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Economic Commission for Europe**Inland Transport Committee****World Forum for Harmonization of Vehicle Regulations****Working Party on Lighting and Light-Signalling****Eightieth session**

Geneva, 23-26 October 2018

Item 7 (a) of the provisional agenda

Other UN Regulations: UN Regulation No. 10 (Electromagnetic compatibility)**Proposal for the 06 series of amendments to UN Regulation No. 10 (Electromagnetic compatibility)****Submitted by the Task Force on Electromagnetic Compatibility (TF EMC)***

The text reproduced below has been prepared by TF EMC with the aim:

- To be consistent with the International Special Committee on Radio Interference (CISPR) 12 Standard narrow-band limit;
- To be consistent with the last CISPR 12 in terms of definitions, types of artificial networks and description, vehicle in charging mode description and associated figures;
- To clarify the transitional provisions;
- To precise the vehicle “immunity related functions” and the associated vehicle test modes and failure criteria;
- To consider the specific demands from Contracting Parties.

The modifications are marked in bold for new or strikethrough for deleted characters. One issue (extension of vehicle categories) is still to be discussed and marked between square brackets.

* In accordance with the programme of work of the Inland Transport Committee for 2018–2019 (ECE/TRANS/274, para. 123 and ECE/TRANS/2018/21/Add.1, cluster 3.1), 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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I. Proposal

Paragraph 1.1., amend to read:

"1.1. Vehicles of categories L, M, N [~~and~~] O, [**T, R and S**]¹ with regard to electromagnetic compatibility;"

Paragraph 1.1., footnote 1, amend to read:

"¹ As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.3 **6**, para. 2.

Paragraph 2.12., amend to read:

"2.12. **"Immunity related functions" are the following functions; this list is not exhaustive and shall be adapted to the technical evolution of vehicle/technology:**

- (a) Functions related to the direct control of the vehicle:
 - (i) By degradation or change in: e.g. engine, gear, brake, suspension, active steering, speed limitation devices;
 - (ii) By affecting drivers position: e.g. seat or steering wheel positioning;
 - (iii) By affecting driver's visibility: e.g. dipped beam, windscreen wiper, **indirect vision systems, blind spot systems.**
- (b) Functions related to driver, passenger and other road user protection:
 - (i) E.g. airbag and safety restraint systems, **emergency calling systems.**
- (c) Functions which, when disturbed, cause confusion to the driver or other road users:
 - (i) Optical disturbances: incorrect operation of e.g. direction indicators, stop lamps, end outline marker lamps, rear position lamp, light bars for emergency system, wrong information from warning indicators, lamps or displays related to functions in subparagraphs (a) or (b) which might be observed in the direct view of the driver;
 - (ii) Acoustical disturbances: incorrect operation of e.g. anti-theft alarm, horn.
- (d) Functions related to vehicle data bus functionality:
 - (i) By blocking data transmission on vehicle data bus-systems, which are used to transmit data, required to ensure the correct functioning of other immunity related functions.
- (e) Functions which when disturbed affect vehicle statutory data: e.g. tachograph, odometer.
- (f) Function related to charging mode when coupled to the power grid:
 - (i) For vehicle test: by leading to unexpected vehicle motion;
 - (ii) For ESA test: by leading to an incorrect charging condition (e.g. over-current, over-voltage)."

Add *new paragraphs 2.16. to 2.24.*, to read:

- 2.16. **"Mode 1 Charging Mode"** means charging mode as defined in IEC 61851-1 sub-clause 6.2.1 where the vehicle is connected directly to a.c. mains without any communication between the vehicle and the charging station and without any supplementary pilot or auxiliary contacts. In some countries Mode 1 charging may be prohibited or requires special pre-cautions.
- 2.17. **"Mode 2 Charging Mode"** means charging mode as defined in IEC 61851-1 sub-clause 6.2.2 where the vehicle is connected to a.c. mains using a charging harness including an Electric Vehicle Supply Equipment (EVSE) box providing control pilot signalling between the vehicle and the EVSE box and personal protection against electric shock. In some countries, special restrictions have to be applied for mode 2 charging. There is no communication between the vehicle and the AC supply network (mains).
- 2.18. **"Mode 3 Charging Mode"** means charging mode as defined in IEC 61851-1 sub-clause 6.2.3 where the vehicle is connected to an EVSE (e.g. charging station, wallbox) providing a.c. power to the vehicle with communication between the vehicle and the charging station (through signal/control lines and/or through wired network lines).
- 2.19. **"Mode 4 Charging Mode"** means charging mode as defined in IEC 61851-1 sub-clause 6.2.4 where the vehicle is connected to an EVSE providing d.c. power to the vehicle (with an off-board charger) with communication between the vehicle and the charging station (through signal/control lines and/or through wired network lines).
- 2.20. **"Signal/control port"** means port intended for the interconnection of components of an ESA, or between an ESA and local AE (Ancillary 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.
- 2.21. **"Wired network port"** means port for the connection of voice, data and signaling transfers intended to interconnect widely dispersed systems by direct connection to a single-user or multi-user communication network. Examples of these include CATV, PSTN, ISDN, xDSL, LAN and similar networks. These ports may support screened or unshielded cables and may also carry AC or DC power where this is an integral part of the telecommunication specification.
- 2.22. **"Asymmetric artificial network (AAN)"** means network used to measure (or inject) asymmetric (common mode) voltages on unshielded symmetric signal (e.g. telecommunication) lines while rejecting the symmetric (differential mode) signal. This network is inserted in the communication/signal lines of the vehicle in charging mode to provide a specific load impedance and/or a decoupling (e.g. between communication/signal lines and power mains). AAN is also used in this regulation for symmetric lines
- 2.23. **"Direct current charging artificial network (DC-charging-AN)"** means network inserted in the high voltage DC lead of vehicle in charging mode which provides, in a given frequency range, a specified load impedance

and which may isolate the vehicle from the HV DC charging station in that frequency range.

- 2.24. **"Artificial mains network (AMN)" means provides a defined impedance to the ESA at radio frequencies, couples the disturbance voltage to the measuring receiver and decouples the test circuit from the supply mains. There are two basic types of AMN, the V-network (V-AMN) that couples the unsymmetrical voltages, and the delta-network that couples the symmetric and the asymmetric voltages separately. The terms line impedance stabilization network (LISN) and V-AMN are used interchangeably. Network inserted in the power mains of the vehicle in charging mode which provides, in a given frequency range, a specified load impedance and which isolates the vehicle from the power mains in that frequency range."**

Paragraph 3.1.8., amend to read:

- "3.1.8. For vehicles of categories [L], M, N ~~and~~ O, **[T, R and S]**, the vehicle manufacturer shall provide a statement of frequency bands, power levels, antenna positions and installation provisions for the installation of radio frequency transmitters (RF-transmitters), even if the vehicle is not equipped with an RF transmitter at time of type approval. This should cover all mobile radio services normally used in vehicles. This information shall be made publicly available following the type approval."

Paragraph 3.1.9., to be deleted.

Paragraph 5.3.1., footnote 2, amend to read:

- "² The distinguish numbers of the Contracting Parties to the 1958 Agreement are reproduced in Annex 3 to Consolidated Resolution on the Construction of Vehicles (R.E.3), document ECE/TRANS/WP.29/78/Rev.3 **6**, Annex 3."

Paragraph 6.3.2.1., amend to read:

- "6.3.2.1. If measurements are made using the method described in Annex 5 using a vehicle-to-antenna spacing of 10.0 ± 0.2 m, the limits shall be ~~22 dB microvolts/m in the 30 to 75 MHz frequency band and 22 to 33 dB microvolts/m in the 75 to 400 MHz frequency band, this limit increasing logarithmically with frequencies above 75 MHz as shown in Appendix 4 to this Regulation. In the 400 to 1,000 MHz frequency band the limit remains constant at 33 dB microvolts/m.~~ **28 dB microvolts/m in the 30 to 230 MHz frequency band and 35 dB microvolts/m in the 230 to 1,000 MHz frequency band.**"

Paragraph 6.3.2.2., amend to read:

- "6.3.2.2. If measurements are made using the method described in Annex 5 using a vehicle-to-antenna spacing of 3.0 ± 0.05 m, the limit shall be ~~32 dB microvolts/m in the 30 to 75 MHz frequency band and 32 to 43 dB microvolts/m in the 75 to 400 MHz frequency band, this limit increasing logarithmically with frequencies above 75 MHz as shown in Appendix 5 to this Regulation. In the 400 to 1,000 MHz frequency band the limit remains constant at 43 dB microvolts/m.~~ **38 dB microvolts/m in the 30 to 230 MHz frequency band and 45 dB microvolts/m in the 230 to 1,000 MHz frequency band.**"

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 ~~able~~ **harness** delivered by the

manufacturer. In this case, the cable shall be type approved as part of the vehicle."

Paragraph 7.1.4., amend to read:

"7.1.4. Artificial networks

AC Power mains shall be applied to the vehicle / ESA through 50 μ H/50 Ω AN(s) AMN(s) as defined in ~~CISPR 16 1 2 paragraph 4.3.~~ **Appendix 8 clause 4.**

DC Power mains shall be applied to the vehicle / ESA through 5 μ H/50 Ω ~~HVDC-charging-~~AN(s) as defined in ~~CISPR 25~~ **Appendix 8 clause 3.**

High voltage power line shall be applied to the ESA through a 5 μ H/50 Ω HV-AN(s) as defined in Appendix 8 clause 2."

Paragraph 7.3.2.2., table 4; amend to read:

"Table 4

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

Minimum R_{scc}	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 Distorsion (THD) and Partial Weighted Harmonic Distorsion (PWHD) the same way than odd harmonics.

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

Paragraph 7.4.2.1., amend to read:

"7.4.2.1. If measurements are made using the method described in Annex 12, the limits for rated current \leq 16 A per phase and not subjected to conditional connection are those defined in IEC 61000-3-3, paragraph 5-:

- **the value of Pst shall not be greater than 1.0;**
- **the value of Plt shall not be greater than 0.65;**
- **the value of d(t) during a voltage change shall not exceed 3.3 per cent for more than 500 ms;**
- **the relative steady-state voltage change, dc, shall not exceed 3.3 per cent;**
- **the maximum relative voltage change dmax, shall not exceed 6 per cent."**

Paragraph 7.4.2.2., amend to read:

"7.4.2.2. If measurements are made using the method described in Annex 12, the limits for rated current > 16 A and \leq 75 A per phase and subjected to conditional connection are those defined in IEC 61000-3-11, paragraph 5-:

- the value of Pst shall not be greater than 1.0;
- the value of Plt shall not be greater than 0.65;
- the value of d(t) during a voltage change shall not exceed 3.3 per cent for more than 500 ms;
- the relative steady-state voltage change, dc, shall not exceed 3.3 per cent;
- the maximum relative voltage change dmax, shall not exceed 6 per cent."

Paragraph 7.6., amend to read:

"7.6. Specifications concerning emission of radiofrequency conducted disturbances on ~~network and telecommunication access~~ **wired network port** from vehicles".

Paragraph 7.6.1., amend to read:

"7.6.1. Method of measurement

The emission of radiofrequency conducted disturbances on ~~network and telecommunication access~~ **wired network port** generated by the vehicle representative of its type shall be measured using the method described in Annex 14. The method of measurement shall be defined by the vehicle manufacturer in accordance with the Technical Service."

Paragraph 7.6.2.1., amend to read:

"7.6.2.1. If measurements are made using the method described in Annex 14, the limits on ~~network and telecommunication access~~ **wired network port** (~~telecommunication access as defined in paragraph 3.6. of CISPR22~~) are those defined in IEC 61000-6-3 and given in Table 9.

Table 9

Maximum allowed radiofrequency conducted disturbances on ~~network and telecommunication access~~ **wired network port**

Frequency (MHz)	Voltage limits (detector)	Current limits (detector)
0.15 to 0.5	84 to 74 dB μ V (quasi-peak) 74 to 64 dB μ V (average) (linearly decreasing with logarithm of frequency)	40 to 30 dB μ A (quasi-peak) 30 to 20 dB μ A (average) (linearly decreasing with logarithm of frequency)
0.5 to 30	74 dB μ V (quasi-peak) 64 dB μ V (average)	30 dB μ A (quasi-peak) 20 dB μ A (average)

Paragraph 7.11.2.2., table 11, amend to read:

"Table 11

Maximum allowed harmonics (input current > 16 A and \leq 75 A per phase) for **single phase or equipment** 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

Minimum R_{sce}	Acceptable individual harmonic current I_n/I_1 %						Maximum current harmonic ratio %	
	35	20	13	9	8	6	40	40
250								
≥ 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."

Paragraph 7.14., amend to read:

"7.14. Specifications concerning emission of radiofrequency conducted disturbances ~~network and telecommunication access~~ **wired network port** from ESA"

Paragraph 7.14.1., amend to read:

"7.14.1. Method of measurement

The emission of radiofrequency conducted disturbances on ~~network and telecommunication access~~ **wired network port** generated by the ESA representative of its type shall be measured using the method described in Annex 20. The method of measurement shall be defined by the ESA manufacturer in accordance with the Technical Service."

Paragraph 7.14.2.1., amend to read:

"7.14.2.1. If measurements are made using the method described in Annex 20, the limits on ~~network and telecommunication access~~ **wired network port** (~~telecommunication access as defined in paragraph 3.6 of CISPR22~~) are those defined in IEC 61000-6-3 and given in Table 16.

Table 16

Maximum allowed radiofrequency conducted disturbances on ~~network and telecommunication access~~ **wired network port**

Frequency (MHz)	Voltage limits (detector)	Current limits (detector)
0.15 to 0.5	84 to 74 dB μ V (quasi-peak) 74 to 64 dB μ V (average) (linearly decreasing with logarithm of frequency)	40 to 30 dB μ A (quasi-peak) 30 to 20 dB μ A (average) (linearly decreasing with logarithm of frequency)
0.5 to 30	74 dB μ V (quasi-peak) 64 dB μ V (average)	30 dB μ A (quasi-peak) 20 dB μ A (average)

Paragraph 7.19.1., table 18; amend to read:

"Table 18

Immunity of ESA

Test pulse number	Immunity test level	Functional status for systems:	
		Related to immunity related functions	Not related to immunity related functions
1	III	C	D
2a	III	B	D
2b	III	C	D
3a/3b	III	A	D
4	III	B (for ESA which shall be operational during engine start phases) C	D

Test pulse number	Immunity test level	Functional status for systems:	
		Related to immunity related functions (for other ESA)	Not related to immunity related functions

"

Paragraph 7.20.1., amend to read:

"7.20.1. When there is no direct connection to a ~~telecommunication network~~ **wired network** which includes telecommunication service additional to the charging communication service, Annex 14 and Annex 20 shall not apply."

Paragraph 7.20.2., amend to read:

"7.20.2. When ~~network and telecommunication access~~ **wired network port** of the vehicle uses power line Transmission (PLT) on its AC/DC power lines, Annex 14 shall not apply."

Paragraph 7.20.3., amend to read:

"7.20.3. When ~~network and telecommunication access~~ **wired network port** of the ESA uses Power Line Transmission (PLT) on its AC/DC power lines, Annex 20 shall not apply."

Paragraph 7.20.4., amend to read:

"7.20.4. Vehicles and / or ESA which are intended to be used in "REESS charging mode coupled to the power grid" in the configuration connected to a DC-charging station with a length of a DC network cable (**cable between the DC charging station and the vehicle plug**) shorter than 30 m do not have to fulfil the requirements of ~~Annex 13, Annex 15, Annex 16, Annex 19, Annex 21 and Annex 22.~~ **paragraphs 7.5., 7.8., 7.9., 7.13., 7.15., 7.16.**"

Paragraph 7.20.5., amend to read:

"7.20.5. Vehicles and/or ESA which are intended to be used in "REESS charging mode coupled to the power grid" in the configuration connected to a local/private DC-charging station without additional participants do not have to fulfil requirements of ~~Annex 13, Annex 15, Annex 16, Annex 19, Annex 21 and Annex 22.~~ **paragraphs 7.5., 7.8., 7.9., 7.13., 7.15., 7.16.**"

Paragraphs 13.1. to 13.11., amend to read:

~~"13.1. As from the official date of entry into force of the 03 series of amendments, no Contracting Party applying this Regulation shall refuse to grant approval under this Regulation as amended by the 03 series of amendments.~~

~~13.2. As from 12 months after the date of entry into force of this Regulation, as amended by the 03 series of amendments, Contracting Parties applying this Regulation shall grant approvals only if the vehicle type, component or separate technical unit to be approved meets the requirements of this Regulation as amended by the 03 series of amendments.~~

~~13.3. Contracting Parties applying this Regulation shall not refuse to grant extensions of approval to the preceding series of amendments to this Regulation.~~

~~13.4. Starting 48 months after the entry into force of the 03 series of amendments to this Regulation, Contracting Parties applying this Regulation may refuse first national registration (first entry into service) of a vehicle, component or separate technical unit which does not meet the requirements of the 03 series of amendments to this Regulation.~~

- ~~13.5. As from the official date of entry into force of the 04 series of amendments, no Contracting Party applying this Regulation shall refuse to grant type approvals under this Regulation as amended by the 04 series of amendments.~~
- ~~13.6. As from 36 months after the official date of entry into force of this Regulation, as amended by the 04 series of amendments, Contracting Parties applying this Regulation shall grant approvals only if the vehicle type, component or separate technical unit, to be approved meets the requirements of this Regulation as amended by the 04 series of amendments.~~
- ~~13.7. Contracting Parties applying this Regulation shall continue to grant approvals to those types of vehicles or component or separate technical unit type which comply with the requirements of this Regulation as amended by the preceding series of amendments during the 36 months period which follows the date of entry into force of the 04 series of amendments.~~
- ~~13.8. Until 60 months after the date of entry into force of the 04 series of amendments, no Contracting Parties shall refuse national or regional type approval of a vehicle, component or separate technical unit type approved to the preceding series of amendments to this Regulation.~~
- ~~13.9. As from 60 months after the date of entry into force of the 04 series of amendments, Contracting Parties applying this Regulation may refuse national or regional type approval and may refuse first registration of a vehicle type, or first entry into service of component or separate technical unit which does not meet the requirements of the 04 series of amendments to this Regulation.~~
- ~~13.10. Notwithstanding paragraphs 13.8. and 13.9. above, approvals granted to the preceding series of amendments to the Regulation for vehicle type which are not equipped with a coupling system to charge the REESS, or for component or separate technical unit which doesn't include a coupling part to charge the REESS, shall remain valid and Contracting Parties applying this Regulation shall continue to accept them.~~
- ~~13.11 As from 36 months after the date of entry into force of the 05 series of amendments, Contracting Parties applying this Regulation shall grant type approvals only if the vehicle type, component or separate technical unit, to be approved meets the requirements of this Regulation as amended by the 05 series of amendments.~~
- 13.1 Transitional provisions applicable to the 05 series of amendments**
- 13.1.1. As from 09 October 2014, no Contracting Party applying this UN Regulation shall refuse to grant or refuse to accept UN type-approvals under this UN Regulation as amended by the 05 series of amendments.**
- 13.1.2. As from [09 October 2017], Contracting Parties applying this UN Regulation shall not be obliged to accept UN type-approvals to the preceding series of amendments, first issued after [09 October 2017] or extensions thereof.**
- 13.1.3. Notwithstanding paragraph 13.1.2. Contracting Parties applying the UN Regulation shall continue to accept UN type-approvals issued according to the preceding series of amendments to the UN Regulation, for the vehicle type which are not equipped with a coupling system to charge the REESS, or for component or separate technical unit which doesn't include a coupling part to charge the REESS which are not affected by the changes introduced by the 05 series of amendments**

- 13.1.4.** Contracting Parties applying this UN Regulation shall not refuse to grant UN type-approvals according to any preceding series of amendments to this UN Regulation or extensions thereof.
- 13.2** Transitional provisions applicable to 06 series of amendments
- 13.2.1.** As from the official date of entry into force of the 06 series of amendments, no Contracting Party applying this UN Regulation shall refuse to grant or refuse to accept UN type-approvals under this UN Regulation as amended by the 06 series of amendments.
- 13.2.2.** As from [01 September 2022], Contracting Parties applying this UN Regulation shall not be obliged to accept UN type-approvals to the preceding series of amendments, first issued after [01 September 2022] or extensions thereof.
- 13.2.3.** Notwithstanding paragraph 13.2.2., Contracting Parties applying the UN Regulation shall continue to accept UN type-approvals issued according to the preceding series of amendments to the UN Regulation, for the vehicle type which are not equipped with a coupling system to charge the REESS, or for component or separate technical unit which doesn't include a coupling part to charge the REESS which are not affected by the changes introduced by the 05 or 06 series of amendments.
- 13.2.4.** Contracting Parties applying this UN Regulation shall not refuse to grant UN type-approvals according to any preceding series of amendments to this UN Regulation or extensions thereof."

Appendix 1, paragraph 4., to be deleted.

Appendix 1, paragraphs 5. to 6., renumber as 4. to 5., respectively.

Appendix 1, paragraph 7., renumber as 6. and amend to read:

- "~~76.~~ ISO 11451 "Road vehicles - Electrical disturbances by narrowband radiated electromagnetic energy - Vehicle test methods":
- Part 1: General and definitions (ISO 11451-1, third edition 2005 and Amd1: 2008);
- Part 2: Off-vehicle radiation source (ISO 11451-2, ~~third edition 2005~~ **fourth edition 2015**);
- Part 4: Bulk current injection (BCI) (ISO 11451-4, ~~first edition 1995~~ **third edition 2013**)."

Appendix 1, paragraph 8., renumber as 7. and amend to read:

- "~~87.~~ ISO 11452 "Road vehicles - Electrical disturbances by narrowband radiated electromagnetic energy - Component test methods":
- Part 1: General and definitions (ISO 11452-1, third edition 2005 and Amd1: 2008);
- Part 2: Absorber-lined chamber (ISO 11452-2, second edition 2004);
- Part 3: Transverse electromagnetic mode (TEM) cell (ISO 11452-3, third edition ~~2004~~ **2016**);
- Part 4: Bulk current injection (BCI) (ISO 11452-4, ~~third edition 2005 and Corrigendum 1:2009~~ **fourth edition 2011**);
- Part 5: Stripline (ISO 11452-5, second edition 2002)."

Appendix 1, paragraphs 9. to 15., renumber as 8. to 14., respectively.

Appendix 1, paragraph 16., delete.

Appendix 1, paragraphs 17. to 19., renumber as 15. to 17., respectively.

Appendix 1, paragraph 20., renumber 18. and amend to read:

"20-18. 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 1.2: 2006~~ **edition 2 2014.**"

Appendix 1, insert a new paragraph 19, to read.

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

Appendix 1, insert a new paragraph 20, to read:

"20. CISPR 32 "Electromagnetic compatibility of multimedia equipment – Emission requirements", **edition 2.0 – 2015.**"

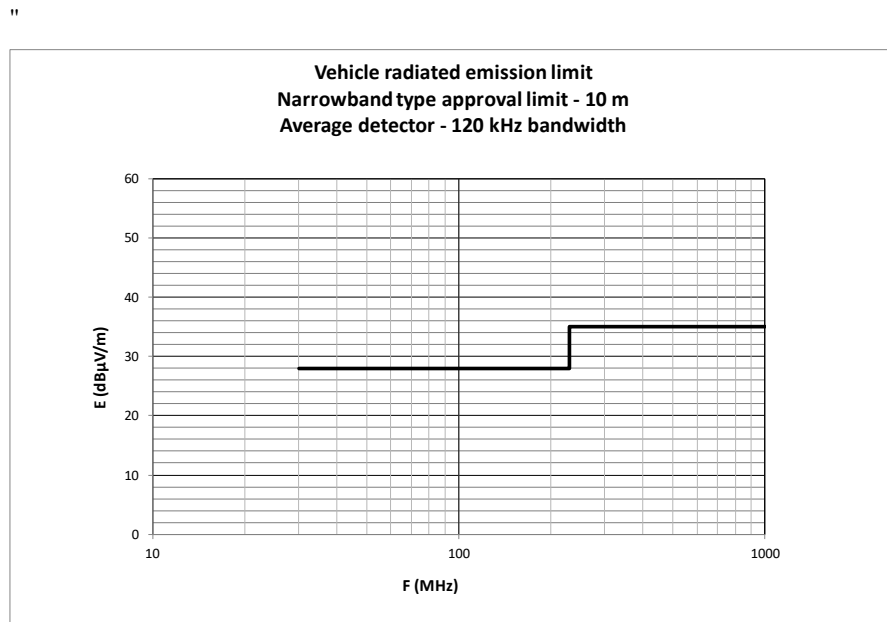
Appendix 4, table, amend to read:

"

Limit E (dBµV/m) at frequency F (MHz)	
30-230 MHz	230-1,000 MHz
E = 28	E = 35

"

Appendix 4, figure, amend to read:



Frequency - megahertz - logarithmic
 (See paragraph 6.3.2.1. of this Regulation) "

Appendix 5, table, amend to read:

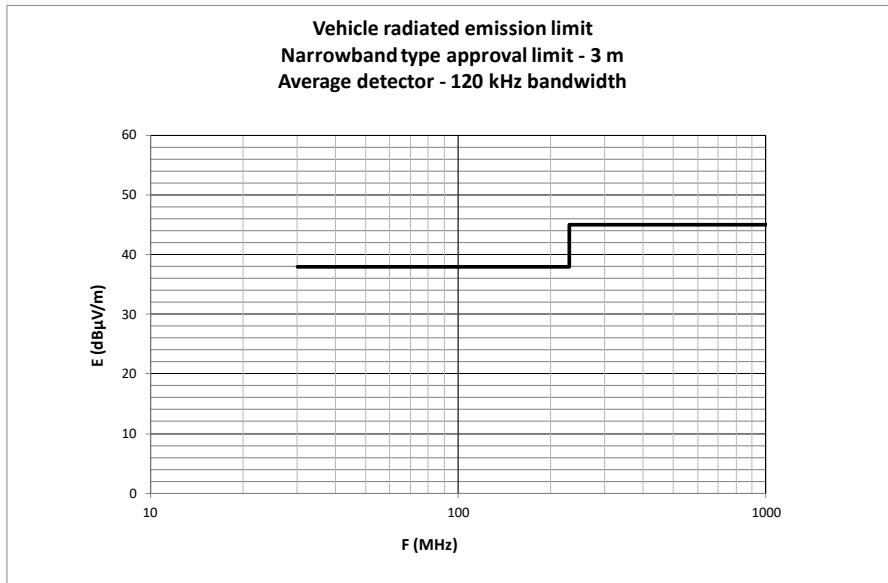
"

Limit E (dB μ V/m) at frequency F (MHz)	
30-230 MHz	230-1,000 MHz
$E = 38$	$E = 45$

"

Appendix 5, figure, amend to read:

"



Frequency - megahertz - logarithmic
(See paragraph 6.3.2.2. of this Regulation) "

Appendix 8, amend to read:

"Appendix 8

Artificial networks (AN), High Voltage Artificial Networks (HV-AN), Direct Current charging Artificial Networks (DC-charging-AN), Artificial Mains Networks (AMN) and Asymmetric Artificial Networks (AAN)

This appendix defines the artificial networks for vehicle in charging mode:

- Artificial networks (AN): used for low voltage power supplies
- High Voltage Artificial networks (HV-AN) : used for d.c. power supplies;
- Direct Current charging Artificial Networks (DC-charging-AN) : used for d.c. power supplies;
- Artificial Mains Networks (AMN) : used for a.c. power mains;

- Asymmetric artificial network (AAN): used for signal/control port lines and/or wired network port lines.

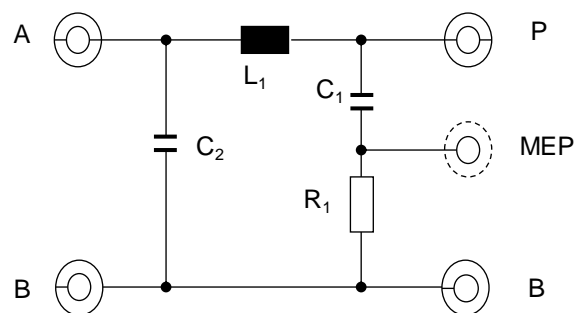
1. Artificial networks (AN)

For an ESA powered by LV, a $5 \mu\text{H} / 50 \Omega$ AN as defined in Figure 1 shall be used.

The AN(s) shall be mounted directly on the ground plane. The grounding connection of the AN(s) shall be bonded to the ground plane.

Measurement ports of AN(s) shall be terminated with a 50Ω load.

The AN impedance Z_{PB} (tolerance $\pm 20\%$) in the measurement frequency range of 0,1 MHz to 100 MHz is shown in Figure 2. It is measured between the terminals P and B (of Figure 1) with a 50Ω load on the measurement port with terminals A and B (of Figure 1) short circuited.



Legend

L_1 : $5 \mu\text{H}$	A : Port to power supply
C_1 : $0,1 \mu\text{F}$	P : Port to Vehicle or ESA
C_2 : $1 \mu\text{F}$ (default value)	B : Ground
R_1 : $1 \text{k}\Omega$	MEP : Measuring Port

Figure 1 – Example of $5 \mu\text{H}$ AN schematic

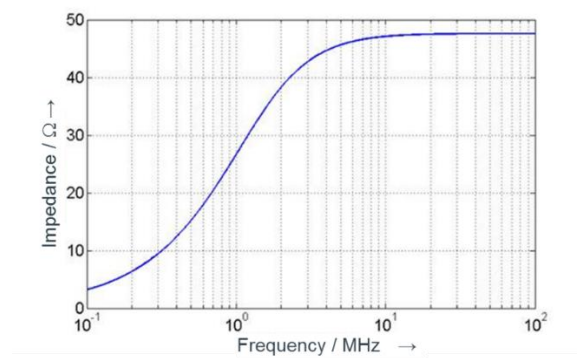


Figure 2 – Characteristics of the AN impedance Z_{PB}

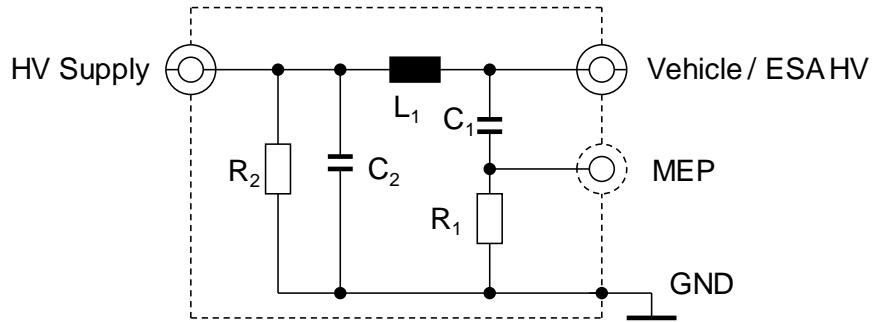
2. High Voltage Artificial networks (HV-AN)

For an ESA powered by HV, a 5 μH / 50 Ω HV-AN as defined in Figure 3 shall be used.

The HV-AN(s) shall be mounted directly on the ground plane. The grounding connection of the HV-AN(s) shall be bonded to the ground plane.

Measurement ports of HV-AN(s) shall be terminated with a 50 Ω load.

The HV-AN impedance Z_{PB} (tolerance $\pm 20\%$) in the measurement frequency range of 0,1 MHz to 100 MHz is shown in Figure 2. It is measured between the “Vehicle/ESA HV” and “GND” terminals (of Figure 3) with a 50 Ω load on the measurement port and with the “HV supply” and “GND” terminals short circuited.

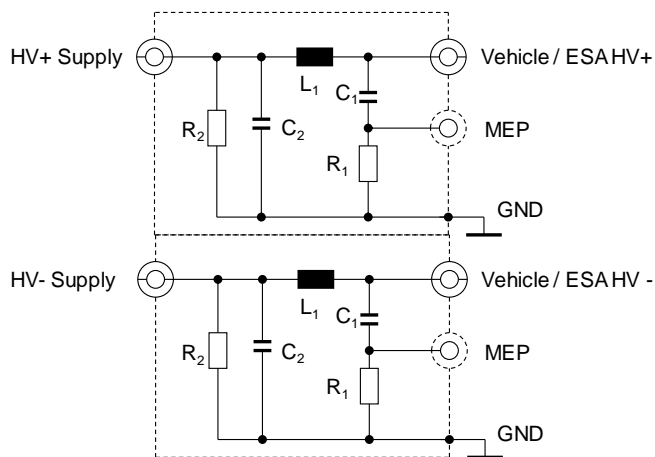


Legend

- | | |
|---|---|
| L_1 : 5 μH | HV supply : High Voltage power supply |
| C_1 : 0,1 μF | Vehicle / ESA HV : High Voltage of Vehicle or ESA |
| C_2 : 0,1 μF (default value) | MEP : Measuring Port |
| R_1 : 1 k Ω | GND : Ground |
| R_2 : 1 M Ω (discharging C_2 to $> 50 V_{dc}$ within 60 s) | |

Figure 3 – Example of 5 μH HV AN schematic

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.



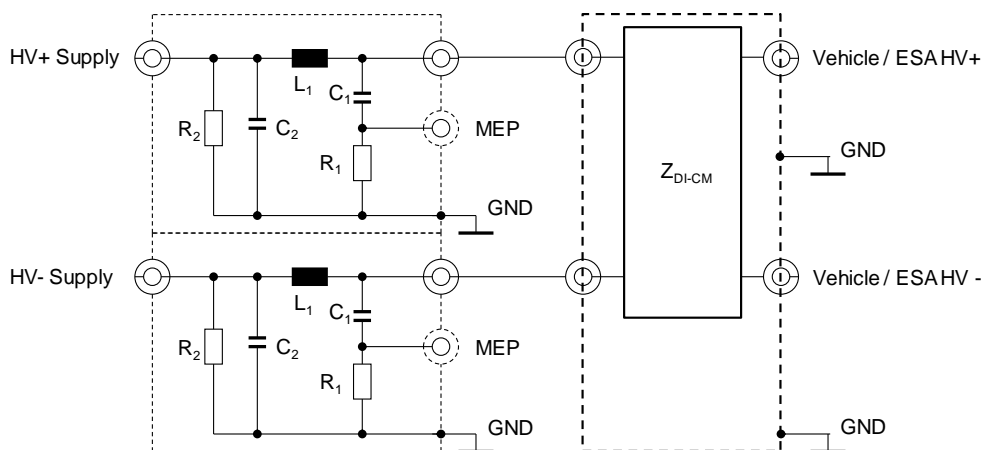
Legend

- | | |
|-------------------------|---|
| L_1 : 5 μH | HV supply : High Voltage power supply (positive and negative) |
|-------------------------|---|

C_1 : 0,1 μ F	Vehicle / ESA HV : High Voltage of Vehicle or ESA (positive and negative)
C_2 : 0,1 μ F (default value)	MEP : Measuring Port
R_1 : 1 k Ω	GND : Ground
R_2 : 1 M Ω (discharging C_2 to > 50 V _{dc} within 60 s)	

Figure 4 – Example of 5 μ H HV AN combination in a single shielded box

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).



Legend

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

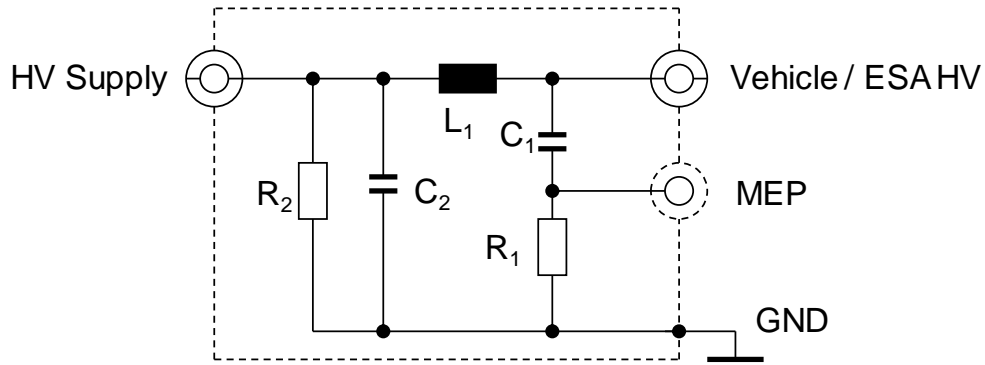
Figure 5 – Impedance matching network attached between HV ANs and ESA

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

For a vehicle in charging mode connected to a d.c. 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 ZPB (tolerance $\pm 20\%$) 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.



Legend

- | | |
|---|---|
| L_1 : 5 μH | HV supply : High Voltage power supply |
| C_1 : 0,1 μF | Vehicle / ESA HV : High Voltage of Vehicle or ESA |
| C_2 : 1 μF (default value, if another value is used, it has to be justified) | MEP : Measuring Port |
| R_1 : 1 $\text{k}\Omega$ | GND : Ground |
| R_2 : 1 $\text{M}\Omega$ (discharging C_2 to $> 50 V_{\text{dc}}$ within 60 s) | |

Figure 6 – Example of 5 μH DC-charging-AN schematic

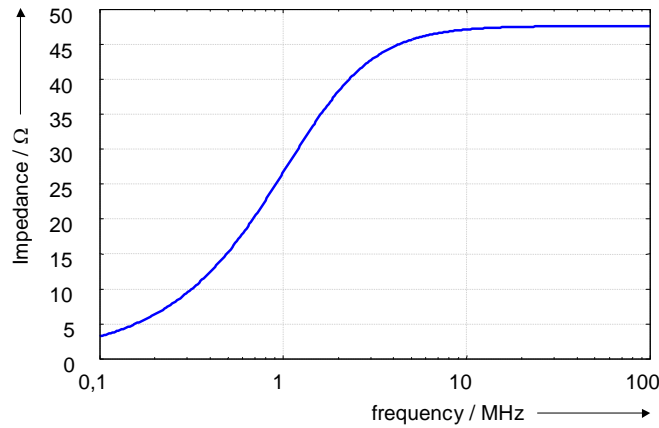


Figure 7 – Characteristics of the DC-charging-AN impedance

4. Artificial Mains networks (AMN)

For a vehicle in charging mode connected to an a.c. power mains, a 50 μH / 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

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. 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 $50\ \Omega$ 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.

5.1. Signal/Control port with symmetric lines

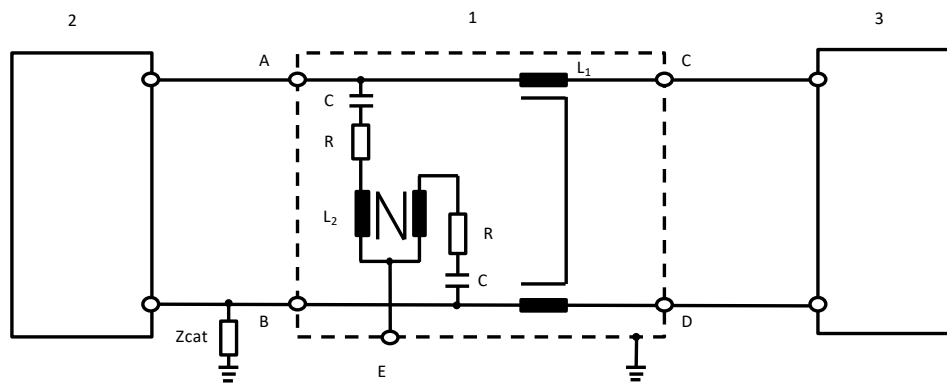
An asymmetric artificial network (AAN) to be connected between the vehicle and the charging station or any associated equipment (AE) used to simulate communication is defined in CISPR 16-1-2 Annex E clause E.2 (T network circuit) (see example in Figure 8).

The AAN has a common mode impedance of $150\ \Omega$. The impedance Z_{cat} adjusts the symmetry of the cabling and attached periphery typically expressed as longitudinal conversion loss (LCL). The value of LCL should be predetermined by measurements or be defined by the manufacturer of the charging station/charging harness. The selected value for LCL and its origin shall be stated in the test report.

CAN communication is an example of symmetric lines used for vehicle d.c. charging mode.

If an original charging station can be used for the test, an AAN is not required for CAN communication.

If the CAN communication is emulated and if the presence of the AAN prevents proper CAN communication then no AAN should be used.



Legend :

1 : AAN

2 : Vehicle

3 : Charging station

L1 : $2 \times 38\ \text{mH}$

L2 : $2 \times 38\ \text{mH}$

R : $200\ \Omega$

Z_{cat} : Symmetric adjustment impedance

A : Symmetrical line 1 (in vehicle)

B : Symmetrical line 2 (in vehicle)

C : Symmetrical line 1 (charging station side)

D : Symmetrical line 2 (charging station side)

C : 4,7 μ F

E : Measuring port with 50 Ω load

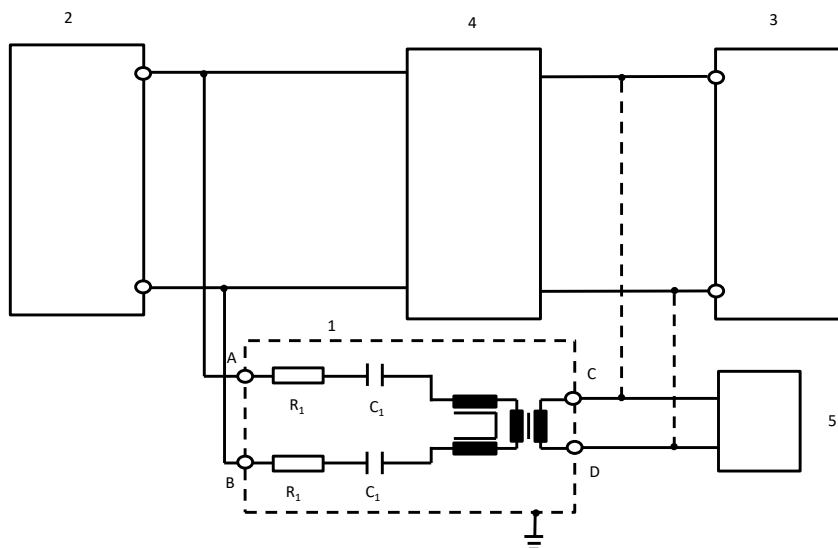
Figure 8
Example of an AAN for Signal/Control port with symmetric lines (e.g. CAN)

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 associated 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.

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



Legend :

- | | |
|-------------------------------------|---|
| 1 : AAN | C_1 : 4,7 nF |
| 2 : Vehicle | A : PLC on a.c. or d.c. power line (vehicle side) |
| 3 : Charging station / Power supply | B : PLC on a.c. or d.c. power line (vehicle side) |
| 4 : HV-AN or AMN or DC-charging-AN | C : PLC line (charging station or AE side) |
| 5 : AE | D : PLC line (charging station or AE side) |
| R_1 : 2,5 k Ω | |

The value of the resistors depends on the allowed attenuation and the design impedance of the PLC modem (here: 40dB attenuation, 100 Ω PLC design impedance)

Figure 9 Example of AAN with Signal/Control port with PLC on a.c. or d.c. power lines

5.3. Signal/Control port with PLC (technology) on control pilot

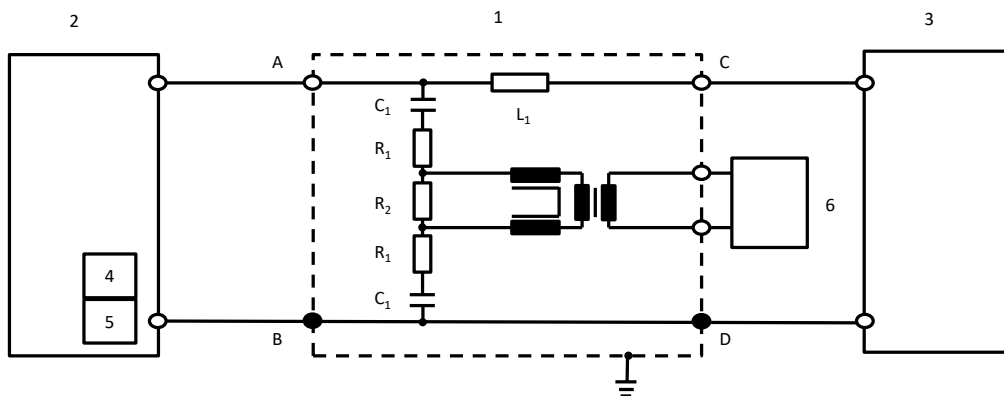
Some communication systems use the control pilot line (versus PE) with a superimposed (high frequency) communication. Typically the technology developed for powerline communication (PLC) is used for that purpose. On one hand the communication lines are operated unsymmetrically, on the other hand two different communication systems operate on the same line. Therefore a special AAN must be used as defined in Figure 10.

It provides a common mode impedance of $150 \Omega \pm 20 \Omega$ (150 kHz to 30 MHz) on the control pilot line (assuming a design impedance of the modem of 100Ω). Both types of communications (control pilot, PLC) are separated by the network.

Therefore, typically a communication simulation is used in combination with this network. The attenuator built by the resistors and the design impedance of the PLC modem makes sure that the signal on the charging harness is dominated by the vehicle's communication signals rather than the AE PLC modem.

The values of inductance and capacitance in the networks added for PLC on control pilot shown in Figure 10 shall not induce any malfunction of communication between vehicle and AE or charging station. It may therefore be necessary to adapt these values to ensure proper communication.

If PLC communication is emulated and if the presence of the AAN prevents proper PLC communication then no AAN should be used.



Legend :

1 : AAN

2 : Vehicle

3 : Charging station

4 : Control pilot (in vehicle)

5 : PLC (in vehicle)

6 : AE

R_1 : 39Ω

R_2 : 270Ω

C_1 : $2,2 \text{ nF}$

L_1 : $100 \mu\text{F}$

A : Control pilot line (vehicle side)

B/D : Protective earth

C : Control pilot line (charging station side)

The values of the three resistors depend on the design impedance of the PLC modem connected at AE side. The values given in the schematic are valid for a design impedance of 100Ω .

Figure 10 Example of AAN circuit for Signal/Control port with PLC on control pilot

5.4. Signal/Control port with control pilot

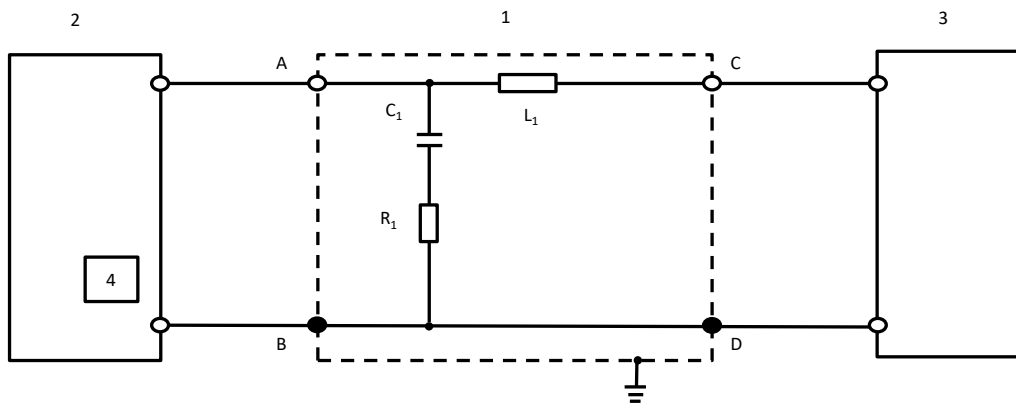
Some communication systems use the control pilot line (versus PE). On one hand the communication lines are operated unsymmetrically, on the other hand two different communication systems operate on the same line. Therefore a special AAN must be used as defined in Figure 11.

It provides a common mode impedance of $150 \Omega \pm 20 \Omega$ (150 kHz to 30 MHz) on the control pilot line (between A and B/D).

Therefore, typically a communication simulation is used in combination with this network.

The values of inductance and capacitance in the networks on control pilot shown in Figure 11 shall not induce any malfunction of communication between vehicle and charging station. It may therefore be necessary to adapt these values to ensure proper communication.

If Control pilot communication is emulated and if the presence of the AAN prevents proper Control pilot communication then no AAN should be used.



Legend :

1 : AAN

C_1 : 1 nF

2 : Vehicle

L_1 : 100 μ F

3 : Charging station

A : Control pilot line (vehicle side)

4 : Control pilot (in vehicle)

B/D : Protective earth

R_1 : 150 Ω

C : Control pilot line (charging station side)

Figure 11 Example of AAN circuit for pilot line"

Annex 2A, second paragraph, amend to read:

~~"Any drawings shall be supplied in appropriate scale and in sufficient detail on size A4 or in a folder of A4 format.~~

Any drawings shall be supplied in appropriate scale and in sufficient detail. If submission is paper based, documents shall be on size A4 or in a folder of A4 format. Electronic submissions may be of any standard size."

Annex 2A, bullets 71. and 72., amend to read:

71. Charging ~~cable~~ **harness** delivered with the vehicle: yes/no¹

72. If charging ~~cable~~ **harness** delivered with the vehicle: "

Annex 2B, first paragraph, amend to read:

~~"The following information, if applicable, shall be supplied in triplicate and shall include a list of contents. Any drawings shall be supplied in appropriate scale and in sufficient detail on size A4 or on a folder of A4 format. Any drawings shall be supplied in appropriate scale and in sufficient detail. If submission is paper based, documents shall be on size A4 or in a folder of A4 format. Electronic submissions may be of any standard size. Photographs, if any, shall show sufficient detail."~~

Annex 4, 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."

Annex 4, paragraph 2.2., amend to read:

2.2. Vehicle 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 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 nominal value.~~

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

If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its nominal value 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."

Annex 4, paragraph 2.3. to 2.6., renumber 2.3. to 2.4. and amend to read:

~~2.3. Charging station / Power mains~~

~~The charging station may be placed either in the test location or outside the test location.~~

~~Note 1: If the communication between the vehicle and the charging station could be simulated, the charging station may be replaced by the supply from power mains.~~

~~In both case, duplicated power mains and communication lines socket(s) shall be placed in the test location with the following conditions:~~

- ~~(a) It shall be placed on the ground plane.~~
- ~~(b) The length of the harness between the power mains/communication lines socket and the AN(s)/IS(s) shall be kept as short as possible.~~
- ~~(c) The harness between the power mains/communication lines socket and the AN(s)/IS(s) shall be placed as close as possible to the ground plane.~~

~~Note 2: The power mains and communication lines socket(s) should be filtered.~~

~~If the charging station is placed inside the test location then the harness between charging station and the power mains / communication lines socket shall be placed with the following conditions:~~

- ~~(a) The harness on charging station side shall hang vertically down to the ground plane.~~
- ~~(b) The extraneous length shall be placed as close as possible to the ground plane and "Z folded" if necessary.~~

~~Note 3: The charging station should be placed outside the beam width of the receiving antenna.~~

~~2.4. Artificial networks~~

~~The AN(s) shall be mounted directly on the ground plane. The cases of the AN(s) shall be bonded to the ground plane.~~

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

~~The AN shall be placed as defined in Figures 3a to 3h.~~

~~2.5. Impedance stabilization~~

~~Communication lines shall be applied to the vehicle through IS(s).~~

~~The impedance stabilization (IS) to be connected in the network and communication cables is defined in CISPR 22, paragraph 9.6.2.~~

~~The IS(s) shall be mounted directly on the ground plane. The case of the IS(s) shall be bonded to the ground plane.~~

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

~~The IS shall be placed as defined in Figures 3e to 3h.~~

2.6. ~~Power charging / communication cable~~

~~The power charging / communication cable shall be placed in a straight line between the AN(s) / IS(s) and the vehicle charging plug. The projected cable length shall be 0.8 m (+0.2 / 0 m).~~

~~If the length of the cable is longer than 1 m, the extraneous length shall be "Z folded" in less than 0.5 m width.~~

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

~~The whole cable shall be placed on a non conductive, low relative permittivity (dielectric constant) material ($\epsilon_r \leq 1.4$), at 100 mm (± 25 mm) above the ground plane~~

2.3. Vehicle in charging mode 1 or mode 2 (a.c. power charging without communication)

2.3.1. Charging station / Power mains

The power mains socket can be placed anywhere in the test site with the following conditions:

- (a) The socket(s) shall be placed on the ground plane (ALSE) or floor (OTS).
- (b) The length of the harness between the power mains socket and the AMN(s) shall be kept as short as possible, but not necessarily aligned with the charging harness.
- (c) The harness shall be placed as close as possible to the ground plane (ALSE) or floor (OTS).

2.3.2. Artificial network

Power mains shall be applied to the vehicle through 50 μ H/50 Ω artificial networks (AMN(s)) (see Appendix 8 clause 4).

The AMN(s) shall be mounted directly on the ground plane (ALSE) or floor (OTS). The case of the AMN(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 AMN shall be terminated with a 50 Ω load.

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 3d and Figure 3e). 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 3d and Figure 3e.

For a longer harness the extraneous length shall be "Z-folded" in a less than 0,5 m width approximately around the middle of the AMN to vehicle distance. If it is impractical to do so because of harness bulk or stiffness, or because the testing is being done at a user's installation, the disposition of the excess harness 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).

2.4. Vehicle in charging mode 3 (a.c. power charging with communication) or mode 4 (d.c. power charging with communication)

2.4.1. Charging station / Power mains

The charging station may be placed either in the test site or outside the test site.

If the local/private communication between the vehicle and the charging station can be simulated, the charging station may be replaced by a supply from the a.c. power mains network.

In both cases power mains and communication or signal lines socket(s) shall be placed in the test site with the following conditions:

- (a) The socket(s) shall be placed on the ground plane (ALSE) or floor (OTS).
- (b) The length of the harness between the power mains / local/private communication socket and the AMN(s) / DC-charging-AN(s) / AAN(s) shall be kept as short as possible, but not necessarily aligned with the charging harness.
- (c) The harness between the power mains / local/private communication socket and the AMN(s) / DC-charging-AN(s) / AAN(s) shall be placed as close as possible of the ground plane (ALSE) or floor (OTS).

If the charging station is placed inside the test site then the harness between the charging station and the power mains / local/private communication socket shall satisfy the following conditions:

- (i) The harness at charging station side shall hang vertically down to the ground plane (ALSE) or floor (OTS).
- (ii) The extraneous length shall be placed as close as possible to the ground plane (ALSE) or floor (OTS) and “Z-folded” if necessary. If it is impractical to do so because of cable bulk or stiffness, or because the testing is being done at a user installation, the disposition of the excess cable shall be precisely noted in the test report.

The charging station should be placed outside of the 3 dB beamwidth of the receiving antenna. If this is not technically feasible, the charging station can be placed behind a panel of absorbers but not between the antenna and the vehicle.

2.4.2. Artificial network

A.c. power mains shall be applied to the vehicle through $50 \mu\text{H}/50 \Omega$ AMN(s) (see Error! Reference source not found.clause 4).

D.c. power mains shall be applied to the vehicle through $5 \mu\text{H}/50 \Omega$ High Voltage Artificial Networks (DC-charging-AN(s)) (see Appendix 8, clause 3).

The AMN(s) / DC-charging-AN(s) shall be mounted directly on the ground plane (ALSE) or floor (OTS). The cases of the AMN(s) / DC-

charging-AN(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 AMN / DC-charging-AN shall be terminated with a 50 Ω load.

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 associated 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 3f 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.

For a longer harness the extraneous length shall be "Z-folded" in less than 0,5 m width. If it is impractical to do so because of harness bulk or stiffness, or because the testing is being done at a user installation, the disposition of the excess harness 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)."

Annex 4, paragraph 3.2., amend to read:

"3.2. ~~Enclosed test facilities may be used if correlation can be shown between the results obtained in the enclosed test facility and those obtained at an outdoor site. Enclosed test facilities do not need to meet the dimensional requirements of the outdoor site other than the distance from the antenna to the vehicle and the height of the antenna.~~

Absorber lined shielded enclosures (ALSE) and open area test sites (OATS) may be used. An ALSE has the advantage of all all-weather testing, a controlled environment and improved repeatability because of the stable chamber electrical characteristics."

Annex 4, paragraph 4.1., amend to read:

"4.1. The limits apply throughout the frequency range 30 to 1,000 MHz for measurements performed in ~~a semi-anechoic chamber~~ **an absorber lined shielded enclosure (ALSE)** or an outdoor test site **(OTS)**."

Annex 4, paragraph 4.2., amend to read:

"4.2. Measurements can be performed with either quasi-peak or peak detectors. The limits given in paragraphs 6.2. and ~~6.5.~~ **7.2.** of this Regulation are for quasi-peak detectors. If peak detectors are used a correction factor of 20 dB as defined in CISPR 12 shall be applied."

Annex 4, 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.

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 scan time	BW at -6 dB	Step size ^a	Minimum Dwell time	BW at -6 dB	Step size ^a	Minimum scan 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."

Annex 4, insert a new paragraph 4.6.:

"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·β: 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

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 1
Clear horizontal surface free of electromagnetic reflection delimitation of the surface defined by an ellipse

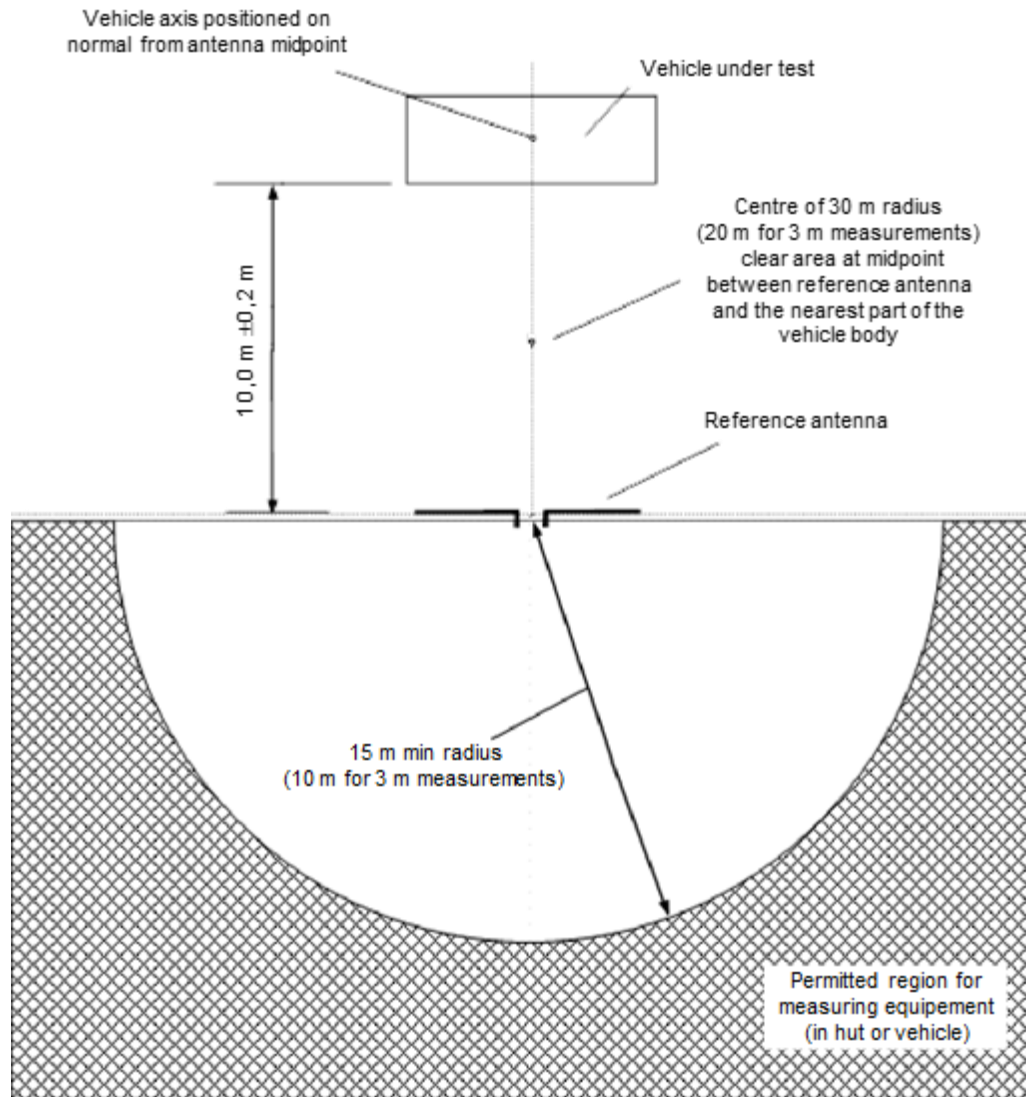


Figure 2
Position of antenna in relation to the vehicle:

Figure 2a
Dipole antenna in position to measure the vertical radiation components

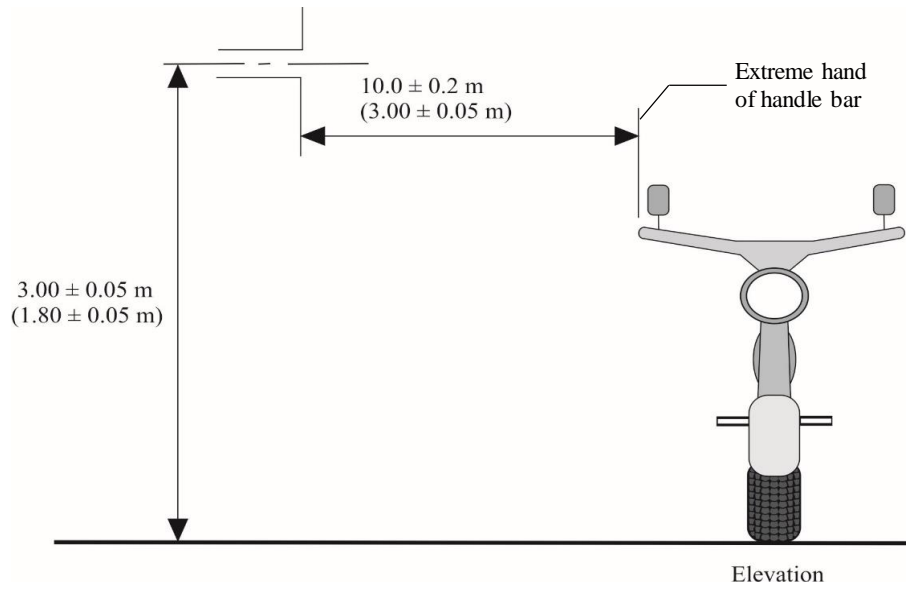


Figure 2b
Dipole antenna in position to measure the horizontal radiation components

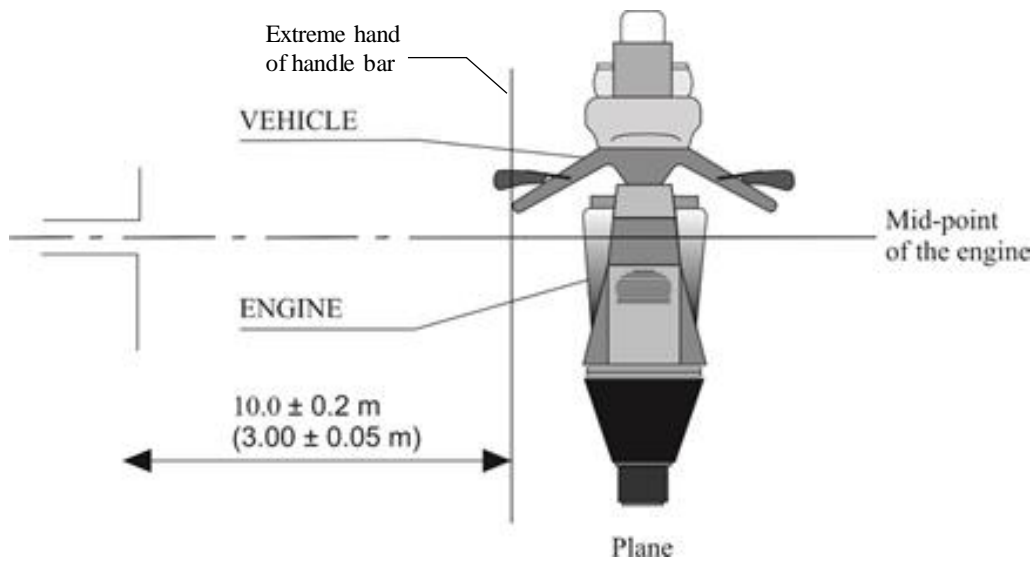


Figure 3
 Vehicle in configuration "REESS charging mode" coupled to the power grid:

~~Example of test set up for vehicle with plug located on vehicle side (AC powered without communication)~~

Example of test setup for vehicle with socket located on vehicle side (charging mode 1 or 2, a.c. powered, without communication)

Figure 3a

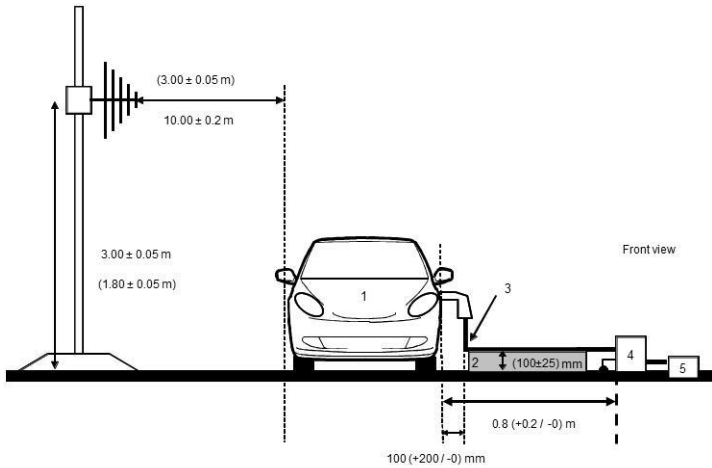
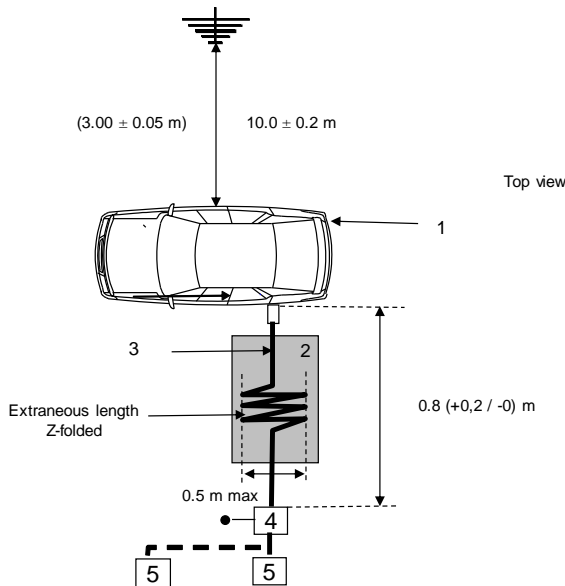


Figure 3b



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging cable harness (including EVSE for charging mode 2)
- 4 Artificial network(s)-AMN(s) or DC-charging-AN(s) grounded
- 5 Power mains socket

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

Example of test setup for vehicle with plug located front/rear of vehicle (AC powered without communication)

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

Figure 3c

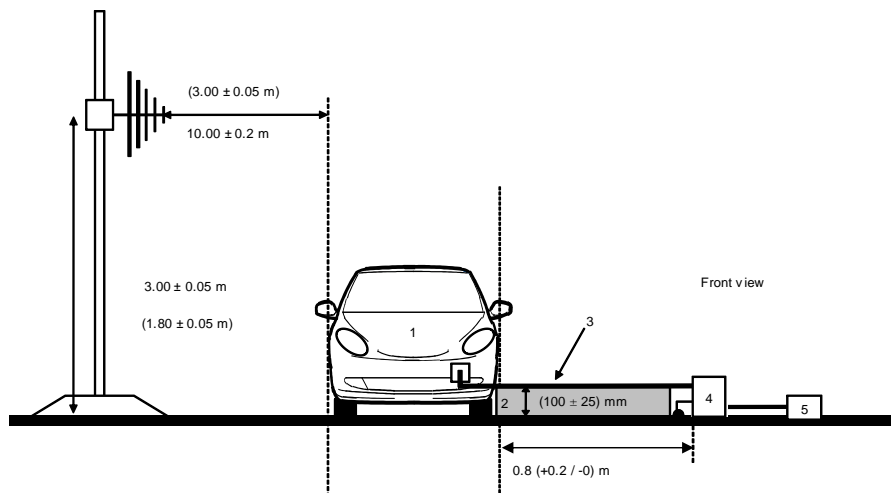
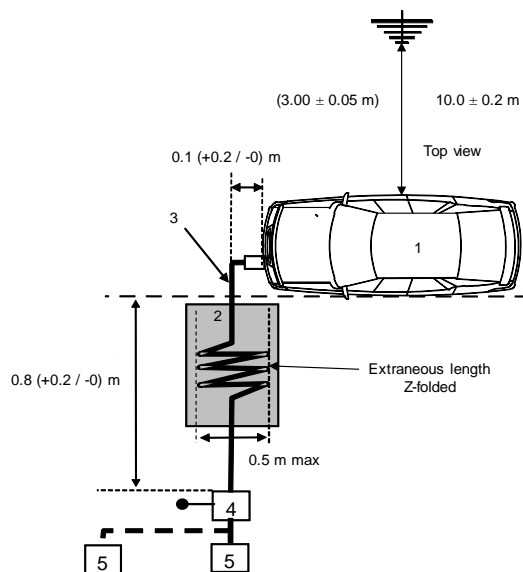


Figure 3d



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging cable harness (including EVSE for charging mode 2)
- 4 Artificial network(s) AMN(s) or DC-charging-AN(s) grounded
- 5 Power mains socket

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

Example of test set up for vehicle with plug located on vehicle side (AC or DC powered with communication)

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

Figure 3e

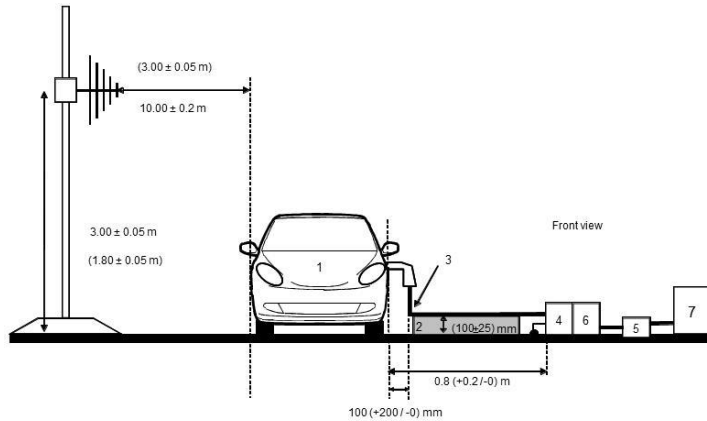
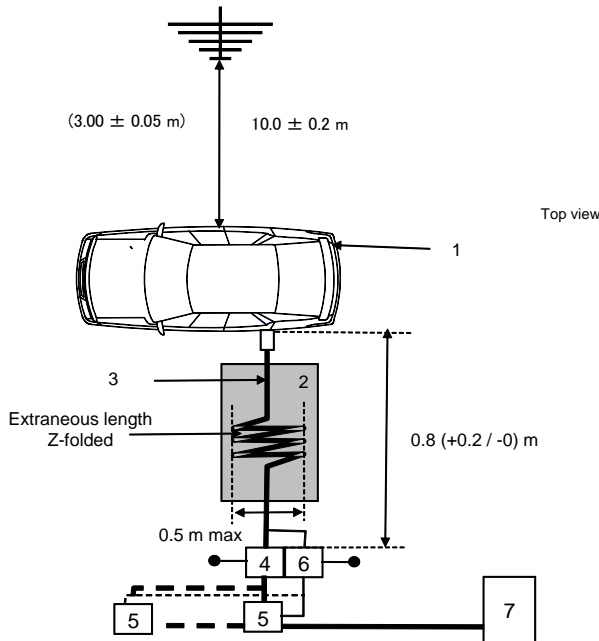


Figure 3f



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging ~~communication~~ cable harness with local/private communication lines
- 4 AC or DC artificial network(s) AMN(s) or DC-charging-AN(s) grounded
- 5 Power mains socket
- 6 Impedance stabilization(s) AAN(s) grounded (optional)
- 7 Charging station

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

Example of test setup for vehicle with plug located front/rear of the vehicle (AC or DC powered with communication)

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

Figure 3g

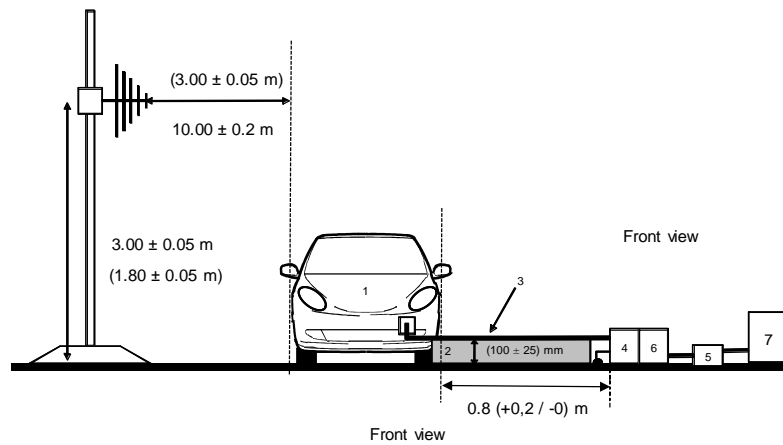
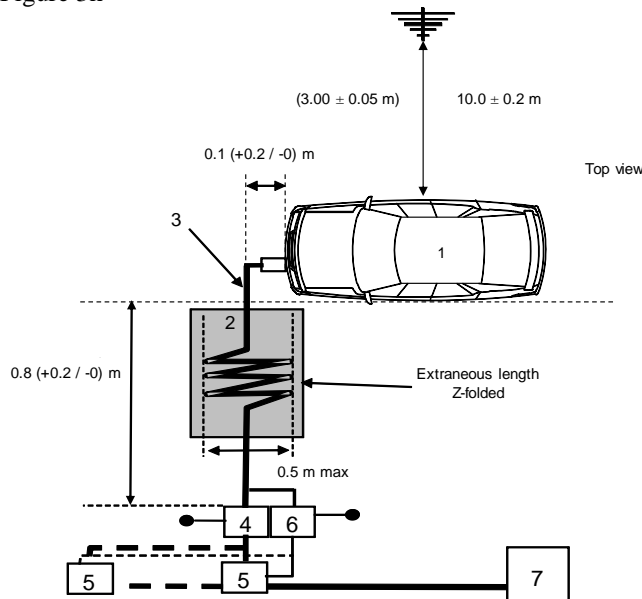


Figure 3h



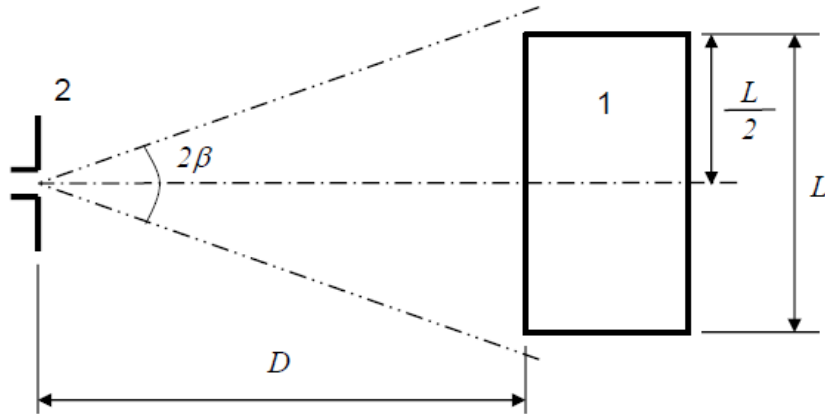
Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 ~~Charging cable~~ **Charging cable harness with local/private communication lines**
- 4 ~~AC or DC artificial network(s) AMN(s) or DC-charging-AN(s) grounded~~
- 5 Power mains socket
- 6 ~~Impedance stabilization(s) AAN(s) grounded (optional)~~
- 7 "Charging station"

Antenna position

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

Figure 4

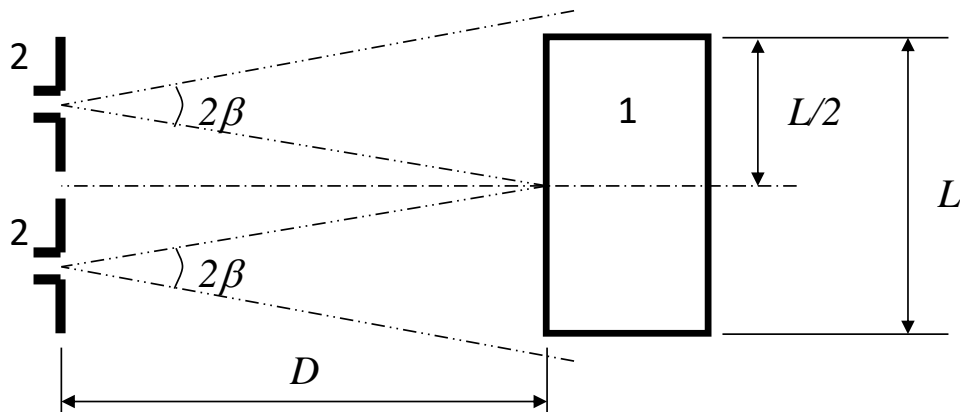


Legend

- 1 Vehicle under test
- 2 Antenna

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

Figure 5



Legend

- 1 Vehicle under test
- 2 Antenna (two positions)"

Annex 5, insert a new paragraph 3:

"3. Measuring location

3.1. Absorber lined shielded enclosures (ALSE) and outdoor test site (OTS) may be used. An ALSE has the advantage of all all-weather testing, a controlled environment and improved repeatability because of the stable chamber electrical characteristics."

Annex 5, paragraph 3., renumber as 4.

Annex 5, paragraph 3.1., renumber as 4.1. amend to read:

"~~3.1.~~ The limits apply throughout the frequency range 30 to 1,000 MHz for measurements performed in ~~a semi-anechoic chamber~~ **an absorber lined shielded enclosure (ALSE)** or an outdoor test site (OTS)."

Annex 5, paragraph 3.2., renumber as 4.2.

Annex 5, paragraph 3.3., renumber as 4.3. amend to read:

"~~3.3.~~ 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.

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	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 scan time	BW at -6 dB	Step size ^a	Dwell time	BW at -6 dB	Step size ^a	Minimum scan 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."

Annex 5, paragraph 3.4., renumber as 4.4.

Annex 5, paragraph 3.5., renumber as 4.5.

Annex 5, insert a new paragraph 4.6.:

"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·β: 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

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."

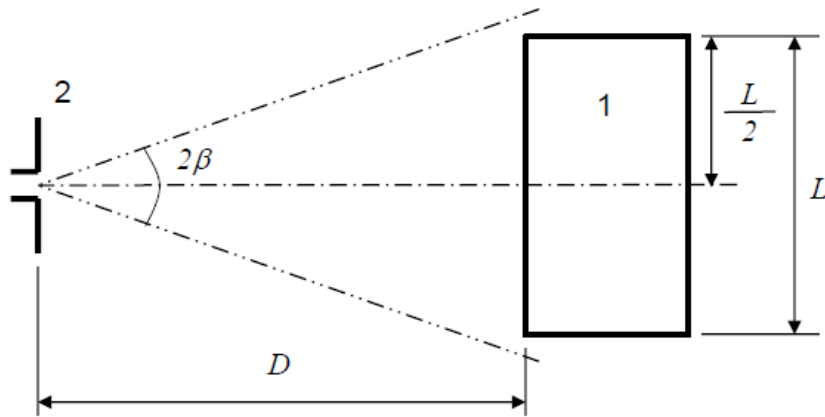
Annex 5, insert a new appendix 1.:

"Annex 5 – Appendix 1

Antenna position

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

Figure 4

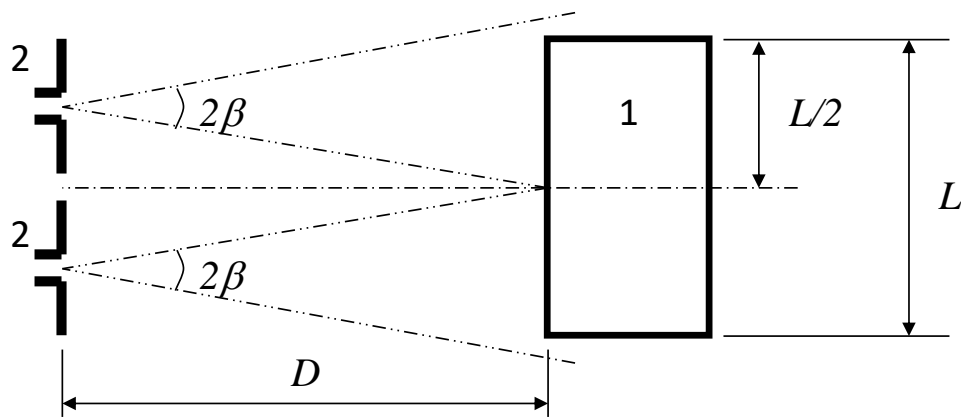


Legend

- 1 Vehicle under test
- 2 Antenna

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

Figure 5



Key

- 1 Vehicle under test
- 2 Antenna (two positions)"

Annex 6, 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 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>"50 km/h eyele 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 operational . 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.
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
<i>"Brake eyele mode" vehicle test conditions</i>	<i>Failure criteria</i>

<i>"Brake eyele mode" vehicle test conditions</i>	<i>Failure criteria</i>
<p>To be defined in brake cycle test plan. This shall include operation of the brake pedal (unless there are technical reasons not to do so) but not necessarily an anti-lock brake system action.</p> <p>Vehicle in a state that allows the braking system to operate normally, parking brake released, vehicle speed 0 km/h.</p> <p>Brake pedal depressed to activate the brake function and the stop lights without any dynamic cycle.</p>	<p>Stop lights inactivated during eyele mode</p> <p>Brake warning light ON with loss of brake function.</p> <p>Unexpected activation</p>
Day running light (DRL) ON	DRL inactivated during mode

"

Annex 6, paragraph 2.1.2., amend to read:

"2.1.2. If there are vehicle electrical/electronic systems which form an integral part of the ~~direct control of the vehicle~~ **immunity related functions**, which will not operate under the conditions described in paragraph 2.1., it will be permissible for the manufacturer to provide a report or additional evidence to the Technical Service that the vehicle electrical/electronic system meets the requirements of this Regulation. Such evidence shall be retained in the type approval documentation."

Annex 6, paragraph 2.2.1.1., amend to read:

"2.2.1.1. ~~The vehicle shall be immobilized, engine OFF and in charging mode.~~

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

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 nominal value.</p> <p>In case of multiple batteries the average state of charge must be considered.</p>	<p>Vehicle sets in motion.</p> <p>Electric parking brake warning indicator OFF</p>

"

Annex 6, paragraph 2.2.1.3., amend to read:

"2.2.1.3. All other equipment which can be switched on permanently by the driver or passenger should be OFF.

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

Annex 6, paragraph 2.3. to 2.6., renumber 2.3. to 2.4. and amend to read:

~~2.3. Charging station / Power mains~~

~~The charging station may be placed either in the test location or outside the test location.~~

~~Note 1: If the communication between the vehicle and the charging station could be simulated, the charging station may be replaced by the supply from power mains.~~

~~In both case duplicated power mains and communication lines socket(s) shall be placed in the test location with the following conditions:~~

- ~~(a) It shall be placed on the ground plane;~~
- ~~(b) The length of the harness between the power mains / communication lines socket and the AN(s) / IS(s) shall be kept as short as possible;~~
- ~~(c) The harness between the power mains / communication lines socket and the AN(s) / IS(s) shall be placed as close as possible of the ground plane.~~

~~Note 2: The power mains and communication lines socket(s) should be filtered.~~

~~If the charging station is placed inside the test location then harness between charging station and the power mains / communication lines socket shall be placed with the following conditions:~~

- ~~(a) The harness at charging station side shall hang vertically down to the ground plane;~~
- ~~(b) The extraneous length shall be placed as close as possible of the ground plane and "Z folded" if necessary.~~

~~Note 3: The charging station should be placed outside the beam width of the emitting antenna.~~

~~2.4. Artificial networks~~

~~The AN(s) shall be mounted directly on the ground plane. The cases of the AN(s) shall be bonded to the ground plane.~~

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

~~The AN shall be placed as defined in Figures 4a to 4h.~~

~~2.5. Impedance stabilization~~

~~Communication lines shall be applied to the vehicle through IS(s).~~

~~The impedance stabilization (IS) to be connected in the network and communication cables is defined in CISPR 22 paragraph 9.6.2.~~

~~The IS(s) shall be mounted directly on the ground plane. The case of the IS(s) shall be bonded to the ground plane.~~

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

~~The IS shall be placed as defined in Figures 4e to 4h.~~

~~2.6. Power charging / Communication cable~~

The power charging / communication cable shall be placed in a straight line between the AN(s) / IS(s) and the vehicle charging plug. The projected cable length shall be 0.8 m (+0.2/ -0 m).

If the length of the cable is longer than 1 m, the extraneous length shall be "Z folded" in less than 0.5 m width.

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

The whole cable shall be placed on a non conductive, low relative permittivity (dielectric constant) material ($\epsilon_r \leq 1.4$), at 100 mm (± 25 mm) above the ground plane.

2.3. Vehicle in charging mode 1 or mode 2 (a.c. power charging without communication)

2.3.1. Charging station / Power mains

The power mains socket can be placed anywhere in the test site with the following conditions:

- (a) The socket(s) shall be placed on the ground plane (ALSE) or floor (OTS).
- (b) The length of the harness between the power mains socket and the AMN(s) shall be kept as short as possible, but not necessarily aligned with the charging harness.
- (c) The harness shall be placed as close as possible to the ground plane (ALSE) or floor (OTS).

2.3.2. Artificial network

Power mains shall be applied to the vehicle through 50 μ H/50 Ω artificial networks (AMN(s)) (see appendix 8 clause 4).

The AMN(s) shall be mounted directly on the ground plane (ALSE) or floor (OTS). The case of the AMN(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 AMN shall be terminated with a 50 Ω load.

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 3d and Error! Reference source not found. 3e). 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 3d and Figure 3e.

For a longer harness the extraneous length shall be "Z-folded" in a less than 0,5 m width approximately around the middle of the AMN to vehicle distance. If it is impractical to do so because of harness bulk or stiffness, or because the testing is being done at a user's installation, the disposition of the excess harness 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 \pm 25) mm above the ground plane (ALSE) or floor (OTS).

2.4. Vehicle in charging mode 3 (a.c. power charging with communication) or mode 4 (d.c. power charging with communication)

2.4.1. Charging station / Power mains

The charging station may be placed either in the test site or outside the test site.

If the local/private communication between the vehicle and the charging station can be simulated, the charging station may be replaced by a supply from the a.c. power mains network.

In both cases power mains and communication or signal lines socket(s) shall be placed in the test site with the following conditions:

- (a) The socket(s) shall be placed on the ground plane (ALSE) or floor (OTS).
- (b) The length of the harness between the power mains / local/private communication socket and the AMN(s) / DC-charging-AN(s) / AAN(s) shall be kept as short as possible, but not necessarily aligned with the charging harness.
- (c) The harness between the power mains / local/private communication socket and the AMN(s) / DC-charging-AN(s) / AAN(s) shall be placed as close as possible of the ground plane (ALSE) or floor (OTS).

If the charging station is placed inside the test site then the harness between the charging station and the power mains / local/private communication socket shall satisfy the following conditions:

- (i) The harness at charging station side shall hang vertically down to the ground plane (ALSE) or floor (OTS).
- (ii) The extraneous length shall be placed as close as possible to the ground plane (ALSE) or floor (OTS) and “Z-folded” if necessary. If it is impractical to do so because of cable bulk or stiffness, or because the testing is being done at a user installation, the disposition of the excess cable shall be precisely noted in the test report.

The charging station should be placed outside the beamwidth of the receiving antenna

2.4.2. Artificial network

A.c. power mains shall be applied to the vehicle through 50 μ H/50 Ω AMN(s) (see Appendix 8, clause 4).

D.c. power mains shall be applied to the vehicle through 5 μ H/50 Ω High Voltage Artificial Networks (DC-charging-AN(s)) (see Appendix 8, clause 3).

The AMN(s) / DC-charging-AN(s) shall be mounted directly on the ground plane (ALSE) or floor (OTS). The cases of the AMN(s) / DC-charging-AN(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 AMN / DC-charging-AN shall be terminated with a 50 Ω load.

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 associated 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 3f 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.

For a longer harness the extraneous length shall be "Z-folded" in less than 0,5 m width. If it is impractical to do so because of harness bulk or stiffness, or because the testing is being done at a user installation, the disposition of the excess harness 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)."

Annex 6, paragraph 3.2., amend to read:

"3.2. For categories M, N, O, [T, R and S] vehicles according to ISO 11451-2."

Annex 6, paragraph 3.3.5., amend to read:

"3.3.5. If it is decided to radiate the rear of the vehicle, the reference point shall be established as in paragraphs 3.3.1. to 3.3.4. above. The vehicle shall then be installed 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. This is illustrated in Figure 3 of Appendix 1 to this annex."

Annex 6, paragraph 5.1.2., amend to read;

"5.1.2. Calibration

For TLS one field probe at the ~~facility~~ **vehicle** reference point shall be used.

For antennas four field probes at the ~~facility~~ **vehicle** reference line shall be used."

Annex 6, 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 ~~facility~~ **vehicle** reference point or line. The vehicle shall normally face a fixed antenna. However, where ~~the~~ 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 long vehicles (i.e. excluding vehicles of categories L, M₁ and N₁), which have electronic control units **with immunity related functions** and associated wiring harness predominantly towards the middle of the vehicle, a reference point may be established based on either the right side surface or the left side surface of the vehicle. This reference point shall be at the midpoint of the vehicle's length or at one point along the side of the vehicle 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

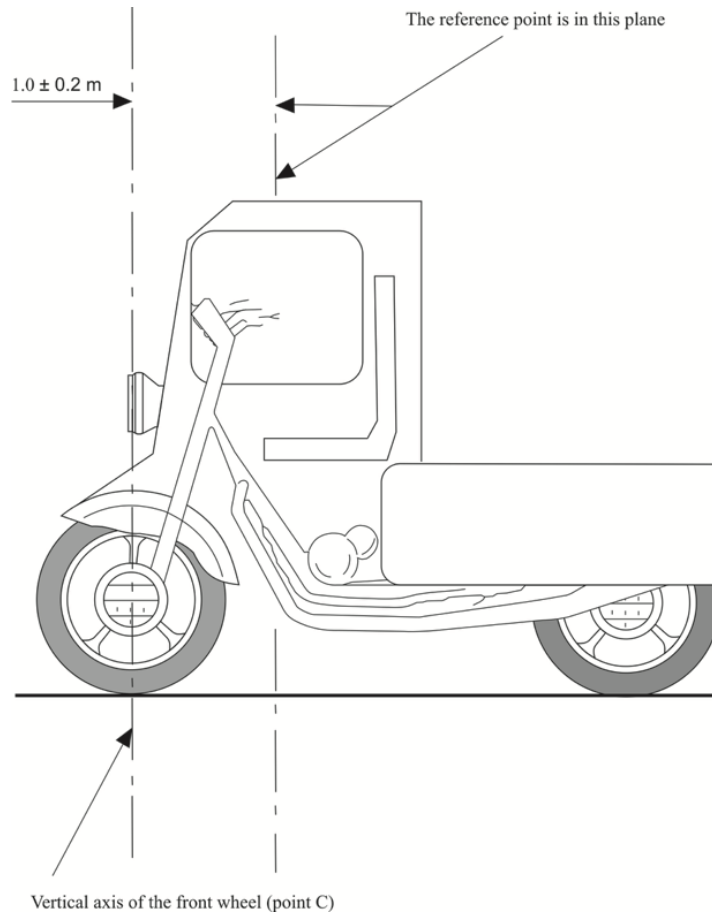


Figure 2

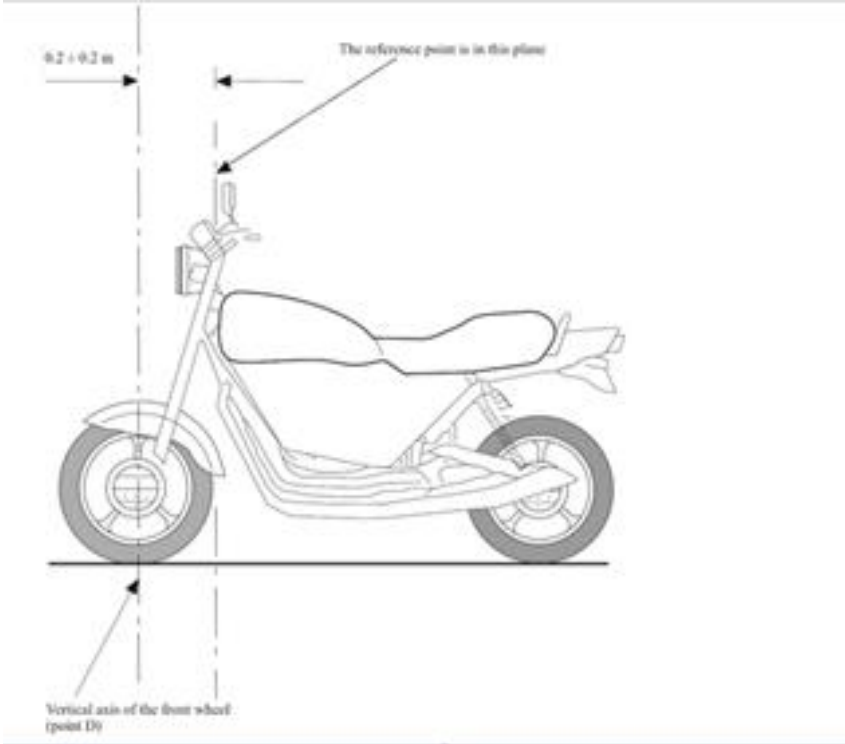


Figure 3

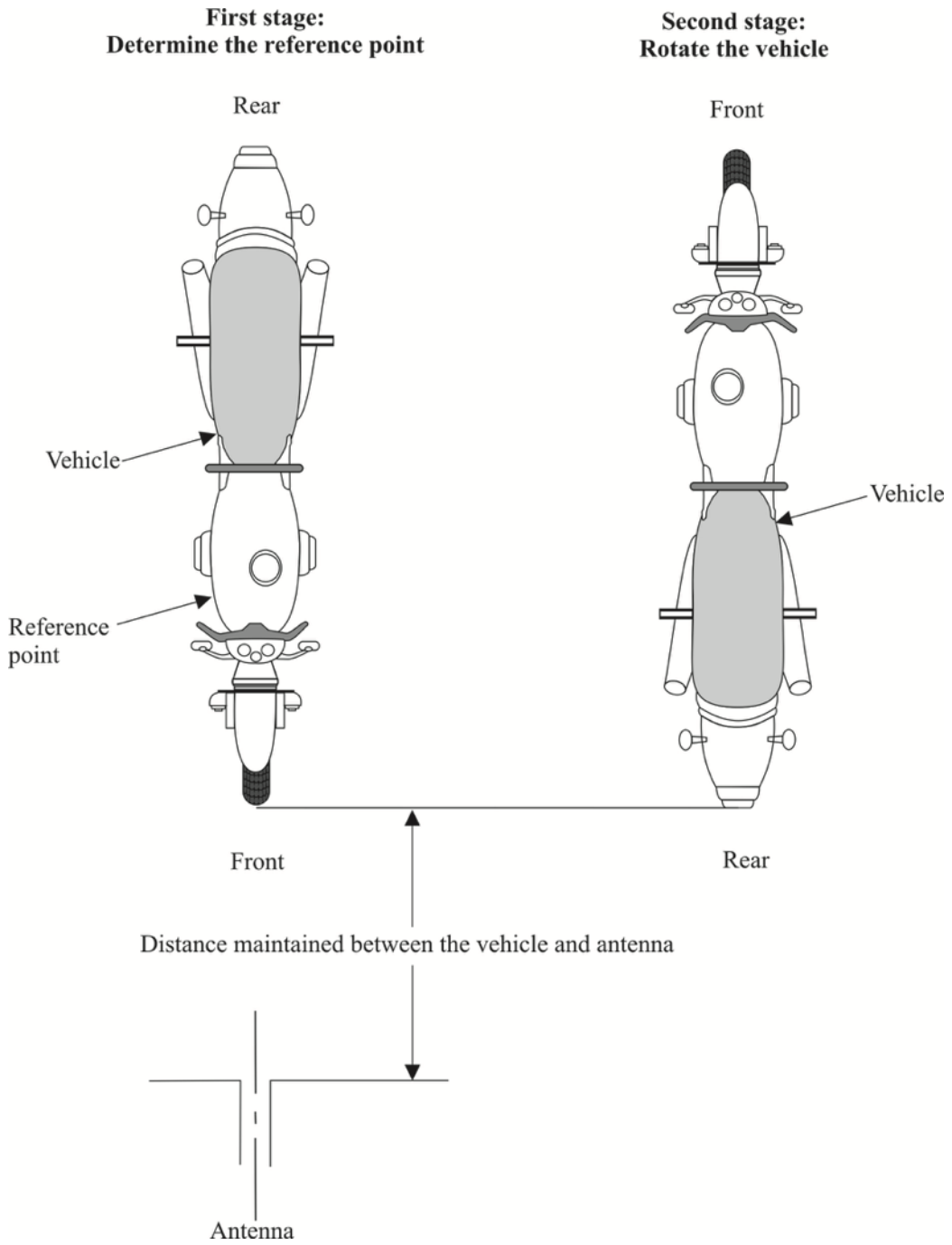


Figure 4

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

Example of test setup for vehicle with plug located on the vehicle side (AC power charging without communication)

Example of test setup for vehicle with socket located on vehicle side (charging mode 1 or 2, a.c. powered, without communication)

Figure 4a

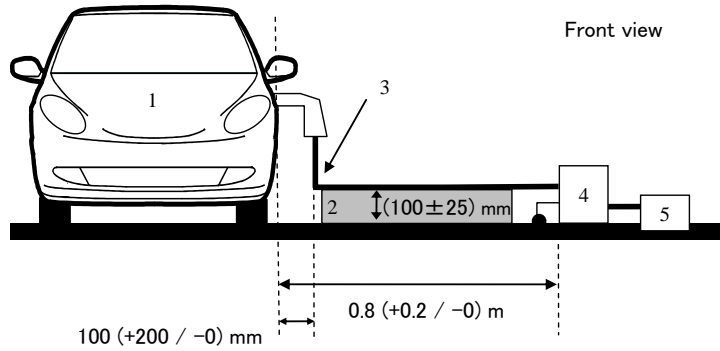
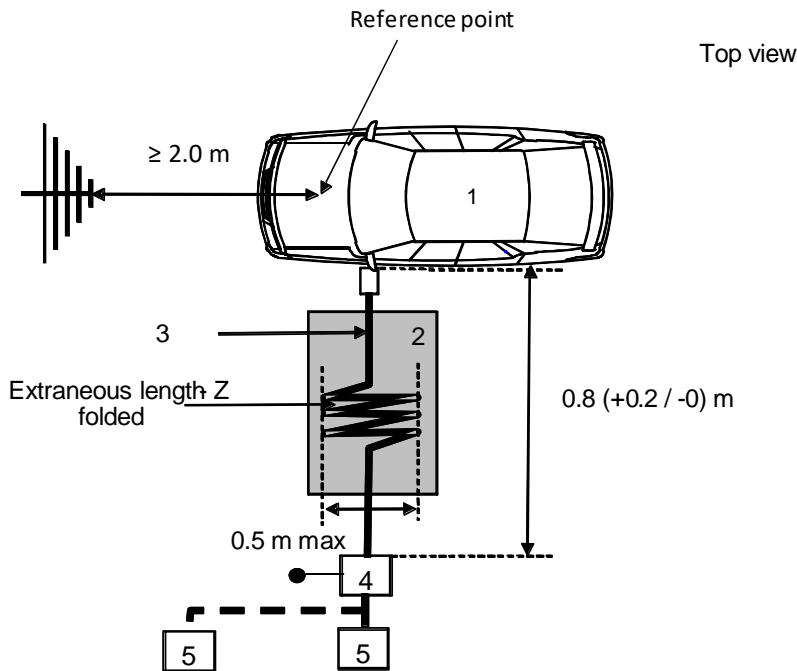


Figure 4b



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging cable harness (including EVSE for charging mode 2)
- 4 Artificial network(s)-AMN(s) or DC-charging-AN(s) grounded
- 5 Power mains socket

Example of test set up for vehicle with plug located front / rear of vehicle (AC power charging without communication)

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

Figure 4c

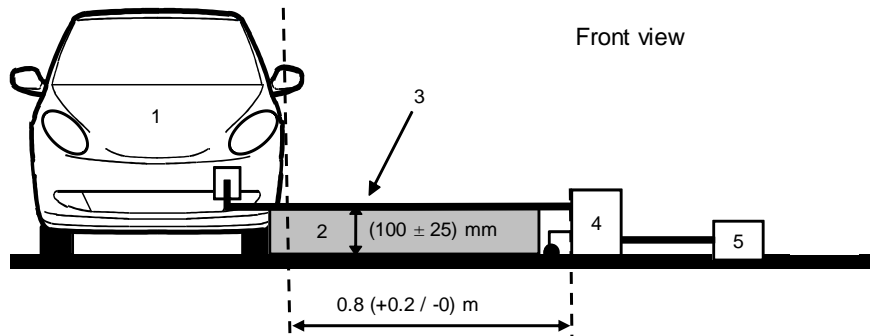
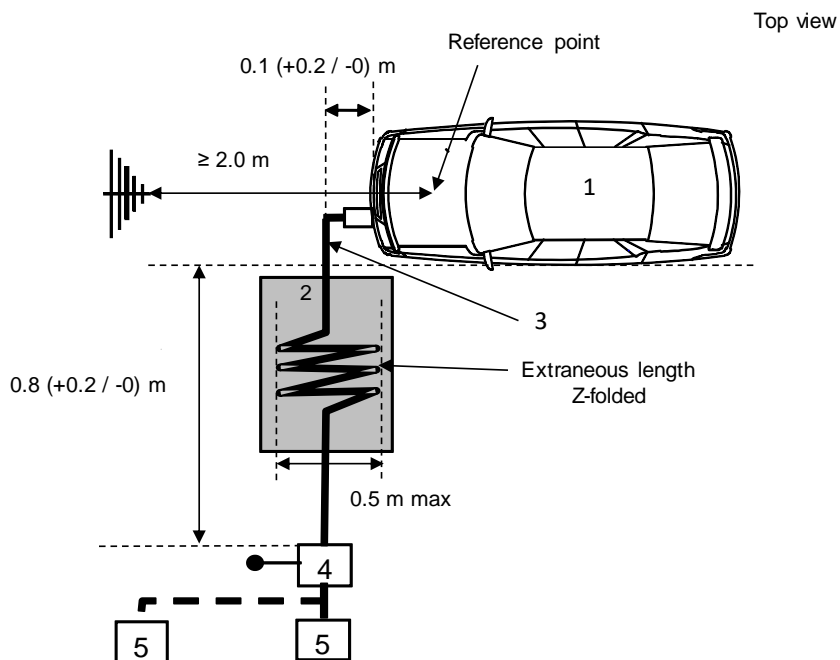


Figure 4d



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging cable harness (including EVSE for charging mode 2)
- 4 Artificial network(s)-AMN(s) or DC-charging-AN(s) grounded
- 5 Power mains socket

Example of test set up for vehicle with plug located on vehicle side (AC or DC power charging with communication)

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

Figure 4e

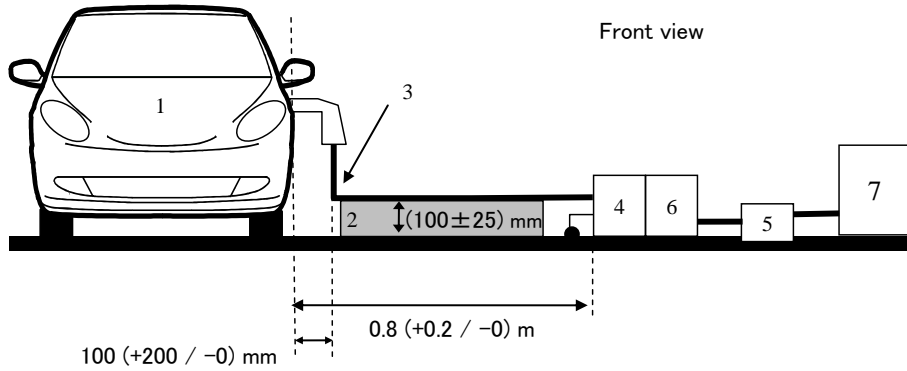
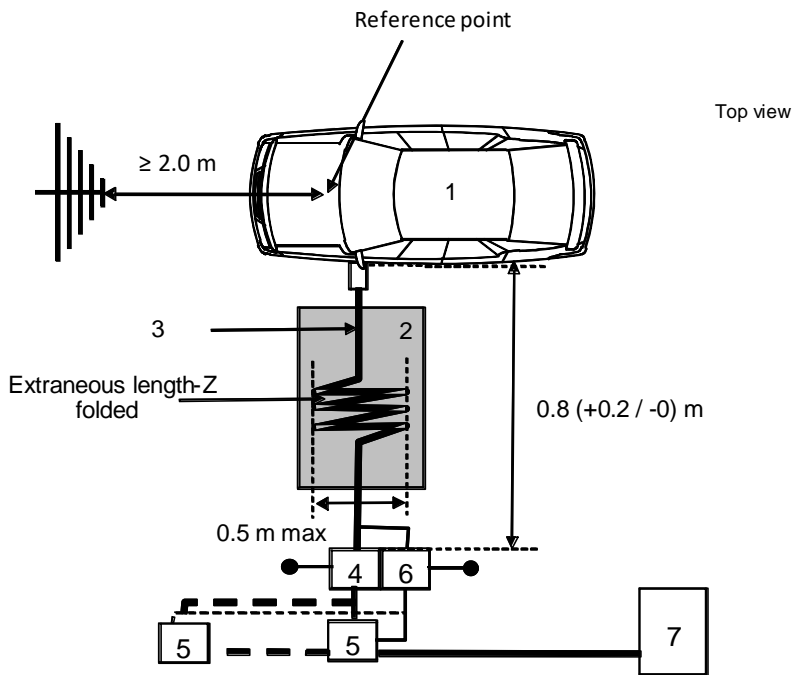


Figure 4f



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging / communication cable harness with local/private communication lines
- 4 AC or DC artificial network(s) AMN(s) or DC-charging-AN(s) grounded
- 5 Power mains socket
- 6 Impedance stabilisation(s) AAN(s) grounded (optional)
- 7 Charging station

Example of test set up for vehicle with plug located front / rear of the vehicle (AC or DC power charging with communication)

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

Figure 4g

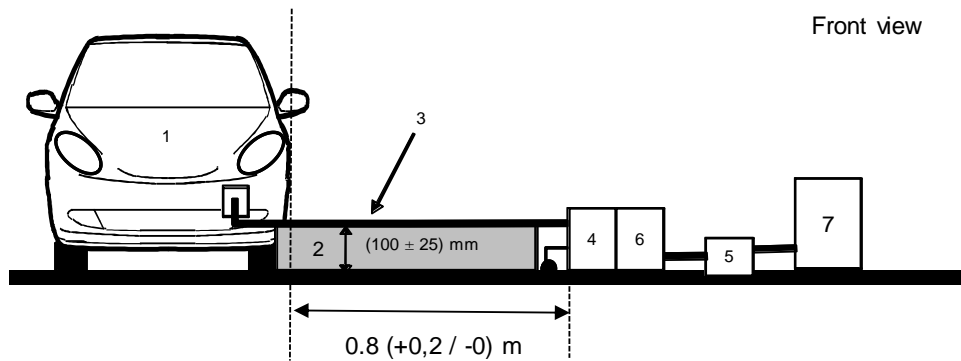
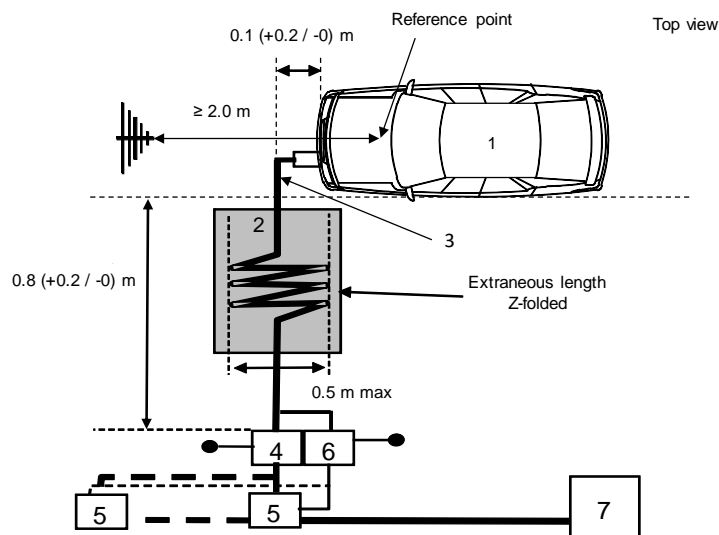


Figure 4h



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging ~~communication~~ cable harness with local/private communication lines
- 4 AC or DC artificial network(s) AMN(s) or DC-charging-AN(s) grounded
- 5 Power mains socket
- 6 Impedance stabilisation(s) AAN(s) grounded (optional)
- 7 Charging station"

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 nominal value.~~

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

If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its nominal value for DC charging unless another value is agreed with the type approval authorities."

Annex 7, insert a new paragraph 3.2.2.:

"**3.2.2. The ESA power supply lead shall be connected to the power supply through an HV-AN (for ESA with d.c. HV supply) and/or AMN (for ESA with a.c. supply).**

d.c. HV supply shall be applied to the ESA via a 5 μ H/50 Ω HV-AN (see Appendix 8 clause 2).

a.c. supply shall be applied to the ESA via a 50 μ H/50 Ω AMN (see Appendix 8 clause 4)."

Appendix 7, paragraphs 3.2.2. to 3.2.6., renumber as 3.2.3. to 3.2.7., respectively.

Annex 7, paragraph 3.3., amend to read:

"3.3. Alternative measuring location

As an alternative to an absorber lined shielded enclosure (ALSE) an open area test site (OATS), which complies with the requirements of CISPR 16-1-4 may be used (see **Figure 1 of the appendix** to this annex)."

Annex 7, paragraph 4.1., amend to read:

"4.1. The limits apply throughout the frequency range 30 to 1,000 MHz for measurements performed in ~~a semi anechoic chamber~~ **absorber lined shielded enclosure (ALSE)** or ~~outdoor test sites~~ **open area test site (OATS)."**

Annex 7, paragraph 4.2., amend to read:

"4.2. Measurements can be performed with either quasi-peak or peak detectors. The limits given in paragraphs ~~6.2.~~ **6.5.** and ~~6.5.~~ **7.10.** of this Regulation are for quasi-peak detectors. If peak detectors are used a correction factor of 20 dB as defined in CISPR 12 shall be applied."

Annex 7, 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.

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 7, Appendix, amend to read:

“Annex 7 - Appendix

Figure 1
Open area test site: Electrical/electronic sub-assembly test area boundary
Level clear area free from electromagnetic reflecting surfaces

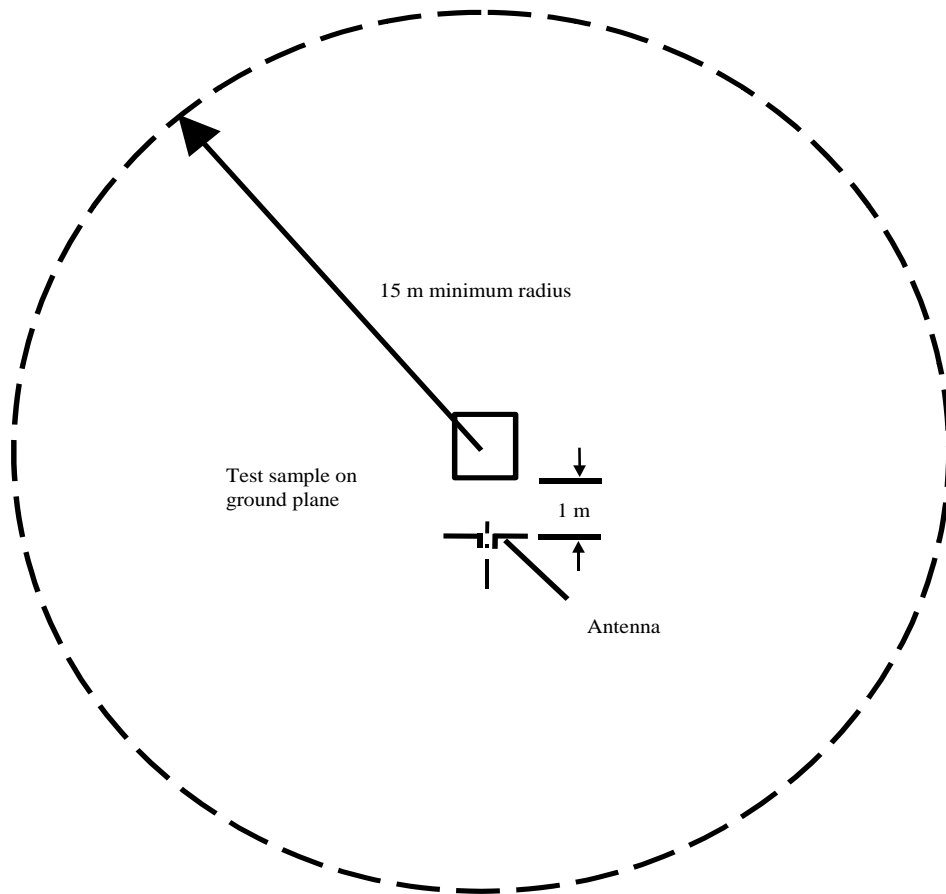
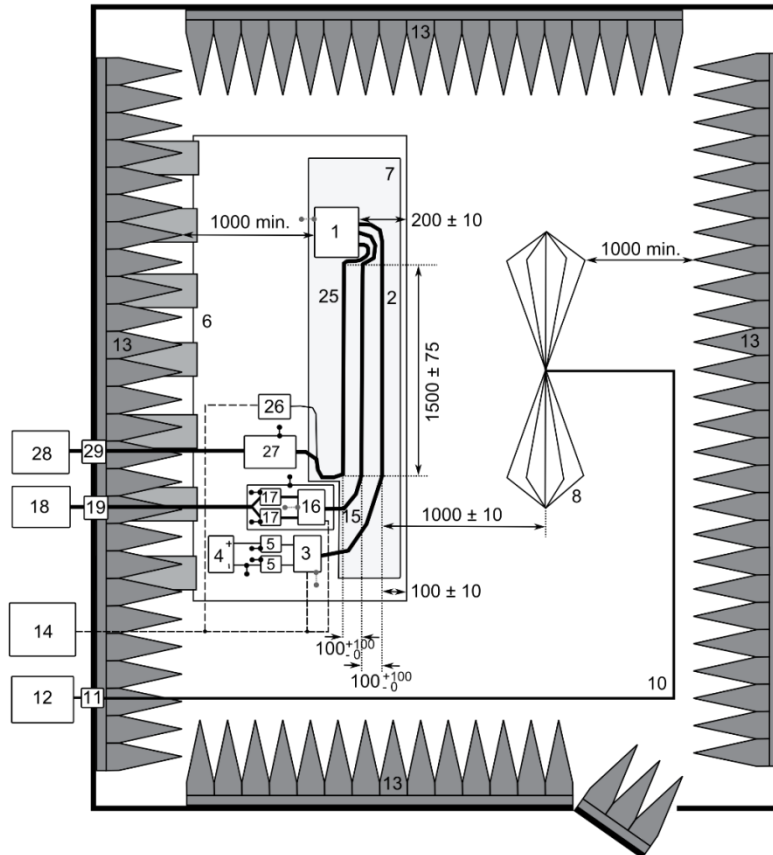


Figure 2

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

Top view (horizontal polarization)



Legend:

- | | | | |
|----|---|----|--|
| 1 | ESA (grounded locally if required in test plan) | 13 | RF absorber material |
| 2 | LV Test harness | 14 | Stimulation and monitoring system |
| 3 | LV Load simulator (placement and ground connection according to CISPR 25 paragraph 6.4.2.5) | 15 | HV harness |
| 4 | Power supply (location optional) | 16 | HV load simulator |
| 5 | LV Artificial network (AN) | 17 | HV AN |
| 6 | Ground plane (bonded to shielded enclosure) | 18 | HV power supply |
| 7 | Low relative permittivity support ($\epsilon_r \leq 1.4$) | 19 | HV feed-through |
| 8 | Biconical antenna | 25 | AC/DC charger harness |
| 10 | High-quality coaxial cable e.g. double-shielded (50 Ω) | 26 | AC/DC load simulator (e.g. Programmable Logic Controller (PLC)) |
| 11 | Bulkhead connector | 27 | 50 μ H Line Impedance Stabilization Network (LISN) (AC) or HVAN (DC) AMN(s) or DC-charging-AN(s) |
| 12 | Measuring instrument | 28 | AC/DC power supply |
| | | 29 | AC/DC feed-through" |

Annex 8, paragraph 4.1., amend to read:

"4.1. The limits apply throughout the frequency range 30 to 1,000 MHz for measurements performed in ~~semi-anechoic chambers~~ **absorber lined shielded enclosure (ALSE)** or ~~outdoor test sites~~ **open area test site (OATS).**"

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.

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	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 band width shall be at least three times the resolution band width (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	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

^aFor 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 band width."

Annex 9, paragraph 4.3.2., amend to read:

"4.3.2. Test methodology

The test shall be performed according to ISO 11452-4 on a test bench. As an alternative the ESA may be tested while installed in the vehicle according to ISO 11451-4 with the following characteristics:

- (a) ~~The injection probe shall be positioned in 150 mm distance to the ESA to be tested;~~
- (b) ~~The reference method shall be used to calculate injected currents from forward power;~~
- (c) ~~The frequency range of the method is limited by the injection probe specification.~~

The test shall be performed according to ISO 11452-4 on a test bench with the following characteristics:

- BCI test method with substitution method and injection probe positioned at 150 mm distance to the ESA
- Or BCI test method with closed loop method and injection probe positioned at 900 mm distance to the ESA

As an alternative the ESA may be tested while installed in the vehicle according to ISO 11451-4 with the following characteristics:

- **BCI test method with substitution method and injection probe positioned at 150 mm distance to the ESA "**

Annex 9, paragraph 4.3.2.1., amend to read:

"4.3.2.1. ~~For ESAs in configuration "REESS charging mode coupled to the power grid", the test arrangement shall be according to Appendix 4 to this annex.~~

For ESAs in configuration "REESS charging mode coupled to the power grid", an example of test arrangement (for substitution method) is given in Appendix 4 to this annex (figure 1 for substitution method and figure 2 for closed loop method)."

Annex 9, paragraph 4.3.2.1.2., amend to read:

"4.3.2.1.2. **When using substitution method**, unless otherwise specified the length of the LV harness and the HV harness shall be 1,700 mm (+300/-0 mm). The distance between the LV harness and the HV harness shall be 100 mm (+100/-0 mm). **The HV/LV wiring harness shall be straight over at least 1,400 mm starting at the ESA for all test methods defined in part 4 of ISO 11452 except for the BCI test method using the closed-loop method with power limitation.**

When using closed loop method, unless otherwise specified the length of the LV harness and the HV harness shall be 1,000 mm (+200/-0 mm). The distance between the LV harness and the HV harness shall be 100 mm (+100/-0 mm). **The HV/LV wiring harness shall be straight over its entire length for the BCI test method using the closed-loop method with power limitation."**

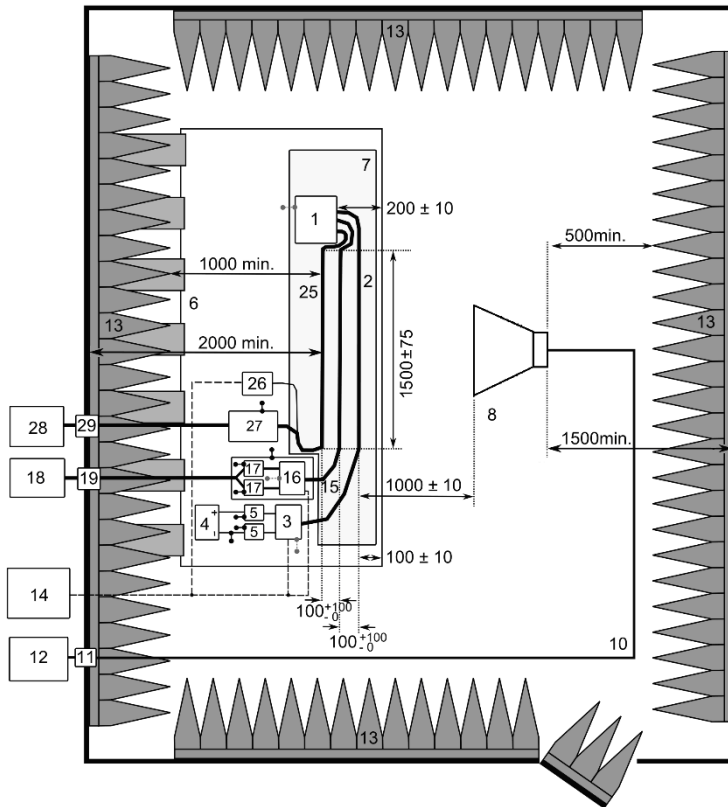
Annex 9, Appendix 3, amend to read:

"Annex 9 – Appendix 3

Absorber chamber test

Test configuration for ESA's involved in "REESS charging mode coupled to the power grid". The test shall be performed according to ISO 11452-2.

Top view (Vertical polarization)



Legend:

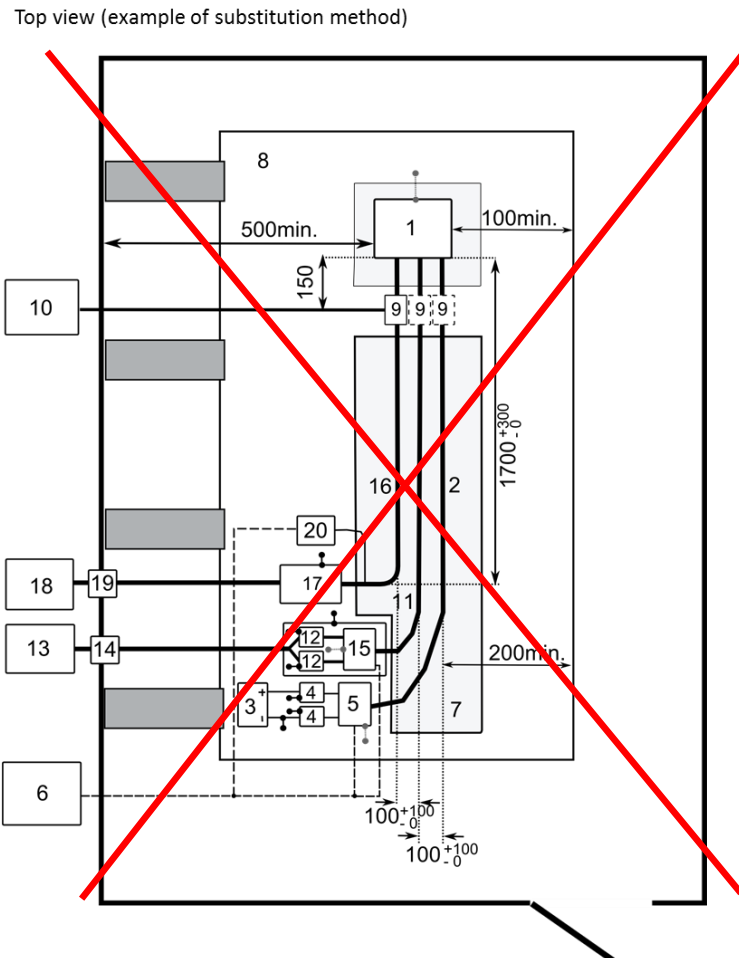
1	ESA (grounded locally if required in test plan)	13	RF absorber material
2	LV Test harness	14	Stimulation and monitoring system
3	LV Load simulator (placement and ground connection according to CISPR 25 paragraph 6.4.2.5.)	15	HV harness
4	Power supply (location optional)	16	HV load simulator
5	LV Artificial network (AN)	17	HV AN
6	Ground plane (bonded to shielded enclosure)	18	HV power supply
7	Low relative permittivity support ($\epsilon_r \leq 1.4$)	19	HV feed-through
8	Horn antenna	25	AC/DC charger harness
10	High-quality coaxial cable e.g. double-shielded (50 Ω)	26	AC/DC load simulator (e.g. PLC)
11	Bulkhead connector	27	50 μ H Line Impedance Stabilization Network (LISN) (AC) or HVAN (DC) AMN(s) or DC-charging-AN(s)
12	RF signal generator and amplifier	28	AC/DC power supply
		29	AC/DC feed-through"

Annex 9, Appendix 4, amend to read:

"BCI test

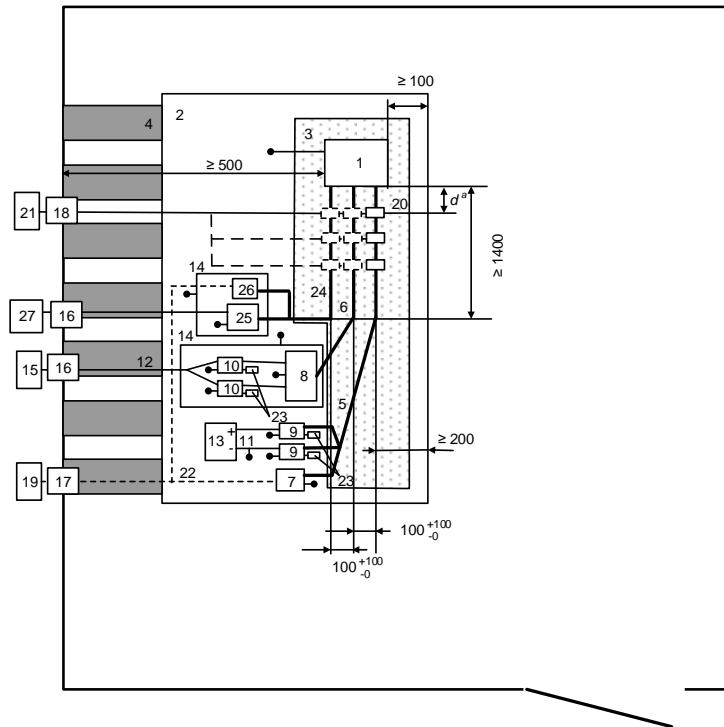
Test configuration for ESAs involved in "REESS charging mode coupled to the power grid". The test shall be performed according to ISO 11452-4.

Figure 1 : Example of test set-up for substitution method - Injection on LV (or HV or a.c.) lines for ESAs with shielded power supply systems and inverter/charger device



Legend:

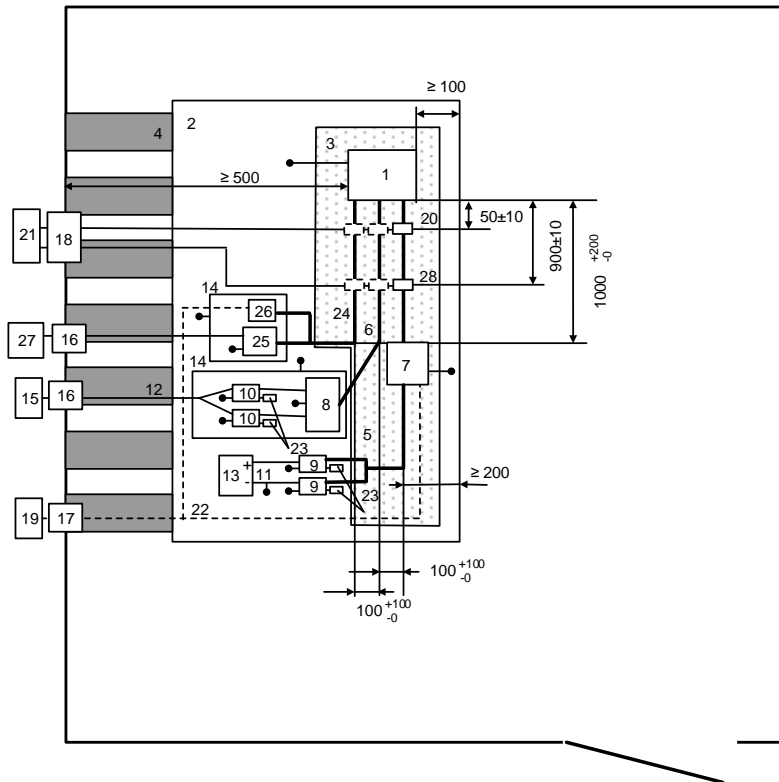
- | | |
|---|---|
| 1 — ESA (grounded locally if required in test plan) | 11 — HV DC harness |
| 2 — LV Test harness | 12 — HV AN |
| 3 — LV supply | 13 — HV DC load |
| 4 — LV LISN | 14 — HV DC feed-through |
| 5 — LV load simulator | 15 — HV DC load simulator |
| 6 — Stimulation and monitoring system | 16 — HV AC/DC charger harness |
| 7 — Low relative permittivity support | 17 — 50 μ H LISN (AC) or HV AN (DC) AMN(s) or DC charging AN(s) |
| 8 — Ground plane | 18 — HV AC/DC power supply |
| 9 — Injection probe | 19 — HV AC/DC feed-through |
| 10 — RF signal amplifier and generator | 20 — HV AC/DC load simulator (e.g. PLC) |



Legend:

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

Figure 2 : Example of test set-up for closed loop method - Injection on LV (or HV or a.c.) lines for ESAs with shielded power supply systems and inverter/charger device



Legend:

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

Annex 11, paragraph 2.1., amend to read:

"2.1. The vehicle 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 **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 nominal value **for AC charging.**

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

~~The vehicle shall be immobilized, engine OFF.~~

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

~~And all other equipment which can be switched on permanently by the driver or passenger should be OFF.~~

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

Annex 11, paragraph 3.2., amend to read:

"3.2. The test set-up for single phase / **three-phase** vehicle in configuration "REESS charging mode coupled to the power grid" is shown in Figure 1a to 1d of Appendix 1 to this annex."

Annex 11, paragraph 3.3., delete.

Annex 11, paragraph 4.3., amend to read:

"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 4 of paragraph 7.3.2.2. of this Regulation."

Annex 11, paragraph 4.4., amend to read:

"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 5 of paragraph 7.3.2.2. of this Regulation."

Annex 11, Appendix 1, amend to read:

"Annex 11 – Appendix 1

Figure 1

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

Example of test setup for vehicle with plug located on vehicle side

Figure 1a

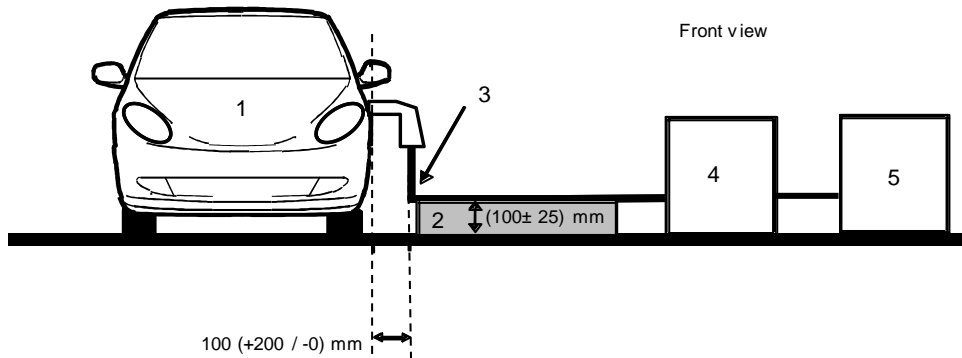
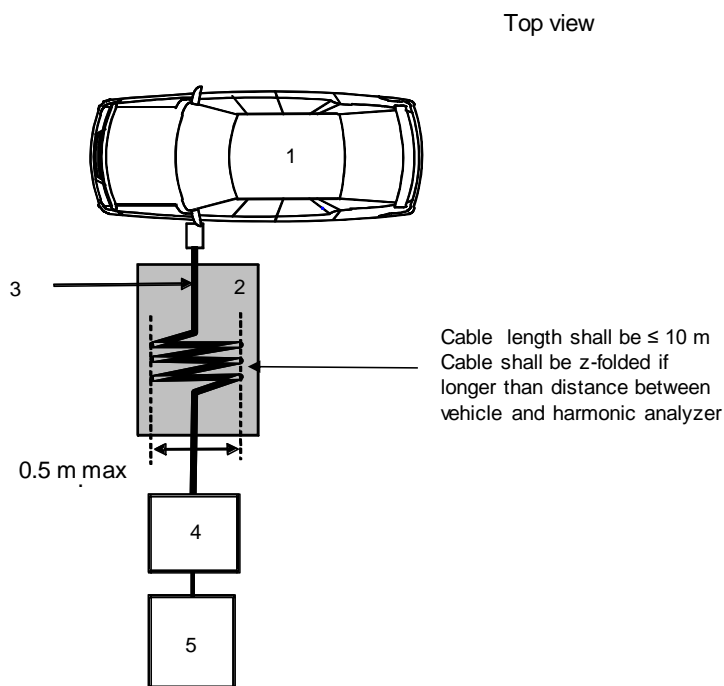


Figure 1b



Legend:

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

Example of test setup for vehicle with plug located front/rear of vehicle

Figure 1c

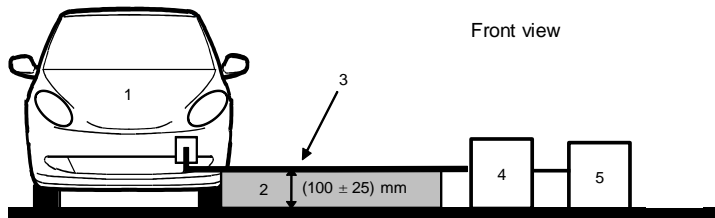
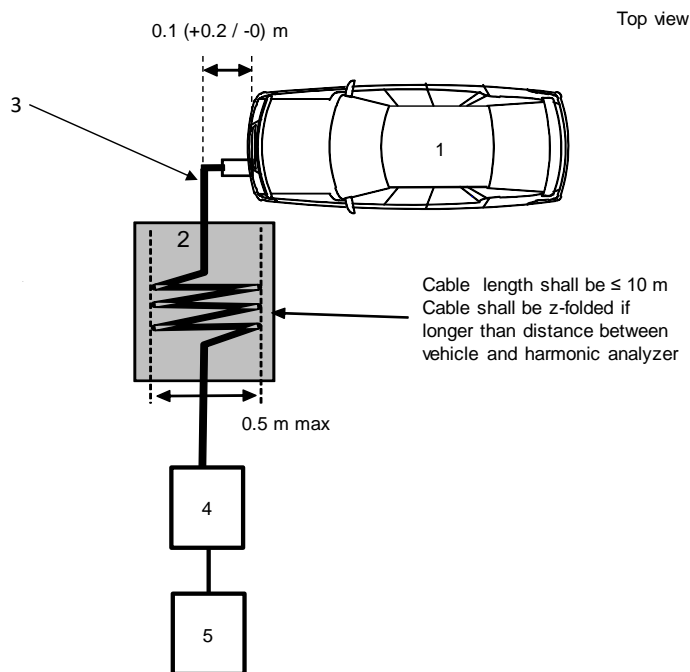


Figure 1d



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging cable 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".

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 nominal value **for AC charging.**

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

~~The vehicle shall be immobilized, engine OFF.~~

~~And all other equipment which can be switched on permanently by the driver or passenger should be OFF.~~

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, paragraph 3.1., amend to read:

"3.1. The tests for vehicle in configuration "REESS charging mode coupled to the power grid" with rated current ≤ 16 A per phase and not subjected to conditional connection shall be performed according to paragraph ~~4~~ **6.** of IEC 61000-3-3."

Annex 12, paragraph 3.3., amend to read:

"3.3. The test set-up for vehicle in configuration "REESS charging mode coupled to the power grid" is shown in Figures 1a ~~to 1d and 1b~~ of Appendix 1 to this annex."

Annex 12, Appendix 1, amend to read:

"Annex 12 - Appendix 1

Figure 1

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

Example of test setup for vehicle with plug located on vehicle side

Figure 1a

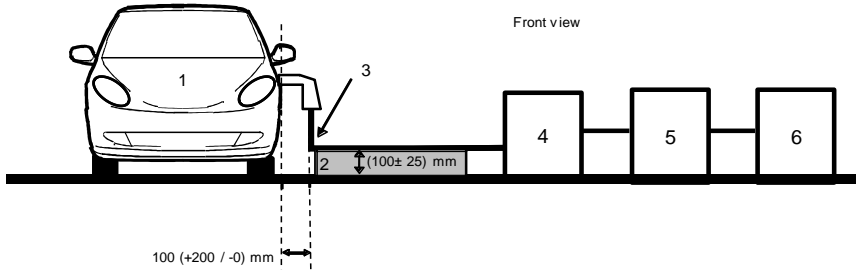
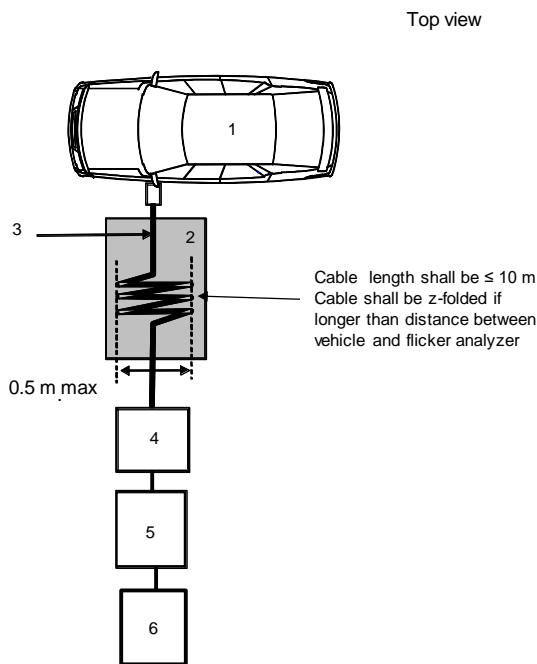


Figure 1b



Legend:

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

Example of test setup for vehicle with plug located front/rear of vehicle

Figure 1c

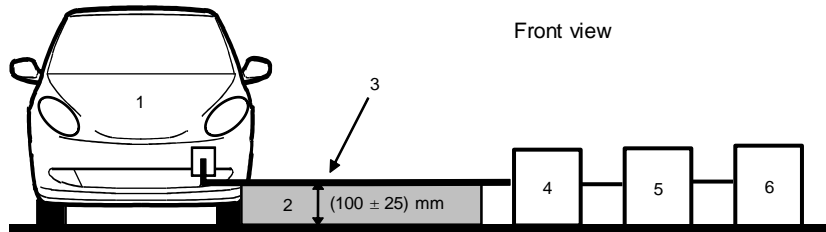
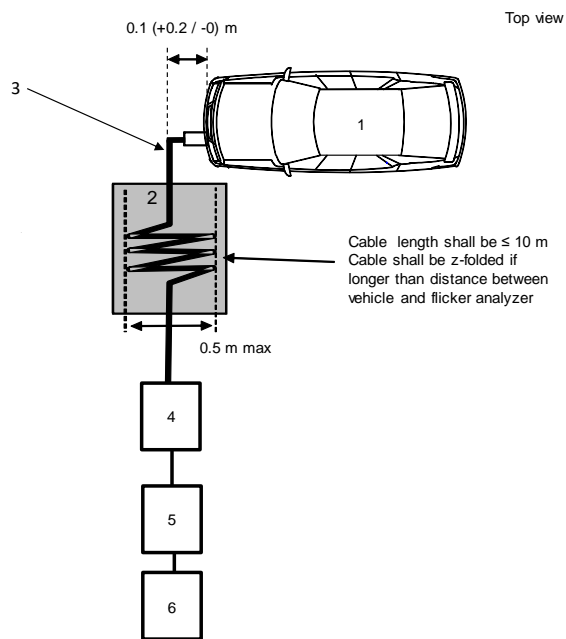


Figure 1d



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging cable 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".

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 nominal value.~~

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

If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its nominal value 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, engine OFF.~~

~~And all other equipment which can be switched on permanently by the driver or passenger should be OFF.~~

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 13, insert a new paragraph 3.2.:

"3.2. **Measuring location**

A shielded enclosure or an absorber lined shielded enclosure (ALSE) or an open area test site (OATS) which complies with the requirements of CISPR 16-1-4 may be used."

Annex 13, paragraph 3.2., renumber as 3.3., amend to read:

"3.2.3. The artificial mains-network(s) to be used for the measurement on vehicle ~~is~~ **are**

(a) the AMN(s) defined in paragraph 4.3. of CISPR 16-1-2 Appendix 8 clause 4 for AC power lines

(b) the DC-charging-AN(s) defined in appendix 8 clause 3 for DC power lines

Artificial networks

The ~~AN(s)~~ **AMN(s)/DC-charging-AN(s)** shall be mounted directly on the ground plane. The cases of the ~~AN(s)~~ **AMN(s)/DC-charging-AN(s)** shall be bonded to the ground plane.

~~The measuring port of the AN shall be terminated with a 50 Ω load.~~

The conducted emissions on AC and DC power lines are measured successively on each power line by connecting the measuring receiver on the measuring port of the related AMN/DC-charging-AN. The measuring port of the AMN/DC-charging-AN inserted in the other power line shall be terminated with a 50 Ω load.

The ~~AN-AMN(s)/DC-charging-AN(s)~~ shall be placed as defined in Figures 1a to 1d. of Appendix 1 to this annex."

Annex 13, paragraphs 3.3., renumber as 3.4.:

Annex 13, paragraphs 3.4., renumber as 3.5., amend to read:

"3.45. 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.

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 ^a	Minimum dwell time	BW at -6 dB	Step size ^a	Minimum dwell time	BW at -6 dB	Step size ^a	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

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

Annex 13, paragraph 4.1., amend to read:

"4.1. The limits apply throughout the frequency range 0.15 to 30 MHz for measurements performed in ~~a semi-anechoic chamber~~ **a shielded enclosure or an absorber lined shielded enclosure (ALSE) or an outdoor test site an open area test site (OATS).**"

Annex 13, Appendix 1, amend to read:

"Annex 13 - Appendix 1

Figure 1

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

Example of test setup for vehicle with plug located on vehicle side (AC powered without communication)

Figure 1a

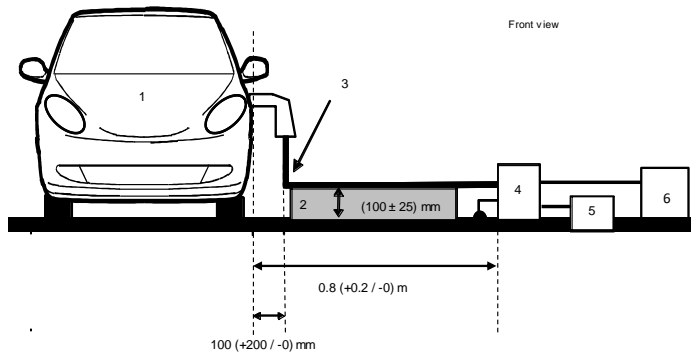
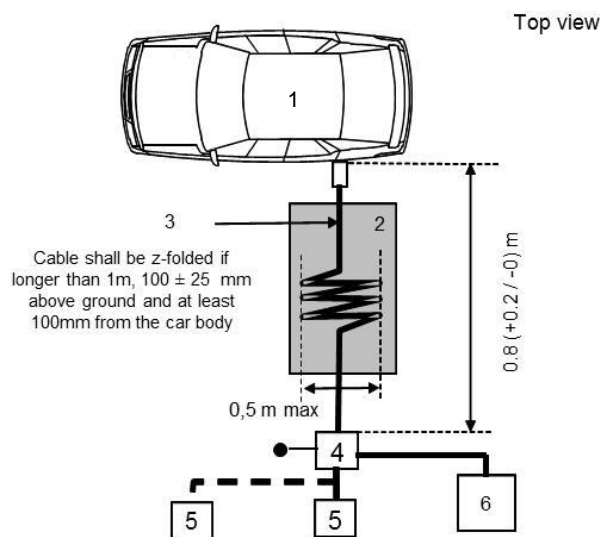


Figure 1b



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging cable harness
- 4 Artificial network(s) AMN(s) or DC-charging-AN(s) grounded (for AC or DC power lines)
- 5 Power mains socket
- 6 Measuring receiver

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

Example of test setup for vehicle with plug located front / rear of vehicle (AC powered without communication)

Figure 1c

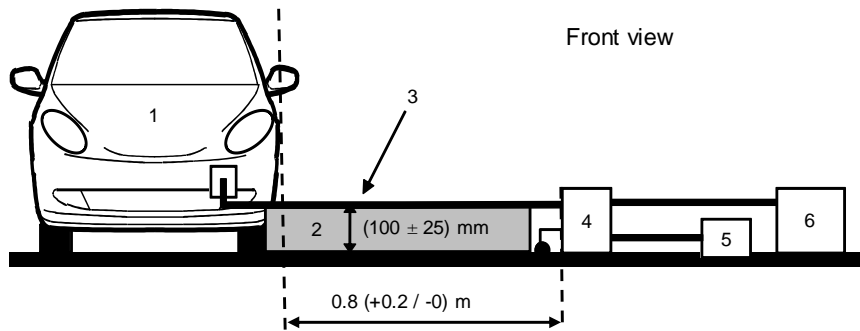
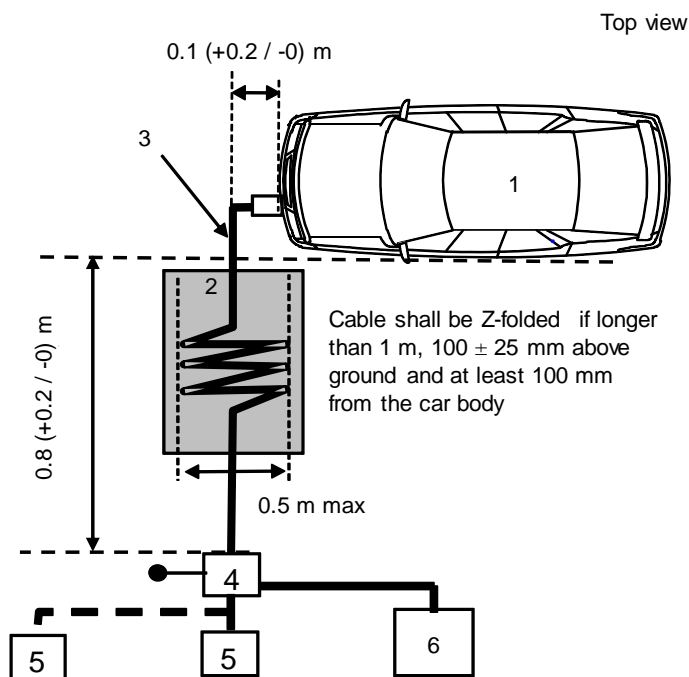


Figure 1d



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging cable harness
- 4 Artificial network(s)-AMN(s) or DC-charging-AN(s) grounded (for AC or DC power lines)
- 5 Power mains socket
- 6 Measuring receiver"

Annex 14, title., amend to read:

"Method(s) of testing for emission of radiofrequency conducted disturbances on ~~network and telecommunication access~~ wired network port from vehicles"

Annex 14, paragraph 1.2., amend to read:

"1.2. Test method

This test is intended to measure the level of radio frequency conducted disturbances generated by vehicle in configuration "REESS charging mode coupled to the power grid" through its ~~network and telecommunication access~~ **wired network port** in order to ensure it is compatible with residential, commercial and light industrial environments."

Annex 14, paragraph 2.1., amend to read:

"2.1. The vehicle 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 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 nominal value.~~

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

If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its nominal value 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, engine OFF.~~

~~And all other equipment which can be switched on permanently by the driver or passenger should be OFF.~~

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 14, insert a new paragraph 3.2.:

"3.2. **Measuring location**

A shielded enclosure or an absorber lined shielded enclosure (ALSE) or an open area test site (OATS) which complies with the requirements of CISPR 16-1-4 may be used."

Annex 14, renumber paragraph 3.2. as 3.3., amend to read:

"3.23. ~~The impedance stabilisation to be used for the measurement on vehicle is defined in paragraph 9.6.2. of CISPR 22.~~

~~Impedance Stabilization~~

~~Communication lines shall be applied to the vehicle through IS(s).~~

~~The IS(s) shall be mounted directly on the ground plane. The case of the IS(s) shall be bonded to the ground plane.~~

~~The measuring port of each IS shall be terminated with a 50 Ω load. The IS shall be placed as defined in Figures 1a to 1d of Appendix 1 to this annex.~~

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 associated 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."

Annex 14, renumber paragraph 3.3. as 3.4., amend to read:

"3.34. The test set-up for the connection of the vehicle in configuration "REESS charging mode coupled to the power grid" is shown in Figures 1a to 1d of Appendix 1 to this annex.

If it is impossible to guarantee the functionality of vehicle, due to introduction of ~~IS~~ AAN, an alternate method described in CISPR 22 (according to Figures 2a to 2d of Appendix 1 to this annex) shall be applied."

Annex 14, renumber paragraph 3.4. as 3.5., amend to read:

"3.45. 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.

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 ^a	Minimum dwell time	BW at -6 dB	Step size ^a	Minimum dwell time	BW at -6 dB	Step size ^a	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

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

Annex 14, paragraph 4.1., amend to read:

- "4.1. The limits apply throughout the frequency range 0.15 to 30 MHz for measurements performed in ~~a semi anechoic chamber~~ **a shielded enclosure or an absorber lined shielded enclosure (ALSE) or an outdoor test site an open area test site (OATS).**"

Annex 14, Appendix 1, amend to read:

"Annex 14 – Appendix 1

Figure 1

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

Example of test setup for vehicle with plug located on vehicle side (AC or DC powered with communication)

Figure 1a

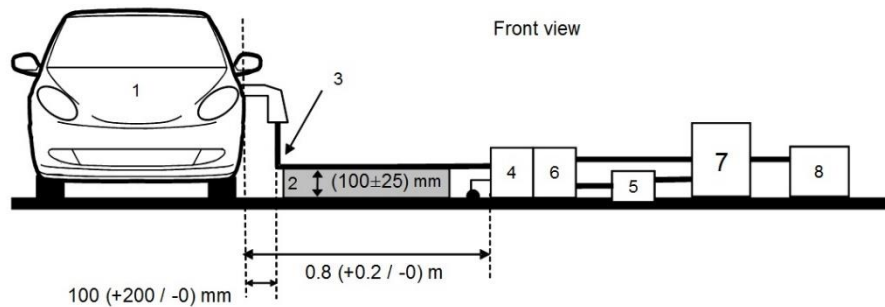
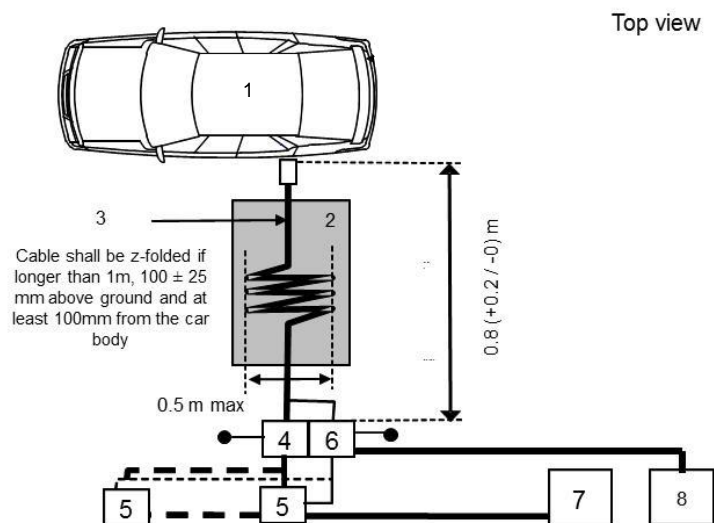


Figure 1b



Legend:

- | | | | |
|---|---|---|--|
| 1 | Vehicle under test | 5 | Power mains socket |
| 2 | Insulating support | 6 | Impedance stabilization AN(s) grounded (for communication lines) |
| 3 | Charging / communication cable harness | 7 | Charging station |
| 4 | Artificial network(s)-AMN(s) or DC-charging-AN(s) grounded (for AC or DC power lines) | 8 | Measuring receiver |

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

Example of test set-up for vehicle with plug located front/rear of vehicle (AC or DC powered with communication)

Figure 1c

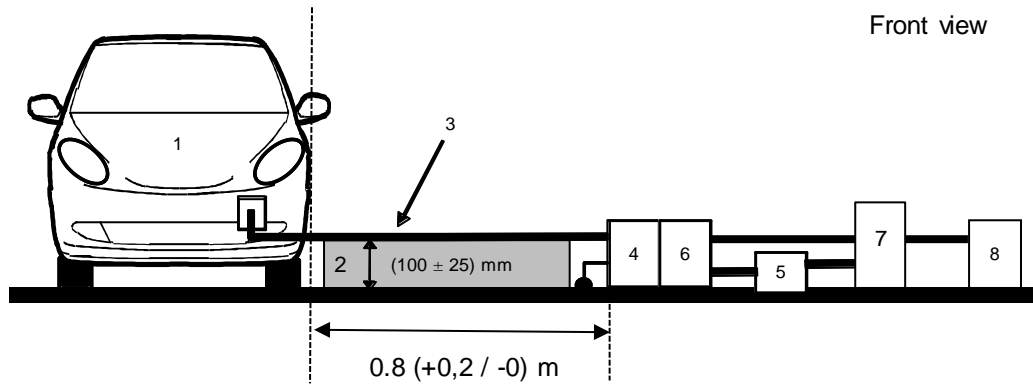
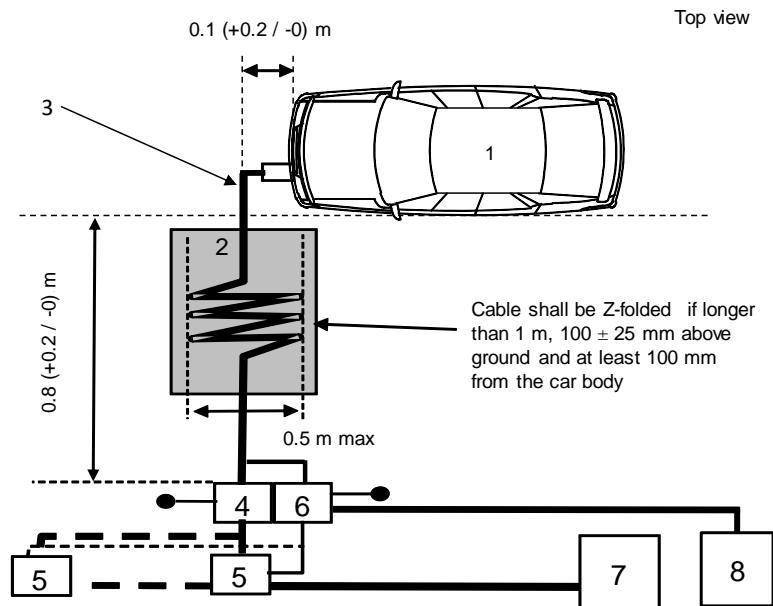


Figure 1d



Legend:

- | | | | |
|---|---|---|--|
| 1 | Vehicle under test | 5 | Power mains socket |
| 2 | Insulating support | 6 | Impedance stabilization network (s) grounded (for communication lines) |
| 3 | Charging / communication cable harness | 7 | Charging station |
| 4 | Artificial network(s) AMN(s) or DC-charging-AN(s) grounded (for AC or DC power lines) | 8 | Measuring receiver |

Figure 2
Alternative measurement for vehicle in configuration "REESS charging mode coupled in the power grid"

Example of test setup for vehicle with plug located on vehicle side (AC or DC powered with communication)

Figure 2a

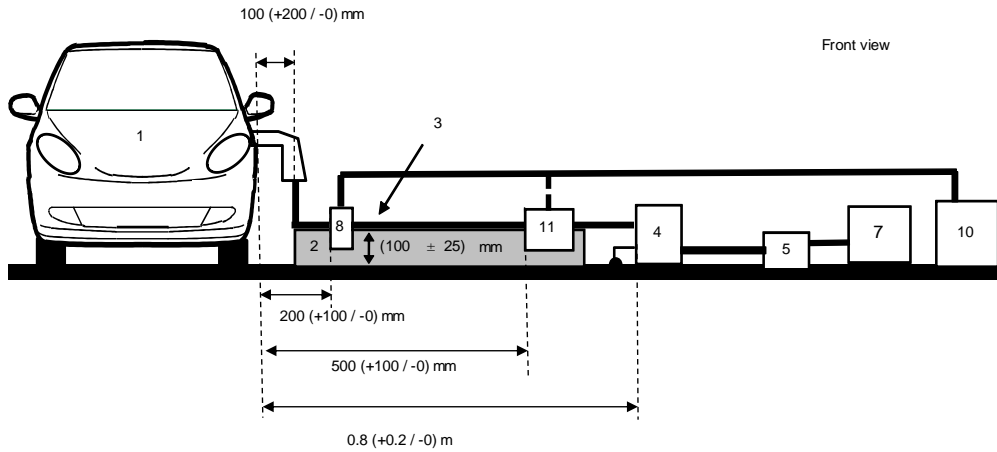
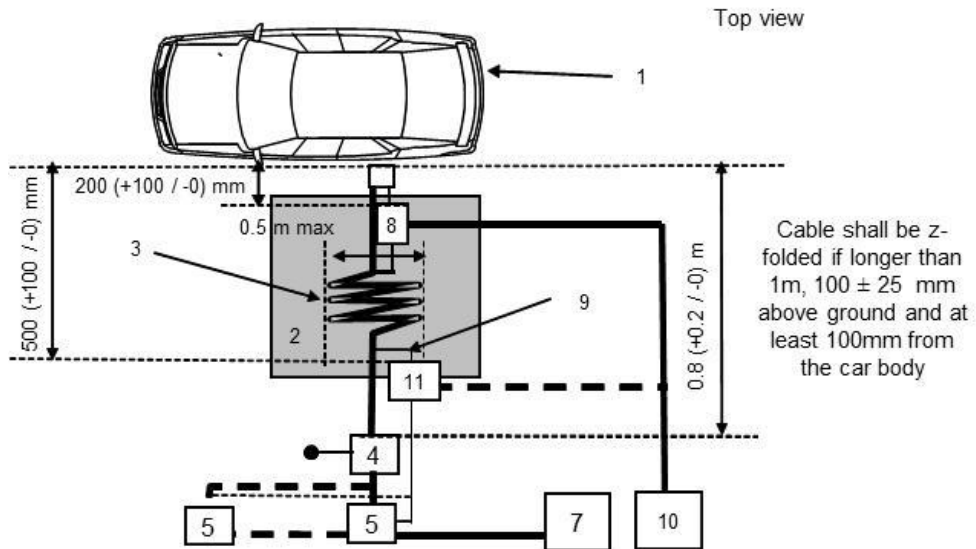


Figure 2b



Legend:

- | | | | |
|---|---|----|--------------------------|
| 1 | Vehicle under test | 7 | Charging station |
| 2 | Insulating support | 8 | Current probe |
| 3 | Charging / communication cable harness | 9 | Communication lines |
| 4 | Artificial network(s) AMN(s) or DC-charging-AN(s) grounded (for AC or DC power lines) | 10 | Measuring receiver |
| 5 | Power mains socket | 11 | Capacitive voltage probe |

Alternative measurement for vehicle in configuration "REESS charging mode coupled in the power grid"

Example of test setup for vehicle with plug located front / rear of vehicle (AC or DC powered with communication)

Figure 2c

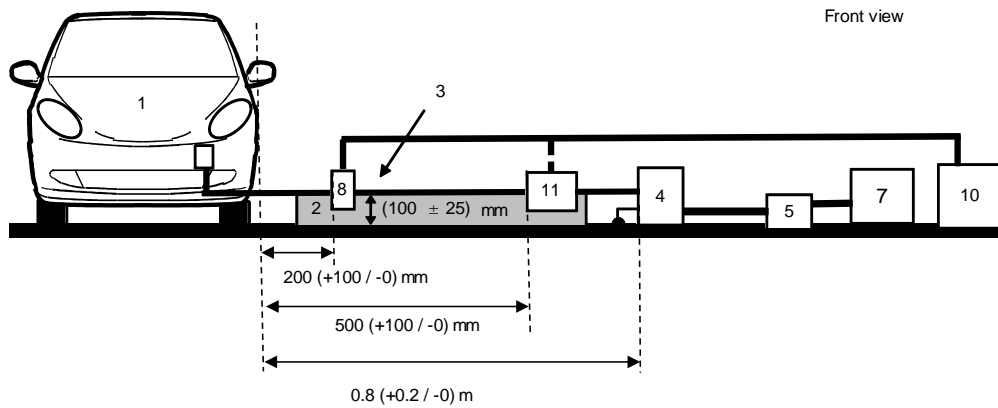
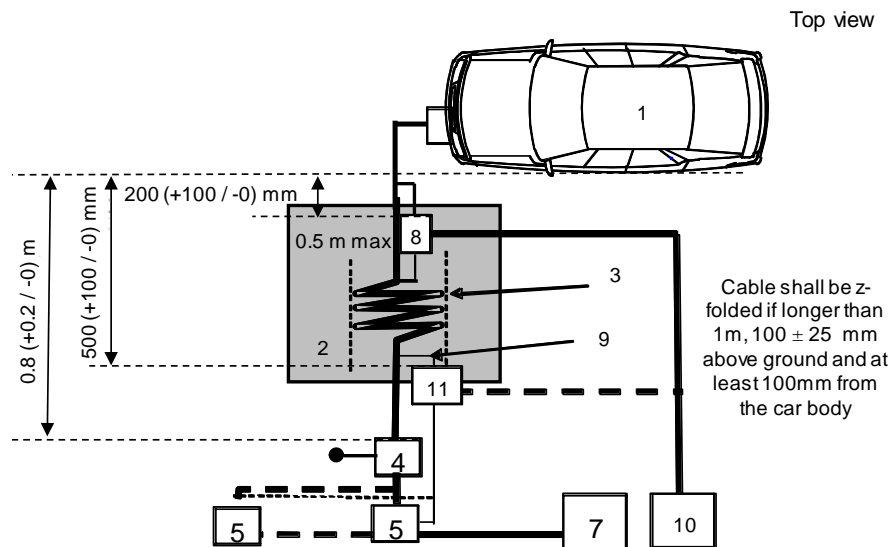


Figure 2d



Legend:

- | | | | |
|---|---|----|---|
| 1 | Vehicle under test | 7 | Charging station |
| 2 | Insulating support | 8 | Current probe (or capacitive voltage probe) |
| 3 | Charging / communication cable harness | 9 | Communication lines |
| 4 | Artificial network(s) AMN(s) or DC-charging-AN(s) grounded (for AC or DC power lines) | 10 | Measuring receiver |
| 5 | Power mains socket | 11 | Capacitive voltage probe |

Annex 15, paragraph 2.1.1., amend to read:

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

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>
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 nominal value. In case of multiple batteries the average state of charge must be considered.	Vehicle sets in motion Electric parking brake warning indicator OFF

Annex 15, paragraph 2.1.3., amend to read:

- "2.1.3. ~~All other equipment which can be switched on permanently by the driver or passenger should be OFF.~~
All other equipment which can be switched ON by the driver or passengers shall be OFF."

Annex 15, paragraph 4.3., amend to read:

- "4.3. The Technical Service shall perform the test as specified in paragraph ~~7.7.2.1.~~ **7.8.2.1.** of this Regulation.
 Alternatively, if the manufacturer provides measurement from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type Approval Authority, the Technical Service may choose not to perform the test to confirm that the vehicle meets the requirements of this annex."

Annex 15, paragraph 5.1.2., amend to read:

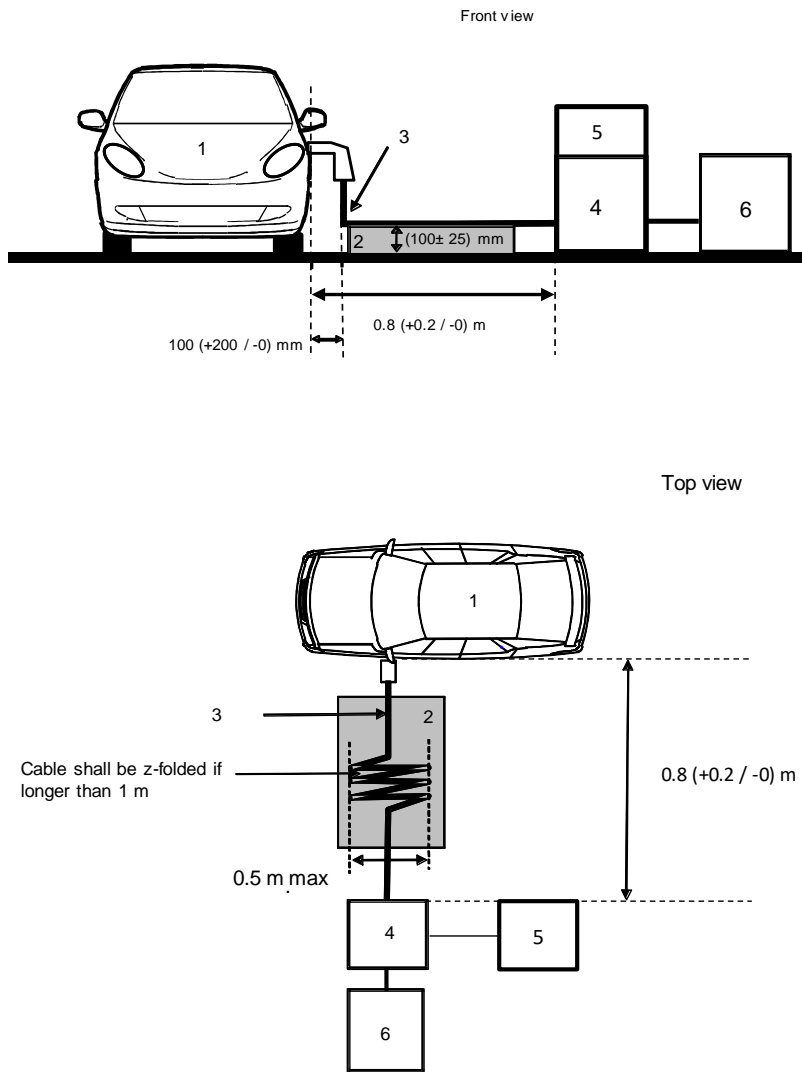
- "5.1.2. Test phase
 The vehicle shall be positioned on the ground plane. The electrical fast transient/burst (EFT/B) shall be applied on the vehicle on the AC/DC power lines in common modes by using CDN as described in Figures **1a to 1d** of Appendix 1 to this annex.
 The test set-up shall be noted in the test report."

Annex 15, Appendix 1, amend to read:

"Annex 15 - Appendix 1

Figure 1
Vehicle in configuration "REESS charging mode coupled to the power grid"
Example of test setup for vehicle with plug located on vehicle side

Figure 1a



Legend:

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

Example of test setup for vehicle with plug located front/rear of vehicle

Figure 1c

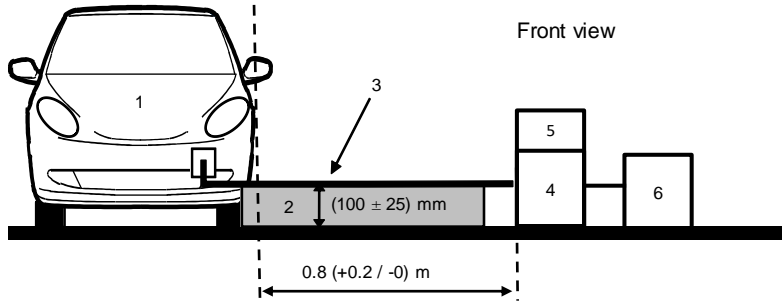
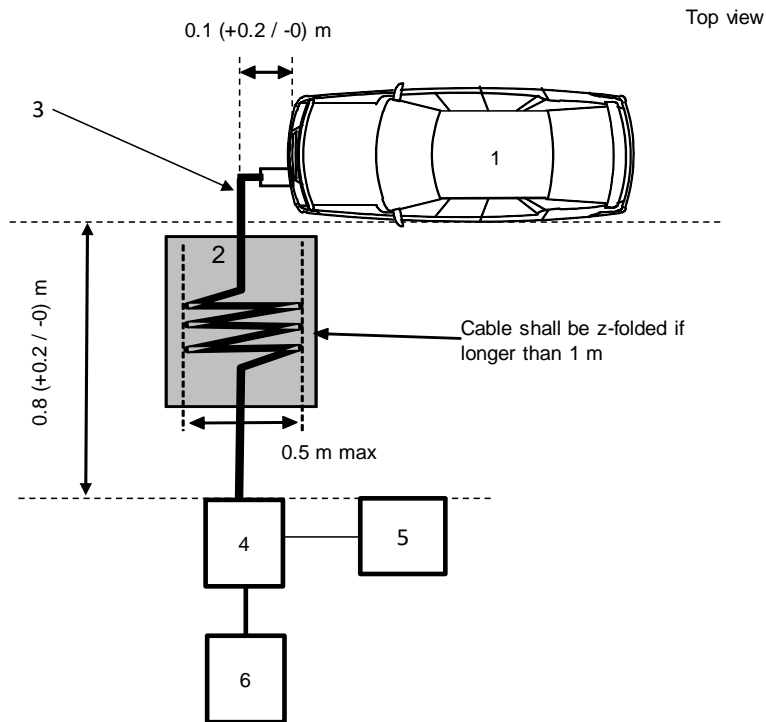


Figure 1d



Legend:

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

Annex 16, paragraph 1.2., amend to read:

"1.2. Test method

This test is intended to demonstrate the immunity of the vehicle electronic systems. The vehicle shall be subject to surges conducted along AC and DC power lines of the vehicle 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 IEC 61000-4-5 **for lightning transients (clause 4.2).**"

Annex 16, paragraph 2.1.1., amend to read:

"2.1.1. ~~The vehicle shall be immobilized, engine OFF and in charging mode.~~

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

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>
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 nominal value. In case of multiple batteries the average state of charge must be considered.	Vehicle sets in motion Electric parking brake warning indicator OFF

"

Annex 16, paragraph 2.1.3., amend to read:

"2.1.3. ~~All other equipment which can be switched on permanently by the driver or passenger should be OFF.~~

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

Annex 16, paragraph 4.3., amend to read:

"4.3. The Technical Service shall perform the test as specified in paragraph ~~7.8.2.1.~~ **7.9.2.1.** of this Regulation."

Annex 16, paragraph 5.1.2., amend to read:

"5.1.2. Test phase

The vehicle shall be positioned on the ground plane. The electrical surge shall be applied on the vehicle on the AC/DC power lines between each line and earth and between lines by using CDN as described in Figures **1a** to **1d** of Appendix 1 to this annex,

The test setup shall be noted in the test report."

Annex 16, Appendix 1, amend to read:

"Annex 16 - Appendix 1

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

Figure 1

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

Example of test setup for vehicle with plug located on vehicle side

Figure 1a

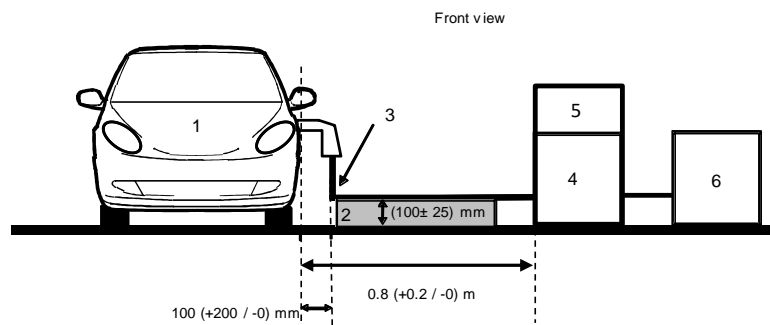
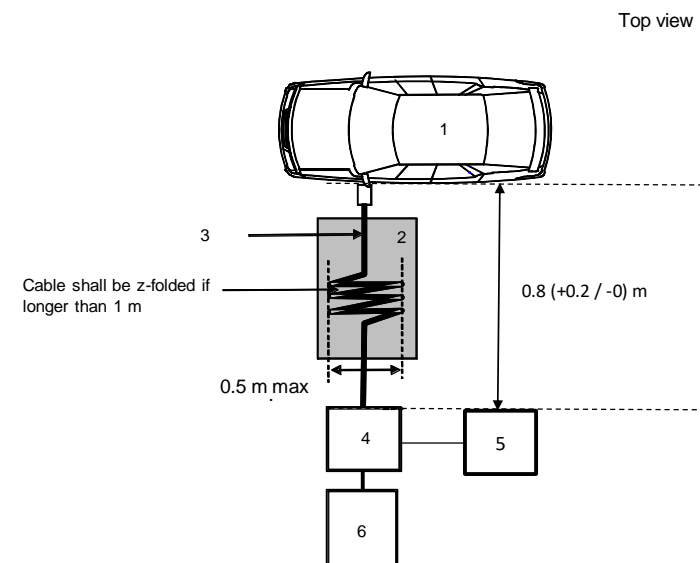


Figure 1b



Legend:

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

Example of test setup for vehicle with plug located front/rear of vehicle

Figure 1c

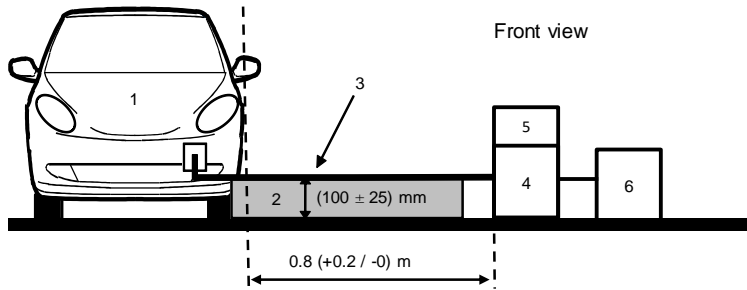
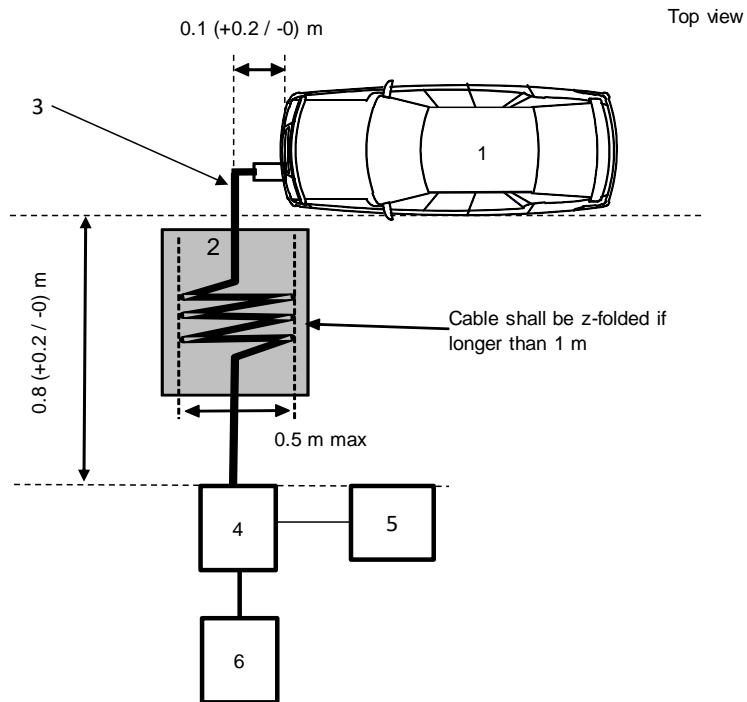


Figure 1d



Legend:

- 1 Vehicle under test
- 2 Insulating support
- 3 Charging cable 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 nominal value **for AC charging.**"

Annex 17, Paragraph 4.3., amend to read:

"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 11 of paragraph 7.11.2.2. of this Regulation."

Annex 17, Paragraph 4.4., amend to read:

"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 12 of 7.11.2.2. of this Regulation."

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 nominal 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 nominal value.~~

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

If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its nominal value for DC charging unless another value is agreed with the type approval authorities."

Annex 19, Paragraph 3.1., delete.

Annex 19, Paragraph 3.2., renumber as 3.1. and amend to read:

"3.2-1. The artificial ~~main~~ network(s) to be used for the measurement on vehicle ~~is~~ **are**

(a) the AMN(s) defined in paragraph 4.3. of CISPR 16-1-2 Appendix 8 clause 4 for AC power lines

(b) the DC-charging-AN(s) defined in appendix 8 clause 3 for DC power lines

Artificial networks

The ~~AN(s)~~ **AMN(s)/DC-charging-AN(s)** shall be mounted directly on the ground plane. The cases of the ~~AN(s)~~ **AMN(s)/DC-charging-AN(s)** shall be bonded to the ground plane.

The conducted emissions on AC and DC power lines are measured successively on each power line by connecting the measuring receiver on the measuring port of the related ~~AN-AMN/DC-charging-AN~~. The measuring port of the ~~AN-AMN/DC-charging-AN~~ inserted in the other power lines ~~being~~ **shall be** terminated with a 50 Ω load.

The ~~AN~~ **AMN(s)/DC-charging-AN(s)** shall be placed in front, aligned and on the same side of the vehicle power charging plug."

Annex 19, insert a new paragraph 3.2.:

"3.2. Measuring location

A shielded enclosure or an absorber lined shielded enclosure (ALSE) or an open area test site (OATS) which complies with the requirements of CISPR 16-1-4 may be used."

Annex 19, paragraph 3.3., amend to read:

"3.3. The test set-up (**floor-standing equipment**) for the connection of the ESAs in configuration "REESS charging mode coupled to the power grid" is shown in Figure 1 of Appendix 1 to this annex."

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.

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 ^a	Minimum Dwell time	BW at -6 dB	Step size ^a	Minimum Dwell time	BW at -6 dB	Step size ^a	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

~~“ 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.”

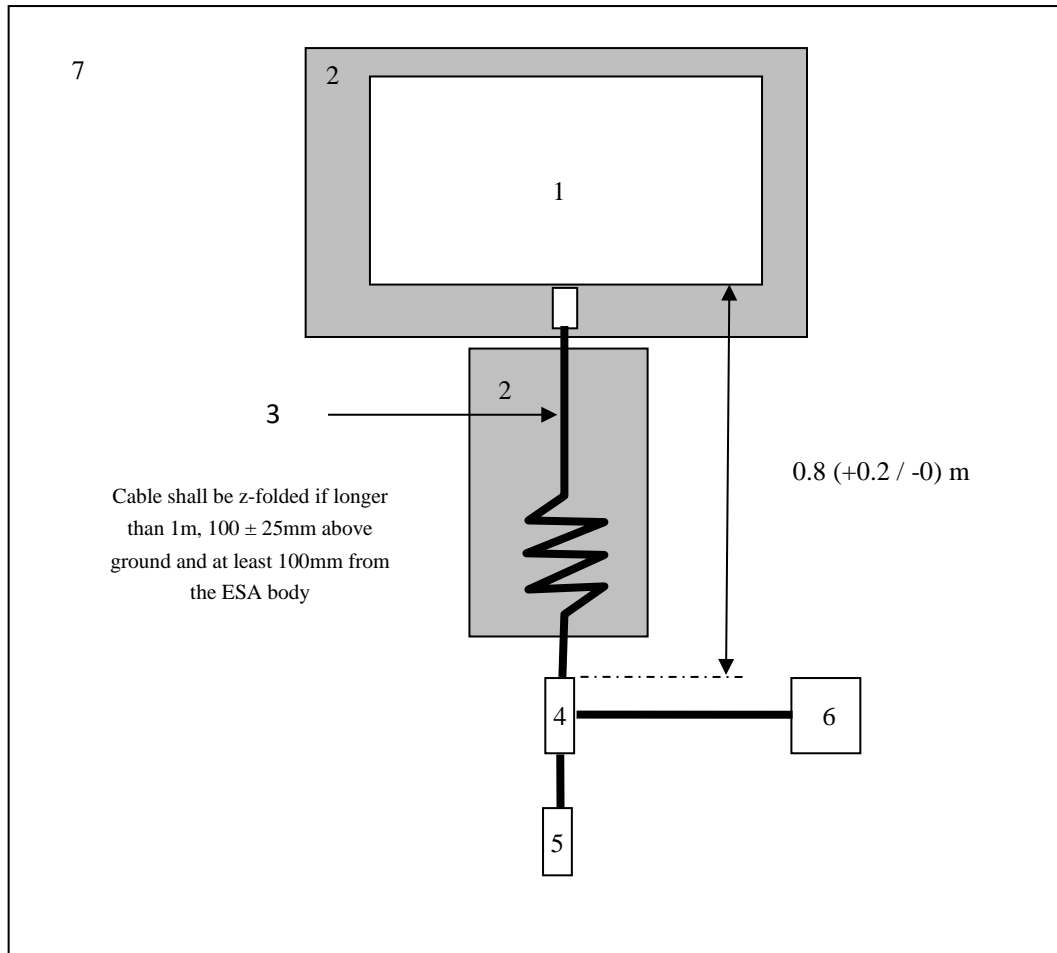
Annex 19, paragraph 4.1., amend to read:

"4.1 The limits apply throughout the frequency range 0.15 to 30 MHz for measurements performed in ~~a semi-anechoic chamber~~ **a shielded enclosure or an absorber lined shielded enclosure (ALSE)** or an ~~outdoor test sites~~ **open area test site (OATS).**"

Annex 19, Appendix 1, amend to read:

"Annex 19 – Appendix 1

Figure 1
ESA in configuration "REESS charging mode coupled to the power grid" (floor-standing equipment)



Legend:

- 1 ESA under test
- 2 Insulating support
- 3 Charging cable harness
- 4 AC or DC Artificial network(s)-AMN(s) or DC-charging-AN(s) grounded
- 5 Power mains socket
- 6 Measuring receiver
- 7 Ground plane"

Annex 20, title., amend to read:

"Method(s) of testing for emission of radiofrequency conducted disturbances on ~~network and telecommunication access~~ wired network port from an ESA"

Annex 20, paragraph 1.2., amend to read:

"1.2. Test method

This test is intended to measure the level of radio frequency conducted disturbances generated by ESA in configuration "REESS charging mode coupled to the power grid" through its ~~network and telecommunication access~~ **wired network port** in order to ensure it is compatible with residential, commercial and light industrial environments.

If not otherwise stated in this annex the test shall be performed according to CISPR 22."

Annex 20, 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 nominal value.~~

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

If the current consumption can be adjusted, then the current shall be set to at least 80 per cent of its nominal value for DC charging unless another value is agreed with the type approval authorities."

Annex 20, paragraph 3.1., delete.

Annex 20, paragraph 3.2., renumber as 3.1., amend to read:

"~~3.2.1. Impedance stabilization~~

~~Communication lines shall be applied to the ESA through the Impedance Stabilization(s) (IS)(s).~~

~~IS to be connected in the network and communication cables is defined in paragraph 9.6.2. of CISPR 22.~~

~~The IS(s) shall be mounted directly on the ground plane. The case of the IS(s) shall be bonded to the ground plane.~~

~~The conducted emissions on network and telecommunication lines are measured successively on each line by connecting the measuring receiver on the measuring port of the related IS, the measuring port of the IS inserted in the other lines being terminated with a 50 Ω load.~~

~~The IS shall be placed in front, aligned and on the same side of the vehicle power charging plug.~~

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 associated 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."

Annex 20, insert a new paragraph 3.2.:

"3.2. Measuring location

A shielded enclosure or an absorber lined shielded enclosure (ALSE) or an open area test site (OATS) which complies with the requirements of CISPR 16-1-4 may be used."

Annex 20, paragraph 3.3., amend to read:

"3.3. The test set-up (**floor-standing equipment**) for the connection of the ESA in configuration "REESS charging mode coupled to the power grid" is shown in Figure 1 of Appendix 1 to this annex."

Annex 20, 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.

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	Peak detector	Quasi-peak detector	Average detector
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<i>range MHz</i>	<i>BW at -6 dB</i>	<i>Step size^a</i>	<i>Minimum Dwell time</i>	<i>BW at -6 dB</i>	<i>Step size^a</i>	<i>Minimum Dwell time</i>	<i>BW at -6 dB</i>	<i>Step size^a</i>	<i>Minimum Dwell time</i>
0.15 to 30	9 kHz	5 kHz	50 ms	9 kHz	5 kHz	1 s	9 kHz	5 kHz	50 ms

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

Annex 20, paragraph 4.1., amend to read:

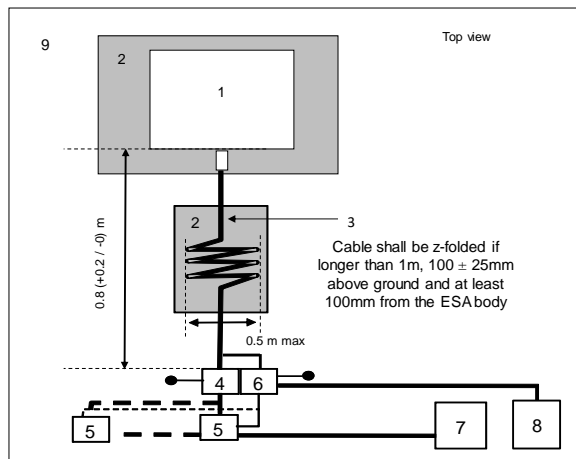
- "4.1. The limits apply throughout the frequency range 0.15 to 30 MHz for measurements performed in ~~a semi-anechoic chamber~~ **a shielded enclosure or an absorber lined shielded enclosure (ALSE)** or an ~~outdoor test sites~~ **open area test site (OATS).**"

Annex 20, Appendix 1, delete and replace by:

"Annex 20 – Appendix 1

Figure 1

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



Legend:

- 1 ESA under test
- 2 Insulating support
- 3 Charging / communication cable harness
- 4 AC or DC Artificial network(s) AMN(s) or DC-charging-AN(s) grounded
- 5 Power mains socket
- 6 Impedance stabilization(s) AAN(s)
- 7 Charging station
- 8 Measuring receiver
- 9 Ground plane"

II. Justification

- [1. Update of vehicle categories by adding T, R and S was done for consistency with the European Union (EU) Regulation 2015/208].
2. Footnotes were updated to be consistent with the last revision of ECE/TRANS/WP.29/78.
3. The definition of “immunity related function” was updated due to the technology evolution.
4. Definitions were added to be consistent with the last updates of CISPR 12 (charging modes, networks, ...).
5. Clause 3.1.9. was added to the 04 series of amendments to UN Regulation No. 10, because there had been no description of the rechargeable energy storage system (REESS) equipment electrical sub-assembly (ESA) tests and, therefore, these specific REESS tests could only be performed at the vehicle level. When the 05 series of amendments to UN Regulation No. 10 was adopted, including the specific REESS-equipment ESA test, clause 3.1.9. should have been deleted.
6. The 05 series of amendments vehicle broadband reference limits (at 3m and 10m) are consistent with the CISPR 12 broadband reference limits (at 3 m and 10 m), while the 05 series of amendments vehicle narrowband reference limits (at 3 m and 10 m) are not consistent with those from CISPR 12. Thus, it is proposed to have the 06 series of amendments vehicle narrowband reference limits (at 3 m and 10 m) consistent with the CISPR 12 narrowband ones (the CISPR12 narrowband limit minus 2 dB as a more stringent requirement for type approval, as defined in CISPR 12).
7. Updates in line with the last CISPR 12 and CISPR 25, fourth edition, were done for:
 - Descriptions of set-ups and associated figures for vehicle in charging mode;
 - Updated annex and updated wording for Artificial networks (AN, HV-AN, DC-charging-AN, AMN and AAN);
 - Update of wording for signal / control port and wired network port;
 - Use of “charging harness” instead of “charging cable”.
8. Single phase equipment with the current between 16 A and 75 A is addressed by the International Electrotechnical Commission (IEC) standard 61000-3-12 and implicitly included in “other than balanced three phase equipment”. Consistency between tables titles for harmonic emission requirements and wording in annexes was ensured.
9. Additional precisions were made concerning the limits of IEC 61000-3-3, paragraph 5 and IEC 61000-3-11, paragraph 5, and the associated parameters (Pst, Plt, d(t), ...).
10. Paragraph 7 concerns "Additional specifications in the configuration of the "REESS charging mode coupled to the power grid". For ESAs connected both to low (12V/24V) and high voltages, pulse 4 cannot occur because there is no starter or cranking motor.
11. The proposal includes a precision on “DC network cable” and replaces references to Annexes with references to paragraphs in the body text, because the requirements are laid down in the paragraphs of the main body and not in the Annexes.
12. The proposal for transitional provisions (TPs) includes:
 - suppression of TPs concerning the 03 and 04 series of amendments (paragraphs 13.1. to 13.10.)
 - replacement of the single TP concerning the 05 series of amendments (paragraph 13.11.) by TPs concerning the 05 series of amendments (paragraph 13.1.1. to

13.1.4.) based on “Draft General Guidelines for United Nations regulatory procedures and transitional provisions in un Regulations” (ECE/TRANS/WP.29/2017/107) using Annex 1 paragraph II “Aide-mémoire” guidelines and consideration of extensions and vehicle types which are not equipped with a coupling system to charge REESS, or component or separate technical unit which does not include a coupling part to charge the REESS for proposed TPs 13.1.3.

- new TPs concerning the 06 series of amendments (paragraph 13.2.1. to 13.2.4.) based on “Draft General Guidelines for United Nations regulatory procedures and transitional provisions in un Regulations” (ECE/TRANS/WP.29/2017/107) using Annex 1 paragraph II “Aide-mémoire” guidelines and consideration of extensions and vehicle types which are not equipped with a coupling system to charge REESS, or component or separate technical unit which does not include a coupling part to charge the REESS for proposed TPs 13.2.3.

13. Updated references of standards as follows: - suppression of reference to ISO 7637-1 (not referred in the document), updates of ISO 11451-2 and ISO 11451-4 to the last edition, corrects ISO 11452-3 (error), update ISO 11452-4 to the last edition, deletes IEC 61000-6-2 (not referred in the document) and update CISPR 16-1-2 to the last edition, addition of references of IEC 61851-1 and CISPR 32.

14. Consideration of electronic drawing submission was added.

15. Consideration of long vehicles specific condition to install on roller bench was added.

16. Precisions were made for vehicles in charging mode: minimum current value (with distinction between AC and DC charging, consideration of multiple batteries and vehicle operating mode.

17. The state of the art wording was inserted for absorber lined shielded enclosure (ALSE).

18. The figures for the vehicle in charging mode were updated to make them consistent with the last updates in CISPR 12 FDIS, CISPR 25 and ISO/TC22/SC32/WG3 for the test site, the position of the motorcycle (error) and precision on “extreme hand of handle bar”, artificial(s) network(s) were updated with use of AMN and DC-charging-AN, editorial corrections and various configurations (side or front/rear plug) were also introduced.

19. The quasi-peak detector and the sentence on broadband disturbances were deleted, because they did not concern narrowband disturbances measurements.

20. “Minimum” for scan time or dwell time was added.

21. A precision was made on multiple antenna positions for 3 m or 10 m measurement in line with CIPSR 12.

22. Measuring location for vehicle narrowband emission measurement were not precised in Annex 5.

23. Update of description of vehicle modes and failure criteria for immunity tests was made in order to be as precise as possible and to avoid discrepancies in terms of application.

24. The description of failure criteria for immunity tests on vehicle in charging mode was updated.

25. A precision was made for vehicle operating mode (when not in charging mode).

26. A change from the facility to vehicle reference point was introduced for consistency with the last ISO 11451-2 update.

27. A precision was made for vehicle positioning in case of rear irradiation.
 28. The figures for ESA in charging mode were updated for consistency with the last updates in CISPR 25 and ISO/TC22/SC32/WG3 for artificial(s) network(s) with use of AMN and DC-charging-AN.
 29. A clarification on the ISO 11452-4 test methodology was introduced to make it consistent with the two methodologies defined in the last editions of ISO 11452-4.
 30. The proposal introduced a precision by adding of “three phase” and references to all new figures (1a to 1d).
 31. The two “generic” figures for the vehicle in charging mode were replaced by four detailed figures for the various configurations (side or front/rear plug).
 32. An additional paragraph or precision on “Measuring location” in the annexes 4, 7, 13, 14, 19 and 20 were made.
 33. Additional wording concerning the measurement with a 50 Ω load was inserted.
 34. A clarification was made to reflect the fact that the concerned test in IEC 61000-4-5 is lightning transients.
 35. A precision was inserted that the set-up to be considered is “floor-standing equipment”.
 36. The other corrections were purely editorial.
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