *Quasi-peak detector* | |
| --- | --- | --- | --- | --- |
| *RBW at -3 dB* | *Minimum scan  time* | *RBW at -6 dB* | *Minimum scan  time* |
| 30 to  1,000 | 100/120 kHz | 100 ms/MHz | 120  kHz | 20  s/MHz |

*Note:* If a spectrum analyser is used for peak measurements, the video bandwidth shall be at least three times the resolution bandwidth (RBW).

Table 2

**Scanning receiver parameters**

| *Frequency range MHz* | *Peak detector* | | | *Quasi-peak detector* | | |
| --- | --- | --- | --- | --- | --- | --- |
| *BW at -6 dB* | *Maximum step size a* | *Minimum dwell time* | *BW at -6 dB* | *Maximum step size a* | *Minimum dwell time* |
| 30 to 1,000 | 120 kHz | 60 kHz | 5 ms | 120 kHz | 60 kHz | 1 s |

*a* For purely broadband disturbances, the maximum frequency step size may be increased up to a value not greater than the bandwidth value."

*Annex 4 – Appendix 1,*

*Figure 3b, Key and NOTE,* amend to read:

"**Figure 3b**

…

Key

|  |  |
| --- | --- |
| 1 | vehicle under test |
| 2 | insulating support |
| 3 | charging cable (including EVSE for charging mode 2) |
| 4 | artificial mains network(s) grounded |
| 5 | power mains socket |
| 6 | extraneous length Z-folded |

NOTE: The cable between the AC mains and the AMN may not be aligned in the same direction as the cable between the AMN and the EV.

Example of test setup for vehicle with socket located front / rear of vehicle (charging mode 1 or 2, AC powered, without communication)."

*Figure 3d, Key and NOTE*, amend to read:

"**Figure 3d**

…

Key

|  |  |
| --- | --- |
| 1 | vehicle under test |
| 2 | insulating support |
| 3 | charging cable (including EVSE for charging mode 2) |
| 4 | artificial mains network(s) grounded |
| 5 | power mains socket |
| 6 | extraneous length Z-folded |

NOTE: The cable between the AC mains and the AMN may not be aligned in the same direction as the cable between the AMN and the EV.

Example of test setup for vehicle with socket located on vehicle side   
(charging mode 3 or mode 4, with communication)"

*Figure 3f, Key and NOTE*, amend to read:

**"Figure 3f**

…

Key

|  |  |
| --- | --- |
| 1 | vehicle under test |
| 2 | insulating support |
| 3 | charging harness with communication lines |
| 4 | AMN(s) or DC-charging-AN(s), grounded |
| 5 | power mains / supply socket (optional) |
| 6 | AAN(s), grounded (optional, not represented in the front view) |
| 7 | charging station (can be emulated) |
| 8 | communication lines |
| 9 | communication module |
| 10 | power cable |
| 11 | extraneous length Z-folded |

NOTE : The cable between the AC/DC mains/supply and the AMN/DC-charging-AN may not be aligned in the same direction as the cable between the AMN/DC-charging-AN and the EV.

Example of test setup for vehicle with socket located front / rear of vehicle (charging mode 3 or mode 4, with communication) "

*Figure 3h, Key and NOTE*, amend to read:

**"Figure 3h**

…

Key

|  |  |
| --- | --- |
| 1 | vehicle under test |
| 2 | insulating support |
| 3 | charging harness with communication lines |
| 4 | AMN(s) or DC-charging-AN(s), grounded |
| 5 | power mains / supply socket (optional) |
| 6 | AAN(s), grounded (optional, not represented in the front view) |
| 7 | charging station (can be emulated) |
| 8 | communication lines |
| 9 | communication module |
| 10 | power cable |
| 11 | extraneous length Z-folded |

NOTE: The cable between the AC/DC mains/supply and the AMN/DC-charging-AN may not be aligned in the same direction as the cable between the AMN/DC-charging-AN and the EV."

*Figure 4,* amend to read:

"Figure 4

**Antenna position for N = 1 (one antenna position to be used) – Horizontal polarization shown**

**Une image contenant ligne, diagramme, croquis, Parallèle

Description générée automatiquement**

Key

1 vehicle under test

2 antenna"

*Figure 5,* amend to read:

"Figure 5

**Antenna positions for N = 2 (multiple antenna positions to be used) – Horizontal polarization shown**

****

Key

1vehicle under test

2 antenna (two positions)"

*Annex 5,*

*Paragraph 1.2.,* amend to read:

"1.2. Test method

This test is intended to measure the narrowband electromagnetic emissions that may emanate from microprocessor-based systems or other narrowband source.

If not otherwise stated in this annex the test shall be performed according to CISPR 12."

*Paragraph 4.3., table 2,* amend to read:

"4.3. …

Table 2  
**Scanning receiver parameters**

| *Frequency range MHz* | *Peak detector* | | | *Average detector* | | |
| --- | --- | --- | --- | --- | --- | --- |
| *BW at -6 dB* | *Maximum step size* | *Minimum dwell time* | *BW at -6 dB* | *Maximum ~~S~~step size* | *Minimum dwell time* |
| 30 to 1,000 | 120 kHz | 60 kHz | 5 ms | 120 kHz | 60 kHz | 5 ms |

"

*Annex 5, Appendix 1,*

*Figure 1,* amend to read:

"Figure 1

**Antenna position for N = 1 (one antenna position to be used) –   
Horizontal polarization shown**

**Une image contenant ligne, diagramme, croquis, Parallèle

Description générée automatiquement**

Key

1 vehicle under test

2 antenna"

*Figure 2,* amend to read:

"Figure 2

**Antenna positions for N = 2 (multiple antenna positions to be used) –   
Horizontal polarization shown**

****

Key

1 vehicle under test

2 antenna (two positions)"

*Annex 6,*

*Paragraph 1.3.,* amend to read:

"1.3. Alternative test methods

The test may be alternatively performed in an outdoor test site for all vehicles (including “large vehicles”). The test facility shall comply with (national) legal requirements regarding the emission of electromagnetic fields. The test shall be performed according to ISO 11451-2 in an OTS:

• with front irradiation for vehicle not considered as “large vehicles”. Rear irradiation is specified in paragraph 5.1.3.

• with front irradiation and with additional antenna positions for “large vehicles”. Additional antenna position(s) shall be chosen by the manufacturer in conjunction with the Type Approval Authority after considering the distribution of electronic systems with immunity related functions and the layout of any wiring harness. Tests shall be performed with levels defined in paragraph 6.4.2.1. of this Regulation. For REESS charging mode, only the electronic systems and wiring harnesses required for charging mode shall be considered for antenna positions.

…"

*Paragraph 1.4.,* amend to read:

"1.4 Applicability of test methods:

**Figure 1**

**Type approval procedures for testing the immunity of vehicles to electromagnetic radiation**

**Alternative**

**No**

**Yes**

**Regular or alternative test method**

**One of the following test methods shall be used**

**Large vehicle as defined in Annex 6, paragraph 1.1**

**Regular**

**Regular**

**Alternatives**

**Alternatives**

**Vehicle test according to ISO 11451-4 BCI (20MHz – 2 GHz)**

**+ according to ISO 11451-2 in ALSE or OTS (additional antenna positions for ESA with immunity related functions) (2 – 6 GHz)**

**Vehicle test according to ISO 11451-2 in ALSE**

**Vehicle test according to ISO 11451-2 in OTS**

**Vehicle test according to ISO 11451-4 BCI (20MHz – 2 GHz)**

**+ Component test according to R10 Annex 9 (2 – 6 GHz)**

**Vehicle test according to ISO 11451-2 in ALSE or OTS (20MHz – 6 GHz)**

**+ Component test according to R10 Annex 9 (20 MHz – 6 GHz) for each ESA with immunity related functions outside antenna beamwidth**

**Vehicle test according to ISO 11451-2 in ALSE (additional antenna positions for ESA with immunity related functions)**

**Vehicle test according to ISO 11451-2 in OTS (additional antenna positions for ESA with immunity related functions)**

"

*Paragraph 2.1.1.2.,* amendto read:

"…

| ***"Brake mode" vehicle test conditions*** | ***Failure criteria*** |
| --- | --- |
| Vehicle in a state that allows the braking system to operate normally, parking brake released, vehicle speed 0 km/h.  Brake pedal depressed to activate the brake function and the stop lights without any dynamic cycle. | Stop lights inactivated during mode Brake warning light ON with loss of brake function. |
| Day running light (DRL) ON | DRL inactivated during mode |
| ADS shall be operational (1) | ADS does not remain in a failure safe mode or expected failure operational mode |
| (1): ADS are turned on by the driver but some or all ADS functions may revert to a mode where system is monitoring sensors but is not actively ‘driving’ the vehicle due to plausibility issues caused by the EMC laboratory environment. | |

*…*"

*Annex 6, paragraph 2.2.1.1., Figure 2*, amend to read:

"Figure 2

**Charging mode configuration for Annex 6**

Mode 3 test in one configuration (single or 3-phase) to be selected based on the maximum total nominal charge current

N

Y

Mode 4 test with cable from the test facility

Mode 4 available?

End of test REESS coupled to the power grid

Test in only one AC Mode 1 or 2

N

N

Y

Y

Key

Y yes

N no

AC Mode available?

Mode 3 available?

**Annex 6:** test modes to be selected for REESS coupled to the power grid

"

*Annex 6, Appendix 1, Figure 4.,* amend *to read:*

"Figure 4

**Example of a selection of antenna placements for lateral illumination of a large vehicle**

Une image contenant croquis, dessin, art, illustration

Description générée automatiquement

Key

θ3 dB antenna beamwidth

D the distance between the tip or phase centre of the antenna and the nearest part of the vehicle body without considering small extruding elements (such as side mirrors or fenders)"

*Annex 6,* *Appendix 1,*

*Figure 5b,* amend to read:

"Figure 5b

Une image contenant croquis, diagramme, dessin, Dessin technique

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness (including EVSE for charging mode 2)

4 AMN(s) or DC-charging-AN(s) grounded

5 power mains socket

NOTE: The cable between the AC mains and the AMN may not be aligned in the same direction as the cable between the AMN and the EV."

*Figure 5d,* amend to read:

"Figure 5d

Une image contenant croquis, diagramme, dessin, Dessin technique

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness (including EVSE for charging mode 2)

4 AMN(s) or DC-charging-AN(s) grounded

5 power mains socket

NOTE: The cable between the AC mains and the AMN may not be aligned in the same direction as the cable between the AMN and the EV."

*Figure 5f,* amend to read:

"Figure 5f

Une image contenant croquis, diagramme, Dessin technique, Plan

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness with local/private communication lines

4 AMN(s) or DC-charging-AN(s) grounded

5 power mains socket

6 AAN(s) grounded (optional)

7 charging station

8 communication lines

9 communication module

10 power cable

NOTE: The cable between the AC/DC mains/supply and the AMN/DC-charging-AN may not be aligned in the same direction as the cable between the AMN/DC-charging-AN and the EV."

*Figure 5h,* amend to read:

"Figure 5h

Une image contenant croquis, diagramme, dessin, Dessin technique

Description générée automatiquement

Key

|  |  |
| --- | --- |
| 1 | vehicle under test |
| 2 | insulating support |
| 3 | charging harness with communication lines |
| 4 | AMN(s) or DC-charging-AN(s), grounded |
| 5 | power mains / supply socket (optional) |
| 6 | AAN(s) grounded (optional, not represented in the front view) |
| 7 | charging station (can be emulated) |
| 8 | communication lines |
| 9 | communication module |
| 10 | power cable |

NOTE: The cable between the AC/DC mains/supply and the AMN/DC-charging-AN may not be aligned in the same direction as the cable between the AMN/DC-charging-AN and the EV."

*Annex 7, paragraph 4.3., tables 1 and 2,* amend to read:

"4.3. ...

Table 1

**Spectrum analyser parameters**

| *Frequency range MHz* | *Peak detector* | | *Quasi-peak detector* | |
| --- | --- | --- | --- | --- |
| *RBW at -3 dB* | *Minimum scan  time* | *RBW at -6 dB* | *Minimum scan  time* |
| 30 to  1,000 | 100/120 kHz | 100 ms/MHz | 120  kHz | 20  s/MHz |

*Note:* If a spectrum analyser is used for peak measurements, the video bandwidth shall be at least three times the resolution bandwidth (RBW).”

Table 2

**Scanning receiver parameters**

| *Frequency range MHz* | *Peak detector* | | | *Quasi-peak detector* | | |
| --- | --- | --- | --- | --- | --- | --- |
| *BW at -6 dB* | *Maximum step size a* | *Minimum dwell time* | *BW at -6 dB* | *Maximum step size a* | *Minimum dwell time* |
| 30 to 1,000 | 120 kHz | 60 kHz | 5 ms | 120 kHz | 60 kHz | 1 s |

*a* For purely broadband disturbances, the maximum frequency step size may be increased up to a value not greater than the bandwidth value.

*Note:* For emissions generated by brush commutator motors without an electronic control unit, the maximum step size may be increased up to five times the bandwidth."

*Annex 7, Appendix 1, Figure 2,* amend to read:

"Figure 2

**Test configuration for ESAs involved in "REESS charging mode coupled to the power grid" (example for** **biconical antenna)**

Dimensions in millimetres

Une image contenant croquis, dessin, diagramme, conception

Description générée automatiquement

15

22

16

16

14

10

11

12

12

12

13

18

17

12

9

23

19

20

21

Key

1 ESA (grounded locally if required in test plan) 12 RF absorber material

2 LV Test harness 13 stimulation and monitoring system

3 LV Load simulator (placement and ground connection 14 HV harness

according to CISPR 25 paragraph 6.4.2.5) 15 HV load simulator

4 power supply (location optional) 16 HV AN

5 LV Artificial network (AN) 17 HV power supply

6 ground plane (bonded to shielded enclosure) 18 HV feed-through

7 low relative permittivity support (εr ≤ 1.4) 19 AC/DC charger harness

8 biconical antenna 20 AC/DC load simulator (e.g

9 high-quality coaxial cable e.g. double-shielded (50 Ω) Programmable Logic Controller (PLC))

10 bulkhead connector 21 AMN(s) or DC-charging-AN(s)

11 measuring instrument 22 AC/DC power supply

23 AC/DC feed-through"

*Annex 8, paragraph 4.3., table 2,* amend to read:

"4.3. …

Table 2

**Scanning receiver parameters**

| *Frequency range MHz* | *Peak detector* | | | *Average detector* | | |
| --- | --- | --- | --- | --- | --- | --- |
| *BW at -6 dB* | *Maximum step size* | *Minimum dwell time* | *BW at -6 dB* | *Maximum step size* | *Minimum dwell time* |
| 30 to 1,000 | 120 kHz | 60 kHz | 5 ms | 120 kHz | 60 kHz | 5 ms |

"

*Annex 9, Appendix 2, Figure 1,* amend to read:

"Figure 1

**Example of test set-up for log-periodic antenna**

***Top view Dimensions in millimetres***



|  |  |  |  |
| --- | --- | --- | --- |
| Key | |  |  |
| 1 | ESA (grounded locally if required in test plan) | 16 | power line filter |
| 2 | ground plane | 17 | fibre optic feed through |
| 3 | low relative permittivity support (*ε*r ≤ 1.4); thickness 50 mm | 18 | bulk head connector |
| 4 | ground straps | 19 | stimulating and monitoring system |
| 5 | LV harness | 20 | RF signal generator and amplifier |
| 6 | HV lines (HV+, HV-) | 21 | high quality coaxial cable e.g. double shielded (50 Ω) |
| 7 | LV load simulator | 22 | optical fibre |
| 8 | impedance matching network (optional) | 23 | log-periodic antenna |
| 9 | LV AN | 24 | RF absorber material |
| 10 | HV AN | 25 | AC power mains |
| 11 | LV supply lines | 26 | AMN for AC power mains |
| 12 | HV supply lines | 27 | AC charging load simulator |
| 13 | LV power supply 12 V / 24 V / 48 V (placed on the bench) | 28 | 50 Ω load |
| 14 | additional shielded box (optional) | 29 | AC lines |
| 15 | HV power supply (should be shielded if placed inside ALSE) |  |  |

"

*Annex 9, Appendix 2, Figure 2,* amend to read:

"Figure 2

**Example of test set-up for horn antenna**

***Top view Dimensions in millimetres***



|  |  |  |  |
| --- | --- | --- | --- |
| Key | |  |  |
| 1 | ESA (grounded locally if required in test plan) | 16 | power line filter |
| 2 | ground plane | 17 | fibre optic feed through |
| 3 | low relative permittivity support (*ε*r ≤ 1.4); thickness 50 mm | 18 | bulk head connector |
| 4 | ground straps | 19 | stimulating and monitoring system |
| 5 | LV harness | 20 | RF signal generator and amplifier |
| 6 | HV lines (HV+, HV-) | 21 | high quality coaxial cable e.g. double shielded (50 Ω) |
| 7 | LV load simulator | 22 | optical fibre |
| 8 | impedance matching network (optional) | 23 | horn antenna |
| 9 | LV AN | 24 | RF absorber material |
| 10 | HV AN | 25 | AC power mains |
| 11 | LV supply lines | 26 | AMN for AC power mains |
| 12 | HV supply lines | 27 | AC charging load simulator |
| 13 | LV power supply 12 V / 24 V / 48 V (placed on the bench) | 28 | 50 Ω load |
| 14 | additional shielded box (optional) | 29 | AC lines |
| 15 | HV power supply (should be shielded if placed inside ALSE) |  |  |

"

*Annex 9, Appendix 3, Figure 1,* amend to read:

"Figure 1

**Example of test set-up for substitution method - Injection on LV (or HV or AC) lines for ESAs with shielded power supply systems and inverter/charger device (dimensions in millimetres)**



|  |  |  |  |
| --- | --- | --- | --- |
|  | Key |  |  |
| 1 | ESA | 14 | additional shielded box |
| 2 | ground plane | 15 | HV power supply (should be shielded if placed inside ALSE) |
| 3 | low relative permittivity support (εr ≤ 1,4); thickness 50 mm | 16 | power line filter |
| 4 | ground straps | 17 | fibre optic feed through |
| 5 | LV harness | 18 | bulk head connector |
| 6 | HV lines (HV+, HV-) | 19 | stimulating and monitoring system |
| 7 | LV load simulator | 20 | injection probe |
| 8 | impedance matching network (optional) (see ISO 11452-1) | 21 | high frequency equipment (generator and amplifier) |
| 9 | LV AN | 22 | optical fibre |
| 10 | HV AN | 23 | 50 Ω load |
| 11 | LV supply lines | 24 | AC lines |
| 12 | HV supply lines | 25 | AMN for AC power mains |
| 13 | LV power supply 12 V / 24 V / 48 V (should be placed on the bench) | 26 | AC charging load simulator |
|  |  | 27 | AC power mains |

"

*Annex 9, Appendix 3, Figure 2,* amend to read:

"Figure 2

**Example of test set-up for closed loop method - Injection on LV (or HV or AC) lines for ESAs with shielded power supply systems and inverter/charger device** **(dimensions in millimetres)**



|  |  |  |  |
| --- | --- | --- | --- |
|  | Key |  |  |
| 1 | ESA | 15 | HV power supply (should be shielded if placed inside ALSE) |
| 2 | ground plane | 16 | power line filter |
| 3 | low relative permittivity support (εr ≤ 1,4); thickness 50 mm | 17 | fibre optic feed through |
| 4 | ground straps | 18 | bulk head connector |
| 5 | LV harness | 19 | stimulating and monitoring system |
| 6 | HV lines (HV+, HV-) | 20 | measuring probe |
| 7 | LV load simulator | 21 | high frequency equipment (generator, amplifier and spectrum analyser) |
| 8 | impedance matching network (optional) (see ISO 11452-1) | 22 | optical fibre |
| 9 | LV AN | 23 | 50 Ω load |
| 10 | HV AN | 24 | AC lines |
| 11 | LV supply lines | 25 | AMN for AC power mains |
| 12 | HV supply lines | 26 | AC charging load simulator |
| 13 | LV power supply 12 V / 24 V / 48 V (should be placed on the bench) | 27 | AC power mains |
| 14 | additional shielded box | 28 | injection probe |

"

*Annex 10, paragraphs 2 and 3.,* amend to read:

"2. Immunity against transient disturbances conducted along 12/24 V supply lines.

Apply the test pulses 1, 2a, 2b, 3a and 3b according to the International Standard ISO 7637-2**:**2011 to the supply lines as well as to other connections of ESAs which may be operationally connected to supply lines.

Apply the test pulses 4 according to the International Standard ISO 7637-2:2004 to the supply lines as well as to other connections of ESAs which may be operationally connected to supply lines.

ESAs that are exclusively reserved for mounting on electric vehicles (vehicles without 12V/24V starter motor) are not subject to pulse 4.

3. Emission of transient conducted disturbances generated by ESAs on 12/24 V supply lines.

Measurement according to the International Standard ISO 7637-2:2011 on supply lines as well as to other connections of ESAs which may be operationally connected to supply lines."

*Annex 11, paragraph 2.1., Figure 1*, amend to read:

"Figure 1

**Charging mode configuration for Annex 11**

Mode 3 test~~2~~

End of test REESS coupled to the power grid.

N

N

Y

Y

N

N

Y

Y

N

Y

N

Y

Key

Y yes

N no

Mode 3 available**2**?

Mode 2 test with one representative cable provided by the vehicle manufacturer~~1~~

Mode 2 test with one representative cable delivered with the vehicle to the customer ~~1,2~~

Mode 2 test with all ICCPD variants delivered with the vehicle to the customer which do not comply with IEC 61851-21-2~~2~~

Cables delivered with the vehicle?

Mode 2 available**2**?

Mode 1 test with cable provided by the vehicle manufacturer.

Mode 1 available?

Mode 2 or 3 available?

**Annex 11:** test modes to be selected for REESS coupled to the power grid.

1 IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

2 For available charging modes on the vehicle with a maximum current ≤ 16A, the test shall be done either in Mode 2 or Mode 3 according to IEC 61000-3-2;

For available charging modes on the vehicle with a maximum current > 16A and <75A, the test shall be done only once either in Mode 2 or Mode 3 with a charging current > 16A according to IEC 61000-3-12.

ICCPD

compliant with IEC 61851-21-2**1**?

"

*Annex 11, Appendix 1,*

*Figure 1b,* amend to read:

"Figure 1b

Une image contenant texte, capture d’écran, Graphique, noir

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness

4 harmonic analyzer

5 power supply"

*Annex 11, Appendix 1,*

*Figure 1d,* amend to read:

"Figure 1d

Une image contenant noir, obscurité, capture d’écran, fenêtre

Le contenu généré par l’IA peut être incorrect.

Key

1 vehicle under test

2 insulating support

3 charging harness

4 harmonic analyzer

5 power supply"

*Annex 12, paragraph 2.1., Figure 1*

"Figure 1

**Charging mode configuration for Annex 12**

Mode 3 test in one configuration (single or 3-phase) to be selected based on the maximum total nominal charge current~~2~~

End of test REESS coupled to the power grid.

N

N

Y

Y

N

N

Y

Y

N

Y

N

Y

Key

Y yes

N no

Mode 3 available**2**?

Mode 2 test with one representative cable provided by the vehicle manufacturer~~1~~

Mode 2 test with one representative cable delivered with the vehicle to the customer~~1,2~~

Mode 2 test with all ICCPD variants delivered with the vehicle to the customer which do not comply with IEC 61851-21-2~~1~~

Cables delivered with the vehicle?

Mode 2 available**2**?

Mode 1 test with cable provided by the vehicle manufacturer.

Mode 1 available?

Mode 2 or 3 available?

**Annex 12:** test modes to be selected for REESS coupled to the power grid.

1 IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

2 For available charging modes on the vehicle with a maximum current ≤ 16A, the test shall be done either in Mode 2 or Mode 3 according to IEC 61000-3-3;

For available charging modes on the vehicle with a maximum current > 16A and <75A, the test shall be done only once either in Mode 2 or Mode 3 with a charging current > 16A according to IEC 61000-3-11.

ICCPD

compliant with IEC 61851-21-2**1**?

"

*Annex 12, Appendix 1, Figure 1b,* amendto read:

"Figure 1b

Une image contenant capture d’écran, noir, noir et blanc, Rectangle

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness

4 flicker analyzer

5 impedance simulator

6 power supply"

*Annex 12, Appendix 1, Figure 1d,* amendto read:

"Figure 1d

Une image contenant obscurité, noir, fenêtre, capture d’écran

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness

4 flicker analyzer

5 impedance simulator

6 power supply"

*Annex 13, Paragraph 2.1., Figure 1*, amend to read:

"Figure 1

**Charging mode configuration for Annex 13**

1 IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

Mode 3 test in both configurations (single and 3-phase), if available

N

N

N

Y

Y

Y

N

N

Y

Y

N

Y

N

Y

Key

Y yes

N no

Mode 4 test with cable from the test facility

Mode 4 available?

End of test REESS coupled to the power grid

Mode 3 available?

Mode 2 test with one representative cable provided by the vehicle manufacturer.

Mode 2 test with one representative cable delivered with the vehicle to the customer~~1~~

Mode 2 test with all ICCPD variants delivered with the vehicle to the customer which do not comply with IEC 61851-21-2~~1~~

Cables delivered with the vehicle?

Mode 2 available?

Mode 1 test with cable provided by the vehicle manufacturer.

Mode 1 available?

Mode 2 or 3 available?

**Annex 13:** test modes to be selected for REESS coupled to the power grid.

ICCPD

compliant with IEC 61851-21-2**1**?

"

*Annex 13, paragraph 3.5., table 2,* amend to read:

"3.5. …

Table 2

**Scanning receiver parameters**

| *Frequency range MHz* | *Peak detector* | | | *Quasi-peak detector* | | | *Average detector* | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *BW at -6 dB* | *Maximum step size* | *Minimum dwell time* | *BW at -6 dB* | *Maximum step size* | *Minimum dwell time* | *BW at -6 dB* | *Maximum step size* | *Minimum dwell time* |
| 0.15 to 30 | 9  kHz | 5  kHz | 50 ms | 9  kHz | 5  kHz | 1  s | 9  kHz | 5  kHz | 50 ms |

"

*Annex 13, Appendix 1, Figure 1b,* amendto read:

"Figure1b

Une image contenant horloge, capture d’écran, texte, Graphique

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness

4 AMN(s) or DC-charging-AN(s) grounded

5 power mains socket

6 measuring receiver"

*Annex 13, Appendix 1, Figure 1d,* amendto read:

"Figure 1d

Une image contenant capture d’écran, noir, obscurité, noir et blanc

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness

4 AMN(s) or DC-charging-AN(s) grounded

5 power mains socket

6 measuring receiver"

*Annex 15, paragraph 2., Figure 1*, amend to read:

"Figure 1

**Charging mode configuration for Annex 15**

Mode 3 test in only one configuration, 3-phase if available.

N

N

N

Y

Y

Y

N

N

Y

Y

N

Y

N

Y

Key

Y yes

N no

Mode 4 test with cable from the test facility.

Mode 4 available?

End of test REESS coupled to the power grid.

Mode 3 available?

Mode 2 test with one representative cable provided by the vehicle manufacturer.

Mode 2 test with one representative cable delivered with the vehicle to the customer~~1~~

Mode 2 test with all ICCPD variants delivered with the vehicle to the customer which do not comply with IEC 61851-21-2~~1~~

Cables delivered with the vehicle?

Mode 2 available?

Mode 1 test with cable provided by the vehicle manufacturer.

Mode 1 available?

Mode 2 or 3 available?

**Annex 15:** test modes to be selected for REESS coupled to the power grid.

ICCPD

compliant with IEC 61851-21-2**1**?

1 IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

"

*Annex 15, Appendix 1, Figure 1b,* amendto read:

"Figure 1b

Une image contenant capture d’écran, noir, noir et blanc, conception

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness

4 CDN

5 fast Transients / burst generator

6 power supply"

*Annex 15, Appendix 1, Figure 1d,* amendto read:

"Figure 1d

Une image contenant capture d’écran, noir, obscurité, noir et blanc

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness

4 CDN

5 fast Transients / burst generator

6 power supply"

*Annex 16, paragraph 2., Figure 1*, amend to read:

"Figure 1

**Charging mode configuration for Annex 16**

1 IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

Mode 3 test in only one configuration, 3-phase if available

N

N

N

Y

Y

Y

N

N

Y

Y

N

Y

N

Y

Key

Y yes

N no

Mode 4 test with cable from the test facility

Mode 4 available?

End of test REESS coupled to the power grid

Mode 3 available?

Mode 2 test with one representative cable provided by the vehicle manufacturer

Mode 2 test with one representative cable delivered with the vehicle to the customer~~1~~

Mode 2 test with all ICCPD variants delivered with the vehicle to the customer which do not comply with IEC 61851-21-2~~1~~

Cables delivered with the vehicle?

Mode 2 available?

Mode 1 test with cable provided by the vehicle manufacturer

Mode 1 available?

Mode 2 or 3 available?

**Annex 16:** test modes to be selected for REESS coupled to the power grid.

ICCPD

compliant with IEC 61851-21-2**1**?

"

*Annex 16, Appendix 1, Figure 1b,* amendto read:

"Figure 1b

Une image contenant capture d’écran, noir, noir et blanc, conception

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness

4 CDN

5 surge generator

6 power supply"

*Annex 16, Appendix 1, Figure 1d,* amendto read:

"Figure 1d

Une image contenant capture d’écran, noir, obscurité, noir et blanc

Description générée automatiquement

Key

1 vehicle under test

2 insulating support

3 charging harness

4 CDN

5 surge generator

6 power supply"

*Annex 19, paragraph 3.4., table 2,* amend to read:

"3.4. …

Table 2

**Scanning receiver parameters**

| *Frequency range MHz* | *Peak detector* | | | *Quasi-peak detector* | | | *Average detector* | | |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *BW at -6 dB* | *Maximum step size* | *Minimum dwell time* | *BW at -6 dB* | *Maximum step size* | *Minimum dwell time* | *BW at -6 dB* | *Maximum step size* | *Minimum dwell time* |
| 0.15 to 30 | 9  kHz | 5  kHz | 50 ms | 9  kHz | 5  kHz | 1  s | 9  kHz | 5  kHz | 50 ms |

"

*Annex 19, Appendix 1, Figure 1,* amendto read:

"Figure 1

**ESA in configuration "REESS charging mode coupled to the power grid" (floor-standing equipment)**

2

0.8 (+0.2 / -0) m

5

7

Cable shall be z-folded if longer than 1m, 100 ± 25mm above ground and at least 100mm from the ESA body

1

3

6

4

2

Key

1 ESA under test

2 insulating support

3 charging harness

4 AMN(s) or DC-charging-AN(s) grounded

5 power mains socket

6 measuring receiver

7 ground plane"

*Annex 22, paragraph 5.1.1.,* amend to read:

"5.1.1. Test shall be conducted in accordance with IEC 461000-4-5. Test shall be performed only at the severity levels given in 7.16.2.1."

1. \* In accordance with the programme of work of the Inland Transport Committee for 2025 as outlined in proposed programme budget for 2025 (A/79/6 (Sect. 20), table 20.6), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate. [↑](#footnote-ref-2)