

**Economic and Social Council**Distr.: General
3 September 2024

Original: English

Economic Commission for Europe**Inland Transport Committee****World Forum for Harmonization of Vehicle Regulations****194th session**

Geneva, 12–15 November 2024

Item 4.6.1 of the provisional agenda

1958 Agreement:**Consideration of draft amendments to existing****UN Regulations submitted by GRE****Proposal for the 07 series of amendments to UN Regulation
No. 10 (Electromagnetic compatibility)****Submitted by the Working Party on Lighting and Light-Signalling***

The text reproduced below was adopted by the Working Party on Lighting and Light-Signalling (GRE) at its ninetieth session (ECE/TRANS/WP.29/GRE/90, para. 29). It is based on ECE/TRANS/WP.29/GRE/2023/27/Rev.1 as amended by informal documents GRE-90-19, GRE-90-21-Rev.3, GRE-90-36, GRE-90-37 and GRE-90-38. 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 2024 sessions.

* In accordance with the programme of work of the Inland Transport Committee for 2024 as outlined in proposed programme budget for 2024 (A/78/6 (Sect. 20), table 20.5), 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.

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** *Note by the secretariat:* page numbers will be introduced once the consolidated version of the new 07 series of amendments has been prepared.

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Paragraph 1.3., add a note at the end:

"1.3. ...
 (c) ...

Note: The immunity levels stated in this Regulation ensure robustness of vehicle systems in the electromagnetic environment and therefore address one of the external environments to be considered for functional safety (e.g. in ISO 26262)."

Paragraph 2.12., subparagraph (b) (i), for “emergency call systems” read “emergency calling systems”.

Paragraph 2.12., subparagraph (f), for “function” read “functions”.

Paragraph 2.20., amend to read:

"2.20. "Signal/control port" means port intended for the interconnection of components of an ESA, or between an ESA and local AE (Auxiliary Equipment) and used in accordance with relevant functional specifications (for example for the maximum length of cable connected to it). Examples include RS-232, Universal Serial Bus (USB), High-Definition Multimedia Interface (HDMI), IEEE Standard 1394 (“Fire Wire”). For vehicle in charging mode this includes Control Pilot signal, PLC technology used on Control Pilot signal line, CAN."

Insert new paragraphs 2.26. to 2.32., to read:

"2.26. "Automated Driving System (ADS)" means the vehicle hardware and software that are collectively capable of performing the entire Dynamic Driving Task (DDT) on a sustained basis. ⁽¹⁾

NOTE: ADS means the driver, during the driving, is not responsible for Dynamic Driving Task, unless otherwise specified in other UN Regulations.

2.27. "Dynamic Driving Task (DDT)" means the real-time operational and tactical functions required to operate the vehicle. ⁽¹⁾

2.28. "Failure situations" involve those in which the ADS or another vehicle system experiences a fault or failure that removes or reduces the ADS's ability to perform the DDT, such as sensor or computer failure or a failed propulsion system.

2.29. "Residential environment" refers to clause 3.1.14 of IEC 61000-6-3: 2020.

Area of land designated for domestic dwellings where the mains power within these locations is directly connected to the low-voltage (lower than 1000 V a.c. and 1500 V d.c.) public mains network.

Note 1 to entry: Examples of residential locations are: houses, apartments, farm buildings housing people.

Note 2 to entry: A dwelling can be a single building, separate building or a separate section of a larger building.

Note 3 to entry: Within these locations it is expected to operate a radio receiver within a distance of 10 m from the equipment.

Note 4 to entry: Domestic dwellings are places for one or more people to live.

2.30. *“Non-residential environment”* refers to clause 3.1.12 of IEC 61000-6-4: 2018.

Location characterized by a separate power network, supplied from a high- or medium-voltage transformer, dedicated for the supply of the installation.

Note 1 to entry: Industrial locations can generally be described by the existence of an installation with one or more of the following characteristics:

- items of equipment installed and connected together and working simultaneously;
- significant amount of electrical power generated, transmitted and/or consumed;
- frequent switching of heavy inductive or capacitive loads;
- high currents and associated magnetic fields;
- presence of industrial, high power scientific and medical (ISM) equipment (for example, welding machines).

The electromagnetic environment at an industrial location is predominantly produced by the equipment and installation present at the location. There are types of industrial locations where some of the electromagnetic phenomena appear in a more severe degree than in other installations.

Example locations include metalworking, pulp and paper, chemical plants, car production, farm building, high voltage areas of airports.

2.31. *“Acoustic Vehicle Alerting System (AVAS)”* as defined in the latest series of amendments to UN Regulation No. 138.

2.32. *“Accident Emergency Call Systems (AECS)”* as defined in the latest series of amendments to UN Regulation No. 144.

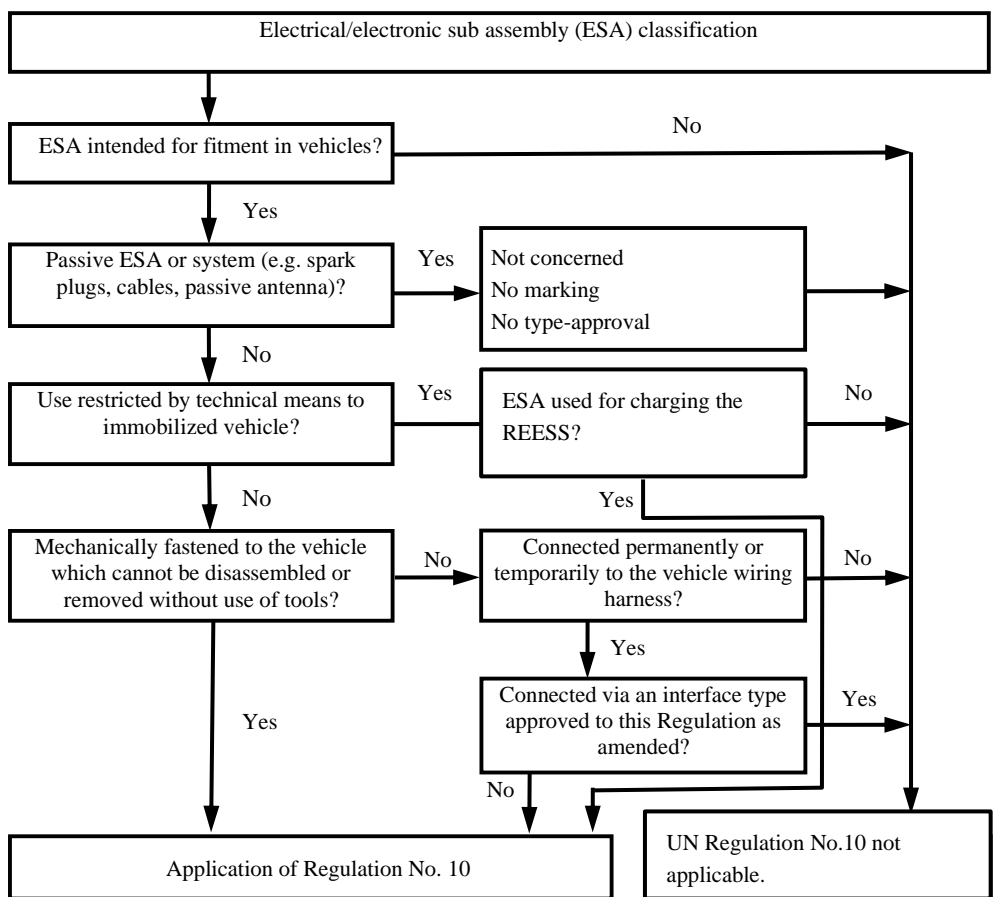
2.33. *“Auxiliary Equipment (AE)”* means equipment needed to exercise or monitor the operation of the test object."

Insert a new footnote (1), to read:

⁽¹⁾ Those definitions are based on the definitions contained in ECE/TRANS/WP.29/2022/58, Annex 1."

Paragraph 3.2.1., amend to read:

"3.2.1. Applicability of this Regulation to ESA:



Paragraph 3.2.8., amend to read:

"3.2.8. ESA which are brought to the market as replacement parts need no type approval if they are obviously marked as a replacement part by an identification number and if they are identical and from the same manufacturer as the corresponding Original Equipment".

Paragraph 5.1., amend to read:

"5.1. An approval number shall be assigned to each vehicle or ESA type approved in accordance with Schedule 4 of the 1958 Agreement (E/ECE/TRANS/505/Rev.3)."

Paragraph 6.1.2., amend to read:

"6.1.2. Before testing, the Technical Service has to prepare a test plan in conjunction with the manufacturer, which contains at least mode of operation, stimulated function(s), monitored function(s), pass/fail criterion(criteria) and intended emissions.

Depending on the intended operating conditions of the propulsion system, the test plan shall define the minimum number of steady state operating conditions of the vehicle, selectable by the driver or by the control system. The test conditions shall consider multiple propulsion system operating strategies which can be activated permanently by the driver or the vehicle control system and shall be based on documentation provided in Annexes 2A and 2B (e.g. risk analysis)."

Paragraph 6.3.2.4., delete.

Paragraph 6.4.2.1., amend to read:

"6.4.2.1. If tests are made using the method described in Annex 6, in accordance with ISO 11451-2, the field strength shall be 30 volts/m rms (root mean squared) in over 90 per cent of the 20 to 2,000 MHz frequency band and a minimum of 25 volts/m rms over the whole 20 to 2,000 MHz frequency band. The field

strength shall be 10 volts/m rms in over 90 per cent of the 2,000 to 6,000 MHz frequency band and a minimum of 8 volts/m rms over the whole 2,000 to 6,000 MHz frequency band.

If tests are made using the method described in Annex 6, in accordance with ISO 11451-4 BCI the current shall be 60 mA rms in over 90 per cent of the 20 to 2,000 MHz frequency band and a minimum of 50 mA rms over the whole 20 to 2,000 MHz frequency band."

Paragraph 6.8.2.1., amend to read:

"6.8.2.1. The immunity to electromagnetic radiation of ESA representative of its type shall be tested by the method(s) as described in Annex 9:

Test severity in over 90 per cent of the 20 to 6,000 MHz frequency band are given in Table 2a.

Test severity for the minimum test Level over the whole 20 to 6,000 MHz frequency band given in Table 2b.

Table 2a

| Frequency range | Test Level in over 90 per cent of the 20 to 6,000 MHz frequency band | | | | |
|--------------------|--|----------------|----------------|--------|-----------------------|
| | Stripline | TEM cell | BCI | ALSE | Reverberation chamber |
| 20 to 2,000 MHz | 60 V/m | 75 V/m | 60 mA | 30 V/m | 21 V/m |
| 2,000 to 6,000 MHz | Not applicable | Not applicable | Not applicable | 10 V/m | 7 V/m |

Table 2b

| Frequency range | Minimum Test Level over the whole 20 to 6,000 MHz frequency band | | | | |
|--------------------|--|----------------|----------------|--------|-----------------------|
| | Stripline | TEM cell | BCI | ALSE | Reverberation chamber |
| 20 to 2,000 MHz | 50 V/m | 62,5 V/m | 50 mA | 25 V/m | 18 V/m |
| 2,000 to 6,000 MHz | Not applicable | Not applicable | Not applicable | 8 V/m | 6 V/m |

Paragraph 6.9.1., amend to read:

"6.9.1. Method of testing

The immunity of ESA representative of this type shall be tested by the method(s) according to ISO 7637-2:2004 for pulse 4 and ISO 7637-2:2011 for pulses 1, 2a, 2b, 3a and 3b, as described in Annex 10, with the test levels given in Tables 3a and 3b. Pulse 4 shall be tested according to the functional status as defined in ISO 7637-2:2004. Functional Performance Status Classification (FPSC) as in ISO 7637-1 shall be applied for pulses 1, 2a, 2b, 3a and 3b.

Immunity of ESA

Table 3a

| Test pulse number | Immunity test level | Functional status for ESA: | |
|-------------------|---------------------|--|---|
| | | Related to immunity related functions | Not related to immunity related functions |
| 4 | III | B (for ESA which shall be operational during engine start phases) C (for other ESA) | D |

Table 3b

| 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 | -450 V | 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 |

Pulse 4 is only applicable to ESAs that could be installed in vehicles with internal combustion engines which are started with a 12V/24V starter motor."

Insert a new paragraph 6.10.8., to read:

"6.10.8. Trolleybuses: AC/DC mains portion of the vehicle propulsion system shall be excluded from this Regulation."

Paragraph 7.1.2., amend to read:

"7.1.2. Before testing the Technical Service has to prepare a test plan in conjunction with the manufacturer, for the configuration "REESS charging mode coupled to the power grid" configuration which contains at least mode of operation, stimulated function(s), monitored function(s), pass/fail criterion (criteria) and intended emissions.

Depending on the available charging modes of the REESS, the test plan shall define the minimum number of test conditions of the vehicle, selectable by the driver or by the control system and shall be based on documentation provided in Annexes 2A and 2B (e.g. risk analysis). Refer to flow charts in Annexes where REESS charge mode is applicable."

Paragraph 7.1.3., amend to read:

"7.1.3. A vehicle in configuration "REESS charging mode coupled to the power grid" should be tested with the charging harness delivered by the manufacturer in line with flowcharts provided in Annexes 4, 6, 11, 12, 13, 15 and 16."

Paragraph 7.1.4., add a new indent at the end:

"7.1.4. ...
Signal port lines, control port lines or wired network port lines should be applied to the vehicle / ESA through an AAN as defined in Appendix 8 clause 5."

Paragraph 7.3.2.1., amend to read:

"7.3.2.1. If measurements are made using the method described in Annex 11, the limits for input current ≤ 16 A per phase are those defined in IEC 61000-3-2-and given in Table 4.

Table 4
Maximum allowed harmonics (input current ≤ 16 A per phase)

| Harmonic number <i>n</i> | Maximum authorized harmonic current A |
|-----------------------------|--|
| Odd harmonics | |
| 3 | 2.3 |
| 5 | 1.14 |
| 7 | 0.77 |
| 9 | 0.40 |
| 11 | 0.33 |
| 13 | 0.21 |

| Harmonic number n | Maximum authorized harmonic current A |
|------------------------|--|
| $15 \leq n \leq 39$ | $0.15 \times 15/n$ |
| Even harmonics | |
| 2 | 1.08 |
| 4 | 0.43 |
| 6 | 0.30 |
| $8 \leq n \leq 40$ | $0.23 \times 8/n$ |

NOTE: For the application of limits given in Table 4, refer to IEC 61000-3-2, paragraph 6.3.3.4."

Paragraph 7.3.2.2., amend to read:

"7.3.2.2. If measurements are made using the method described in Annex 11, the limits for input current > 16 A and ≤ 75 A per phase are those defined in IEC 61000-3-12, and given in given in Table 5, Table 6 and Table 7.

Table 5

Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for single phase or other than balanced three-phase equipment

| Minimum R_{sce} | Acceptable individual harmonic current I_n/I_1 % | | | | | | Maximum current harmonic ratio % | |
|----------------------|---|-------|-------|-------|----------|----------|-------------------------------------|------|
| | I_3 | I_5 | I_7 | I_9 | I_{11} | I_{13} | THD | PWHD |
| 33 | 21.6 | 10.7 | 7.2 | 3.8 | 3.1 | 2 | 23 | 23 |
| 66 | 24 | 13 | 8 | 5 | 4 | 3 | 26 | 26 |
| 120 | 27 | 15 | 10 | 6 | 5 | 4 | 30 | 30 |
| 250 | 35 | 20 | 13 | 9 | 8 | 6 | 40 | 40 |
| ≥ 350 | 41 | 24 | 15 | 12 | 10 | 8 | 47 | 47 |

Relative values of even harmonics lower or equal to 12 shall be lower than $16/n$ %. Even harmonics greater than 12 are taken into account in the Total Harmonic Distortion (THD) and Partial Weighted Harmonic Distortion (PWHD) the same way than odd harmonics.

Linear interpolation between successive values of Short Circuit Ratio of an Equipment (R_{sce}) is authorized.

Table 6

Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment

| Minimum R_{sce} | Acceptable individual harmonic current I_n/I_1 % | | | | Maximum current harmonic ratio % | |
|-------------------|---|-------|----------|----------|-------------------------------------|------|
| | I_5 | I_7 | I_{11} | I_{13} | THD | PWHD |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| 66 | 14 | 9 | 5 | 3 | 16 | 25 |
| 120 | 19 | 12 | 7 | 4 | 22 | 28 |
| 250 | 31 | 20 | 12 | 7 | 37 | 38 |
| ≥ 350 | 40 | 25 | 15 | 10 | 48 | 46 |

Relative values of even harmonics lower or equal to 12 shall be lower than $16/n$ %. Even harmonics greater than 12 are taken into account in the THD and PWHD the same way than odd harmonics.

Linear interpolation between successive values of R_{sce} is authorized.

Table 7

Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment under specific conditions

| Minimum R_{sce} | Acceptable individual harmonic current I_n/I_1 % | | | | Maximum current harmonic ratio % | |
|-------------------|---|-------|----------|----------|-------------------------------------|------|
| | I_5 | I_7 | I_{11} | I_{13} | THD | PWHD |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| ≥ 120 | 40 | 25 | 15 | 10 | 48 | 46 |

Relative values of even harmonics lower or equal to 12 shall be lower than $16/n$ %. Even harmonics greater than 12 are taken into account in the THD and PWHD the same way than odd harmonics."

Paragraphs 7.5.2. to 7.5.2.2., amend to read:

"7.5.2. Vehicle type approval limit for vehicle charged in residential environment

7.5.2.1. If measurements are made using the method described in Annex 13, the limits on AC power lines are those defined in IEC 61000-6-3 and given in Table 8.

Table 8

Maximum allowed radiofrequency conducted disturbances on AC power lines

| Frequency (MHz) | Limits and detector |
|-----------------|---|
| 0.15 to 0.5 | 66 to 56 dB μ V (quasi-peak) 56 to 46 dB μ V (average) (linearly decreasing with logarithm of frequency) |
| 0.5 to 5 | 56 dB μ V (quasi-peak) 46 dB μ V (average) |
| 5 to 30 | 60 dB μ V (quasi-peak) 50 dB μ V (average) |

7.5.2.2. If measurements are made using the method described in Annex 13, the limits on DC power lines are those defined in IEC 61000-6-3 and given in Table 9.

Table 9

Maximum allowed radiofrequency conducted disturbances on DC power lines

| Frequency (MHz) | Limits and detector |
|-----------------|---|
| 0.15 to 0.5 | 79 dB μ V (quasi-peak) 66 dB μ V (average) |
| 0.5 to 30 | 73 dB μ V (quasi-peak) 60 dB μ V (average) |

"

Insert new paragraphs 7.5.3. to 7.5.3.4., to read:

"7.5.3 Vehicle type approval limit for vehicles charged in non-residential environment.

7.5.3.1. For specific vehicles which are charged only with charging stations located in area characterized by a separate power network, supplied from a high or medium voltage transformer, dedicated for the supply of the installation (buses, heavy duty trucks, etc.), limits from IEC 61000-6-4 shall be applied.

7.5.3.2. In this case, the manufacturer shall provide a statement that the vehicle can be used in "REESS charging mode coupled to the power grid" only in area characterized by a separate power network, supplied from a high or medium voltage transformer, dedicated for the supply of the installation. The manufacturer shall provide a statement that the vehicle shall be charged in non-residential environment only. This information shall be made publicly available following the type-approval.

- 7.5.3.3 If measurements are made using the method described in Annex 13, the limits on AC power lines are those defined in IEC 61000-6-4 and given in Table 10.

Table 10

Maximum allowed radiofrequency conducted disturbances on AC power lines

| <i>Frequency (MHz)</i> | <i>Limits and detector</i> |
|------------------------|--|
| 0.15 to 0.5 | 79 dB μ V (quasi-peak) 66 dB μ V (average) |
| 0.5 to 30 | 73 dB μ V (quasi-peak) 60 dB μ V (average) |

- 7.5.3.4. If measurements are made using the method described in Annex 13, the limits on DC power lines are those defined in IEC 61000-6-4 and given in Table 11.

Table 11

Maximum allowed radiofrequency conducted disturbances on DC power lines

| <i>Frequency (MHz)</i> | <i>Limits and detector</i> |
|------------------------|---|
| 0.15 to 0.5 | 89 dB μ V (quasi-peak) 76 dB μ V (average) |
| 0.5 to 30 | 83 dB μ V (quasi-peak) 70 dB μ V (average) |

"

Paragraph 7.6., amend to read:

- "7.6. Specifications concerning emission of radiofrequency conducted disturbances on wired network port from vehicles.

No longer applicable."

Paragraphs 7.6.1. to 7.6.2.1., delete.

Paragraph 7.7.2.1., amend to read:

- "7.7.2.1. If tests are made using the method described in Annex 6, the field strength shall be 30 volts/m rms (root mean squared) in over 90 per cent of the 20 to 2,000 MHz frequency band and a minimum of 25 volts/m rms over the whole 20 to 2,000 MHz frequency band. The field strength shall be 10 volts/m rms in over 90 per cent of the 2,000 to 6,000 MHz frequency band and a minimum of 8 volts/m rms over the whole 2,000 to 6,000 MHz frequency band.

If tests are made using the method described in Annex 6, with ISO 11451-4 BCI method the current shall be 60 mA rms in over 90 per cent of the 20 to 2,000 MHz frequency band and a minimum of 50 mA rms over the whole 20 to 2,000 MHz frequency band."

Paragraph 7.8.2.2., amend to read:

- "7.8.2.2. The vehicle representative of its type shall be considered as complying with immunity requirements if, during the tests performed in accordance with Annex 15, there shall be no degradation of performance of "immunity related functions", according to paragraph 2.1.2. of Annex 15."

Paragraph 7.9.2.1., amend to read:

- "7.9.2.1. If tests are made using the methods described in Annex 16, the immunity test levels shall be:

- (a) For AC power lines: ± 2 kV test voltage in open circuit between line and earth and ± 1 kV between lines with a rise time (T_r) of 1.2 μ s, and a hold time (T_h) of 50 μ s. Each surge shall be applied five times with a maximum delay of 1 minute between each pulse. This shall be applied for the following phases: 0, 90, 180 and 270°,

- (b) For DC power lines: ± 0.5 kV test voltage in open circuit between line and earth and ± 0.5 kV between lines with a rise time (T_r) of $1.2 \mu\text{s}$, and a hold time (T_h) of $50 \mu\text{s}$. Each surge shall be applied five times with a maximum delay of 1 minute."

Paragraph 7.9.2.2., amend to read:

- "7.9.2.2. The vehicle representative of its type shall be considered as complying with immunity requirements if, during the tests performed in accordance with Annex 16, there shall be no degradation of performance of "immunity related functions", according to paragraph 2.1.2. of Annex 16."

Paragraph 7.11.2.1., amend to read:

- "7.11.2.1. If measurements are made using the method described in Annex 17, the limits for input current ≤ 16 A per phase are those defined in IEC 61000-3-2 and given in Table 12.

Table 12

Maximum allowed harmonics (input current ≤ 16 A per phase)

| Harmonic number n | Maximum authorized harmonic current A |
|------------------------|--|
| Odd harmonics | |
| 3 | 2.3 |
| 5 | 1.14 |
| 7 | 0.77 |
| 9 | 0.40 |
| 11 | 0.33 |
| 13 | 0.21 |
| $15 \leq n \leq 39$ | $0.15 \times 15/n$ |
| Even harmonics | |
| 2 | 1.08 |
| 4 | 0.43 |
| 6 | 0.30 |
| $8 \leq n \leq 40$ | $0.23 \times 8/n$ |

NOTE: For the application of limits given in Table 12, refer to IEC 61000-3-2, paragraph 6.3.3.4."

Paragraph 7.11.2.2., amend to read:

- "7.11.2.2. If measurements are made using the method described in Annex 17, the limits for input current > 16 A and ≤ 75 A per phase are those defined in IEC 61000-3-12 and given in Table 13, Table 14 and Table 15.

Table 13

Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for single phase or other than balanced three-phase equipment

| Minimum R_{sce} | Acceptable individual harmonic current I_n/I_1 % | | | | | | Maximum current harmonic ratio % | |
|-------------------|--|-------|-------|-------|----------|----------|----------------------------------|------|
| | I_3 | I_5 | I_7 | I_9 | I_{11} | I_{13} | THD | PWHD |
| 33 | 21.6 | 10.7 | 7.2 | 3.8 | 3.1 | 2 | 23 | 23 |
| 66 | 24 | 13 | 8 | 5 | 4 | 3 | 26 | 26 |
| 120 | 27 | 15 | 10 | 6 | 5 | 4 | 30 | 30 |
| 250 | 35 | 20 | 13 | 9 | 8 | 6 | 40 | 40 |
| ≥ 350 | 41 | 24 | 15 | 12 | 10 | 8 | 47 | 47 |

Relative values of even harmonics lower or equal to 12 shall be lower than $16/n$ %. Even harmonics greater than 12 are taken into account in the THD and PWHD in the same way than odd harmonics.

Linear interpolation between successive values of R_{sce} is authorized.

Table 14

Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment

| Minimum R_{sce} | Acceptable individual harmonic current I_n/I_1 % | | | | Maximum current harmonic ratio % | |
|-------------------|--|-------|----------|----------|----------------------------------|------|
| | I_5 | I_7 | I_{11} | I_{13} | THD | PWHD |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| 66 | 14 | 9 | 5 | 3 | 16 | 25 |
| 120 | 19 | 12 | 7 | 4 | 22 | 28 |
| 250 | 31 | 20 | 12 | 7 | 37 | 38 |
| ≥ 350 | 40 | 25 | 15 | 10 | 48 | 46 |

Relative values of even harmonics lower or equal to 12 shall be lower than $16/n$ %. Even harmonics greater than 12 are taken into account in the THD and PWHD in the same way as odd harmonics.

Linear interpolation between successive values of R_{sce} is authorized.

Table 15

Maximum allowed harmonics (input current > 16 A and ≤ 75 A per phase) for balanced three-phase equipment under specific conditions

| Minimum R_{sce} | Acceptable individual harmonic current I_n/I_1 % | | | | Maximum current harmonic ratio % | |
|-------------------|--|-------|----------|----------|----------------------------------|------|
| | I_5 | I_7 | I_{11} | I_{13} | THD | PWHD |
| 33 | 10.7 | 7.2 | 3.1 | 2 | 13 | 22 |
| ≥ 120 | 40 | 25 | 15 | 10 | 48 | 46 |

Relative values of even harmonics lower or equal to 12 shall be lower than $16/n$ %. Even harmonics greater than 12 are taken into account in the THD and PWHD in the same way as odd harmonics. "

"

Paragraph 7.13.2.1., amend to read:

"7.13.2.1. If measurements are made using the method described in Annex 19, the limits on AC power lines are those defined in IEC 61000-6-3 and given in Table 16.

Table 16

Maximum allowed radiofrequency conducted disturbances on AC power lines

| Frequency (MHz) | Limits and detector |
|-----------------|--|
| 0.15 to 0.5 | 66 to 56 dB μ V (quasi-peak) 56 to 46 dB μ V (average) (linearly decreasing with logarithm of frequency) |
| 0.5 to 5 | 56 dB μ V (quasi-peak) 46 dB μ V (average) |
| 5 to 30 | 60 dB μ V (quasi-peak) 50 dB μ V (average) |

"

Paragraph 7.13.2.2., amend to read:

"7.13.2.2. If measurements are made using the method described in Annex 19, the limits on DC power lines are those defined in IEC 61000-6-3 and given in Table 17.

Table 17

Maximum allowed radiofrequency conducted disturbances on DC power lines

| Frequency (MHz) | Limits and detector |
|-----------------|---|
| 0.15 to 0.5 | 79 dB μ V (quasi-peak) 66 dB μ V (average) |
| 0.5 to 30 | 73 dB μ V (quasi-peak) 60 dB μ V (average) |

"

Paragraph 7.14., amend to read:

"7.14. Specifications concerning emission of radiofrequency conducted disturbances wired network port from ESA

No longer applicable."

Paragraphs 7.14.1. to 7.14.2.1., delete.

Paragraph 7.15.2.2., amend to read:

"7.15.2.2. The ESA representative of its type shall be considered as complying with immunity requirements if, during the tests performed in accordance with Annex 21, there shall be no degradation of performance of the charging function as defined in paragraph 2.1. of Annex 21."

Paragraph 7.16.2.1., amend to read:

"7.16.2.1. If tests are made using the methods described in Annex 22, the immunity test levels shall be:

- (a) For AC power lines: ± 2 kV test voltage in open circuit between line and earth and ± 1 kV between lines with a rise time (T_r) of 1.2 μ s, and a hold time (T_h) of 50 μ s. Each surge shall be applied five times with a maximum delay of 1 minute between each pulse. This shall be applied for the following phases: 0, 90, 180 and 270°,
- (b) For DC power lines: ± 0.5 kV test voltage in open circuit between line and earth and ± 0.5 kV between lines with a rise time (T_r) of 1.2 μ s, and a hold time (T_h) of 50 μ s. Each surge shall be applied five times with a maximum delay of 1 minute."

Paragraph 7.16.2.2., amend to read:

"7.16.2.2. The ESA representative of its type shall be considered as complying with immunity requirements if, during the tests performed in accordance with Annex 22, there shall be no degradation of performance of the charging function as defined in paragraph 2.1. of Annex 22."

Paragraph 7.17.1., amend to read:

"7.17.1. Method of testing

The emission of ESA representative of its type shall be tested by the method(s) according to ISO 7637-2, as described in Annex 10 for the levels given in Table 18.

Table 18

Maximum allowed pulse amplitude

| <i>Polarity of pulse amplitude</i> | <i>Maximum allowed pulse amplitude for</i> | |
|------------------------------------|--|-----------------------------------|
| | <i>Vehicles with 12 V systems</i> | <i>Vehicles with 24 V systems</i> |
| Positive | +75 V | +150 V |
| Negative | -100 V | -450 V |

"

Paragraph 7.18.2.1., amend to read:

"7.18.2.1. The immunity to electromagnetic radiation of ESA representative of its type shall be tested by the method(s) as described in Annex 9:

- for the levels in over 90 per cent of the 20 to 6,000 MHz frequency band given in Table 19a.
- for the minimum test Level over the whole 20 to 6,000 MHz frequency band given in Table 19b.

Table 19a

| | <i>Test Level in over 90 per cent of the 20 to 6,000 MHz frequency band</i> | | | | |
|------------------------|---|-----------------|----------------|-------------|------------------------------|
| <i>Frequency range</i> | <i>Stripline</i> | <i>TEM cell</i> | <i>BCI</i> | <i>ALSE</i> | <i>Reverberation chamber</i> |
| 20 to 2,000 MHz | 60 V/m | 75 V/m | 60 mA | 30 V/m | 21 V/m |
| 2,000 to 6,000 MHz | Not applicable | Not applicable | Not applicable | 10 V/m | 7 V/m |

Table 19b

| | <i>Minimum Test Level over the whole 20 to 6,000 MHz frequency band</i> | | | | |
|------------------------|---|-----------------|----------------|-------------|------------------------------|
| <i>Frequency range</i> | <i>Stripline</i> | <i>TEM cell</i> | <i>BCI</i> | <i>ALSE</i> | <i>Reverberation chamber</i> |
| 20 to 2,000 MHz | 50 V/m | 62,5 V/m | 50 mA | 25 V/m | 18 V/m |
| 2,000 to 6,000 MHz | Not applicable | Not applicable | Not applicable | 8 V/m | 6 V/m |

Paragraph 7.18.2.2., amend to read:

"7.18.2.2. The ESA representative of its type shall be considered as complying with immunity requirements if, during the tests performed in accordance with Annex 9, there shall be no degradation of performance of the charging function as defined in paragraph 2.3. of Annex 9."

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, as described in Annex 10 with the test levels given in Table 20.

Table 20

Immunity of ESA

| <i>Test pulse number</i> | <i>Immunity test level</i> | | <i>Test duration / Number of pulses</i> | <i>FPSC for systems:</i> | |
|--------------------------|----------------------------|-------------------|---|--|--|
| | <i>12V system</i> | <i>24V system</i> | | <i>Related to immunity related functions</i> | <i>Not related to immunity related functions</i> |
| 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 |

Paragraphs 7.20.1. to 7.20.3., delete.

Paragraphs 7.20.4. and 7.20.5., renumber as 7.20.1. and 7.20.2., respectively.

Paragraph 9., amend to read:

"9. Conformity of production

The conformity of production procedures shall comply with those set out in Schedule 1 of the 1958 Agreement (E/ECE/TRANS/505/Rev.3), with the following requirements: ..."

Insert new paragraphs 13.3. to 13.3.7., to read:

"13.3. Transitional provisions applicable to the 07 series of amendments

13.3.1. As from the official date of entry into force of the 07 series of amendments, no Contracting Party applying this Regulation shall refuse to grant or refuse to accept type approvals under this Regulation as amended by the 07 series of amendments.

- 13.3.2. As from 1 September 2029, Contracting Parties applying this Regulation shall not be obliged to accept type approvals to any of the preceding series of amendments, first issued after 1 September 2029.
- 13.3.3. Contracting Parties applying this Regulation shall continue to accept type approvals issued according to the 06 series of amendments to this Regulation first issued before 1 September 2029.
- 13.3.4. Notwithstanding paragraph 13.3.3., Contracting Parties applying this Regulation shall continue to accept type approvals issued according to the 06 series of amendments to this Regulation, for vehicles, vehicle systems, equipment and parts which are not affected by the changes introduced by the 07 series of amendments.
- 13.3.5. Notwithstanding the transitional provisions above, Contracting Parties who start to apply this Regulation after the date of entry into force of the most recent series of amendments are not obliged to accept type approvals which were granted in accordance with any of the preceding series of amendments to this Regulation.
- 13.3.6. Contracting Parties applying this Regulation may grant type approvals according to any of the preceding series of amendments to this Regulation.
- 13.3.7. Contracting Parties applying this Regulation shall continue to grant extensions of existing approvals to any of the preceding series of amendments to this Regulation."

Appendix 1, amend to read:

"Appendix 1

List of standards referred to in this Regulation

1. CISPR 12 "Vehicles', motorboats' and spark-ignited engine-driven devices' radio disturbance characteristics - Limits and methods of measurement", fifth edition 2001 and AMD1:2005.
2. CISPR 16-1-4 "Specifications for radio disturbance and immunity measuring apparatus and methods - Part 1: Radio disturbance and immunity measuring apparatus apparatus - Antennas and test sites for radiated disturbances measurements", fourth edition 2019, AMD1:2020 and AMD2:2023.
3. CISPR 25 "Limits and methods of measurement of radio disturbance characteristics for the protection of receivers used on board vehicles", second edition 2002 and corrigendum 2004.
4. ISO 7637-1 "Road vehicles - Electrical disturbance from conduction and coupling - Part 1: Definitions and general configurations", third edition 2015.

ISO 7637-2 "Road vehicles - Electrical disturbance from conduction and coupling - Part 2: Electrical transient conduction along supply lines only on vehicles with nominal 12 V or 24 V supply voltage", 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 - Electrical disturbances by narrowband radiated electromagnetic energy - Vehicle test methods":
Part 1: General and definitions (ISO 11451-1, fourth edition 2015);
Part 2: Off-vehicle radiation source (ISO 11451-2, fourth edition 2015);
Part 4: Bulk current injection (BCI) (ISO 11451-4, fourth edition 2022).

7. ISO 11452 "Road vehicles - Electrical disturbances by narrowband radiated electromagnetic energy - Component test methods":
 - Part 1: General and definitions (ISO 11452-1, fourth edition 2015);
 - Part 2: Absorber-lined chamber (ISO 11452-2, third edition 2019);
 - Part 3: Transverse electromagnetic mode (TEM) cell (ISO 11452-3, third edition 2016);
 - Part 4: Bulk current injection (BCI) (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).
8. ITU Radio Regulations, edition 2020.
9. IEC 61000-3-2 "Electromagnetic Compatibility (EMC) - Part 3-2 - 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 systems for equipment with rated current ≤ 16 A per phase and not subjected 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 systems - Equipment with rated current ≤ 75 A per phase and subjected to conditional connection", edition 2.0 - 2017.
12. IEC 61000-3-12 "Electromagnetic Compatibility (EMC) - Part 3-12 - Limits for harmonic current emissions produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase", edition 2.1 – 2011 and AMD1:2021.
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 residential, commercial and light-industrial 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 disturbances and immunity measuring apparatus and methods - Part 2-1 - Methods of measurement of disturbances and immunity - Conducted disturbances measurement", 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 - Ancillary equipment - Conducted disturbances", 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.

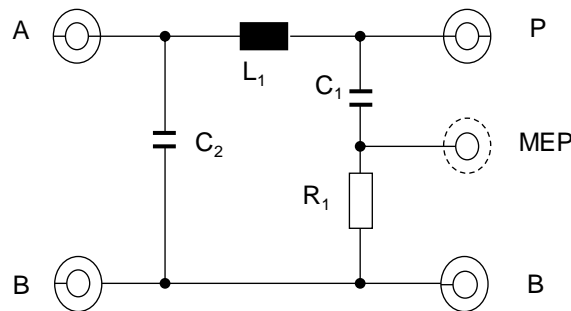
- 21. CISPR 32 "Electromagnetic compatibility of multimedia equipment – Emission requirements", edition 2.1 – 2015 and AMD1:2019.
- 22. CISPR 16-1-1 "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus ", edition 4.0 2015-09."

Appendix 8,

Paragraph 1., figure 1, amend to read:

"Figure 1

Example of 5 μH AN schematic



Legend

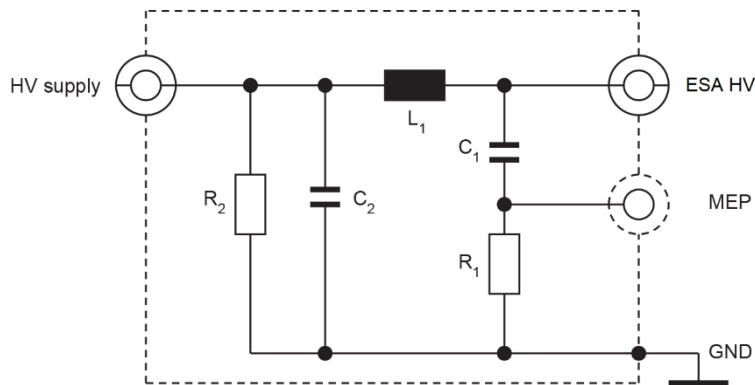
- | | |
|------------------------------|-------------------------|
| L_1 : 5 μH | A: Port to power supply |
| C_1 : 0,1 μF | P: Port to ESA |
| C_2 : 1 μF (default value) | B: Ground |
| R_1 : 1 kΩ | MEP: Measuring Port" |

“

Paragraph 2., figures 3, 4 and 5, amend to read:

"Figure 3

Example of 5 μH / HV-AN schematic



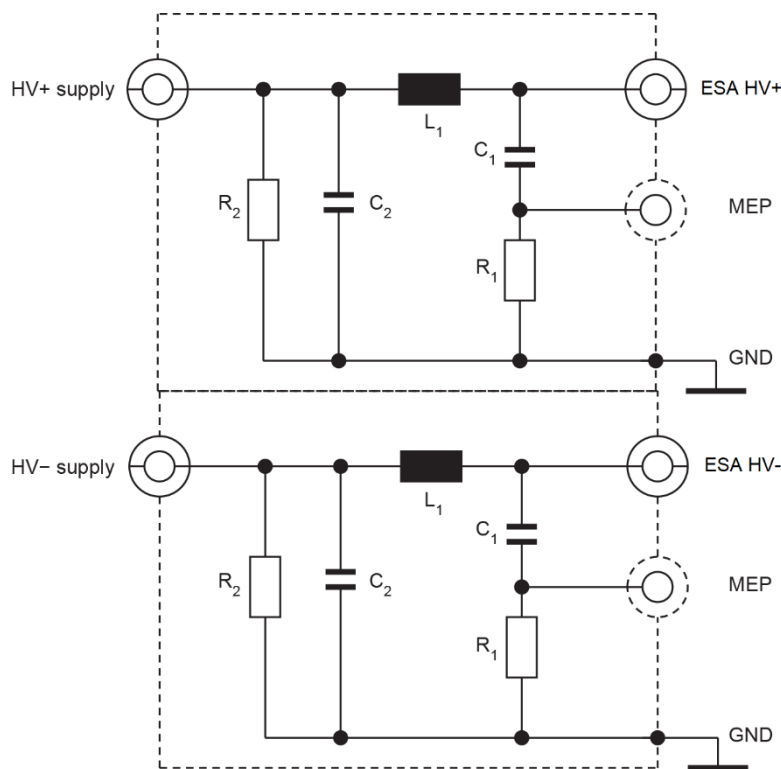
Legend

- | | |
|---|--------------------------------------|
| L_1 : 5 μH | HV supply: High Voltage power supply |
| C_1 : 0,1 μF | ESA HV: High Voltage of ESA |
| C_2 : 0,1 μF (default value) | MEP: Measuring Port |
| R_1 : 1 kΩ | GND: Ground |
| R_2 : 1 MΩ (discharging C_2 to $> 50 V_{dc}$ 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

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



Legend

L_1 : 5 μH

C_1 : 0,1 μF

C_2 : 0,1 μF (default value)

R_1 : 1 $\text{k}\Omega$

R_2 : 1 $\text{M}\Omega$ (discharging C_2 to $> 50 \text{ V}_{\text{dc}}$ within 60 s)

HV supply: High Voltage power supply (positive and negative)

ESA HV: High Voltage of ESA (positive and negative)

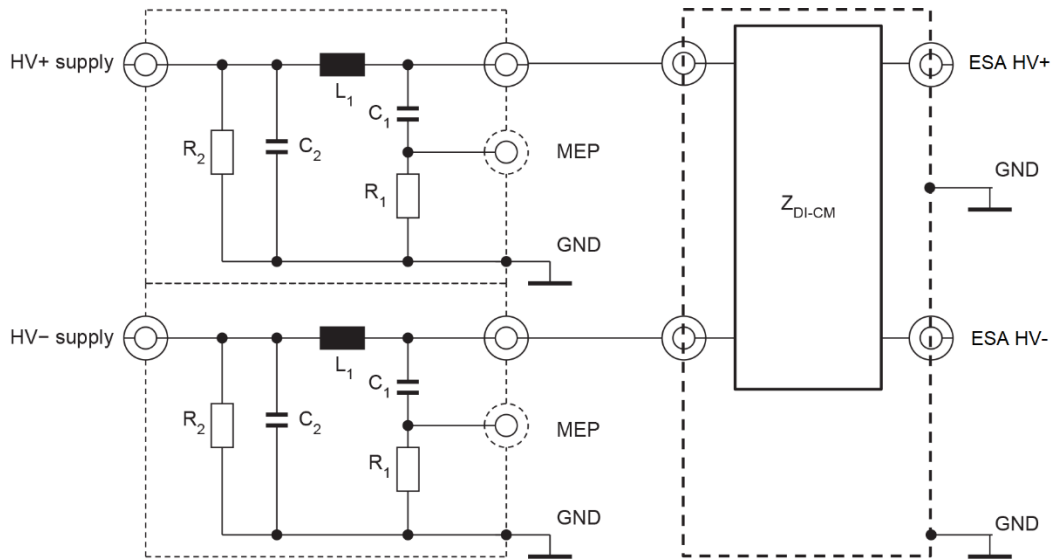
MEP: Measuring Port

GND: Ground

An optional impedance matching network may be used to simulate common mode / differential mode impedance seen by the ESA plugged on HV power supply (see Figure 5)."

"Figure 5

Impedance matching network attached between HV ANs and ESA



Legend

- L_1 : 5 μ H
- C_1 : 0,1 μ F
- C_2 : 0,1 μ F (default value)
- R_1 : 1 k Ω
- R_2 : 1 M Ω (discharging C_2 to > 50 V_{dc} within 60 s)
- HV supply: High Voltage power supply (positive and negative)
- ESA HV: High Voltage of ESA (positive and negative)
- MEP: Measuring Port
- GND: Ground
- Z_{DI-CM} : Differential and common-mode impedance"

Paragraph 3., amend to read:

"3. Direct Current charging Artificial Networks (DC-charging-AN)

For a vehicle/ESA in charging mode connected to a DC power supply, a 5 μ H / 50 Ω DC-charging-AN as defined in Figure 6 shall be used.

Measurement ports of DC-charging-AN(s) shall be terminated with 50 Ω loads.

The DC-charging-AN impedance Z_{PB} (tolerance ± 20 %) in the measurement frequency range of 0,1 MHz to 100 MHz is shown in Figure 7. It is measured between the terminals "Vehicle/ESA HV" and "GND" (of Figure 6) with a 50 Ω load on the measurement port and with terminals "HV Supply" and "GND" (of Figure 6) short circuited.

..."

Paragraph 4., amend to read:

"4. Artificial Mains networks (AMN)

For a vehicle/ESA in charging mode connected to an AC power mains, a 50 μ H / 50 Ω -AMN as defined in CISPR 16-1-2 clause 4.4 shall be used.

Measurement ports of AMN(s) shall be terminated with 50 Ω loads. "

Paragraph 5., amend to read:

"5. Asymmetric artificial network (AAN)

Currently, different technologies for signal/control port lines and/or wired network port lines are used for the communication between charging station and vehicle/ESA. Therefore, a distinction between some specific signal/control port lines and/or wired network port lines (for example, control pilot line, CAN lines) is necessary.

Measurement ports of AAN(s) shall be terminated with 50 Ω loads.

AANs that are defined in 5.1., 5.2., 5.3. and 5.4. are used for unshielded signal/control port lines and/or wired network port lines.

If shielded signal/control port lines are used, then shielded AANs defined in CISPR 32:2015 Annex G, Figures G.10 and G.11 should be used."

Paragraph 5.1., amend to read:

"5.1. Signal/Control port with symmetric lines

An asymmetric artificial network (AAN) to be connected between the vehicle and the charging station or any auxiliary equipment (AE) used to simulate communication is defined in CISPR 16-1-2 Annex E clause E.2 (T network circuit) (see example in Figure 8).

..."

Paragraph 5.2., amend to read:

"5.2. Wired network port with PLC on power lines

If an original charging station can be used for the test, an AAN and/or AMN/DC-charging-AN might not be required for PLC communication.

If the presence of the AMN/DC-charging-AN prevents proper PLC communication with the original charging station or if the PLC communication needs to be simulated by means of a piece of auxiliary equipment (e.g. a PLC modem) instead of the original charging station, it is necessary to add an AAN between the AE (e.g. the PLC modem) and the AMN/DC-charging-AN output (vehicle side), as shown in Figure 9.

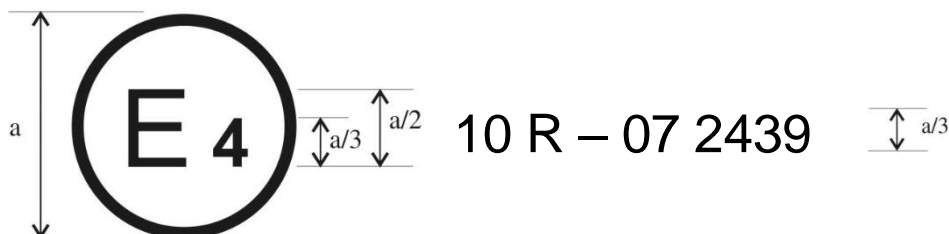
..."

Annex 1, amend to read:

"Examples of approval marks

Model A

(See paragraph 5.2. of this Regulation)

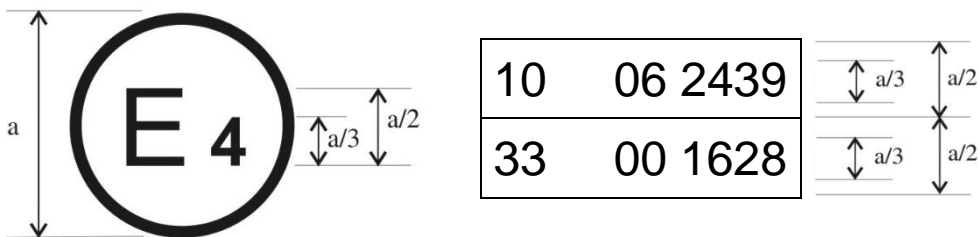


$a = 6 \text{ mm min}$

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 Regulation No. 10 under approval No. 07 2439. The approval number indicates that the approval was granted according to the requirements of Regulation No. 10 as amended by the 07 series of amendments.

Model B

(See paragraph 5.2. of this Regulation)



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 Regulations Nos. 10 and 33.¹ The approval numbers indicate that, at the date when the respective approvals were given, Regulation No. 10 included the 06 series of amendments and Regulation No. 33 was still in its original form."

Annex 2A,

Item 10, renumber and amend to read:

"10a. List propulsion systems, auxiliary engines and components of the charging system:

Insert a new item 10b, to read:

"10b. List modes of operations (selectable by the driver or the system) which are selected during the type approval test:..... "

Item 64, amend to read:

"64. Vehicle equipped with 24 GHz short-range radar equipment: yes/no/optional.¹"

Item 66, amend to read:

"66. List every available charging mode (direct current / alternating current, number of phases/frequency):¹

Item 67, amend to read:

"67. Maximum charging current in each mode:

Item 68, amend to read:

"68. Nominal charging voltage in each mode:..... "

Add a new item 73, to read:

"73. Environment of charging (residential, non-residential)"

After the new item 73, add new subparagraphs to read:

"The applicant for type approval shall also supply, where appropriate:

Appendix 1 A list with make(s) and type(s) of all electrical and/or electronic components concerned by this Regulation (see paragraphs 2.9. and 2.10. of this Regulation) and not previously listed.

Appendix 2: Schematics or drawing of the general arrangement of electrical and/or electronic components (concerned by this Regulation) and the general wiring harness arrangement.

Appendix 3: Description of vehicle chosen to represent the type:

Body style:

Left or right hand drive:

Wheelbase:

¹ The second number is given merely as an example.

Appendix4: Relevant test report(s) supplied by the manufacturer from a test laboratory accredited to ISO 17025 and recognized by the Type-Approval Authority for the purpose of drawing up the type approval certificate."

Annex 3A, amend to read:

"Annex 3A

Communication

(Maximum format: A4 (210 x 297 mm))



issued by: _____
 Name of administration: _____

- Concerning:³
- Approval granted
 - Approval extended
 - Approval refused
 - Approval withdrawn
 - Production definitively discontinued

of a type of vehicle/component/separate technical unit² with regard to Regulation No. 10.

Approval No.: Extension No.:

1. Make (trade name of manufacturer):.....
2. Type:
3. Means of identification of type, if marked on the vehicle/component/separate technical unit².....
- 3.1. Location of that marking:.....
4. Category of vehicle:
5. Name and address of manufacturer:.....
6. In the case of components and separate technical units, location and method of affixing of the approval mark:.....
7. Address(es) of assembly plant(s):
8. Additional information (where applicable): See appendix below
9. Technical Service responsible for carrying out the tests:
-
10. Date of test report:
11. Number of test report:
12. Remarks (if any): See appendix below
13. Place:.....

² Distinguishing number of the country which has granted/extended/refused or withdrawn approval (see Regulation, provisions on approval).

³ Strike out what does not apply.

- 14. Date:.....
- 15. Signature:.....
- 16. The index to the information package lodged with the Approval Authority, which may be obtained on request is attached:.....
- 17. Reasons for extension:

**Appendix to type approval communication form No.....
concerning the type approval of a vehicle under UN Regulation No. 10**

- 1. Additional information:.....
- 2. Electrical system rated voltage: V. pos/neg ground²
- 3. Environment of charging for REESS of EV and PHEV:
Type of vehicle valid for residential environment:
Type of vehicle valid for non-residential environment:
- 4. Type of bodywork:.....
- 5. List of electronic systems installed in the tested vehicle(s) not limited to the items in the information document:
- 5.1. Vehicle equipped with 24 GHz short-range radar equipment: yes/no/optional²
- 6. Laboratory accredited to ISO 17025 and recognized by the Approval Authority responsible for carrying out the tests:
- 7. Remarks: (e.g. valid for both left-hand drive and right-hand drive vehicles):"

Annex 4,

Paragraph 2., amend to read:

- "2. Vehicle state during tests
For two-wheeled vehicles, a non-conductive insulating support with a thickness of 5 – 20 mm shall be used between stand and ground plane."

Paragraph 2.1.1., amend to read:

- "2.1.1. Engine
The engine shall be in operation according to CISPR 12.
For vehicle with an electric propulsion motor or hybrid propulsion system, if this is not appropriate (e.g. in case of busses, trucks, two- and three wheel vehicles), transmission shafts, belts or chains may be disconnected to achieve the same operation condition for the propulsion.
If operating mode defined in CISPR 12 (i.e. 40 km/h) does not activate all traction motors or auxiliary battery charging engines, an alternative, steady state operating mode shall be agreed between the Technical Service and vehicle manufacturer."

Paragraph 2.2., amend to read:

- "2.2. Vehicle in configuration "REESS charging mode coupled to the power grid".
The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of Figure 1.

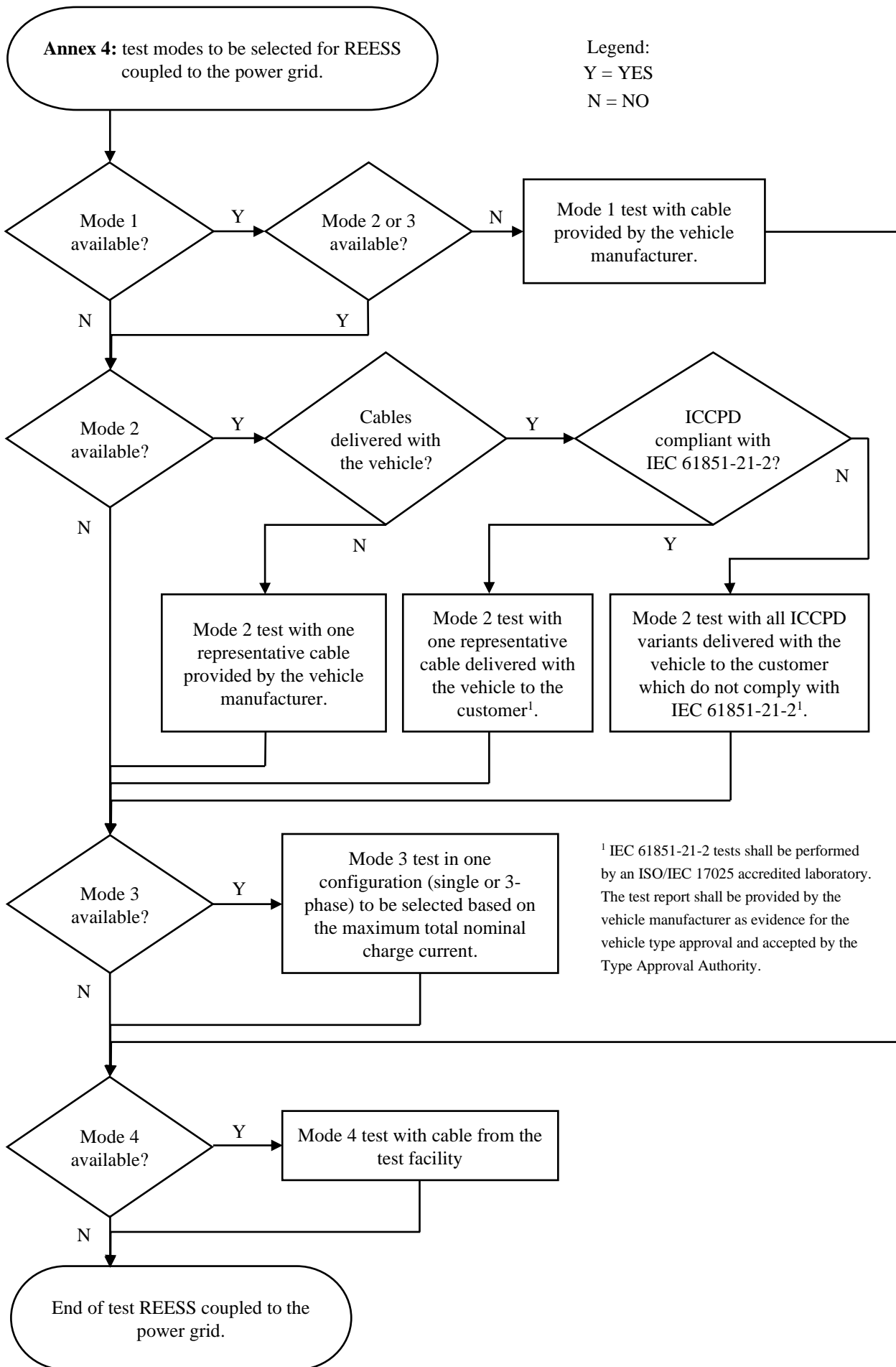


Figure 1
Charging mode configuration for Annex 4

The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole frequency range measurement (this may lead to splitting the measurement into different sub-bands with the need to discharge the vehicle's traction battery before starting the next sub-bands).

If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its maximum rated charging/input current value for AC charging.

If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal value or to a minimum of 16 A (if the 20 per cent of its nominal value cannot be achieved in the test facility) for DC charging unless another value is agreed with the type approval authorities.

In case of multiple batteries, the average state of charge must be considered.

The vehicle shall be immobilized, the engine(s) (ICE and / or electrical engine) shall be OFF and in charging mode. All other equipment which can be switched ON by the driver or passengers shall be OFF.

The test set-up for the connection of the vehicle in configuration "REESS charging mode coupled to the power grid" is shown in Figures 3a to 3h (depending of AC or DC power charging mode, location of charging plug and charging with or without communication) of Appendix 1 to this Annex."

Paragraph 2.3.3., amend to read:

"2.3.3. Power charging harness

The power charging harness shall be placed in a straight line between the AMN(s) and the vehicle charging plug and shall be routed perpendicularly to the vehicle longitudinal axis (see Figure 3a and Figure 3c). The projected harness length from the side of the AMN(s) to the side of the vehicle shall be 0,8 (+0,2 / -0) m as shown in Figure 3b and Figure 3d.

For a longer cable, the extraneous length shall be "Z-folded" symmetrically. No contact or overlap is allowed between windings. The width of the Z-folded cable shall be between 500 mm and 1 000 mm. If it is impractical to do so because of cable bulk or stiffness, or because the testing is being done at a user's installation, the disposition of the excess cable length shall be precisely noted in the test report.

The charging harness at the vehicle side shall hang vertically at a distance of 100 (+200 / -0) mm from the vehicle body.

The whole harness shall be placed on a non-conductive, low relative permittivity (dielectric-constant) material ($\epsilon_r \leq 1,4$), at (100 ± 25) mm above the ground plane (ALSE) or floor (OTS)."

Paragraphs 2.4.3. and 2.4.4., amend to read:

"2.4.3. Asymmetric artificial network

Local/private communication lines connected to signal/control ports and lines connected to wired network ports shall be applied to the vehicle through AAN(s).

The various AAN(s) to be used are defined in Appendix 8, clause 5:

- Clause 5.1 for signal/control port with symmetric lines;
- Clause 5.2 for wired network port with PLC on power lines;
- Clause 5.3 for signal/control port with PLC (technology) on control pilot; and

- Clause 5.4 for signal/control port with control pilot.

The AAN(s) shall be mounted directly on the ground plane. The case of the AAN(s) shall be bonded to the ground plane (ALSE) or connected to the protective earth (OTS, e.g. an earth rod).

The measuring port of each AAN shall be terminated with a 50 Ω load.

If a charging station is used, AAN(s) are not required for the signal/control ports and/or for the wired network ports. The local/private communication lines between the vehicle and the charging station shall be connected to the auxiliary equipment on the charging station side to work as designed. If communication is emulated and if the presence of the AAN prevents proper communication then no AAN should be used

2.4.4. Power charging / local/private communication harness

The power charging local/private communication harness shall be laid out in a straight line between the AMN(s) / DC-charging-AN(s) / AAN(s) and the vehicle charging socket and shall be routed perpendicularly to the vehicle's longitudinal axis (see Figure 3e and Figure 3g). The projected harness length from the side of the AMN(s) to the side of the vehicle shall be 0,8 (+0,2 / -0) m as shown in Figure 3f and Figure 3h.

For a longer cable, the extraneous length shall be "Z-folded" symmetrically. No contact or overlap is allowed between windings. The width of the Z-folded cable shall be between 500 mm and 1 000 mm. If it is impractical to do so because of cable bulk or stiffness, or because the testing is being done at a user's installation, the disposition of the excess cable length shall be precisely noted in the test report.

The power charging local/private communication harness at vehicle side shall hang vertically at a distance of 100 (+200 / -0) mm from the vehicle body.

The whole harness shall be placed on a non-conductive, low relative permittivity (dielectric-constant) material ($\epsilon_r \leq 1,4$), at (100 \pm 25) mm above the ground plane (ALSE) or floor (OTS)."

Paragraphs 4.3. and 4.4., amend to read:

- "4.3. The measurements shall be performed with a spectrum analyser or a scanning receiver. The parameters to be used are defined in Table 1 and Table 2.

Spectrum analysers and FFT-based instruments, that meet the requirements of CISPR 16-1-1, may be used for conformity measurements. FFT-based measuring instruments shall continuously record and evaluate the signal during the measurement time. If using FFT-based instruments, the minimum measurement time shall be 1 s per analysis frequency band (in real-time mode) of the FFT instrument.

Table 1
Spectrum analyser parameters

| Frequency range MHz | Peak detector | | Quasi-peak detector | | Average detector | |
|---------------------|---------------|-------------------|---------------------|-------------------|------------------|-------------------|
| | RBW at -3 dB | Minimum scan time | RBW at -6 dB | Minimum scan time | RBW at -3 dB | Minimum scan time |
| 30 to 1,000 | 100/120 kHz | 100 ms/MHz | 120 kHz | 20 s/MHz | 100/120 kHz | 100 ms/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 | | | Average detector | | |
|---------------------|---------------|------------------------|--------------------|---------------------|------------------------|--------------------|------------------|------------------------|--------------------|
| | BW at -6 dB | Step size ^a | Minimum dwell time | BW at -6 dB | Step size ^a | Minimum Dwell time | BW at -6 dB | Step size ^a | Minimum dwell time |
| 30 to 1,000 | 120 kHz | 50 kHz | 5 ms | 120 kHz | 50 kHz | 1 s | 120 kHz | 50 kHz | 5 ms |

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

4.4. Measurements

The Technical Service shall perform the test at the intervals specified in the CISPR 12 standard throughout the frequency range 30 to 1,000 MHz.

Alternatively, if the manufacturer provides measurement data for the whole frequency band from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type Approval Authority, the Technical Service may divide the frequency range in 14 frequency bands 30–34, 34–45, 45–60, 60–80, 80–100, 100–130, 130–170, 170–225, 225–300, 300–400, 400–525, 525–700, 700–850 and 850–1,000 MHz and perform tests at the 14 frequencies giving the highest emission levels within each band to confirm that the vehicle meets the requirements of this Annex.

For configuration "REESS charging mode coupled to the power grid", if the manufacturer provides measurement data for the whole frequency band from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type-Approval Authority for all the available charging modes configurations defined in 2.2, the Technical Service may perform tests only for one of the available charging mode configuration defined in 2.2 and divide the frequency range in 14 frequency bands 30–34, 34–45, 45–60, 60–80, 80–100, 100–130, 130–170, 170–225, 225–300, 300–400, 400–525, 525–700, 700–850 and 850–1,000 MHz and perform tests at the 14 frequencies giving the highest emission levels within each band to confirm that the vehicle meets the requirements of this Annex.

In the event that the limit is exceeded during the test, investigations shall be made to ensure that this is due to the vehicle and not to background radiation."

Paragraph 4.6., amend to read:

"4.6. Antenna position

Measurements shall be made on the left and right sides of the vehicle.

The horizontal distance is from the reference point of the antenna to the nearest part of the vehicle body.

Multiple antenna positions may be required (both for 10 m and 3 m antenna distance) depending on the vehicle length. The same positions shall be used for both horizontal and vertical polarization measurements. The number of antenna positions and the position of the antenna with respect to the vehicle shall be documented in the test report.

- If the length of the vehicle is smaller than the 3 dB beamwidth of the antenna, only one antenna position is necessary. The antenna shall be aligned with the middle of the total vehicle (see Figure 4);

- If the length of the vehicle is greater than the 3 dB beamwidth of the antenna, multiple antenna positions are necessary in order to cover the total length of the vehicle (see Figure 5). The number of antenna positions shall allow to meet the following condition:

$$N \cdot 2 \cdot D \cdot \tan(\beta) \geq L \quad (1)$$

With:

N: Number of antenna positions;

D: Measurement distance (3 m or 10 m);

$2 \cdot \beta$: 3 dB antenna beamwidth angle in the plane parallel to ground (i.e. the E-plane beamwidth angle when the antenna is used in horizontal polarization, and the H-plane beamwidth angle when the antenna is used in vertical polarization);

L: Total vehicle length covers the whole dimensions including tires, bumpers and lights, etc.

Depending of the chosen values of N (number of antenna positions) different set-up shall be used:

if $N=1$ (only one antenna position is necessary) and the antenna shall be aligned with the middle of the total vehicle length (see Figure 4).

if $N>1$ (more than one antenna position is necessary) and multiple antenna positions are necessary in order to cover the total length of the vehicle (see Figure 5). The antenna positions shall be symmetric in regard to the vehicle perpendicular axis."

Annex 4, Appendix 1, amend to read:

"Annex 4 – Appendix 1

...

Figure 2

Position of antenna in relation to the vehicle

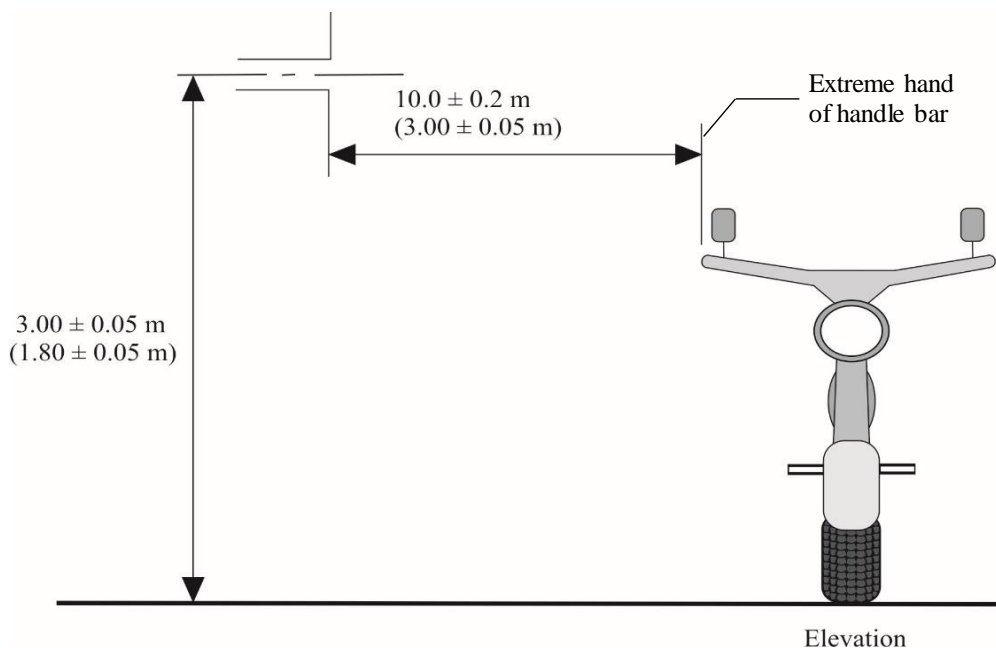


Figure 3

Vehicle in configuration "REESS charging mode" coupled to the power grid:

Example of test setup for vehicle with socket located on vehicle side (charging mode 1 or 2, AC powered, without communication, all dimensions in mm).

Figure 3a

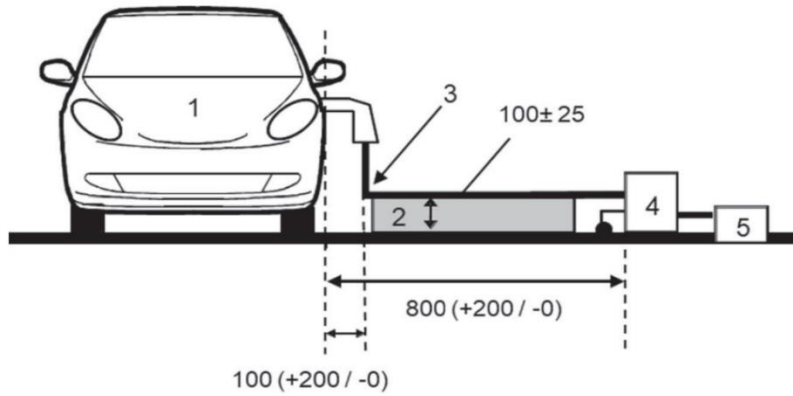
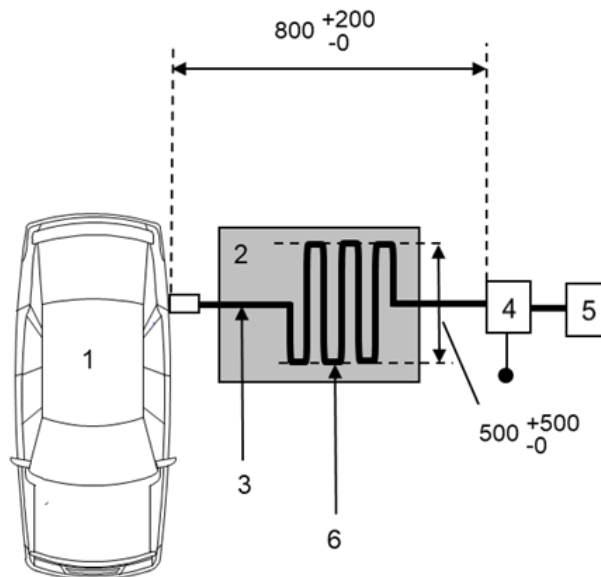


Figure 3b



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 (see 7.3.2.2)
- 6 extraneous length Z-folded

NOTE: The cable between the AC mains and the AMN need not be aligned in 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 3c

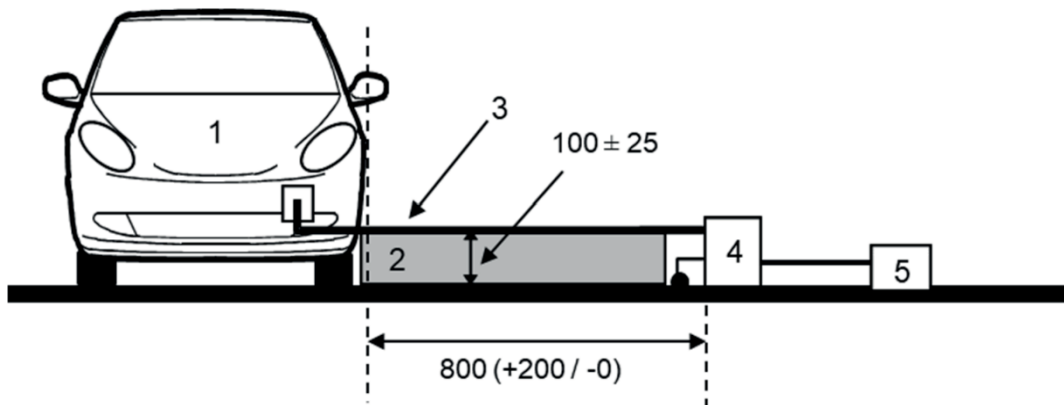
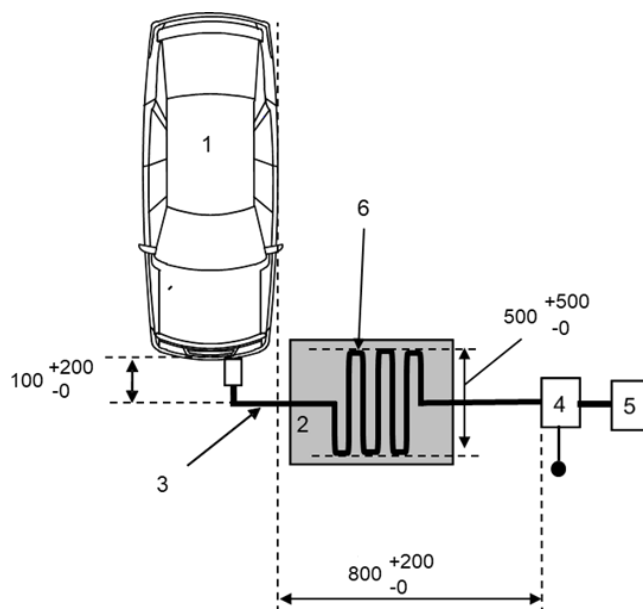


Figure 3d



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 (see 7.3.2.2)
- 6 extraneous length Z-folded

NOTE: The cable between the AC mains and the AMN need not be aligned in 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 3e

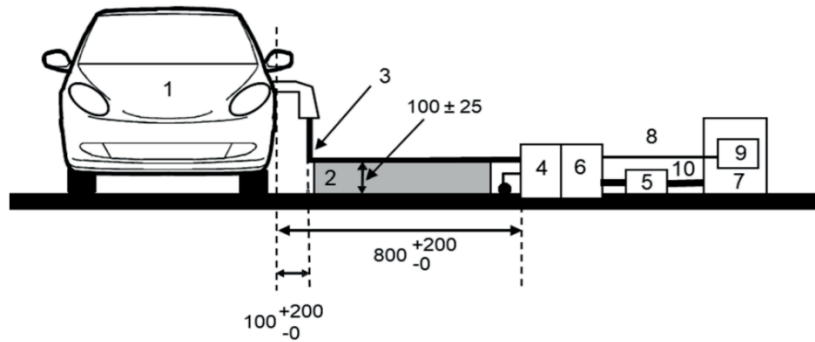
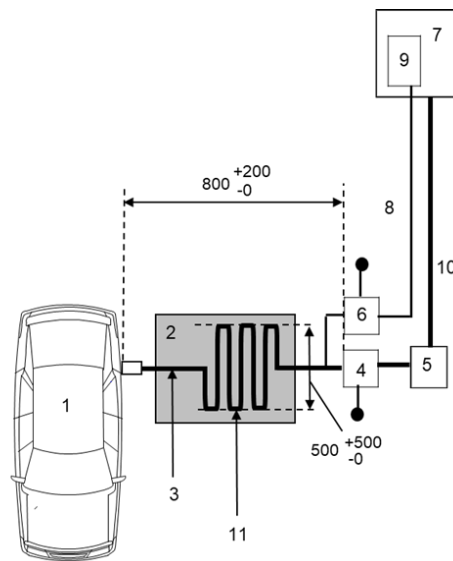


Figure 3f



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, see 7.3.3.2)
- 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 need not be aligned in 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 3g

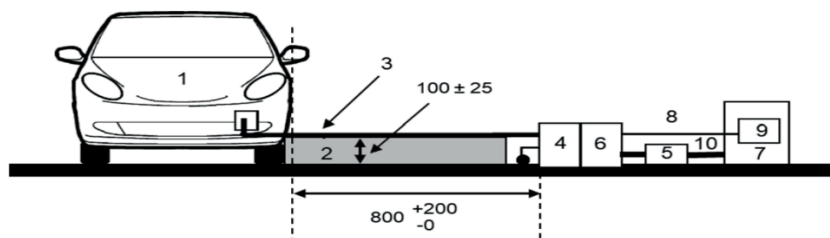
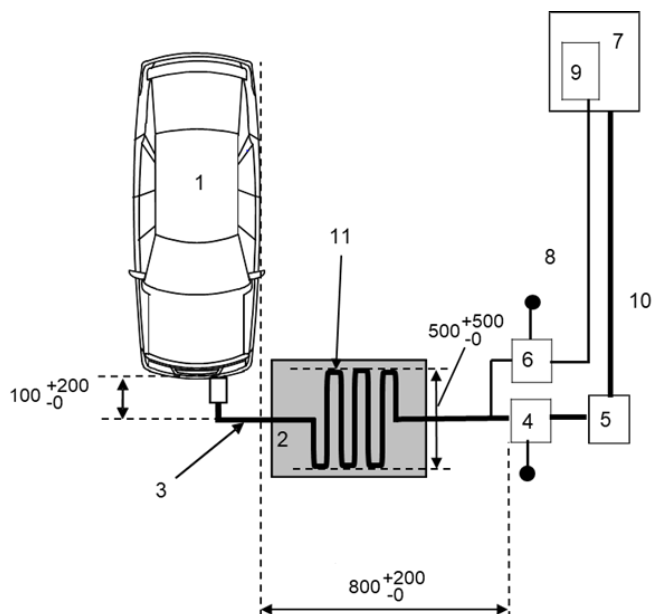


Figure 3h



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, see 7.3.3.2)
- 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
- 1 extraneous length Z-folded

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

..."

Annex 5,

Paragraph 1.3., delete.

Paragraph 1.4., renumber and amend to read:

"1.3. For vehicles of category L the measurement location can be chosen according to Annex 4, paragraphs 3.1. and 3.2."

Paragraph 2.1., amend to read:

"2.1. The ignition switch shall be switched on. The engine shall not be operating.
For two-wheeled vehicles, a non-conductive insulating support with a thickness of 5 – 20 mm shall be used between stand and ground plane."

Paragraph 4.3., amend to read:

"4.3. The measurements shall be performed with a spectrum analyser or a scanning receiver. The parameters to be used are defined in Table 1 and Table 2.

Spectrum analysers and FFT-based instruments, that meet the requirements of CISPR 16-1-1, may be used for conformity measurements. FFT-based measuring instruments shall continuously record and evaluate the signal during the measurement time. If using FFT-based instruments, the minimum measurement time shall be 1 s per analysis frequency band (in real-time mode) of the FFT instrument.

Table 1
Spectrum analyser parameters

| Frequency range MHz | Peak detector | | Average detector | |
|---------------------|---------------|-------------------|------------------|-------------------|
| | RBW at -3 dB | Minimum scan time | RBW at -3 dB | Minimum scan time |
| 30 to 1,000 | 100/120 kHz | 100 ms/MHz | 100/120 kHz | 100 ms/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 | | | Average detector | | |
|---------------------|---------------|-----------|-------------------------|------------------|-----------|-------------------------|
| | BW at -6 dB | Step size | Minimum scan Dwell time | BW at -6 dB | Step size | Minimum scan Dwell time |
| 30 to 1,000 | 120 kHz | 50 kHz | 5 ms | 120 kHz | 50 kHz | 5 ms |

Paragraph 4.6., amend to read:

"4.6. Antenna position
Measurements shall be made on the left and right sides of the vehicle.
The horizontal distance is from the reference point of the antenna to the nearest part of the vehicle body.
Multiple antenna positions may be required (both for 10 m and 3 m antenna distance) depending on the vehicle length. The same positions shall be used for both horizontal and vertical polarization measurements. The number of antenna positions and the position of the antenna with respect to the vehicle shall be documented in the test report.

- If the length of the vehicle is smaller than the 3 dB beamwidth of the antenna, only one antenna position is necessary. The antenna shall be aligned with the middle of the total vehicle (see Figure 1).
- If the length of the vehicle is greater than the 3 dB beamwidth of the antenna, multiple antenna positions are necessary in order to cover the

total length of the vehicle (see Figure 2). The number of antenna positions shall allow to meet the following condition:

$$N \cdot 2 \cdot D \cdot \tan(\beta) \geq L \quad (1)$$

With:

N: number of antenna positions.

D: measurement distance (3 m or 10 m).

$2 \cdot \beta$: 3 dB antenna beamwidth angle in the plane parallel to ground (i.e. the E-plane beamwidth angle when the antenna is used in horizontal polarization, and the H-plane beamwidth angle when the antenna is used in vertical polarization).

L: Total vehicle length covers the whole dimensions including tires, bumpers and lights, etc.

Depending of the chosen values of N (number of antenna positions) different set-up shall be used:

if N=1 (only one antenna position is necessary) and the antenna shall be aligned with the middle of the total vehicle length (see Figure 1).

if N>1 (more than one antenna position is necessary) and multiple antenna positions are necessary in order to cover the total length of the vehicle (see Figure 2). The antenna positions shall be symmetric in regard to the vehicle perpendicular axis."

Annex 6,

Paragraphs 1.1. to 1.3., amend to read:

"1.1. The test method described in this Annex shall only be applied to vehicles. This method concerns both configurations of vehicle:

- (a) Other than "REESS charging mode coupled to the power grid";
- (b) "REESS charging mode coupled to the power grid".

A vehicle is considered to be a "large vehicle", if it is longer than 12 m and/or wider than 2.60 m and/or higher than 4.00 m.

1.2. Regular test method

This test is intended to demonstrate the immunity of the vehicle electronic systems. The vehicle shall be subject to electromagnetic fields as described in this Annex. The vehicle shall be monitored during the tests.

If not otherwise stated in this Annex the test shall be performed according to ISO 11451-2 in an ALSE:

- 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.

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”
- 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 “large vehicles”, the following alternative methods may be chosen by the manufacturer in conjunction with the Type Approval Authority:

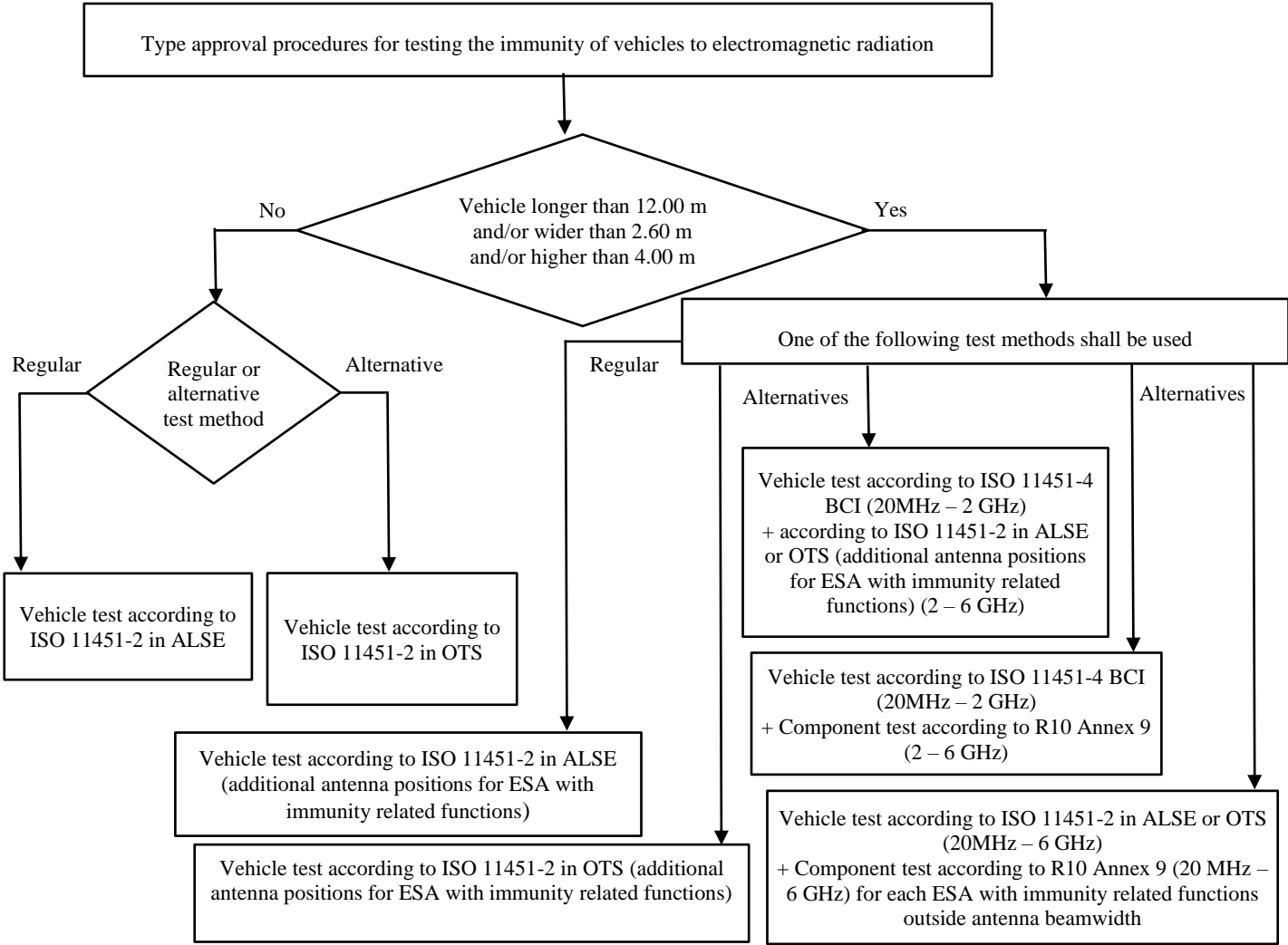
- Harness excitation methods (BCI) according to ISO 11451-4 in the frequency range 20 to 2,000 MHz and immunity to external sources according to ISO 11451-2 in ALSE or OTS in the frequency range 2,000 to 6,000 MHz with additional antenna position(s). Additional antenna positions shall be chosen by the 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.
- Harness excitation methods (BCI) according to ISO 11451-4 in the frequency range 20 to 2,000 MHz and ESA immunity to external sources according to Annex 9 in the frequency range 2,000 to 6,000 MHz for all ESA involved in immunity related functions. ESA involved in immunity related functions shall be chosen by the manufacturer in conjunction with the Type Approval Authority. Vehicle test shall be performed with levels defined in paragraph 6.4.2.1. of this Regulation. ESA shall be performed with levels defined in paragraph 6.8.2.1. of this Regulation.
- Immunity to external sources according to ISO 11451-2 in ALSE or OTS in the frequency range 20 to 6,000 MHz with front irradiation and ESA immunity to external sources according to Annex 9 in the frequency range 20 to 6,000 MHz for ESA with immunity related functions out antenna beamwidth. Concerned ESA shall be chosen by the manufacturer in conjunction with the Type-Approval Authority. Vehicle test shall be performed with levels defined in paragraph 6.4.2.1. of this Regulation. ESA tests shall be performed with levels defined in paragraph 6.8.2.1. of this Regulation.

Alternative method using ESA immunity to external sources according to Annex 9 does not require E-marking of the concerned ESA. The test report shall be prepared or approved by a laboratory accredited to ISO 17025 and recognized by the Type Approval Authority responsible for carrying out the tests and provided along with the information document shown in Annex 2B. The same test method (vehicle type approval in combination with ESA test report for Annex9) shall be applied during Conformity of Production test or any applicable test method according to this Annex."

Insert a new paragraph 1.4., to read:

"1.4 Applicability of test methods:

Figure 1



Paragraph 2., amend to read:

- "2. Vehicle state during tests
For two-wheeled vehicles, a non-conductive insulating support with a thickness of 5 – 20 mm shall be used between stand and ground plane."

Paragraph 2.1.1.2., amend to read:

- "2.1.1.2. Basic vehicle conditions
The paragraph defines minimum test conditions (as far as applicable) and failure criteria for vehicle immunity tests. Other vehicle systems, which can affect immunity related functions, shall be tested in a way to be agreed between manufacturer and Technical Service.

| <i>"50 km/h mode" vehicle test conditions</i> | <i>Failure criteria</i> |
|--|---|
| Vehicle speed 50 km/h (respectively 25 km/h for L ₁ , L ₂ vehicles) ±20 per cent (vehicle driving the rollers). If the vehicle is equipped with a cruise control system, it shall be used to maintain the required constant vehicle speed and maintained without any deactivation. | Speed variation greater than ±10 per cent of the nominal speed. In case of automatic gearbox: change of gear ratio inducing a speed variation greater than ±10 per cent of the nominal speed. |

| <i>"50 km/h mode" vehicle test conditions</i> | <i>Failure criteria</i> |
|---|--|
| Dipped beams ON (manual mode) | Lighting OFF (front light and rear light) |
| Specific warning (e.g Rotating/flashing light, signaling bar, siren...) ON | Specific warning OFF |
| Cluster operate in normal mode | Unexpected warning Inconsistent variation of the odometer |
| Rear view system | Unexpected movement of rear view mirror Loss or freezing of the display (CMS) |
| Front wiper ON (manual mode) maximum speed | Complete stop of front wiper |
| Direction indicator on driver's side ON | Frequency change (lower than 0.75 Hz or greater than 2.25 Hz). Duty cycle change (lower than 25 per cent or greater than 75 per cent). |
| Adjustable suspension in normal position | Unexpected significant variation |
| Driver's seat and steering wheel in medium position | Unexpected variation greater than 10 per cent of total range |
| Alarm unset | Unexpected activation of alarm |
| Horn OFF | Unexpected activation of horn |
| Airbag and safety restraint systems operational with inhibited passenger airbag if this function exists | Unexpected activation |
| Automatic doors closed | Unexpected opening |
| Adjustable endurance brake lever in normal position | Unexpected activation |
| Brake pedal not depressed | Unexpected activation of brake and unexpected activation of stop lights |
| 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. | |

| <i>"Brake mode" vehicle test conditions</i> | <i>Failure criteria</i> |
|---|--|
| 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 failure situation |
| ⁽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. | |

| <i>AECS vehicle test conditions before and after immunity test</i> | <i>Failure criteria</i> |
|--|--|
| A manual emergency call shall be triggered according to the vehicle manufacturer's instructions, both before and after conducting the 50km/h or brake mode test. | An emergency call is not established. |
| Once the MSD has been received the emergency call is established, voice communication shall be evaluated, but only if voice communications are available in the AECS system. | The voice originating inside the vehicle cannot be heard clearly by the remote listener with satisfactory intelligibility. The speech of the remote speaker cannot be heard clearly in the vehicle with satisfactory intelligibility. |
| After the evaluation of the voice call, the emergency call shall be terminated. Subsequently, the transmitted Minimum Set of Data (MSD) shall be evaluated. | Vehicle location data is NOT transmitted, or position error is greater than 150m. Time stamp is not transmitted, or time error is greater than 60 seconds. Vehicle identification number is not transmitted correctly. |

| <i>AECSs vehicle test conditions during immunity test</i> | <i>Failure criteria</i> |
|--|---|
| During the 50km/h or brake test mode, the warning signal device (also known as the tell-tale, which provides a failure indication), and all other displays used for indicating AECS faults, shall be monitored. There is no requirement for a cellular network or satellite navigation signals during these tests. | Emergency calling systems does not operate as intended as indicated by: Failure indication of AECS warning signal device or other vehicle displays. Upon completion of the test, diagnostic trouble code, which is related to emergency calling systems failure indication, is stored in the device memory. |

| <i>AVAS test conditions</i> | <i>Failure criteria</i> |
|---|---|
| Vehicle is tested in an operating state where the AVAS Function/sound is active (if applicable) ⁽¹⁾ | Loss of AVAS function (loss of sound or system error indicator) |
| (1) This test may be incorporated into Brake or 50 km/h mode if AVAS system is active in these modes. If AVAS system is not operational during these two modes, the operating conditions (e.g. vehicle speed) shall be agreed between the Technical Service and the Vehicle Manufacturer. | |

Insert a new paragraph 2.1.1.5., to read:

- "2.1.1.5. If the vehicle is equipped with an ADS, the immunity test shall demonstrate the vehicle stays in a failure safe mode or expected failure operational mode during the test in 50km/h mode or Brake mode. If it is not possible to activate the ADS due to another function (e.g. turn lamp, wiper, etc), these function(s) may be turned off. Then additional test run(s) may be necessary to cover untested function(s) (e.g. turn lamp, wiper, etc). Lateral and longitudinal vehicle motion control and braking may be deactivated if necessary to ensure a safe test environment."

Insert a new paragraph 2.1.1.6., to read:

- "2.1.1.6. If the vehicle is equipped with an AECS according to UN Regulation No. 144, it shall be tested over the air for the transmission of Minimum Set of Data (MSD) and voice call via a real Public Land Mobile Network (PLMN) or via

a network simulator before and after 50 km/h or brake mode and using a private safety answering point (PSAP).

In case of a voice call via a real PLMN, emergency call number should be changed to dedicated PSAP number in order to avoid false calls to the emergency services. Only one specific cellular configuration, including one frequency band and one channel, within a single cellular technology (e.g. 2G, 3G, 4G, 5G.) shall be tested.

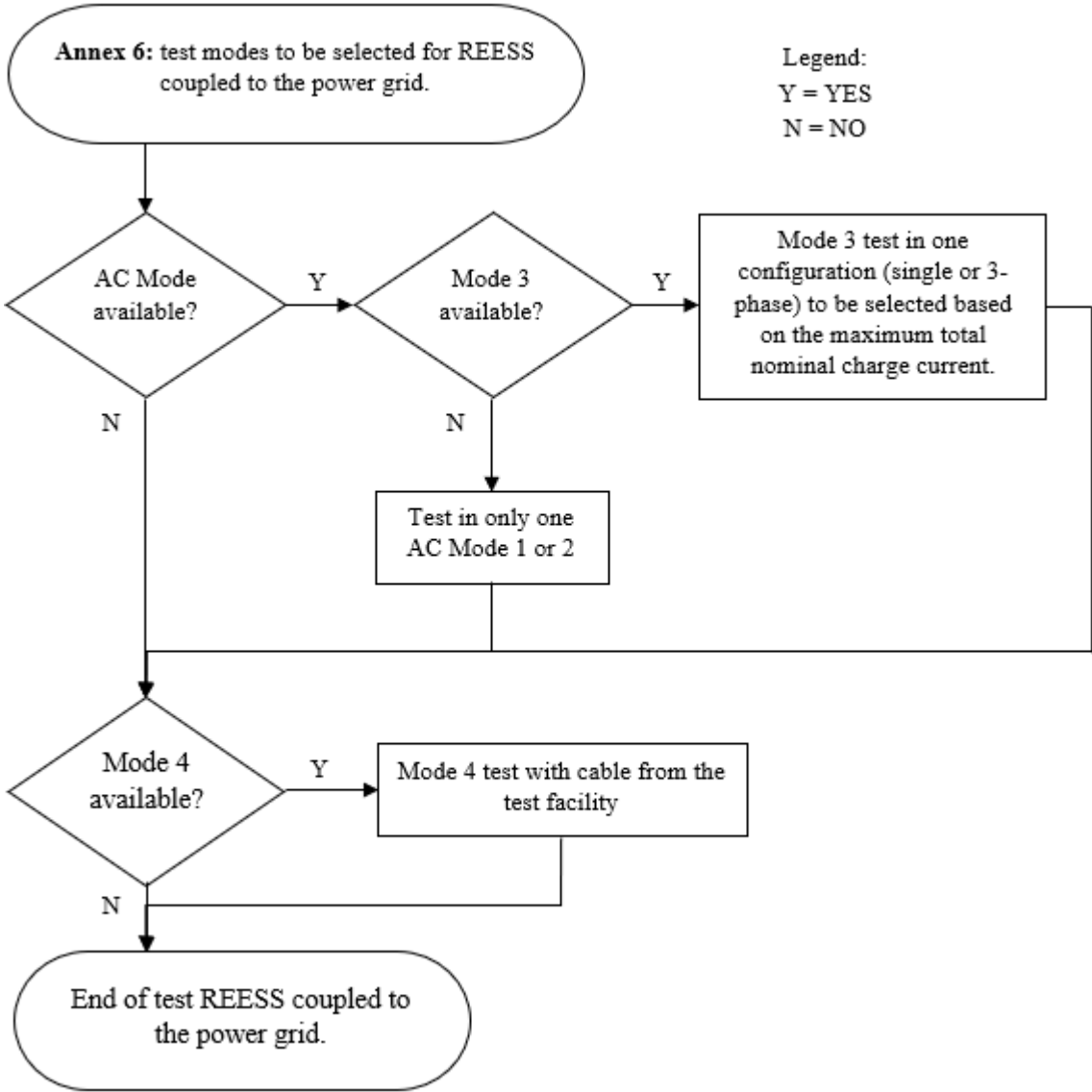
Vehicle manufacturer and Technical Service shall review the AECS warning signal strategy if it will detect AECS system faults even when there is no network coverage. If it is not possible to distinguish between lack of network coverage and a system fault, alternative arrangements shall be made to enable this."

Paragraph 2.2.1.1., amend to read:

"2.2.1.1. The vehicle shall be immobilized, the engine(s) (ICE and / or electrical engine) shall be OFF and in charging mode.

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of Figure 2.

Figure 2
Charging mode configuration for Annex 6



Paragraph 2.2.1.2., amend to read:

"2.2.1.2. Basic vehicle conditions

The paragraph defines minimum test conditions (as far as applicable) and failures criteria for vehicle immunity tests. Other vehicle systems, which can affect immunity related functions, shall be tested in a way to be agreed between manufacturer and Technical Service.

| <i>"REESS charging mode" vehicle test conditions</i> | <i>Failure criteria</i> |
|--|--|
| <p>The REESS shall be in charging mode. The REESS State of charge (SOC) shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole frequency range measurement (this may lead to split the measurement in different sub-bands with the need to discharge the vehicle's traction battery before starting the next sub-bands). If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its maximum rated charging/input current value for AC charging.</p> <p>If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its maximum value or to a minimum of 16 A (if the 20 per cent of its maximum value cannot be achieved in the test facility) for DC charging unless another value is agreed with the Type Approval Authorities.</p> <p>In case of multiple batteries the average state of charge must be considered.</p> | <p>Vehicle sets in motion.</p> <p>Unexpected release of the parking brake.</p> <p>Loss of Parking position for automatic transmission.</p> |

Paragraph 2.3.3., amend to read:

"2.3.3. Power charging harness

The power charging harness shall be placed in a straight line between the AMN(s) and the vehicle charging plug and shall be routed perpendicularly to the vehicle longitudinal axis (see Figure 5a and Figure 5c). The projected harness length from the side of the AMN(s) to the side of the vehicle shall be 0,8 (+0,2 / -0) m as shown in Figure 5b and Figure 5d.

For a longer cable, the extraneous length shall be "Z-folded" symmetrically. No contact or overlap is allowed between windings. The width of the Z-folded cable shall be between 500 mm and 1 000 mm. If it is impractical to do so because of cable bulk or stiffness, or because the testing is being done at a user's installation, the disposition of the excess cable length shall be precisely noted in the test report.

The charging harness at the vehicle side shall hang vertically at a distance of 100 (+200 / -0) mm from the vehicle body.

The whole harness shall be placed on a non-conductive, low relative permittivity (dielectric-constant) material ($\epsilon_r \leq 1,4$), at (100 ± 25) mm above the ground plane (ALSE) or floor (OTS)."

Paragraphs 2.4.3. and 2.4.4., amend to read:

"2.4.3. Asymmetric artificial network

Local/private communication lines connected to signal/control ports and lines connected to wired network ports shall be applied to the vehicle through AAN(s).

The various AAN(s) to be used are defined in Appendix 8, clause 5:

- Clause 5.1. for signal/control port with symmetric lines;
- Clause 5.2. for wired network port with PLC on power lines;
- Clause 5.3. for signal/control port with PLC (technology) on control pilot; and
- Clause 5.4. for signal/control port with control pilot.

The AAN(s) shall be mounted directly on the ground plane. The case of the AAN(s) shall be bonded to the ground plane (ALSE) or connected to the protective earth (OTS, e.g. an earth rod).

The measuring port of each AAN shall be terminated with a 50 Ω load.

If a charging station is used, AAN(s) are not required for the signal/control ports and/or for the wired network ports. The local/private communication lines between the vehicle and the charging station shall be connected to the auxiliary equipment on the charging station side to work as designed. If communication is emulated and if the presence of the AAN prevents proper communication then no AAN should be used

2.4.4. Power charging / local/private communication harness

The power charging local/private communication harness shall be laid out in a straight line between the AMN(s) / DC-charging-AN(s) / AAN(s) and the vehicle charging socket and shall be routed perpendicularly to the vehicle's longitudinal axis (see Figure 5e and Figure 5g). The projected harness length from the side of the AMN(s) to the side of the vehicle shall be 0,8 (+0,2 / - 0) m as shown in Figure 5f and Figure 5h.

For a longer cable, the extraneous length shall be "Z-folded" symmetrically. No contact or overlap is allowed between windings. The width of the Z-folded cable shall be between 500 mm and 1 000 mm. If it is impractical to do so because of cable bulk or stiffness, or because the testing is being done at a user's installation, the disposition of the excess cable length shall be precisely noted in the test report.

The power charging local/private communication harness at vehicle side shall hang vertically at a distance of 100 (+200 / -0) mm from the vehicle body.

The whole harness shall be placed on a non-conductive, low relative permittivity (dielectric-constant) material ($\epsilon_r \leq 1,4$), at (100 ± 25) mm above the ground plane (ALSE) or floor (OTS)."

Insert a new paragraph 3.4., to read:

- "3.4. If a vehicle is longer than 12 m and/or wider than 2.60 m and/or higher than 4.00 m, and tested according to ISO 11451-2, then additional reference point(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 (see Appendix 1, Figure 5)."

Paragraphs 4.1. and 4.1.1., amend to read:

- "4.1. Frequency range, dwell times, polarization.

The vehicle shall be exposed to electromagnetic radiation in the 20 to 6,000 MHz frequency ranges in vertical polarization.

The test signal modulation shall be:

- (a) AM (amplitude modulation), with 1 kHz modulation and 80 per cent modulation depth in the 20 to 400 MHz frequency range;
- (b) PM2 (pulse modulation type 2), Ton 3 μ s, period 3,333 μ s in the 2,700 to 3,100 MHz frequency range; and
- (c) PM3 (pulse modulation type 3), Ton 500 μ s, period 1,000 μ s in the 380 to 2,700 MHz and the 3,100 to 6,000 MHz frequency ranges.

If not otherwise agreed between Technical Service and vehicle manufacturer.

Frequency step size and dwell time shall be chosen according to ISO 11451-1.

- 4.1.1. The Technical Service shall perform the test at the intervals specified in ISO 11451-1 throughout the frequency range 20 to 6,000 MHz.

Alternatively, if the manufacturer provides measurement to data for the whole frequency band from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type Approval Authority, the Technical Service may choose a reduced number of spot frequencies in the range (e.g. 27, 45, 65, 90, 120, 150, 190, 230, 280, 380, 450, 600, 750, 900, 1,300, 1,800, 2,360, 2,600, 3,000, 3,600, 5,200 and 5,900 MHz) to confirm that the vehicle meets the requirements of this Annex.

If the manufacturer provides measurement data for the whole frequency band from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type-Approval Authority for all the charging modes configurations defined in paragraph 2.2.1.1, the Technical Service may perform tests only for one charging mode configurations defined in paragraph 2.2.1.2 and for a reduced number of spot frequencies in the range (e.g. 27, 45, 65, 90, 120, 150, 190, 230, 280, 380, 450, 600, 750, 900, 1,300, 1,800, 2,360, 2,600, 3,000, 3,600, 5,200 and 5,900 MHz) to confirm that the vehicle meets the requirements of this Annex.

If a vehicle fails the test defined in this Annex, it shall be verified as having failed under the relevant test conditions and not as a result of the generation of uncontrolled fields."

Paragraph 5.1.3., amend to read:

"5.1.3. Test phase

The vehicle shall be positioned with the centre line of the vehicle on the vehicle reference point or line. The vehicle shall normally face a fixed antenna. However, where electronic control units with immunity related functions and the associated wiring harness are predominantly in the rear half of the vehicle, the test should normally be carried out with the vehicle facing away from the antenna and positioned as if it had been horizontally rotated 180° around its centre point, i.e. such that the distance from the antenna to the nearest part of the outer body of the vehicle remains the same. In the case of "large vehicles" which have electronic control units with immunity related functions and associated wiring harness which are not located in the region illuminated at the default reference point of the regular test method, then additional reference point(s) may be established. The additional point(s) shall be chosen by the manufacturer in conjunction with the Type Approval Authority after considering the distribution of electronic systems and the layout of any wiring harness.

Such testing may only take place if the physical construction of the chamber permits. The antenna location shall be noted in the test report."

Annex 6, Appendix 1, amend to read:

"Annex 6 – Appendix 1

Figure 1

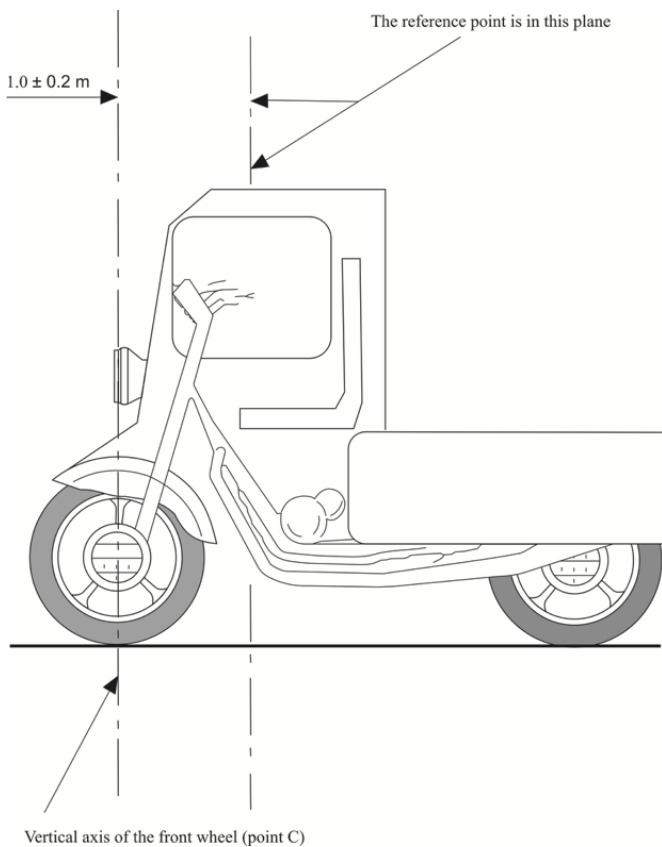
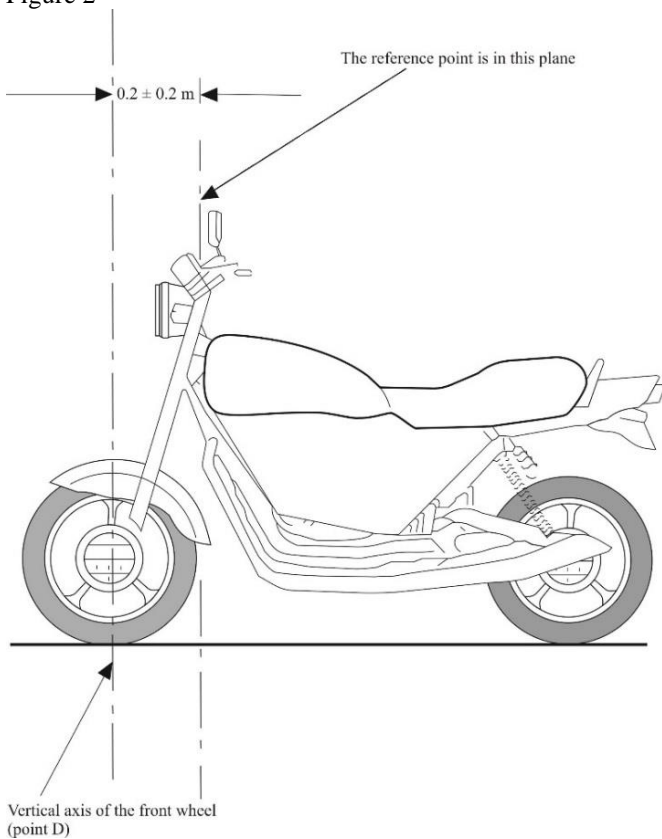


Figure 2



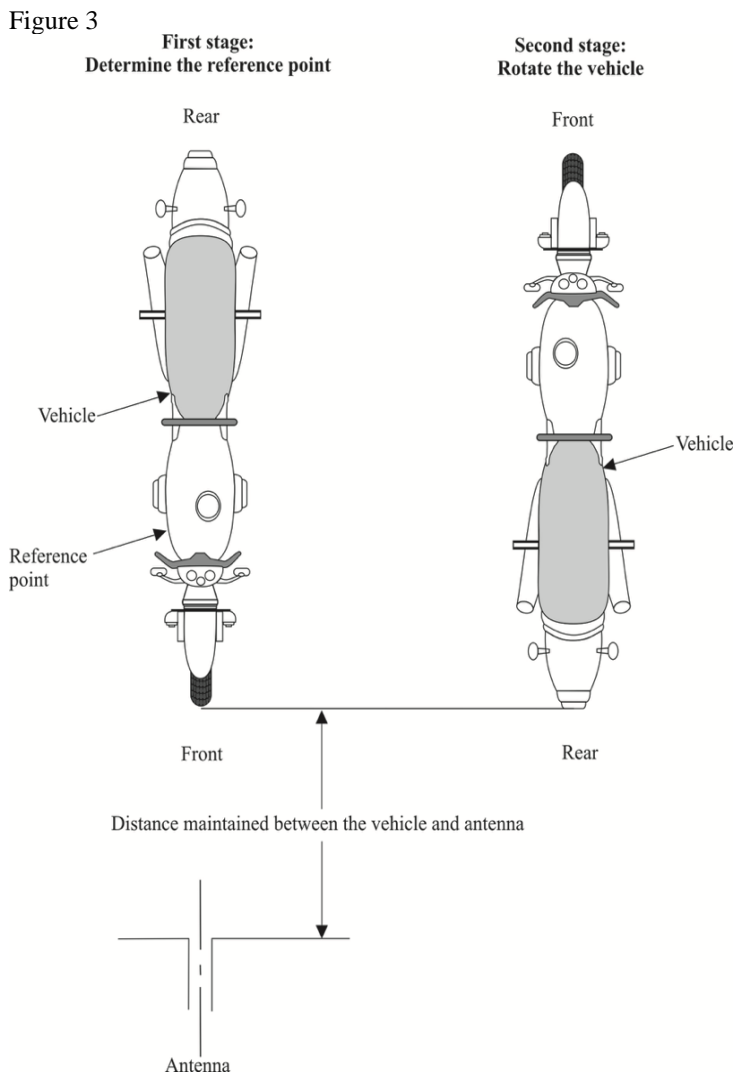
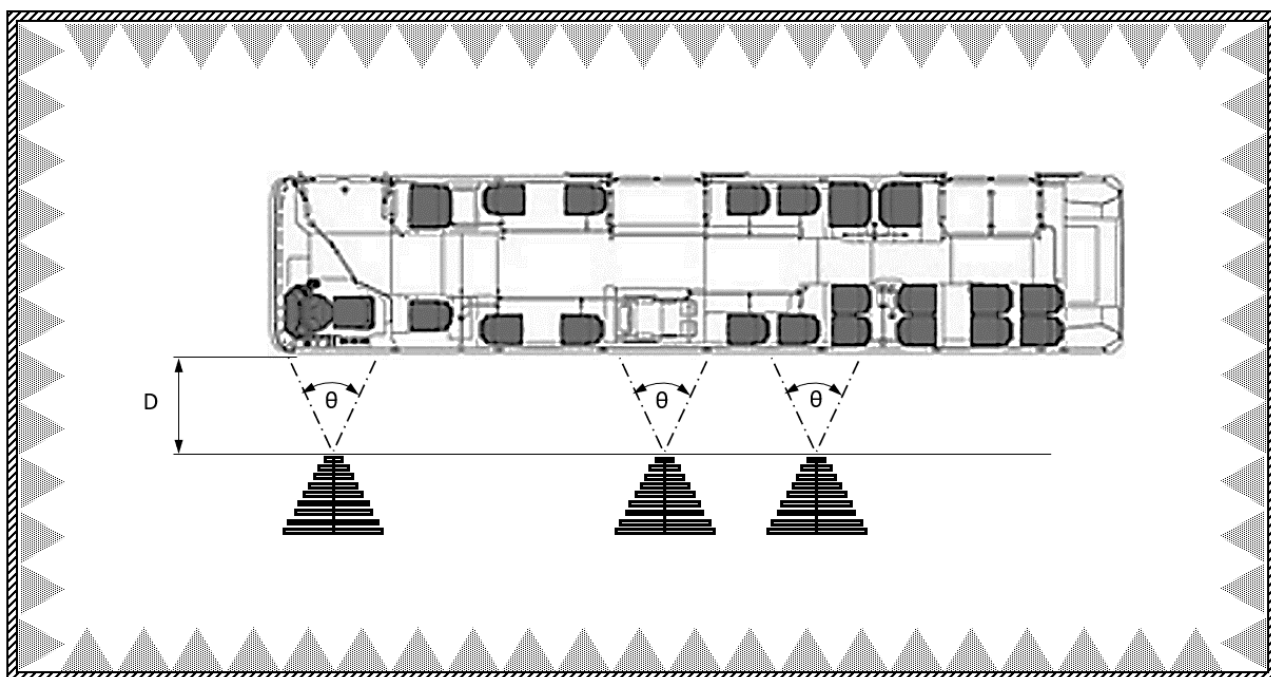


Figure 4
Example of a selection of antenna placements for lateral illumination of a large vehicle



Key

θ : 3 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)

Figure 5
Vehicle in configuration "REESS charging mode coupled to the power grid"

Example of test setup for vehicle with socket located on vehicle side (charging mode 1 or 2, AC powered, without communication, all dimensions in mm)

Figure 5a

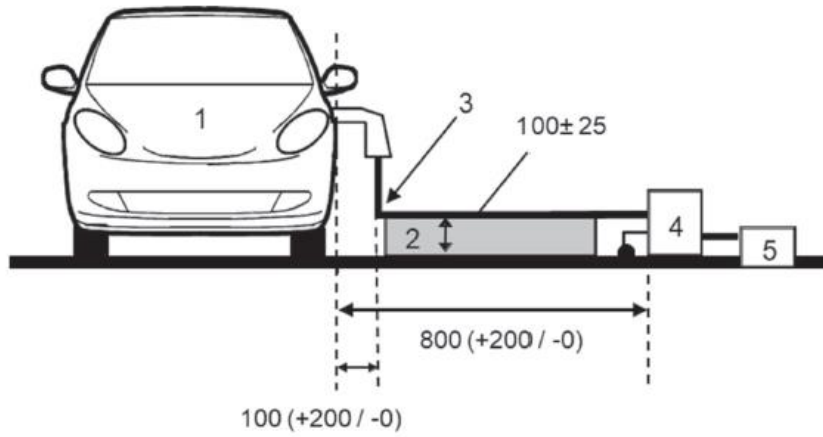
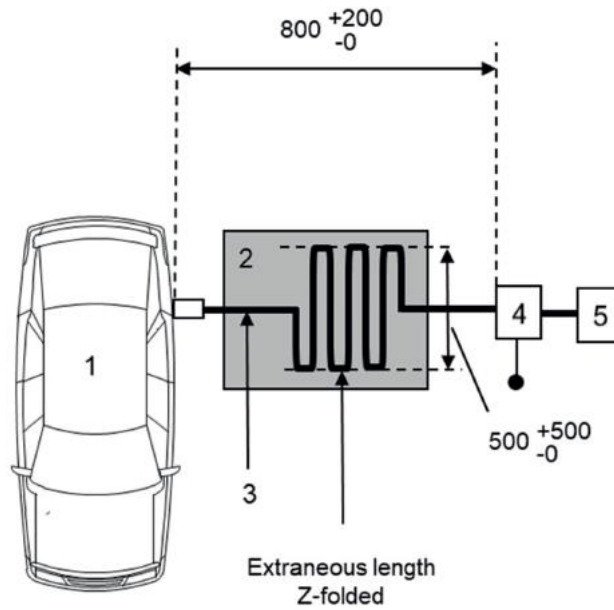


Figure 5b



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

NOTE: The cable between the AC mains and the AMN need 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 side (charging mode 1 or 2, AC powered, without communication)

Figure 5c

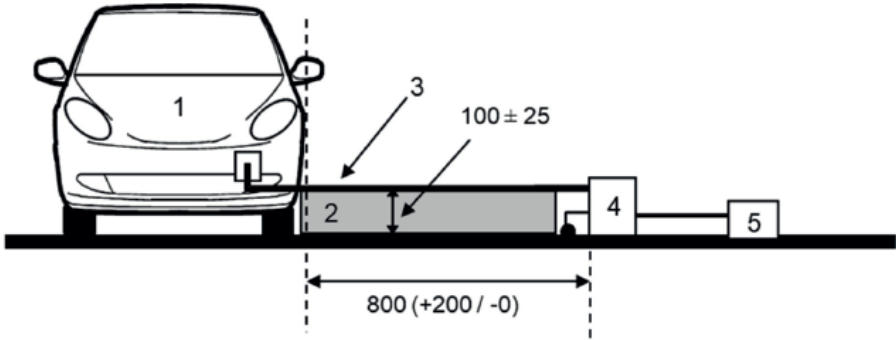
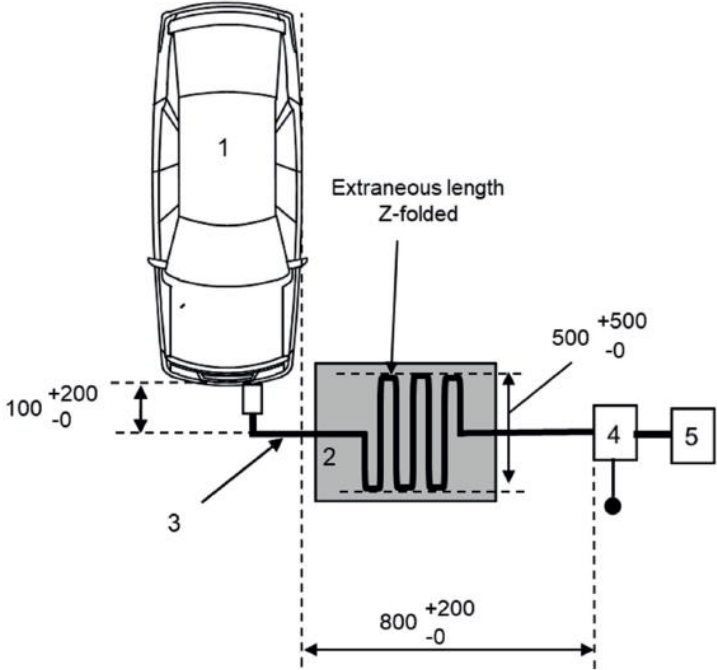


Figure 5d



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

NOTE : The cable between the AC mains and the AMN need 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 5e

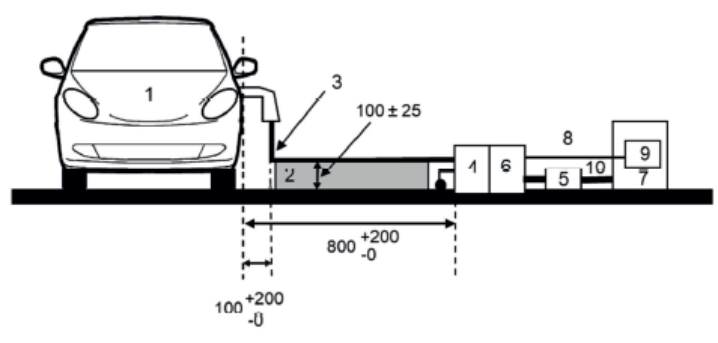
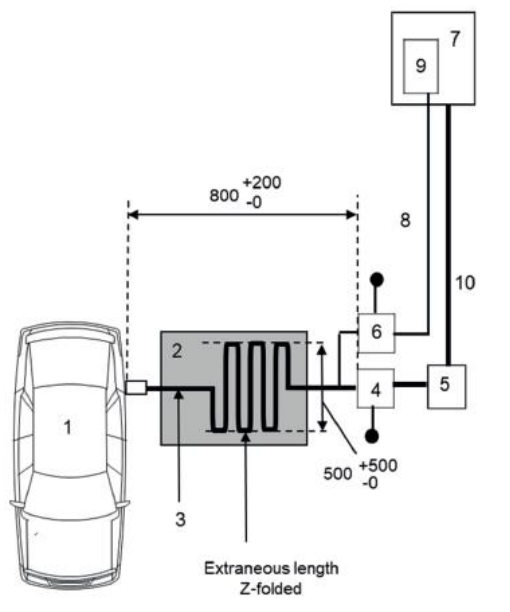


Figure 5f



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 need 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 the vehicle side (charging mode 3 or mode 4, with communication)

Figure 5g

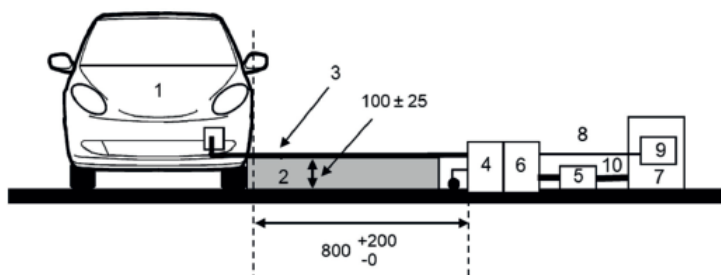
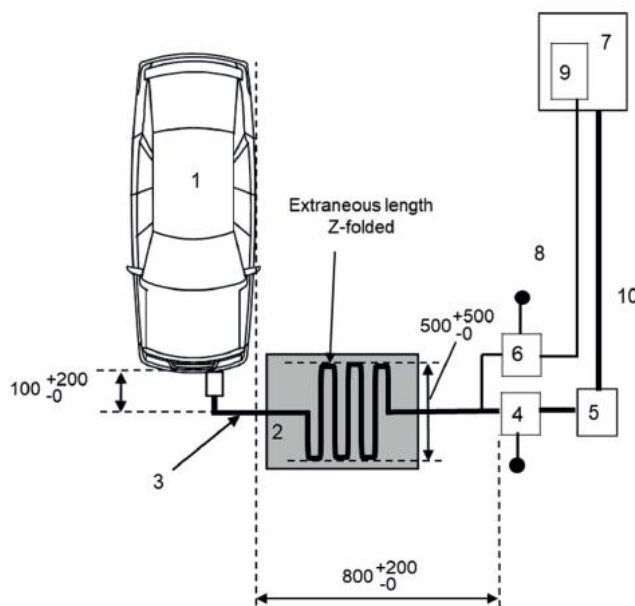


Figure 5h



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, see 7.3.3.2)
- 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 need not be aligned in the same direction as the cable between the AMN/DC-charging-AN and the EV."

Annex 7,

Paragraph 2.1., amend to read:

"2.1. The ESA under test shall be in normal operation mode, preferably in maximum load.

ESAs involved in "REESS charging mode coupled to the power grid" shall be in charging mode.

The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole frequency range measurement (this may lead to split the measurement in different sub-bands with the need to discharge the vehicle's traction battery before starting the next sub-bands).

If the test is not performed with a REESS the ESA should be tested at rated current.

If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its maximum rated charging/input current value for AC charging.

If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal value or to a minimum of 16 A (if the 20 per cent of its nominal value cannot be achieved in the test facility) for DC charging unless another value is agreed with the type approval authorities. "

Paragraph 4.3., amend to read:

"4.3. The measurements shall be performed with a spectrum analyser or a scanning receiver. The parameters to be used are defined in Table 1 and Table 2.

Spectrum analysers and FFT-based instruments, that meet the requirements of CISPR 16-1-1, may be used for conformity measurements. FFT-based measuring instruments shall continuously record and evaluate the signal during the measurement time. If using FFT-based instruments, the minimum measurement time shall be 1 s per analysis frequency band (in real-time mode) of the FFT instrument.

Table 1
Spectrum analyser parameters

| Frequency range MHz | Peak detector | | Quasi-peak detector | | Average detector | |
|---------------------|---------------|-------------------|---------------------|-------------------|------------------|-------------------|
| | RBW at -3 dB | Minimum scan time | RBW at -6 dB | Minimum scan time | RBW at -3 dB | Minimum scan time |
| 30 to 1,000 | 100/120 kHz | 100 ms/MHz | 120 kHz | 20 s/MHz | 100/120 kHz | 100 ms/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 | | | Average detector | | |
|---------------------|---------------|------------------------|--------------------|---------------------|------------------------|--------------------|------------------|------------------------|--------------------|
| | BW at -6 dB | Step size ^a | Minimum dwell time | BW at -6 dB | Step size ^a | Minimum dwell time | BW at -6 dB | Step size ^a | Minimum dwell time |
| 30 to 1,000 | 120 kHz | 50 kHz | 5 ms | 120 kHz | 50 kHz | 1 s | 120 kHz | 50 kHz | 5 ms |

^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 8,

Paragraph 4.3., amend to read:

"4.3. The measurements shall be performed with a spectrum analyser or a scanning receiver. The parameters to be used are defined in Tables 1 and 2.

Spectrum analysers and FFT-based instruments, that meet the requirements of CISPR 16-1-1, may be used for conformity measurements. FFT-based measuring instruments shall continuously record and evaluate the signal during the measurement time. If using FFT-based instruments, the minimum measurement time shall be 1 s per analysis frequency band (in real-time mode) of the FFT instrument.

Table 1
Spectrum analyser parameters

| Frequency range MHz | Peak detector | | Average detector | |
|------------------------|-----------------|-------------------|------------------|----------------------|
| | RBW at -3 dB | Minimum scan time | RBW at -3 dB | Minimum scan time |
| 30 to 1,000 | 100/120 kHz | 100 ms/MHz | 100/120 kHz | 100 ms/MHz |

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

Table 2
Scanning receiver parameters

| Frequency range MHz | Peak detector | | | Average detector | | |
|------------------------|----------------|--------------|-----------------------|------------------|--------------|-----------------------|
| | BW at -6 dB | Step size | Minimum dwell time | BW at -6 dB | Step size | Minimum dwell time |
| 30 to 1,000 | 120 kHz | 50 kHz | 5 ms | 120 kHz | 50 kHz | 5 ms |

Annex 9,

Paragraph 1.2.1., amend to read:

"1.2.1. ESAs may comply with the requirements of any combination of the following test methods at the manufacturer's discretion provided that these results in the full frequency range specified in paragraph 3.1. of this Annex being covered:

- (a) Absorber chamber test according to ISO 11452-2;
- (b) TEM cell testing according to ISO 11452-3;
- (c) Bulk current injection testing according to ISO 11452-4;
- (d) Stripline testing according to ISO 11452-5;
- (e) Reverberation chamber test according to ISO 11452-11;

ESAs in configuration "REESS charging mode coupled to the power grid" shall comply with the requirements of the combination of the Absorber chamber test according to ISO 11452-2 and Bulk current injection testing according to ISO 11452-4 at the manufacturer's discretion provided that these results in the full frequency range specified in paragraph 3.1. of this Annex being covered.

(Frequency range and general test conditions shall be based on ISO 11452-1)."

Paragraph 2.2., amend to read:

"2.2. The ESA under test shall be switched on and shall be stimulated to be in normal operation condition. It shall be arranged as defined in this Annex unless individual test methods dictate otherwise."

Insert a new paragraph 2.3. to read:

"2.3. The paragraph defines minimum test conditions for ESAs involved in "REESS charging mode coupled to the power grid

| <i>"REESS charging mode" ESA test conditions</i> | <i>Failure criteria</i> |
|--|---|
| <p>The REESS shall be in charging mode. The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole time duration of the measurement (this may lead to the measurement being split into different time slots with the need to discharge the vehicle's traction battery before starting the next time slot). If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its maximum rated charging/input current value for AC charging.</p> <p>If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal value or to a minimum of 16 A (if the 20 per cent of its nominal value cannot be achieved in the test facility) for DC charging unless another value is agreed with the Type-Approval Authorities.</p> <p>In case of multiple batteries the average state of charge must be considered.</p> | <p>Temporary loss of charging function is allowed, provided that there is no incorrect charging condition (e.g. over-current, overvoltage) and the function can be restored by a simple intervention, without the use of tools, such as turning off/on the DUT, after the disturbance is removed.</p> |

Paragraphs 2.3. to 2.5.(former), renumber as 2.4. to 2.6., respectively.

Paragraphs 3.1. and 3.2., amend to read:

- "3.1. Frequency range, dwell times
- Measurements shall be made in the 20 to 6,000 MHz frequency range with frequency steps according to ISO 11452-1.
- The test signal modulation shall be:
- (a) AM (amplitude modulation), with 1 kHz modulation and 80 per cent modulation depth in the 20 to 400 MHz frequency range;
 - (b) PM2 (pulse modulation type 2), Ton 3 µs, period 3,333 µs in the 2,700 to 3,100 MHz frequency range; and
 - (c) PM3 (pulse modulation type 3), Ton 500 µs, period 1,000 µs in the 380 to 2,700 MHz and the 3,100 to 6,000 MHz frequency ranges.
- If not otherwise agreed between Technical Service and ESA manufacturer.
- Frequency step size and dwell time shall be chosen according to ISO 11452-1.
- 3.2. The Technical Service shall perform the test at the intervals specified in ISO 11452-1, throughout the frequency range 20 to 6,000 MHz.
- Alternatively, if the manufacturer provides measurement to data for the whole frequency band from a test laboratory accredited to the applicable parts of ISO 17025, and recognized by the Type Approval Authority, the Technical Service may choose a reduced number of spot frequencies in the range (e.g. 27, 45, 65, 90, 120, 150, 190, 230, 280, 380, 450, 600, 750, 900, 1,300, 1,800, 2,360, 2,600, 3,000, 3,600, 5,200 and 5,900 MHz) to confirm that the ESA meets the requirements of this Annex."

Paragraph 4.2., amend to read:

"4.2. TEM cell testing (see Appendix 1 to this Annex)"

Paragraph 4.3.2.1., amend to read:

"4.3.2.1. For ESAs in configuration "REESS charging mode coupled to the power grid", an example of test arrangement (for substitution method) is given in Appendix

3 to this Annex (figure 1 for substitution method and figure 2 for closed loop method)."

Paragraphs 4.5. to 4.5.2.4., delete.

Insert new paragraphs 4.5. to 4.5.2., to read:

"4.5. Reverberation chamber test

4.5.1. Test method

This test method allows the testing of vehicle electrical/electronic systems by exposing an ESA to statistically homogeneous and isotropic electromagnetic fields created by injected and stirred mechanically.

4.5.2. Test methodology

The test shall be performed according ISO 11452-11.

Unless otherwise specified, the reverberation chamber testing method shall be carried out using a test setup with ground plane."

Annex 9, Appendix 1, delete.

Annex 9, Appendices 2, 3 and 4, renumber to 1, 2 and 3, accordingly.

Annex 10, paragraph 2., 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, third edition, 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, second edition 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."

Annex 11,

Paragraph 2.1., amend to read:

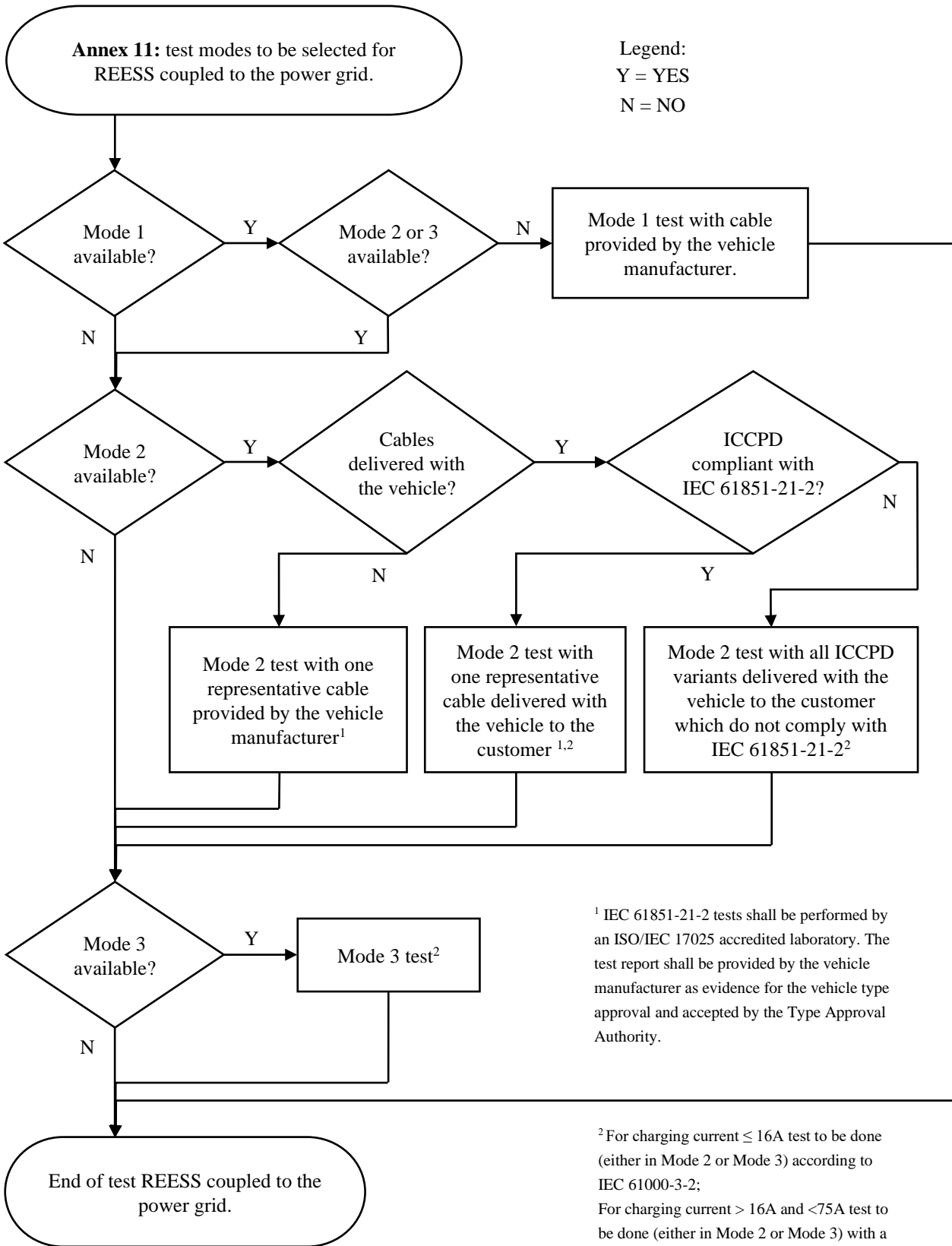
"2.1. The vehicle shall be in configuration "REESS charging mode coupled to the power grid".

For two-wheeled vehicles, a non-conductive insulating support with a thickness of 5 – 20 mm shall be used between stand and ground plane.

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of Figure 1.

Figure 1

Charging mode configuration for Annex 11



The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole time duration of the measurement (this may lead to the measurement being splitting into different time slots with the need to discharge the vehicle's traction battery before starting the next time slot). If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its maximum rated charging/input current value for AC charging.

In case of multiple batteries the average state of charge must be considered.

The vehicle shall be immobilized, the engine(s) (ICE and / or electrical engine) shall be OFF and in charging mode.

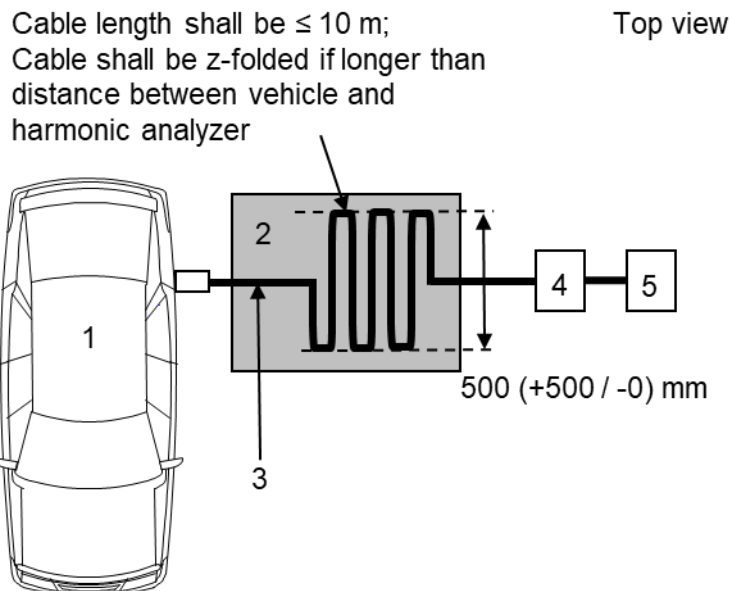
All other equipment which can be switched ON by the driver or passengers shall be OFF."

Paragraphs 4.2. to 4.5., amend to read:

- "4.2. The limits for single phase or three-phase "REESS charging mode coupled to the power grid" with input current ≤ 16 A per phase are given in Table 4 of paragraph 7.3.2.1. of this Regulation.
- 4.3. The limits for single phase or other than balanced three-phase "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in Table 5 of paragraph 7.3.2.2. of this Regulation.
- 4.4. The limits for balanced three-phase "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in Table 6 of paragraph 7.3.2.2. of this Regulation.
- 4.5. For three-phase "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase, when at least one of the three conditions a), b) or c) described in paragraph 5.2. of IEC 61000-3-12 is fulfilled, then the limits given in Table 7 of paragraph 7.3.2.2. of this Regulation can be applied."

Annex 11, Appendix 1, Figure 1b, amend to read:

"Figure 1b



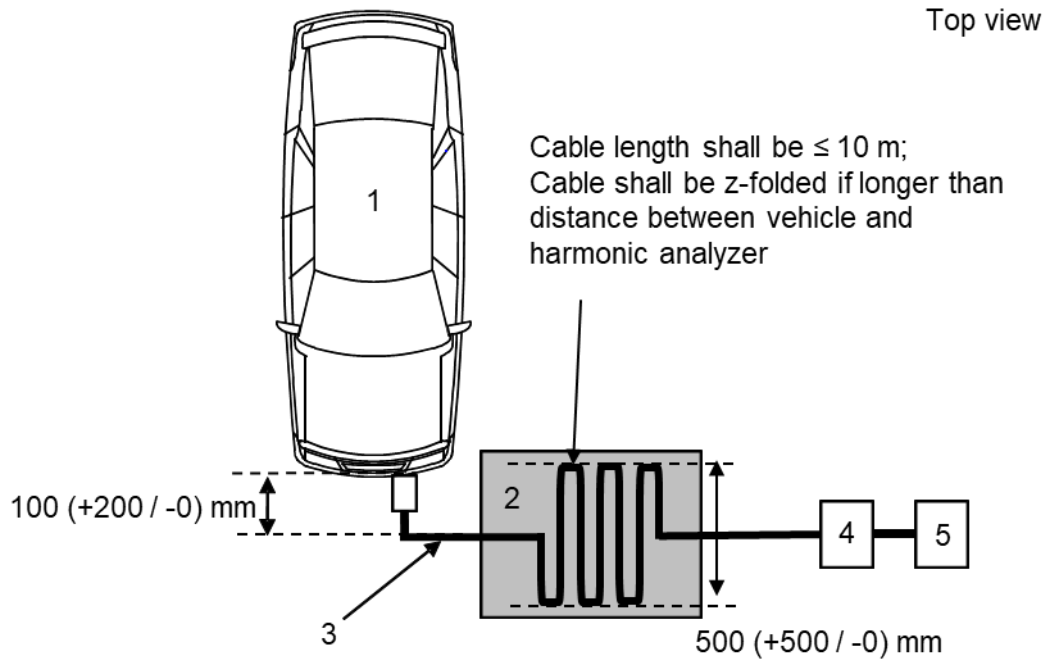
Legend:

- 1 Vehicle under test
2 Insulating support
3 Charging harness
4 Harmonic analyzer

5 Power supply"

Figure 1d, amend to read:

"Figure 1d



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging harness
- 4 Harmonic analyzer
- 5 Power supply"

Annex 12,

Paragraph 2.1., amend to read:

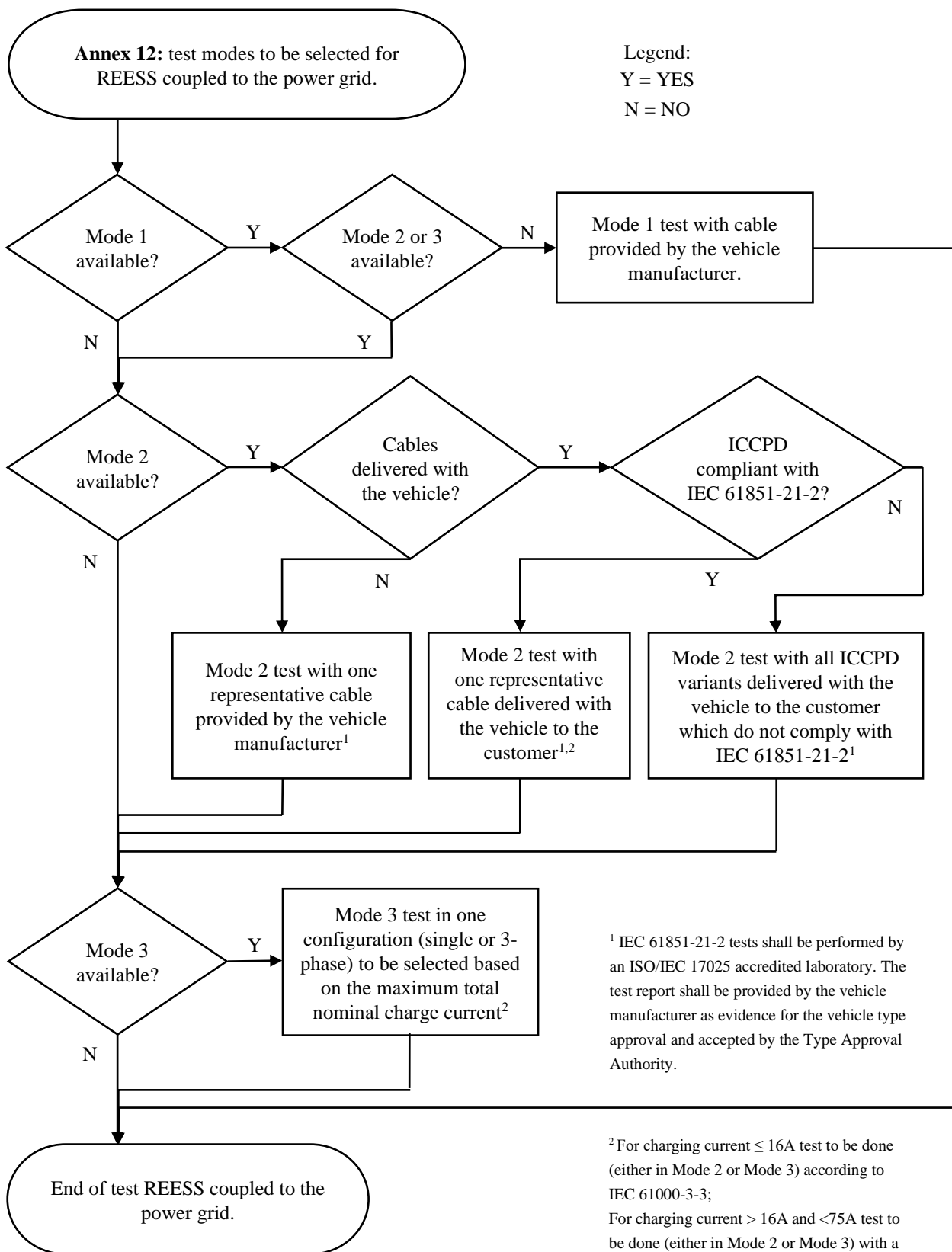
"2.1. The vehicle shall be in configuration "REESS charging mode coupled to the power grid".

For two-wheeled vehicles, a non-conductive insulating support with a thickness of 5 – 20 mm shall be used between stand and ground plane.

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of Figure 1.

Figure 1

Charging mode configuration for Annex 12



The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole time duration of the measurement (this may lead to the measurement being splitting into different time slots with the need to discharge the vehicle's traction battery before starting the next time slot). If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its maximum rated charging/input current value for AC charging.

In case of multiple batteries the average state of charge must be considered.

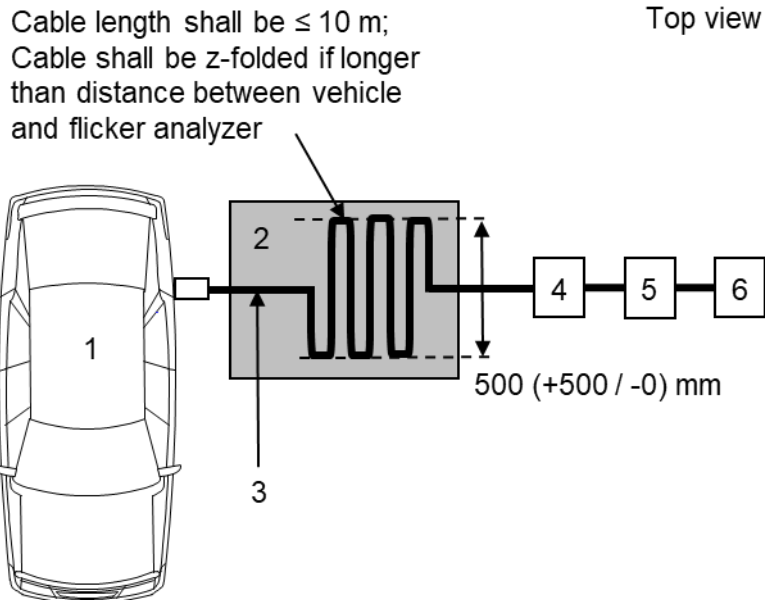
The vehicle shall be immobilized, the engine(s) (ICE and / or electrical engine) shall be OFF and in charging mode.

All other equipment which can be switched ON by the driver or passengers shall be OFF."

Annex 12, Appendix 1,

Figure 1b, amend to read:

"Figure 1b

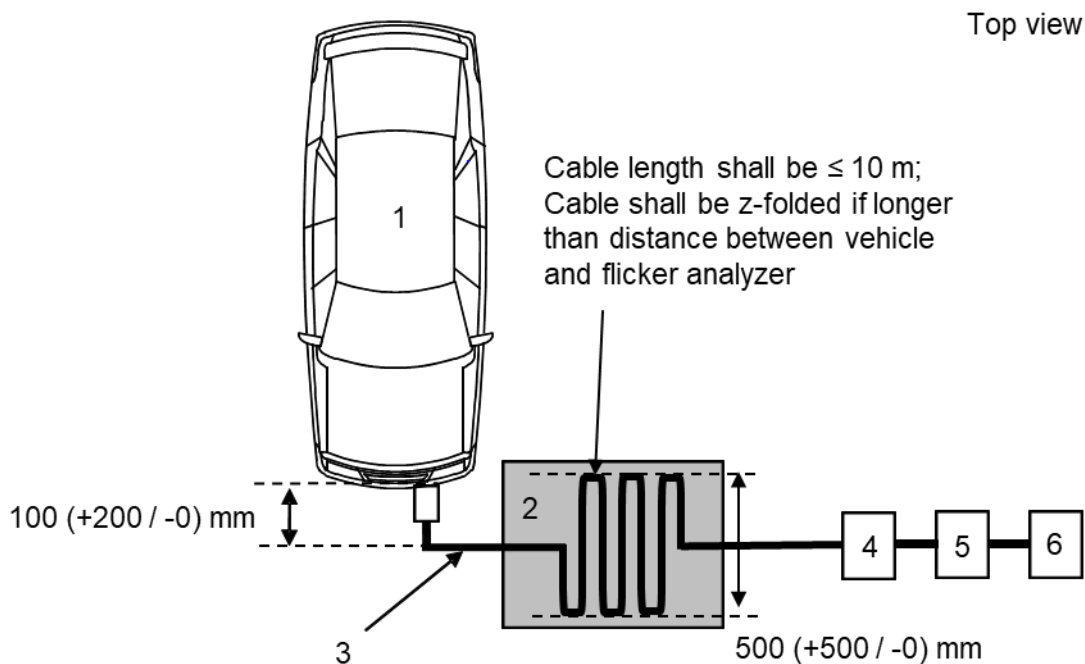


Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging harness
- 4 Flicker analyzer
- 5 Impedance simulator
- 6 Power supply"

Figure 1d, amend to read:

"Figure 1d



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging harness
- 4 Flicker analyzer
- 5 Impedance simulator
- 6 Power supply"

Annex 13,

Paragraph 2.1., amend to read:

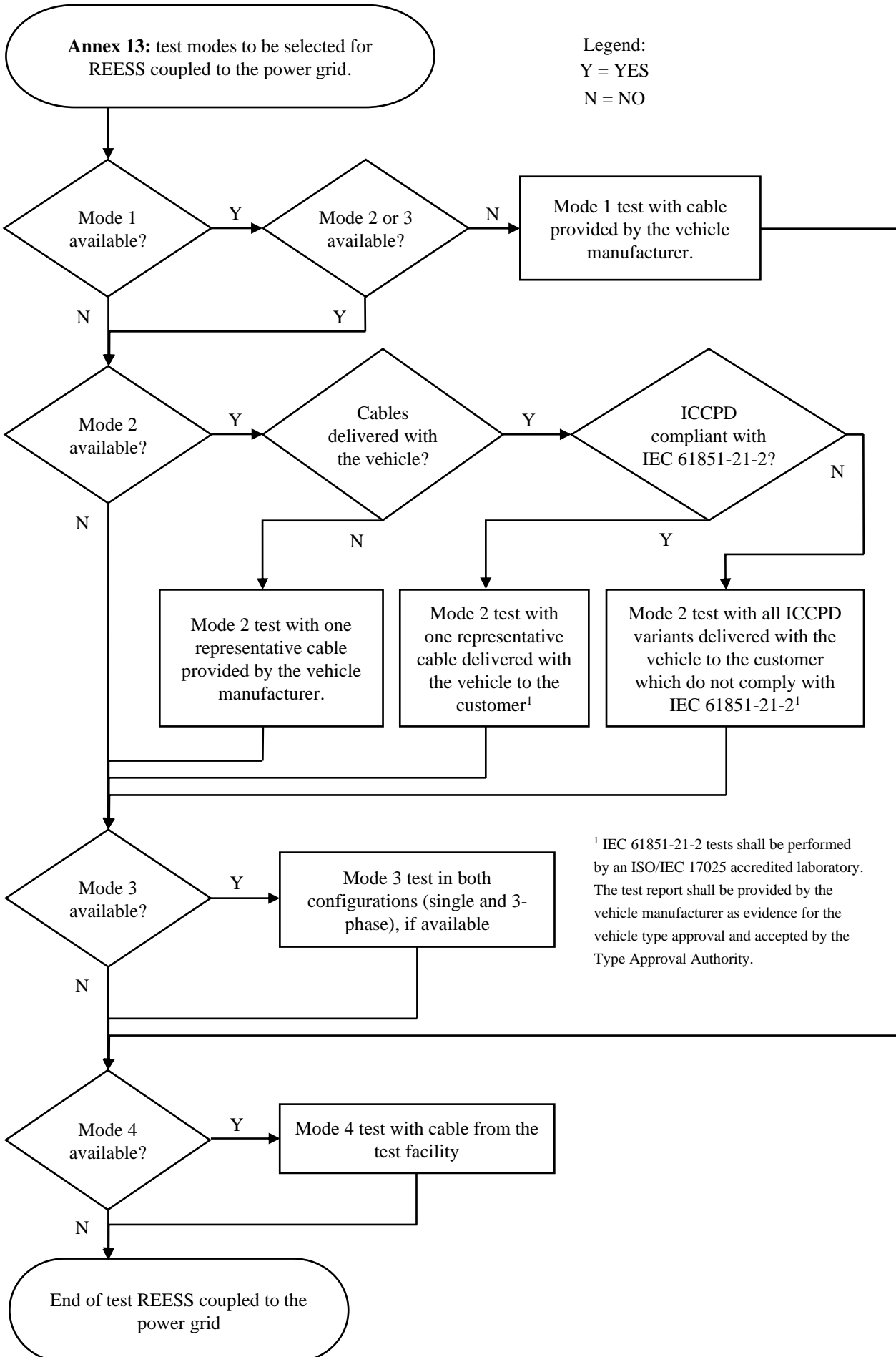
"2.1. The vehicle shall be in configuration "REESS charging mode coupled to the power grid".

For two-wheeled vehicles, a non-conductive insulating support with a thickness of 5 – 20 mm shall be used between stand and ground plane.

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of Figure 1.

Figure 1

Charging mode configuration for Annex 13



The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole frequency range measurement (this may lead to splitting the measurement in different sub-bands with the need to discharge the vehicle's traction battery before starting the next sub-bands).

If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its maximum rated charging/input current value for AC charging.

If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal value or to a minimum of 16 A (if the 20 per cent of its nominal value cannot be achieved in the test facility) for DC charging unless another value is agreed with the Type Approval Authorities.

In case of multiple batteries the average state of charge must be considered.

The vehicle shall be immobilized, the engine(s) (ICE and / or electrical engine) shall be OFF and in charging mode.

All other equipment which can be switched ON by the driver or passengers shall be OFF."

Paragraph 3.5., amend to read:

"3.5. The measurements shall be performed with a spectrum analyser or a scanning receiver. The parameters to be used are defined in Table 1 and Table 2.

Spectrum analysers and FFT-based instruments, that meet the requirements of CISPR 16-1-1, may be used for conformity measurements. FFT-based measuring instruments shall continuously record and evaluate the signal during the measurement time. If using FFT-based instruments, the minimum measurement time shall be 1 s per analysis frequency band (in real-time mode) of the FFT instrument.

Table 1
Spectrum analyser parameters

| Frequency range MHz | Peak detector | | Quasi-peak detector | | Average detector | |
|---------------------|---------------|-------------------|---------------------|-------------------|------------------|-------------------|
| | RBW at -3 dB | Minimum scan time | RBW at -6 dB | Minimum scan time | RBW at -3 dB | Minimum scan time |
| 0.15 to 30 | 9/10 kHz | 10 s/MHz | 9 kHz | 200 s/MHz | 9/10 kHz | 10 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 | | | Average detector | | |
|---------------------|---------------|-----------|--------------------|---------------------|-----------|--------------------|------------------|-----------|--------------------|
| | BW at -6 dB | Step size | Minimum dwell time | BW at -6 dB | Step size | Minimum dwell time | BW at -6 dB | 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 |

Paragraph 4.2., amend to read:

"4.2. Measurements shall be performed with average and either quasi-peak or peak detectors. The limits are given in paragraph 7.5. of this Regulation.

Table 8 for AC lines and Table 9 for DC lines. If peak detectors are used a correction factor of 20 dB as defined in CISPR 12 shall be applied."

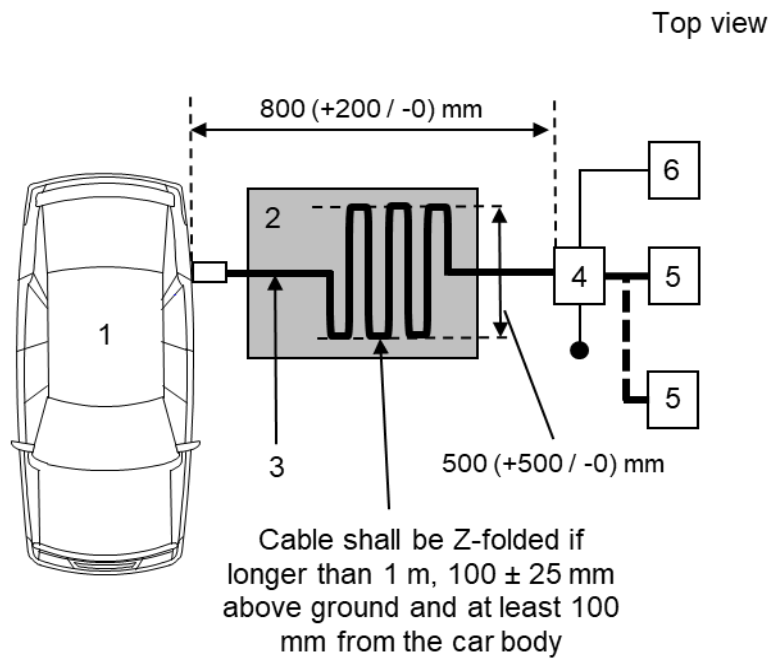
Insert a new paragraph 4.3., to read:

"4.3. If the manufacturer provides measurement data for the whole frequency band for all applicable charging mode configurations from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type-Approval Authority for all the available charging modes configurations defined in paragraph 2.1, the Technical Service may perform tests only for one of the available charging mode configuration defined in paragraph 2.1 to confirm that the vehicle meets the requirements of this Annex."

Annex 13, Appendix 1,

Figure 1b, amend to read:

"Figure1b

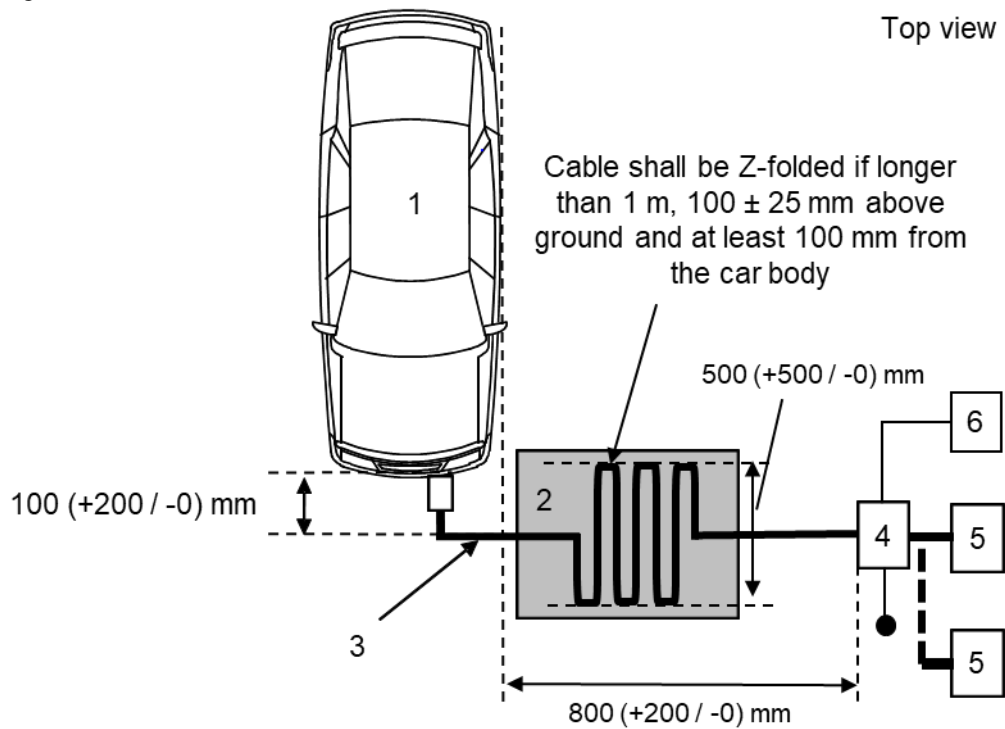


Legend:

- 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"

Figure 1d, amend to read:

"Figure 1d



Legend:

- 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 14, amend to read:

"Annex 14 (RESERVED)

Annex 14, Appendix 1, delete.

Annex 15,

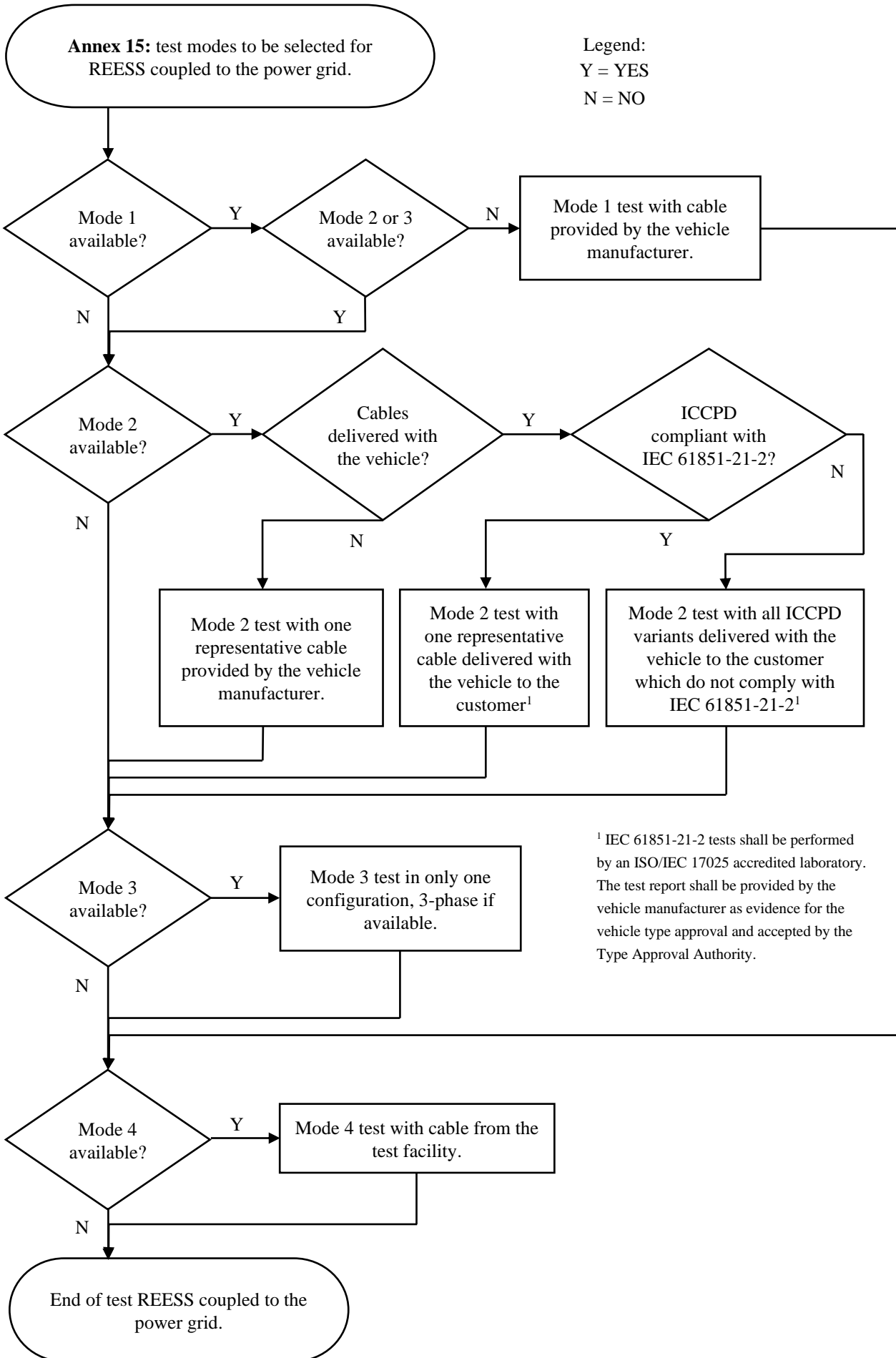
Paragraph 2., amend to read:

"2. Vehicle state during tests in configuration "REESS in charging mode coupled to the power grid

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of Figure 1.

Figure 1

Charging mode configuration for Annex 15



Paragraph 2.1.2., amend to read:

"2.1.2. Basic vehicle conditions

The paragraph defines minimum test conditions (as far as applicable) and failures criteria for vehicle immunity tests. Other vehicle systems, which can affect immunity related functions, shall be tested in a way to be agreed between manufacturer and Technical Service.

| <i>"REESS charging mode" vehicle test conditions</i> | <i>Failure criteria</i> |
|--|--|
| <p>The REESS shall be in charging mode. The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole time duration of the measurement (this may lead to the measurement being split into different time slots with the need to discharge the vehicle's traction battery before starting the next time slot). If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its maximum rated charging/input current value for AC charging.</p> <p>If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal value or to a minimum of 16 A (if the 20 per cent of its nominal value cannot be achieved in the test facility) for DC charging unless another value is agreed with the Type Approval Authorities.</p> <p>In case of multiple batteries the average state of charge must be considered.</p> | <p>Vehicle sets in motion.</p> <p>Unexpected release of the parking brake.</p> <p>Loss of Parking position for automatic transmission.</p> |

"

Paragraph 4.2., amend to read:

"4.2. The vehicle shall be placed directly on the ground plane.

For two-wheeled vehicles, a non-conductive insulating support with a thickness of 5 – 20 mm shall be used between stand and ground plane."

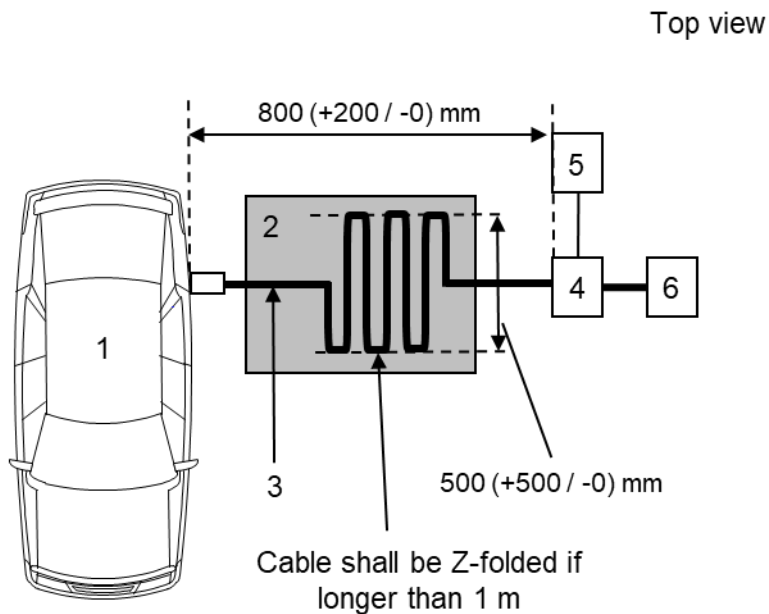
Paragraph 5.1.1., amend to read:

"5.1.1. Test shall be conducted in accordance with IEC 61000-4-4. Test shall be performed only at the severity levels given in paragraph 7.8.2.1."

Insert a new paragraph 6., to read:

"6. If the manufacturer provides measurement data for all applicable charging mode configurations from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type Approval Authority for all the available charging modes configurations defined in paragraph 2.1, the Technical Service may perform tests only for one of the available charging mode configuration defined in paragraph 2.1 to confirm that the vehicle meets the requirements of this Annex."

Annex 15, Appendix 1,
 Figure 1b, amend to read:
 "Figure 1b

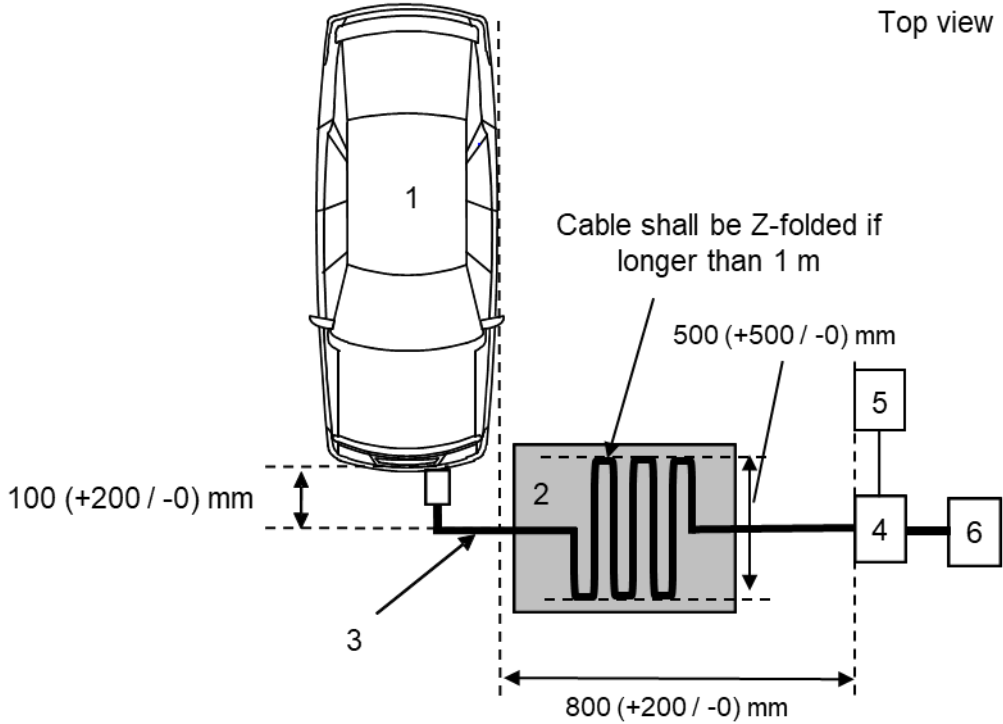


Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging harness
- 4 CDN
- 5 Fast Transients / Burst generator
- 6 Power supply"

Figure 1d, amend to read:

"Figure 1d



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging harness
- 4 CDN
- 5 Fast Transients / Burst generator
- 6 Power supply
- "

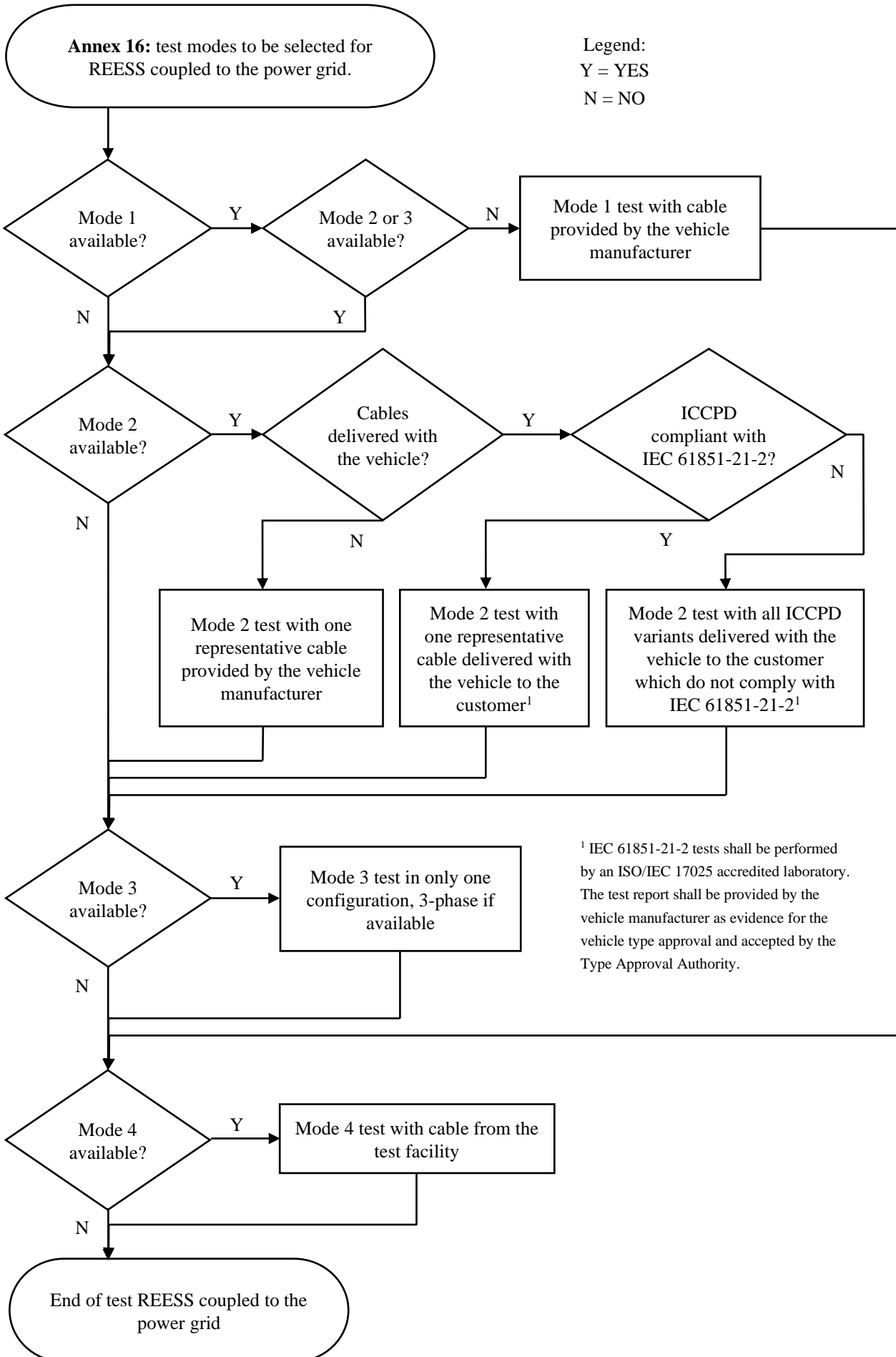
Annex 16,

Paragraph 2., amend to read:

"2. Vehicle state during tests in configuration "REESS in charging mode coupled to the power grid

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of Figure 1.

Figure 1
Charging mode configuration for Annex 16



Paragraph 2.1.2., amend to read:

"2.1.2. Basic vehicle conditions

The paragraph defines minimum test conditions (as far as applicable) and failures criteria for vehicle immunity tests. Other vehicle systems, which can affect immunity related functions, shall be tested in a way to be agreed between manufacturer and Technical Service.

| <i>" REESS charging mode" vehicle test conditions</i> | <i>Failure criteria</i> |
|---|---|
| <p>The REESS shall be in charging mode. The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole time duration of the measurement (this may lead to the measurement being split into different time slots with the need to discharge the vehicle’s traction battery before starting the next time slot).. If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its maximum rated charging/input current value for AC charging.</p> <p>If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal value or to a minimum of 16 A (if the 20 per cent of its nominal value cannot be achieved in the test facility) for DC charging unless another value is agreed with the Type Approval Authorities.</p> <p>In case of multiple batteries the average state of charge must be considered.</p> | <p>Vehicle sets in motion</p> <p>Unexpected release of the parking brake.</p> <p>Loss of Parking position for automatic transmission.</p> |

Paragraph 4.2., amend to read:

"4.2. The vehicle shall be placed directly on the ground plane.

For two-wheeled vehicles, a non-conductive insulating support with a thickness of 5 – 20 mm shall be used between stand and ground plane."

Paragraph 5.1.1., amend to read:

"5.1.1. Test shall be performed in accordance with method according to IEC 61000-4-5 only at the severity levels specified in paragraph 7.9.2.1."

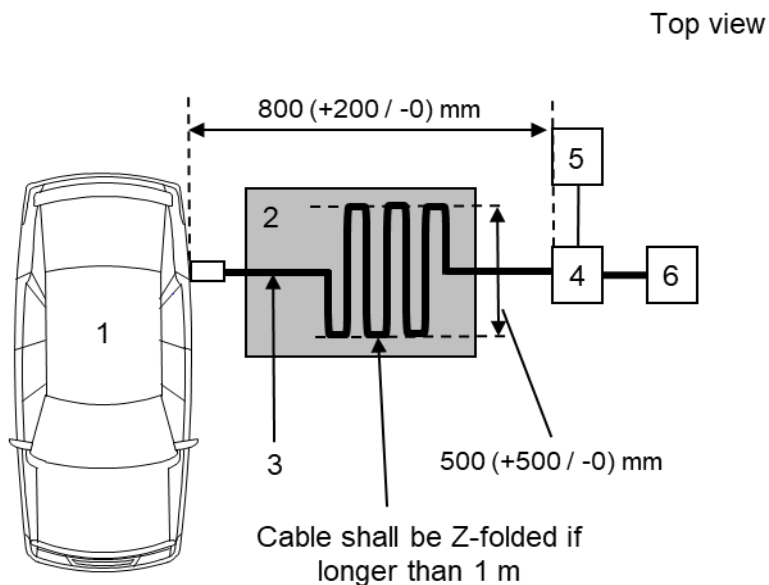
Insert a new paragraph 6., to read:

"6. If the manufacturer provides measurement data for all applicable charging mode configurations from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type Approval Authority for all the available charging modes configurations defined in 2.1, the Technical Service may perform tests only for one of the available charging mode configuration defined in paragraph 2.1. to confirm that the vehicle meets the requirements of this Annex."

Annex 16, Appendix 1,

Figure 1b, amend to read:

"Figure 1b

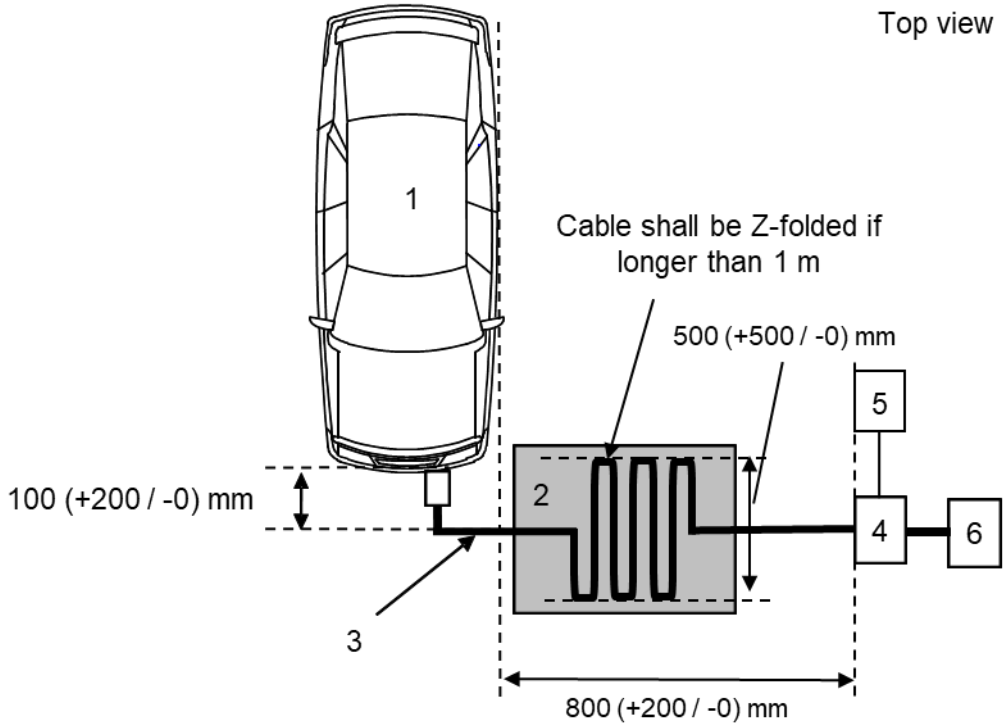


Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging harness
- 4 CDN
- 5 Surge generator
- 6 Power supply"

Figure 1d, amend to read:

"Figure 1d



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging harness
- 4 CDN
- 5 Surge generator
- 6 Power supply "

Annex 17,

Paragraph 2.1., amend to read:

"2.1. The ESA shall be in configuration "REESS charging mode coupled to the power grid".

The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole time duration of the measurement (this may lead to the measurement being split into different time slots with the need to discharge the vehicle's traction battery before starting the next time slot).

If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its maximum rated charging/input current value for AC charging."

Paragraphs 4.2. to 4.5., amend to read:

"4.2. The limits for single phase or three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current ≤ 16 A per phase are given in Table 12 of paragraph 7.11.2.1. of this Regulation.

4.3. The limits for single phase or other than balanced three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in Table 13 of paragraph 7.11.2.2. of this Regulation.

- 4.4. The limits for balanced three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase are given in paragraph Table 14 of 7.11.2.2. of this Regulation.
- 4.5. For three-phase ESAs in configuration "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase, when at least one of the three conditions a), b) or c) described in paragraph 5.2. of IEC 61000-3-12 is fulfilled, then the limits given in Table 15 of paragraph 7.11.2.2. of this Regulation can be applied."

Annex 18, paragraph 2.1., amend to read:

- "2.1. The ESA shall be in configuration "REESS charging mode coupled to the power grid"
- The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole time duration of the measurement (this may lead to the measurement being split into different time slots with the need to discharge the vehicle's traction battery before starting the next time slot).
- If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its maximum rated charging/input current value for AC charging. "

Annex 19, paragraph 2.1., amend to read:

- "2.1. The ESA shall be in configuration "REESS charging mode coupled to the power grid".
- The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole frequency range measurement (this may lead to split the measurement in different sub-bands with the need to discharge the vehicle's traction battery before starting the next sub-bands).
- If the test is not performed with a REESS the ESA should be tested at rated current.
- If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its maximum rated charging/input current value for AC charging.
- If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal value or to a minimum of 16 A (if the 20 per cent of its nominal value cannot be achieved in the test facility) for DC charging unless another value is agreed with the Type Approval Authorities. "

Annex 19,

Paragraph 3.4., amend to read:

- "3.4. The measurements shall be performed with a spectrum analyser or a scanning receiver. The parameters to be used are defined in Table 1 and Table 2.
- Spectrum analysers and FFT-based instruments, that meet the requirements of CISPR 16-1-1, may be used for conformity measurements. FFT-based measuring instruments shall continuously record and evaluate the signal during the measurement time. If using FFT-based instruments, the minimum measurement time shall be 1 s per analysis frequency band (in real-time mode) of the FFT instrument.

Table 1
Spectrum analyser parameters

| Frequency range MHz | Peak detector | | Quasi-peak detector | | Average detector | |
|---------------------|---------------|-------------------|---------------------|-------------------|------------------|-------------------|
| | RBW at -3 dB | Minimum scan time | RBW at -6 dB | Minimum scan time | RBW at -3 dB | Minimum scan time |
| 0.15 to 30 | 9/10 kHz | 10 s/MHz | 9 kHz | 200 s/MHz | 9/10 kHz | 10 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 | | | Average detector | | |
|---------------------|---------------|-----------|--------------------|---------------------|-----------|--------------------|------------------|-----------|--------------------|
| | BW at -6 dB | Step size | Minimum dwell time | BW at -6 dB | Step size | Minimum dwell time | BW at -6 dB | 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 |

"

Paragraph 4.2., amend to read:

"4.2. Measurements shall be performed with average and either quasi-peak or peak detectors. The limits are given in Table 16 of paragraph 7.13.2.1. of this Regulation for AC lines and in Table 17 of paragraph 7.13.2.2. of this Regulation for DC lines. If peak detectors are used a correction factor of 20 dB as defined in CISPR 12 shall be applied."

Annex 20, amend to read:

"Annex 20 (RESERVED)

Annex 20, Appendix 1, delete.

Annex 21,

Paragraph 2.1., amend to read:

"2.1. Basic ESA conditions

The paragraph defines minimum test conditions (as far as applicable) and failures criteria for ESA immunity tests.

| <i>"REESS charging mode" ESA test conditions</i> | <i>Failure criteria</i> |
|---|---|
| <p>ESA shall be in configuration "REESS charging mode coupled to the power grid".</p> <p>The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole time duration of the measurement (this may lead to the measurement being split into different time slots with the need to discharge the vehicle's traction battery before starting the next time slot).</p> <p>If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its maximum rated charging/input current value for AC charging.</p> <p>If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal value or to a minimum of 16 A (if the 20 per cent of its nominal value cannot be achieved in the test facility) for DC charging unless another value is agreed with the Type Approval Authorities.</p> | <p>Temporary loss of charging function is allowed, provided that there is no incorrect charging condition (e.g. over-current, overvoltage) and the function can be restored by a simple intervention, without the use of tools, such as turning off/on the DUT, after the disturbance is removed.</p> |

"

Paragraph 5.1.1., amend to read:

"5.1.1. Test shall be conducted in accordance with IEC 61000-4-4. Test shall be performed only at the severity levels given in paragraph 7.15.2.1."

Annex 22,

Paragraph 2.1., delete.

Paragraph 2.1.2., renumber and amend to read:

"2.1. Basic ESA conditions

The paragraph defines minimum test conditions (as far as applicable) and failures criteria for ESA immunity tests.

| <i>"REESS charging mode" ESA test conditions</i> | <i>Failure criteria</i> |
|--|---|
| <p>ESA shall be in configuration "REESS charging mode coupled to the power grid".</p> <p>The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole frequency range measurement (this may lead to split the measurement in different sub-bands with the need to discharge the vehicle's traction battery before starting the next sub-bands).</p> <p>If the test is not performed with a REESS the ESA should be tested at rated current. If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its maximum rated charging/input current value for AC charging.</p> <p>If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal value or to a minimum of 16 A (if the 20 per cent of its nominal value cannot be achieved in the test facility) for DC charging unless another value is agreed with the Type-Approval Authorities.</p> | <p>Temporary loss of charging function is allowed, provided that there is no incorrect charging condition (e.g. over-current, overvoltage) and the function can be restored by a simple intervention, without the use of tools, such as turning off/on the DUT, after the disturbance is removed.</p> |

"

Paragraph 5.1.1., amend to read:

"5.1.1. Test shall be conducted in accordance with IEC 61000-4-4. Test shall be performed only at the severity levels given in paragraph 7.16.2.1."
