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Item 8 of the provisional agenda
UN Regulation No. 10 (Electromagnetic Compatibility)

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

Submitted by the expert from by the Informal Working Group on Electromagnetic Compatibility*

The text reproduced below was prepared by the experts from the Informal Working Group on Electromagnetic Compatibility (IWG EMC), with the aim to develop Supplement 1 to the 07 series of amendments to UN Regulation No.10. The proposed modifications to the current text of the UN Regulation are marked in bold for new or strikethrough for deleted characters.

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

I. Proposal

Paragraph 6.1.2., amend to read:

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

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

Paragraph 6.7.1., amend to read:

"6.7.1. Method of testing
The emission of ESA representative of its type shall be tested by the method(s) according to ISO 7637-2**:2011** as described in Annex 10 for the levels given in Table 1.

Table 1
Maximum allowed pulse amplitude

	Maximum allowed pulse amplitude for	
Polarity of pulse amplitude	*Vehicles with 12 V systems*	*Vehicles with 24 V systems*
Positive	+75 V	+150 V
Negative	–100 V	–450 V

"

Paragraph 7.1.2., amend to read:

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

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

Paragraph 7.17.1., amend to read:

"7.17.1. Method of testing
The emission of ESA representative of its type shall be tested by the method(s) according to ISO 7637-2**:2011**, as described in Annex 10 for the levels given in Table 18.

Table 18
Maximum allowed pulse amplitude

	Maximum allowed pulse amplitude for	
Polarity of pulse amplitude	*Vehicles with 12 V systems*	*Vehicles with 24 V systems*
Positive	+75 V	+150 V
Negative	–100 V	–450 V

"

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

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

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

Table 19a

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

Table 19b

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

"

Paragraph 7.19.1., amend to read:

"7.19.1 Method of testing

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

Table 20
Immunity of ESA

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

"

Appendix 1, amend to read:

"List of standards referred to in this Regulation

1. CISPR 12 "Vehicles~~'~~, ~~motorboats'~~**boats, and internal combustion** ~~and spark-ignited~~ engine~~-~~ driven devices~~'~~ - **R**~~r~~adio disturbance characteristics - Limits and methods of measurement **for the protection of receivers except those installed in the vehicle/boat/device itself or in adjacent vehicles/boats/devices**", ~~fifth~~ ~~e~~**E**dition **5.1 -** 2001 and AMD1:2005.

2. CISPR 16-1-4 "Specifications for radio disturbance and immunity measuring apparatus and methods - Part 1-**4**: Radio disturbance and immunity measuring apparatus ~~apparatus -~~ Antennas and test sites for radiated disturbances me~~sa~~**as**urements", ~~fourth~~ ~~e~~**E**dition **4.2 -** 2019, AMD1:2020 and AMD2:2023.

3. CISPR 25 "~~Limits and methods of measurement of~~ **R**~~r~~adio disturbance characteristics for the protection of receivers used on board vehicles**, boats, and on devices - Limits and methods of measurement**", ~~second~~ ~~e~~**E**dition **2.0 -** 2002 and corrigendum 2004.

4. ISO 7637-1 "Road vehicles - Electrical disturbance from conduction and coupling - Part 1: Definitions and general ~~configurations~~**considerations**", ~~t~~**T**hird edition 2015.

   ISO 7637-2 "Road vehicles - Electrical disturbance from conduction and coupling - Part 2: Electrical transient conduction along supply lines only~~ on vehicles with nominal 12 V or 24 V supply voltage~~", ~~s~~**S**econd edition 2004.

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

5. ISO/IEC 17025 "General requirements for the competence of testing and calibration laboratories", ~~t~~**T**hird edition 2017.

6. ISO 11451 "Road vehicles – **Vehicle test methods for e**~~E~~lectrical disturbances ~~by~~**from** narrowband radiated electromagnetic energy~~ – Vehicle test methods~~":

   Part 1: General **principles** and ~~definitions~~ **terminology** (ISO 11451-1, ~~f~~**F**ourth edition 2015**)**;

   Part 2: Off-vehicle radiation source**s** (ISO 11451-2, ~~f~~**F**ourth edition 2015);

   Part 4: ~~Bulk current injection (BCI)~~ **Harness excitation methods** (ISO 11451-4, fourth edition 2022).

7. ISO 11452 "Road vehicles - **Component test methods for e**~~E~~lectrical disturbances ~~by~~**from** narrowband radiated electromagnetic energy~~ – Component test methods~~":

   Part 1: General **principles** and ~~definitions~~ **terminology** (ISO 11452-1, ~~f~~**F**ourth edition 2015**)**;

   Part 2: Absorber-lined **shielded enclosure** ~~chamber~~ (ISO 11452-2, ~~t~~**T**hird edition 2019);

   Part 3: Transverse electromagnetic ~~mode~~ (TEM) cell (ISO 11452-3, ~~third~~**Fourth** edition 20**24**~~16~~);

   Part 4: ~~Bulk current injection (BCI)~~ **Harness excitation methods** (ISO 11452-4, ~~f~~**F**ifth edition 2020);

   Part 5: Stripline (ISO 11452-5, ~~s~~**S**econd edition 2002)~~.~~**;**

   Part 11: Reverberation chamber (ISO 11452-11, ~~f~~**F**irst edition 2010).

8. ITU Radio Regulations, edition 2020.

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

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

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

12. IEC 61000-3-12 "Electromagnetic Compatibility (EMC) - Part 3-12**: Limits** - Limits for harmonic current**s** ~~emissions~~ produced by equipment connected to public low-voltage systems with input current > 16 A and ≤ 75 A per phase", ~~e~~**E**dition **1.0 - 2004** ~~2.1 - 2011 and AMD1:2021~~.

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

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

15. IEC 61000-6-3 "Electromagnetic Compatibility (EMC) - Part 6-3**:** ~~-~~ Generic standards - Emission standard for **equipment in** residential~~, commercial and light industrial~~ environments", ~~e~~**E**dition 3.0 - 2020.

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

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

18. CISPR 16-1-2 "Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-2: Radio disturbance and immunity measuring apparatus~~ - Ancillary equipment -~~ **Coupling devices for c**~~C~~onducted disturbance~~s~~ measurements", ~~e~~**E**dition 2.1 - 2014 and AMD1:2017.

19. IEC 61851-1 "Electric vehicle conductive charging system - Part 1: General requirements", ~~e~~**E**dition 3.0 - 2017.

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

21. CISPR 32 "Electromagnetic compatibility of multimedia equipment - Emission requirements”, ~~e~~**E**dition 2.1 - 2015 and AMD1:2019.

22. CISPR 16-1-1 “Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-1: Radio disturbance and immunity measuring apparatus - Measuring apparatus-", ~~e~~**E**dition ~~4~~**5**.0 201~~5~~**9** ~~-09~~.

"

Appendix 8,

Paragraph 1., amend to read:

"**1. Artificial networks (AN)**

For an ESA powered by LV, a 5 µH / 50 Ω AN as defined in Figure 1 shall be used.

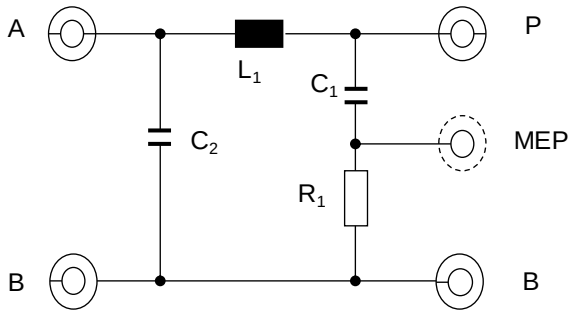
The AN(s) shall be mounted directly on the ground plane. The grounding connection of the AN(s) shall be bonded to the ground plane.

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

The AN impedance Z~~PB~~**PB** (tolerance ± 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 50 Ω load on the measurement port with terminals A and B (of Figure 1) short circuited.

Figure 1, amend to read

"Figure 1
Example of 5 µH AN schematic



~~Legend~~**Key**

L_1~~:~~ 5 µH	A~~:~~ ~~P~~**p**ort to power supply
C_1~~:~~ 0,1 µF	P~~:~~ ~~P~~**p**ort to ESA
C_2~~:~~ 1 µF (default value)	B~~:~~ ~~G~~**g**round
R_1~~:~~ 1 kΩ	MEP~~:~~ ~~M~~**m**easuring ~~P~~**p**ort"

"

Paragraph 2., amend to read:

"**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.

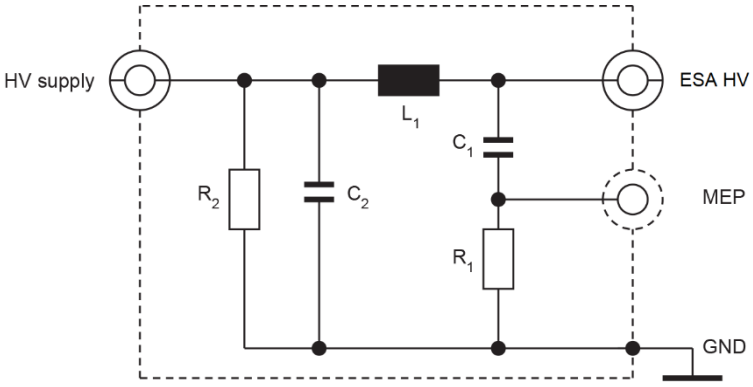
The HV-AN(s) shall be mounted directly on the ground plane. The grounding connection of the HV-AN(s) shall be bonded to the ground plane.

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

The HV-AN impedance $Z_{~~PB~~PB}$ (tolerance ± 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."

Figure 3, amend to read:

"Figure 3
Example of 5 µH / HV-AN schematic



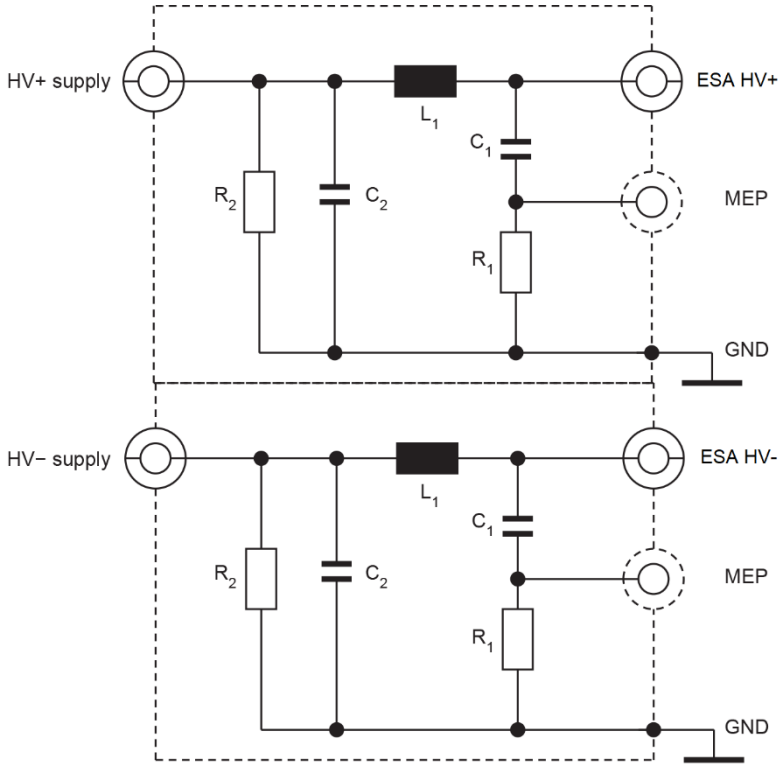
~~Legend~~**Key**

L_1~~:~~ 5 µH	HV supply~~:~~ ~~H~~**h**igh ~~V~~**v**oltage power supply
C_1~~:~~ 0,1 µF	ESA HV~~:~~ ~~H~~**h**igh ~~V~~**v**oltage of ESA
C_2~~:~~ 0,1 µF (default value)	MEP~~:~~ ~~M~~**m**easuring ~~P~~**p**ort
R_1~~:~~ 1 kΩ	GND~~:~~ ~~G~~**g**round
R_2~~:~~ 1 MΩ (discharging C_2 to > 50 V_{dc} within 60 s)	

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

Figure 4, amend to read:

"Figure 4
Example of 5 µH HV-AN combination in a single shielded box



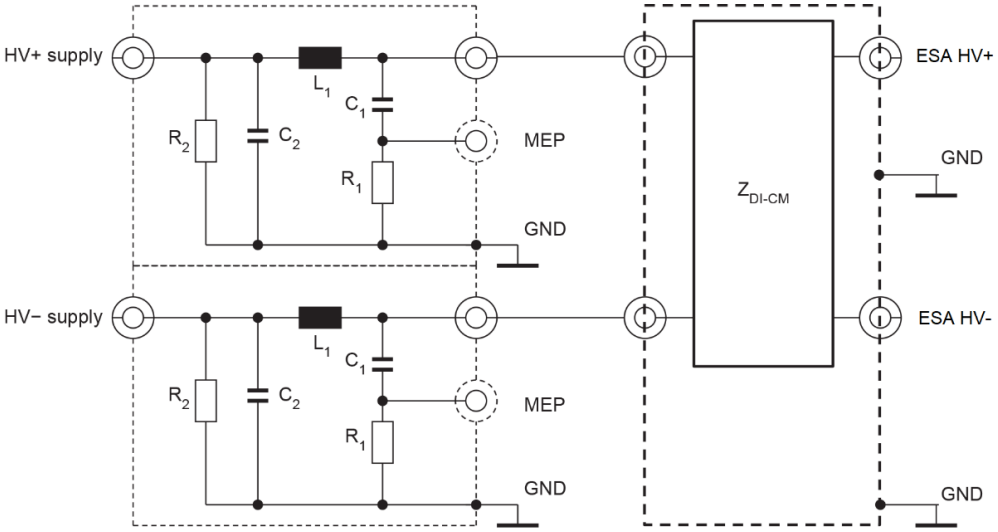
~~Legend~~**Key**

L_1~~:~~ 5 µH	HV supply~~:~~ ~~H~~**h**igh ~~V~~**v**oltage power supply (positive and negative)
C_1~~:~~ 0,1 µF	ESA HV~~:~~ ~~H~~**h**igh ~~V~~**v**oltage of ESA (positive and negative)
C_2~~:~~ 0,1 µF (default value)	MEP~~:~~ ~~M~~**m**easuring ~~P~~**p**ort
R_1~~:~~ 1 kΩ	GND~~:~~ ~~G~~**g**round
R_2~~:~~ 1 MΩ (discharging C_2 to > 50 V_{dc} within 60 s)"	

Figure 5, amend to read:

"Figure 5

Impedance matching network attached between HV-ANs and ESA



~~Legend~~**Key**

L_1~~:~~ 5 µH

C_1~~:~~ 0,1 µF

C_2~~:~~ 0,1 µF (default value)

R_1~~:~~ 1 kΩ

R_2~~:~~ 1 MΩ (discharging C_2 to > 50 V_{dc} within 60 s)

HV supply~~:~~ ~~H~~**h**igh ~~V~~**v**oltage power supply (positive and negative)

ESA HV~~:~~ ~~H~~**h**igh ~~V~~**v**oltage of ESA (positive and negative)

MEP~~:~~ ~~M~~**m**easuring ~~P~~**p**ort

GND~~:~~ ~~G~~**g**round

Z_{DI-CM}~~:~~ ~~D~~**d**ifferential and common-mode impedance

"

Paragraph 3., amend to read:

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

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

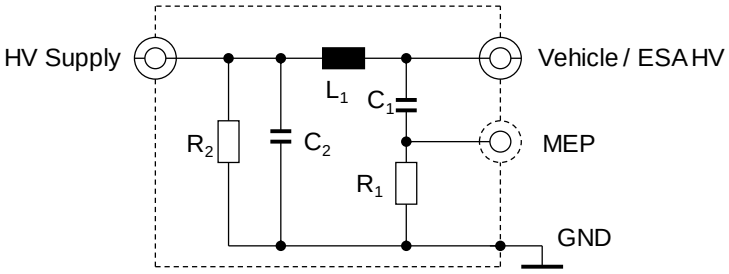
Measurement ports of DC-charging-AN(s) shall be terminated with 50 Ω loads.

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

Figure 6, amend to read:

"Figure 6

Example of 5 µH DC-charging-AN schematic



~~Legend~~**Key**

L_1 ~~:~~ 5 µH

C_1 ~~:~~ 0,1 µF

C_2~~:~~ 1 µF (default value, if another value is used,

HV supply~~:~~ ~~H~~**h**igh ~~V~~**v**oltage power supply

~~V~~**v**ehicle / ESA HV~~:~~ ~~H~~**h**igh ~~V~~**v**oltage ~~V~~**v**ehicle or ESA

MEP~~:~~ ~~M~~**m**easuring ~~P~~**p**ort

it ~~has to~~ **shall** be justified)
R_1 ÷ 1 kΩ GND÷ ~~G~~**g**round
R_2 ÷ 1 MΩ (discharging C_2 to > 50 V_{dc} within 60 s)"

Paragraph 5.1., amend to read:

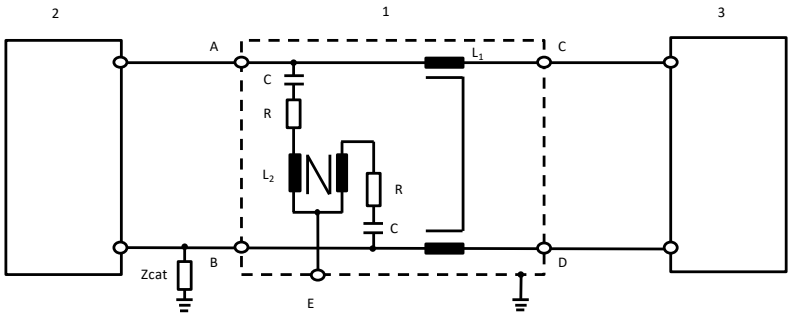
"5.1. Signal/Control port with symmetric lines

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

The AAN has a common mode impedance of 150 Ω. The impedance Z~~cat~~**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."

Figure 8, amend to read:

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



~~Legend~~**Key:**
1÷ AAN
2÷ ~~V~~**v**ehicle
3÷ ~~C~~**c**harging station
L_1÷ 2 x 38 mH
L_2÷ 2 x 38 mH
R÷ 200 Ω
C÷ 4,7 µF
Z_{cat}÷ ~~S~~**s**ymmetric adjustment impedance
A÷ ~~S~~**s**ymmetrical line 1 (in vehicle)
B÷ ~~S~~**s**ymmetrical line 2 (in vehicle)
C÷ ~~S~~**s**ymmetrical line 1 (charging station side)
D÷ ~~S~~**s**ymmetrical line 2 (charging station side)
E÷ ~~M~~**m**easuring ~~P~~**p**ort with 50 Ω load"

Paragraph 5.2., amend to read [remark: "/" between DC-charging-AN and HV-AN]:

"5.2. Wired network port with PLC on power lines

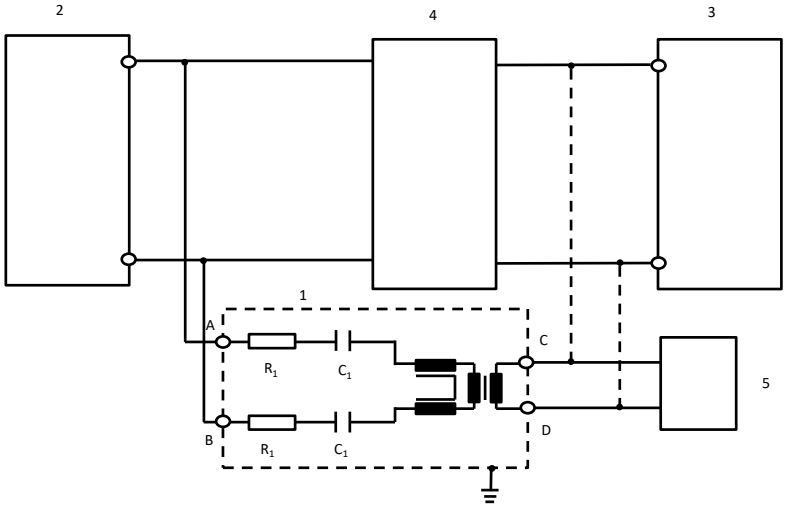
If an original charging station can be used for the test, an AAN and/or AMN/DC-charging-AN might not be required for PLC communication.

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

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

Figure 9, amend to read:

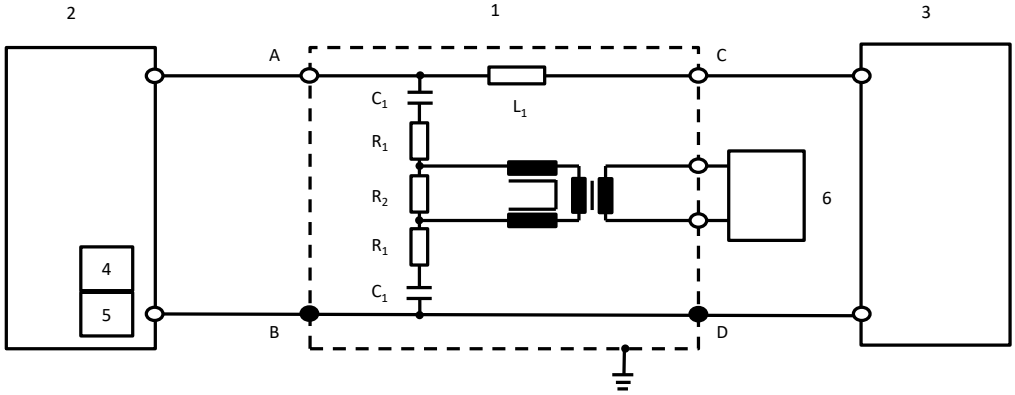
"Figure 9
Example of AAN with Signal/Control port with PLC on AC or DC power lines



~~Legend~~**Key:**
1: AAN
2: ~~V~~vehicle
3: ~~C~~charging station / ~~P~~power supply
4: HV-AN or AMN or DC-charging-AN
5: AE
R_1: 2,5 kΩ"
C_1: 4,7 nF
A: PLC on AC or DC power line (vehicle side)
B: PLC on AC or DC power line (vehicle side)
C: PLC line (charging station or AE side)
D: PLC line (charging station or AE side)

Figure 10, amend to read:

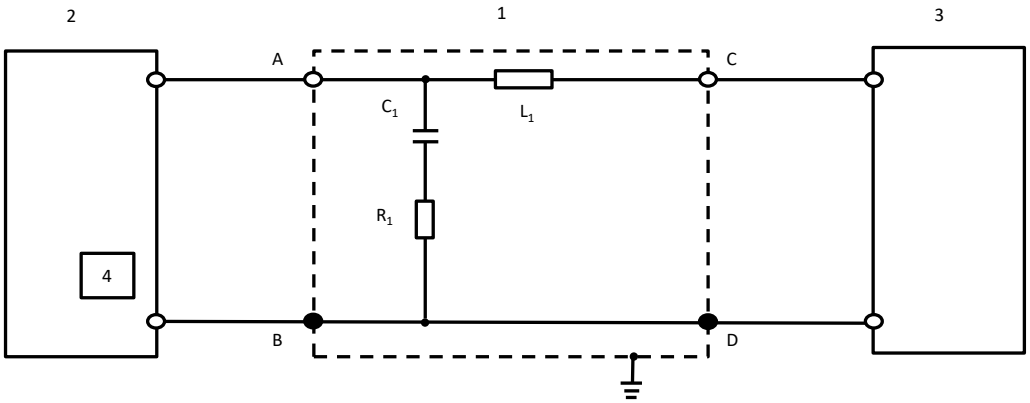
"Figure 10
Example of AAN circuit for Signal/Control port with PLC on control pilot



~~Legend~~**Key:**
1: AAN
2: ~~V~~vehicle
3: ~~C~~charging station
4: ~~C~~control pilot (in vehicle)
5: PLC (in vehicle)
6: AE
R_1: 39 Ω
R_2: 270 Ω
C_1: 2,2 nF
L_1:100 µH
A: ~~C~~control pilot line (vehicle side)
B/D: ~~P~~protective earth
C: ~~C~~control pilot line (charging station side)"

Paragraph 5.4., Figure 11, amend to read:

"Figure 11
Example of AAN circuit for pilot line



~~Legend~~**Key:**

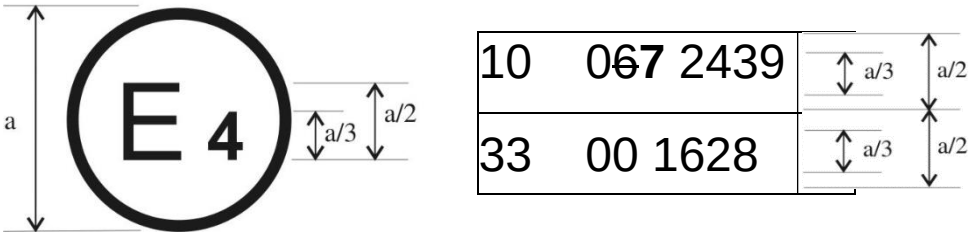
1÷ AAN
2÷ Vehicle
3÷ Charging station
4÷ Control pilot (in vehicle)
R_1÷ 150 Ω
C_1÷1**,1** nF
L_1÷100 µH
A÷ Control pilot line (vehicle side)
B/D÷ Protective earth
C÷ Control pilot line (charging station side)

"

Annex 1, amend to read:

"Model B

(See paragraph 5.2. of this Regulation)

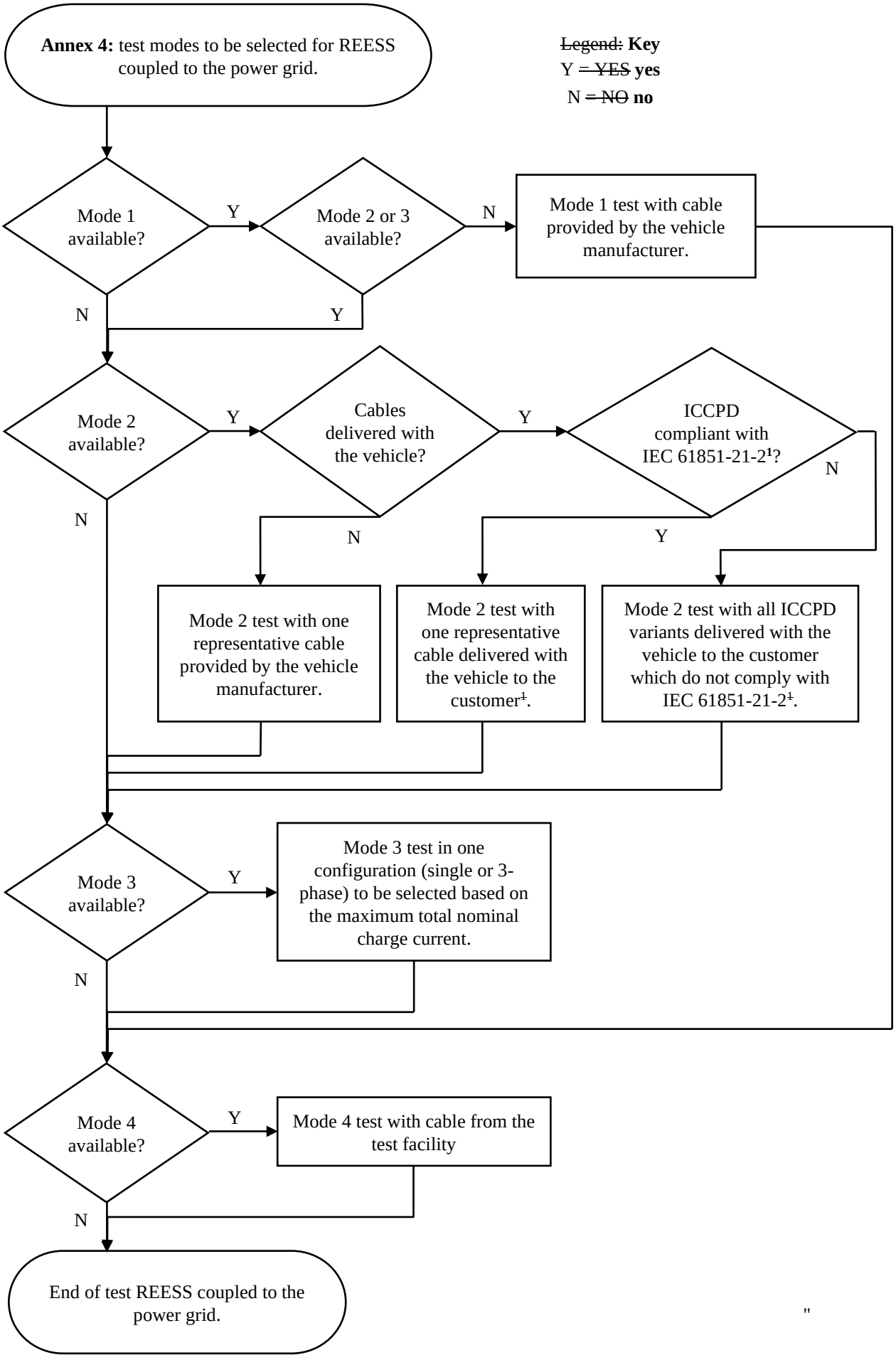


a = 6 mm min

The above approval mark affixed to a vehicle or ESA shows that the vehicle type concerned has, with regard to electromagnetic compatibility, been approved in the Netherlands (E 4) pursuant to Regulations Nos. 10 and 33. The approval numbers indicate that, at the date when the respective approvals were given, Regulation No. 10 included the 0~~6~~7 series of amendments and Regulation No. 33 was still in its original form."

Annex 4,
Paragraph 2.2., Figure 1, amend to read:

"**Charging mode configuration for Annex 4**



"

Paragraphs 4.3., amend to read:

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

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

Table 1
Spectrum analyser parameters

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

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

Table 2
Scanning receiver parameters

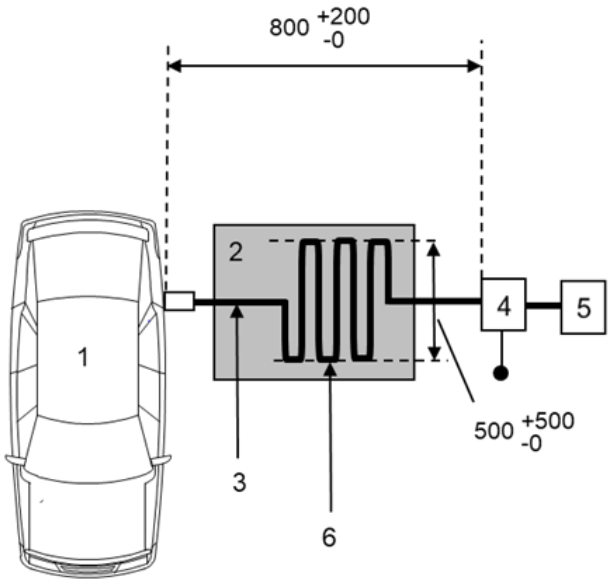
Frequency range MHz	*Peak detector*			*Quasi-peak detector*			~~*Average detector*~~		
	BW at -6 dB	***Maximum*** ~~*S*~~*step size* [a]	*Minimum dwell time*	*BW at -6 dB*	***Maximum*** ~~*S*~~*step size* [a]	*Minimum* ~~*D*~~***d****well time*	~~*BW at -6 dB*~~	~~*Step size*~~ [a]	~~*Minimum dwell time*~~
30 to 1,000	120 kHz	~~50~~**60** kHz	5 ms	120 kHz	~~50~~**60** 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 – Appendix 1,

Figure 3b, Key 5, NOTE, amend to read:

"**Figure 3b**



Key

1 vehicle under test

2 insulating support

3 charging cable (including EVSE for charging mode 2)

4 artificial mains network(s) grounded

5 power mains socket ~~(see 7.3.2.2)~~

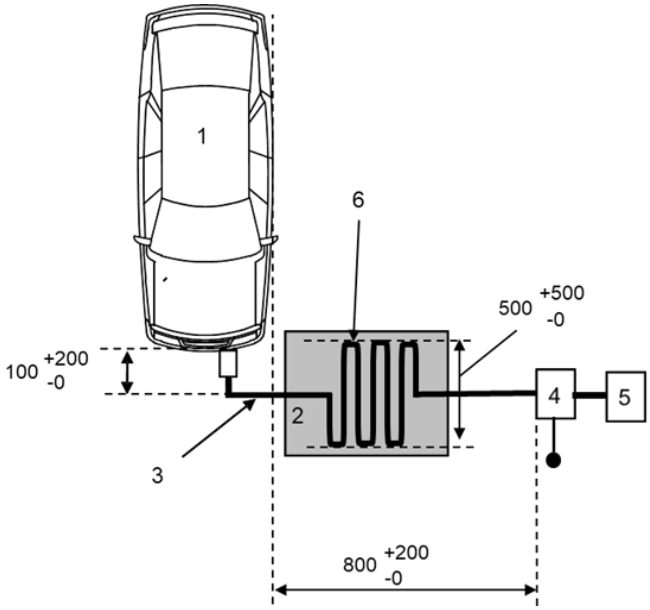
6 extraneous length Z-folded

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

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

Figure 3d, Key 5, NOTE, amend to read:

"**Figure 3d**



Key

1 vehicle under test

2 insulating support

3 charging cable (including EVSE for charging mode 2)

4 artificial mains network(s) grounded

5 power mains socket ~~(see 7.3.2.2)~~

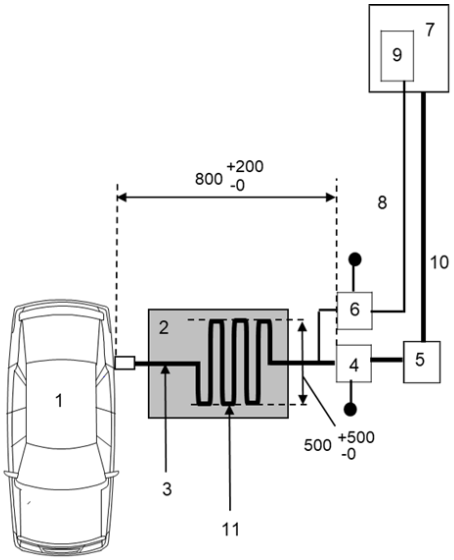
6 extraneous length Z-folded

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

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

Figure 3f, Key 5, NOTE, amend to read:

"**Figure 3f**



Key

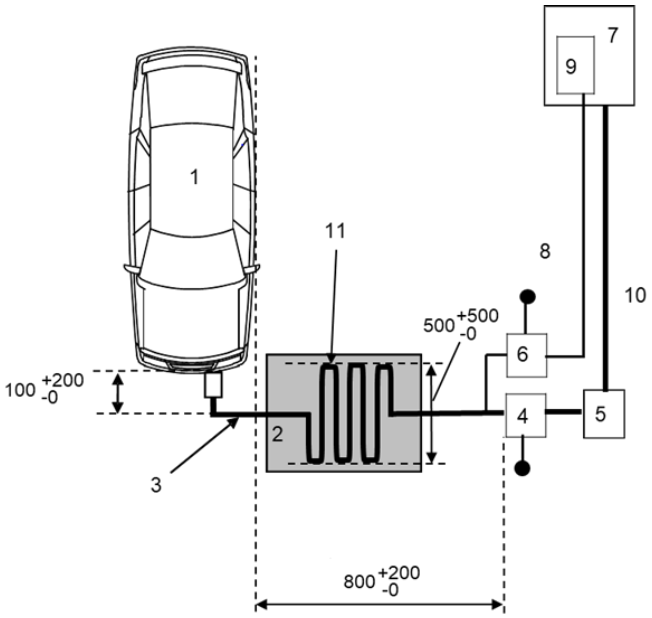
1 vehicle under test
2 insulating support
3 charging harness with communication lines
4 AMN(s) or DC-charging-AN(s), grounded
5 power mains / supply socket (optional~~, see 7.3.3.2~~)
6 AAN(s), grounded (optional, not represented in the front view)
7 charging station (can be emulated)
8 communication lines
9 communication module
10 power cable
11 extraneous length Z-folded

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

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

Annex 4 – Appendix 1, Figure 3h, Key 5 and 11, NOTE, amend to read:

"Figure 3h



Key

1 vehicle under test
2 insulating support
3 charging harness with communication lines
4 AMN(s) or DC-charging-AN(s), grounded
5 power mains / supply socket (optional~~, see 7.3.3.2.~~)
6 AAN(s), grounded (optional, not represented in the front view)
7 charging station (can be emulated)
8 communication lines
9 communication module
10 power cable
11 extraneous length Z-folded
~~1~~

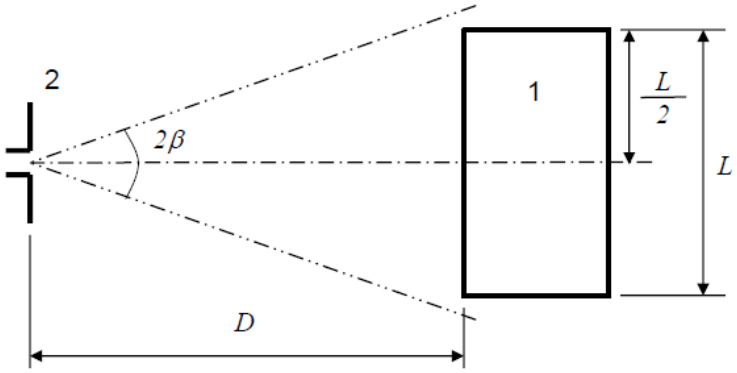
NOTE: The cable between the AC/DC mains/supply and the AMN/DC-charging-AN ~~need~~**may** not be aligned in **the** same direction as the cable between the AMN/DC-charging-AN and the EV."

Figure 4, amend to read:

"**Antenna position**

Figure 4

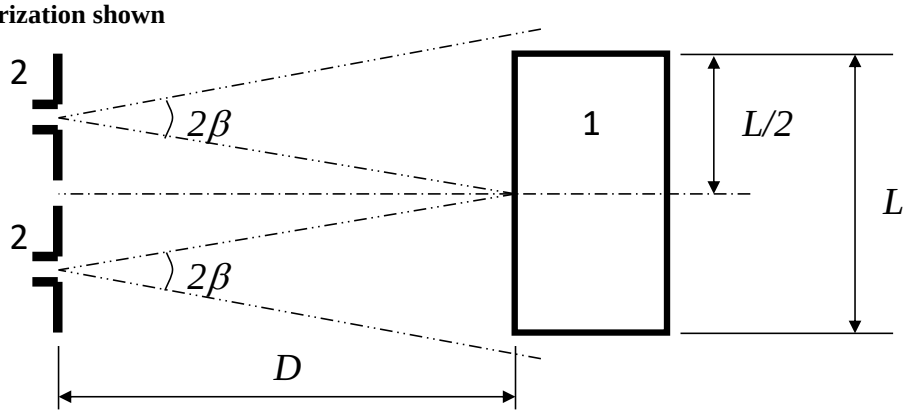
Antenna position for N = 1 (one antenna position to be used) – Horizontal polarization shown



~~Legend~~**Key**:
1~~:~~ ~~V~~**v**ehicle under test~~.~~
2~~:~~ ~~A~~**a**ntenna"

Annex 4, Appendix 1, Figure 5, amend to read:

"Figure 5
Antenna positions for N = 2 (multiple antenna positions to be used) – Horizontal polarization shown



~~Legend~~**Key**:
1~~:~~ ~~V~~**v**ehicle under test~~.~~
2~~:~~ ~~A~~**a**ntenna (two positions)~~.~~"

Annex 5,

Paragraph 1.2., amend to read:

"1.2. Test method
This test is intended to measure the narrowband electromagnetic emissions that may emanate from microprocessor-based systems or other narrowband source.
If not otherwise stated in this annex the test shall be performed according to CISPR 12 ~~or CISPR 25~~."

Paragraph 4.3., amend to read:

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

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

Table 1
Spectrum analyser parameters

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

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

Table 2
Scanning receiver parameters

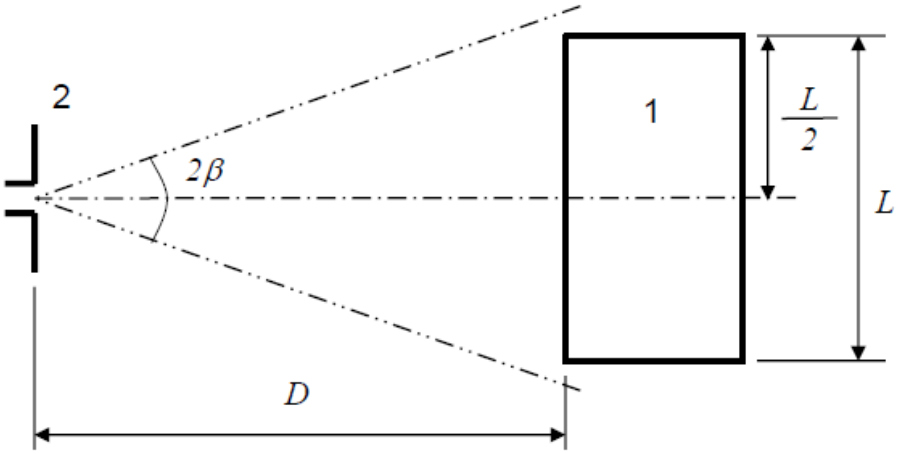
Frequency range MHz	*Peak detector*			*Average detector*		
	BW at -6 dB	***Maximum*** ~~***S***~~*step size*	*Minimum* ~~***D***~~***d****well time*	*BW at -6 dB*	***Maximum*** ~~***S***~~*step size*	*Minimum* ~~***D***~~***d****well time*
30 to 1,000	120 kHz	50 kHz	5 ms	120 kHz	50 kHz	5 ms

"

Annex 5, Appendix 1, Figure 1, amend to read:

"Figure 1

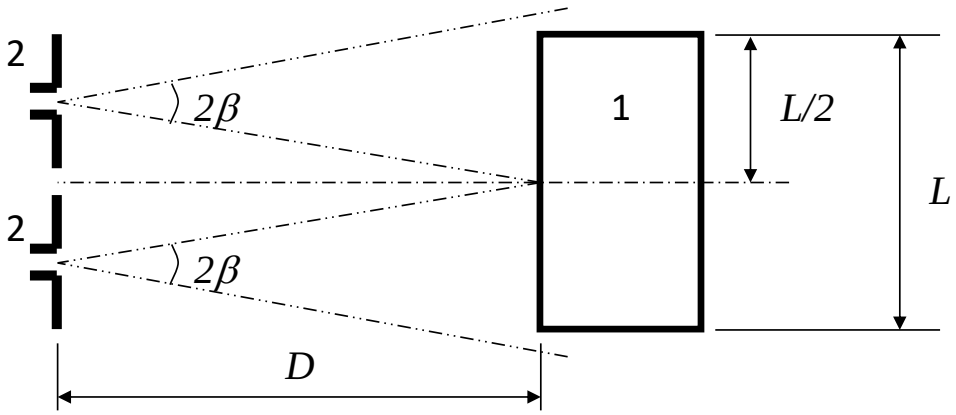
Antenna position for N = 1 (one antenna position to be used) – Horizontal polarization shown



~~Legend~~**Key:**
1: ~~V~~**v**ehicle under test
2: ~~A~~**a**ntenna"

Figure 2, amend to read:

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



~~Legend~~**Key**
1: ~~V~~**v**ehicle under test
2: ~~A~~**a**ntenna (two positions)"

Annex 6,

Paragraph 1.3., amend to read:

"1.3. Alternative test methods

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

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

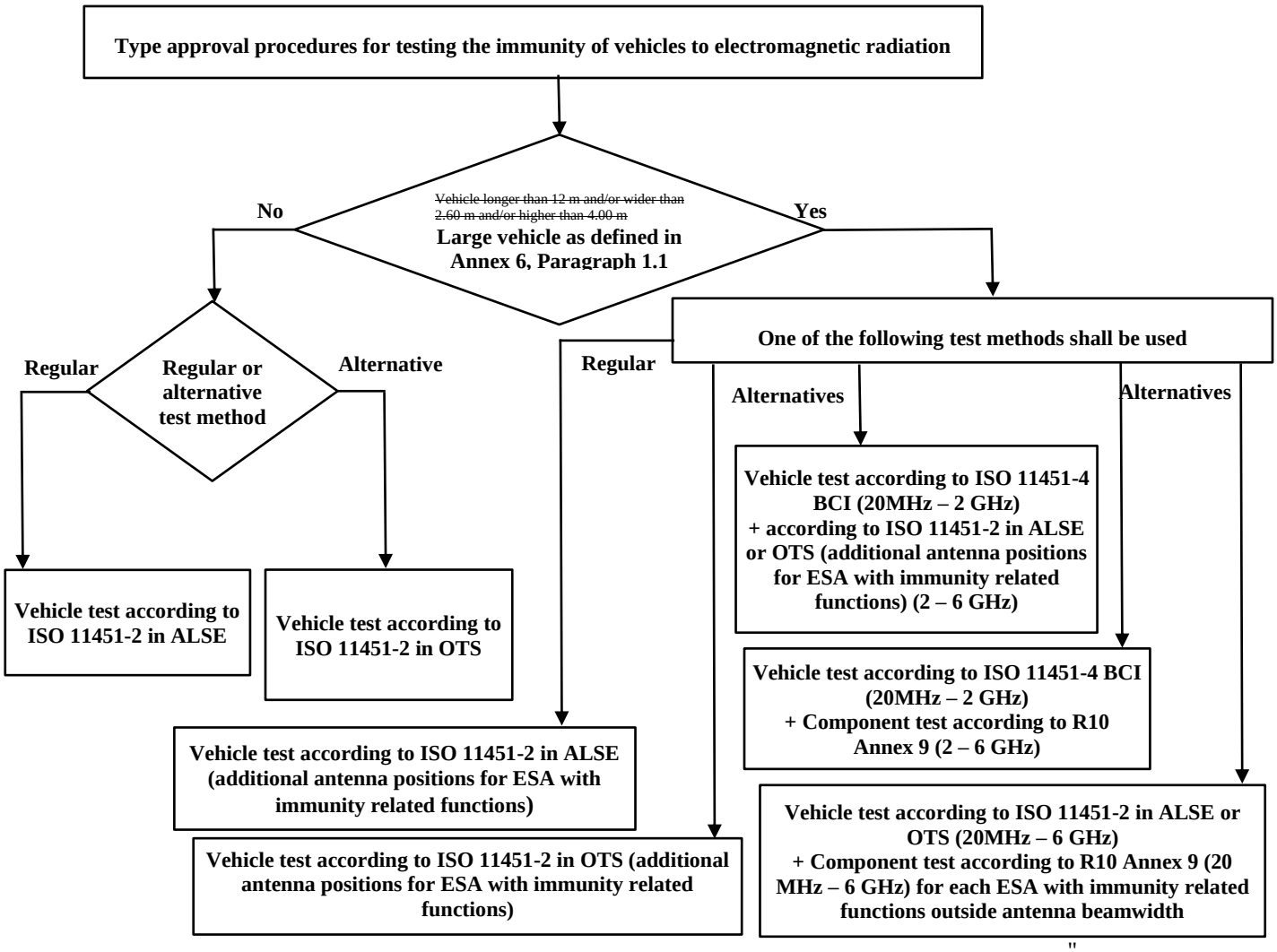
• with front irradiation and with additional antenna positions for "large vehicles". Additional antenna position(s) shall be chosen by the manufacturer in conjunction with the Type Approval Authority after considering the distribution of electronic systems with immunity related functions and the layout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

…"

Paragraph 1.4., amend to read:

"1.4. Applicability of test methods:

Figure 1



"

Paragraph 2.1.1.2., amend to read:

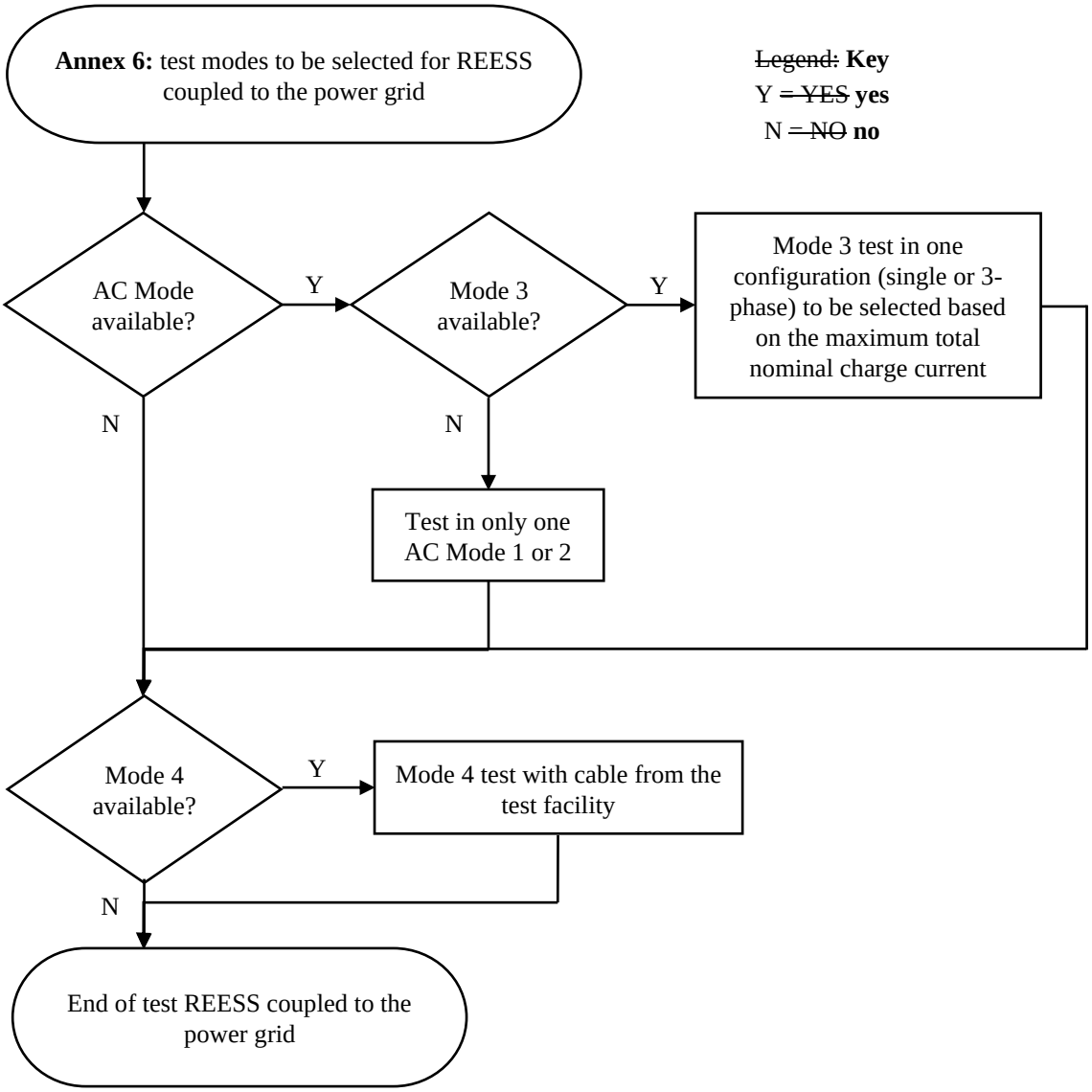
"…

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

…"

Annex 6, Paragraph 2.2.1.1., Figure 2, amend to read:

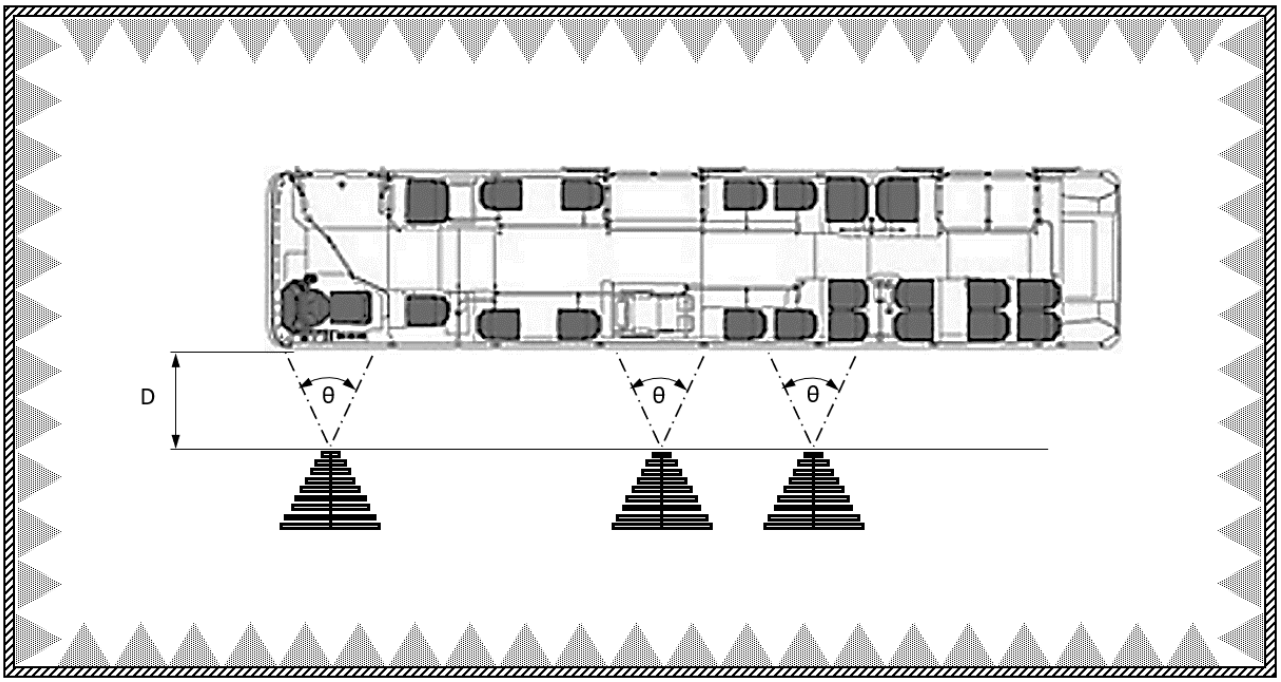
"Figure 2
Charging mode configuration for Annex 6



"

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

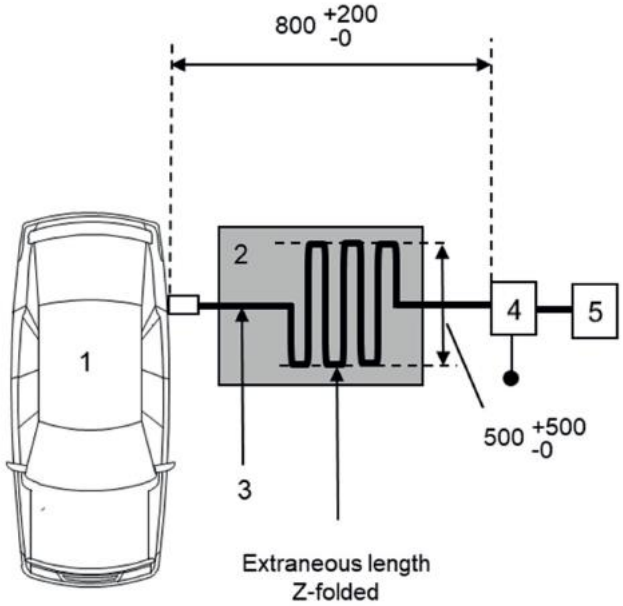
"**Figure 4 - Example of a selection of antenna placements for lateral illumination of a large vehicle**



Key
θ ÷ 3 dB antenna beamwidth
D÷ the distance between the tip or phase centre of the antenna and the nearest part of the vehicle body without considering small extruding elements (such as side mirrors or fenders)
"

Annex 6, Appendix 1, Figure 5b, amend to read:

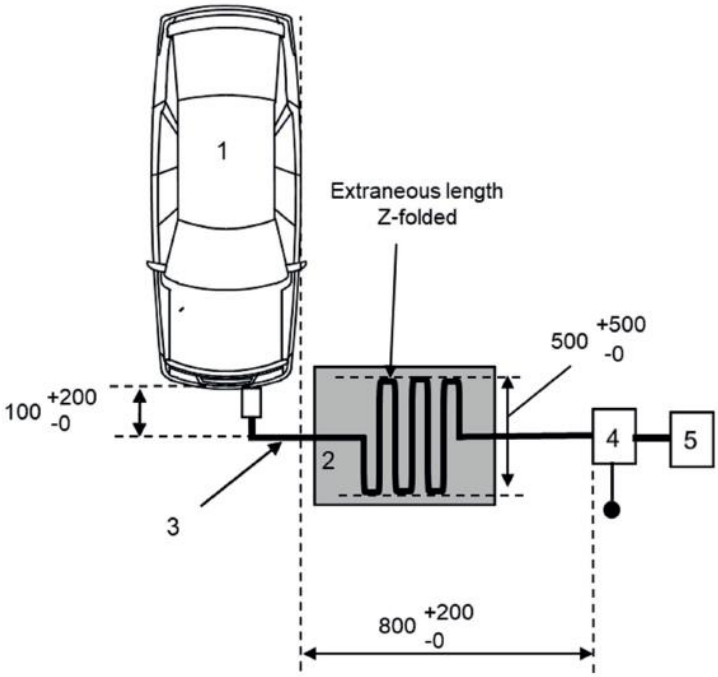
"Figure 5b



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness (including EVSE for charging mode 2)
4 AMN(s) or DC-charging-AN(s) grounded
5 ~~P~~**p**ower mains socket
NOTE: The cable between the AC mains and the AMN ~~need~~**may** not be aligned in the same direction as the cable between the AMN and the EV."

Annex 6, Appendix 1, Figure 5d, amend to read:

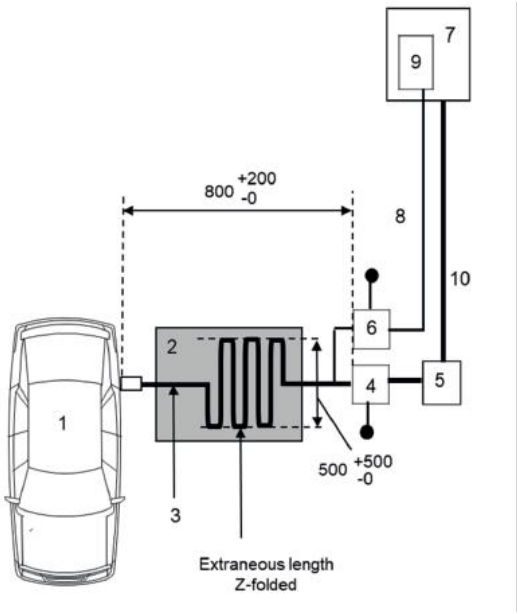
"Figure 5d



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness (including EVSE for charging mode 2)
4 AMN(s) or DC-charging-AN(s) grounded
5 ~~P~~**p**ower mains socket
NOTE : The cable between the AC mains and the AMN ~~need~~**may** not be aligned in the same direction as the cable between the AMN and the EV."

Annex 6, Appendix 1, Figure 5f, amend to read:

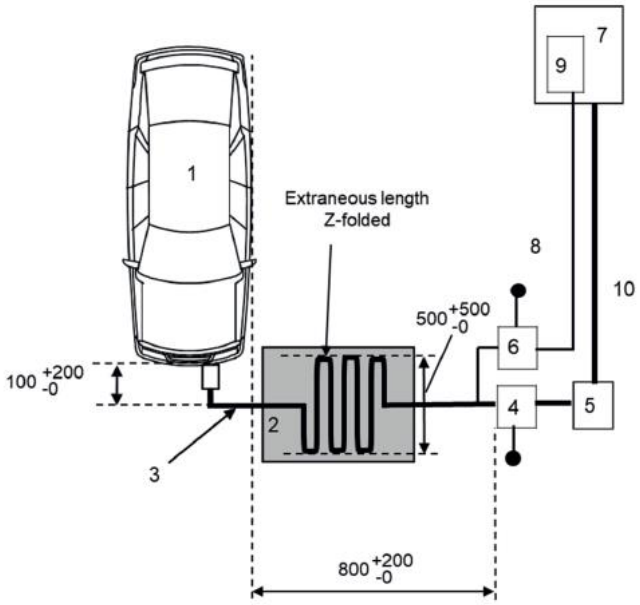
"Figure 5f



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness with local/private communication lines
4 AMN(s) or DC-charging-AN(s) grounded
5 ~~P~~**p**ower mains socket
6 AAN(s) grounded (optional)
7 ~~C~~**c**harging station
8 communication lines
9 communication module
10 power cable
NOTE: The cable between the AC/DC mains/supply and the AMN/DC-charging-AN ~~need~~**may** not be aligned in the same direction as the cable between the AMN/DC-charging-AN and the EV."

Annex 6 – Appendix 1, Figure 5h, amend to read:

"Figure 5h



Key

1 vehicle under test

2 insulating support

3 charging harness with communication lines

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

5 power mains / supply socket (optional~~, see 7.3.3.2~~)

6 AAN(s) grounded (optional, not represented in the front view)

7 charging station (can be emulated)

8 communication lines

9 communication module

10 power cable

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

Annex 7, Paragraph 4.3., amend to read:

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

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

Table 1
Spectrum analyser parameters

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

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

Table 2
Scanning receiver parameters

Frequency range MHz	*Peak detector*			*Quasi-peak detector*			~~*Average detector*~~		
	BW at -6 dB	***Maximum* ~~*S*~~*step size* [a]	*Minimum dwell time*	*BW at -6 dB*	***Maximum* ~~*S*~~*step size* [a]	*Minimum dwell time*	~~*BW at -6 dB*~~	~~*Step size* [a]~~	~~*Minimum dwell time*~~
30 to 1,000	120 kHz	~~50~~**60** kHz	5 ms	120 kHz	~~50~~**60** kHz	1 s	~~120 kHz~~	~~50 kHz~~	~~5 ms~~

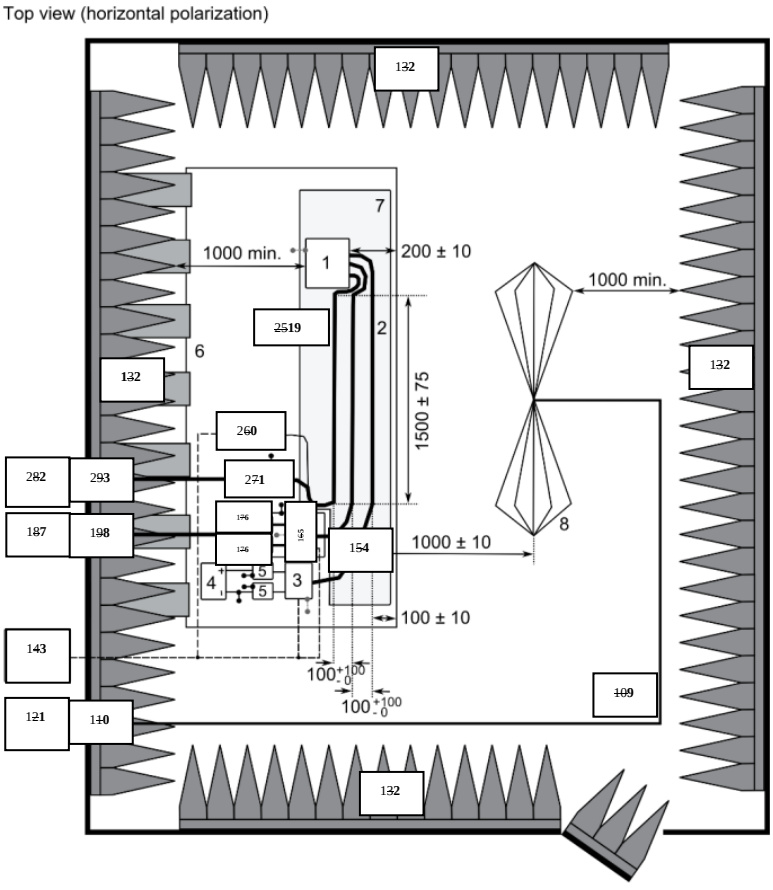
[a] For purely broadband disturbances, the maximum frequency step size may be increased up to a value not greater than the bandwidth value.

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 1, Figure 2, amend to read:

"Figure 2
Test configuration for ESAs involved in "REESS charging mode coupled to the power grid" (example for biconical antenna)

Dimensions in millimetres



~~Legend~~**Key:**

1 ESA (grounded locally if required in test plan)
2 LV Test harness
3 LV Load simulator (placement and ground connection according to CISPR 25 paragraph 6.4.2.5)
4 ~~C~~**p**ower supply (location optional)
5 LV Artificial network (AN)
6 ~~G~~**g**round plane (bonded to shielded enclosure)
7 ~~L~~**l**ow relative permittivity support ($\varepsilon r \leq 1.4$)
8 ~~B~~**b**iconical antenna
~~10~~**9** ~~H~~**b**High-quality coaxial cable e.g. double-shielded (50 Ω)
1~~0~~**0** ~~B~~**b**ulkhead connector
1~~2~~**1** ~~M~~**m**easuring instrument
1~~3~~**2** RF absorber material
1~~4~~**3** ~~S~~**s**timulation and monitoring system
1~~5~~**4** HV harness
1~~6~~**5** HV load simulator
1~~7~~**6** HV AN
1~~8~~**7** HV power supply
1~~9~~**8** HV feed-through
~~25~~**19** AC/DC charger harness
2~~6~~**0** AC/DC load simulator (e.g Programmable Logic Controller (PLC))
2~~7~~**1** AMN(s) or DC-charging-AN(s)
2~~8~~**2** AC/DC power supply
2~~9~~**3** AC/DC feed-through"

Annex 8, Paragraph 4.3., amend to read:

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

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

Table 1
Spectrum analyser parameters

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

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

Table 2
Scanning receiver parameters

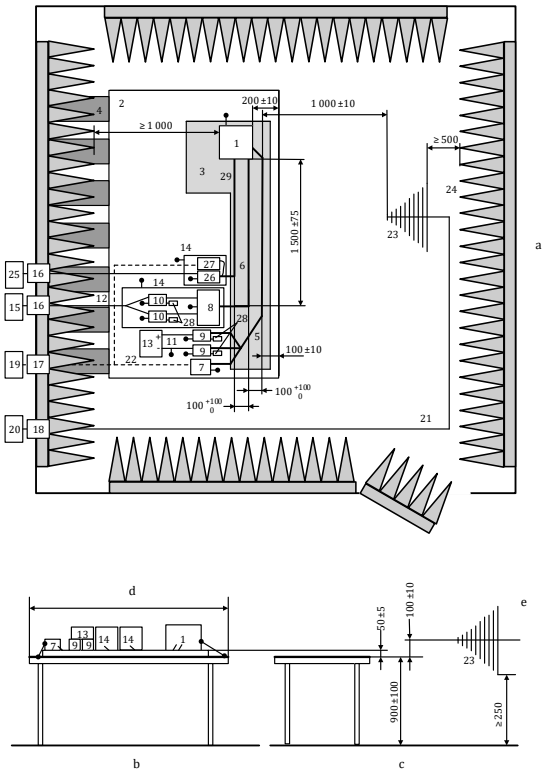
Frequency range MHz	*Peak detector*			*Average detector*		
	BW at -6 dB	***Maximum*** ~~*S*~~*step size*	*Minimum dwell time*	*BW at -6 dB*	***Maximum*** ~~*S*~~*step size*	*Minimum dwell time*
30 to 1,000	120 kHz	~~50~~**60** kHz	5 ms	120 kHz	~~50~~**60** kHz	5 ms

"

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

"Figure 1
Example of test set-up for log-periodic antenna

Top view ***Dimensions in millimetres***



Key~~Legend:~~

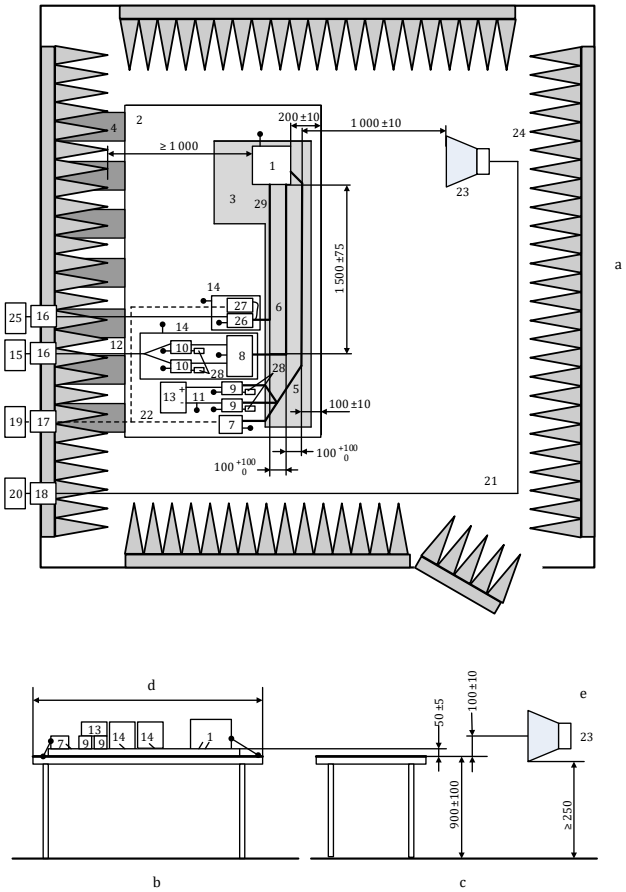
1	ESA (grounded locally if required in test plan)
2	ground plane
3	low relative permittivity support ($\varepsilon_r \leq 1.4$); thickness 50 mm
4	ground straps
5	LV harness
6	HV lines (HV+, HV-)
7	LV load simulator
8	impedance matching network (optional)
9	LV AN
10	HV AN
11	LV supply lines
12	HV supply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

"

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

"Figure 2
Example of test set-up for horn antenna

Top view ***Dimensions in millimetres***



Key~~Legend:~~

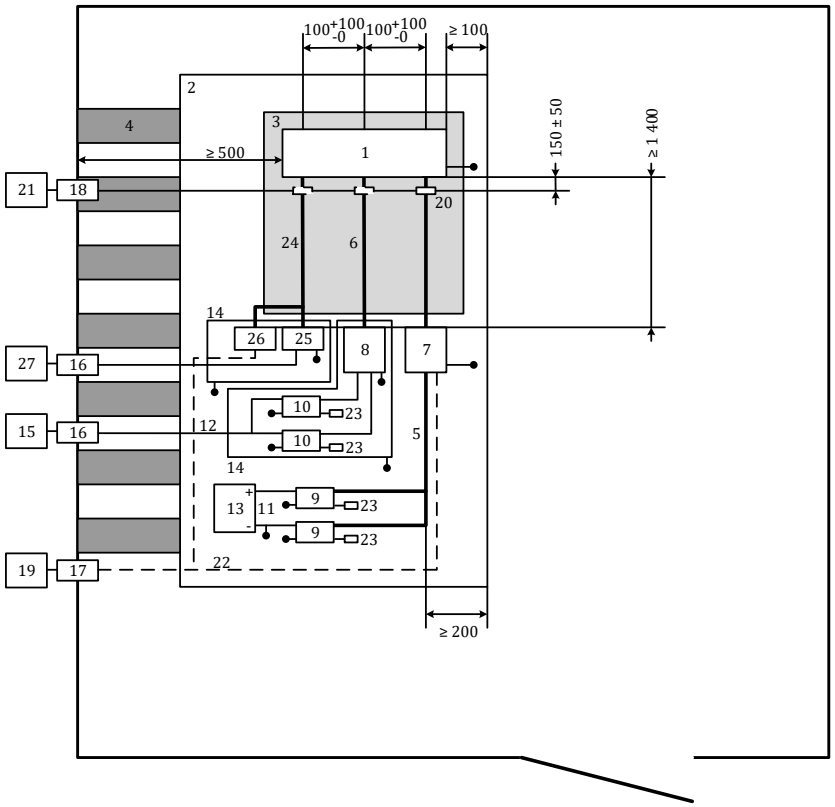
1	ESA (grounded locally if required in test plan)
2	ground plane
3	low relative permittivity support ($\varepsilon_r \leq 1.4$); thickness 50 mm
4	ground straps
5	LV harness
6	HV lines (HV+, HV-)
7	LV load simulator
8	impedance matching network (optional)
9	LV AN
10	HV AN
11	LV supply lines
12	HV supply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

"

Annex 9, Appendix 4, Figure 1, amend to read:

"Figure 1

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



Key~~Legend:~~

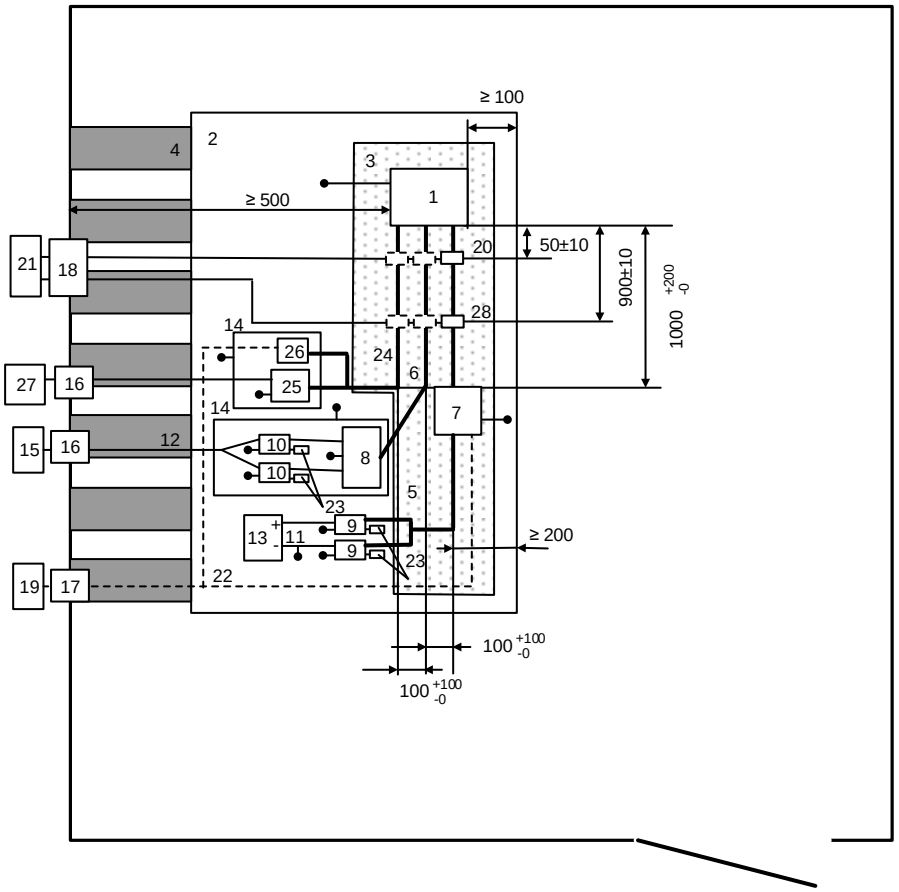
1 ESA
2 ground plane
3 low relative permittivity support (εr ≤ 1,4); thickness 50 mm
4 ground straps
5 LV harness
6 HV lines (HV+, HV-)
7 LV load simulator
8 impedance matching network (optional) (see ISO 11452-1)
9 LV AN
10 HV AN
11 LV supply lines
12 HV supply lines
13 LV power supply 12 V / 24 V /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

"

Annex 9, Appendix 4, Figure 2, amend to read:

"Figure 2

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



Key~~Legend:~~

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

"

Annex 10, paragraph 2., amend to read:

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

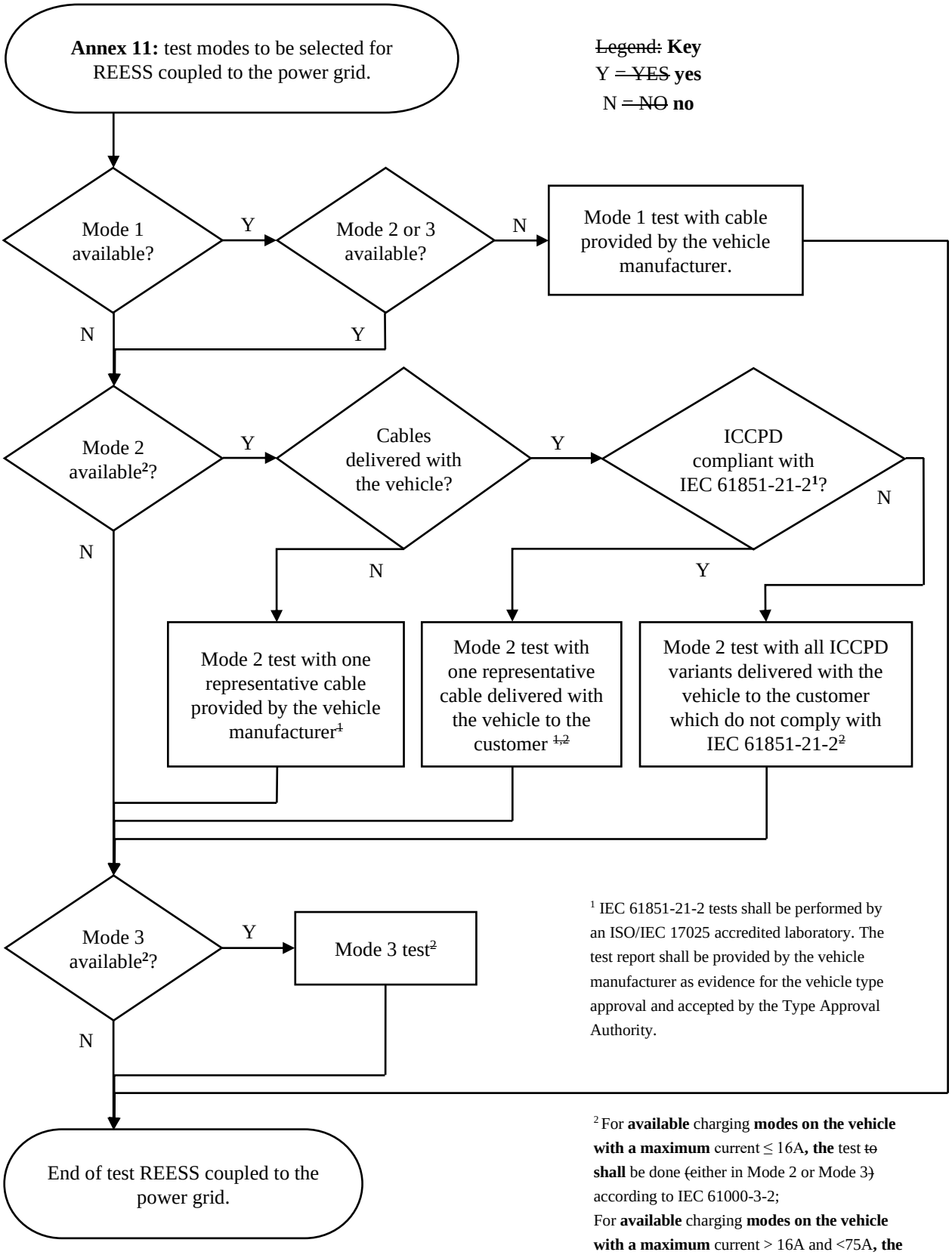
Apply the test pulses 1, 2a, 2b, 3a and 3b according to the International Standard ISO 7637-2**:2011** to the supply lines as well as to other connections of ESAs which may be operationally connected to supply lines.

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

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

Annex 11, Paragraph 2.1., Figure 1, amend to read:

"Figure 1
Charging mode configuration for Annex 11



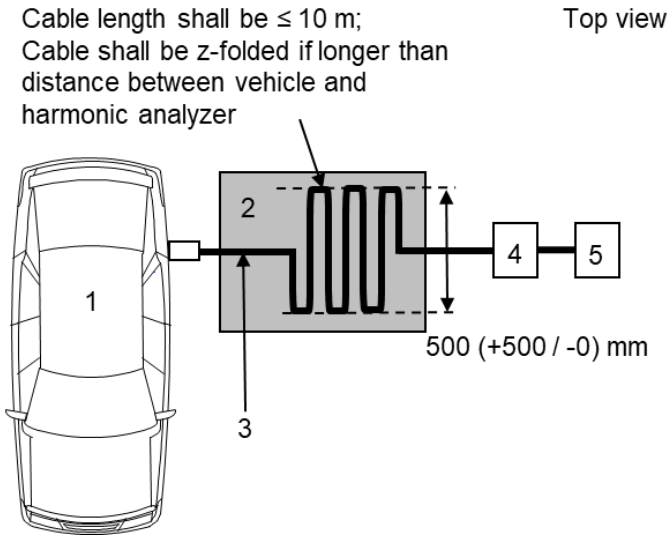
[1] IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

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

"

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

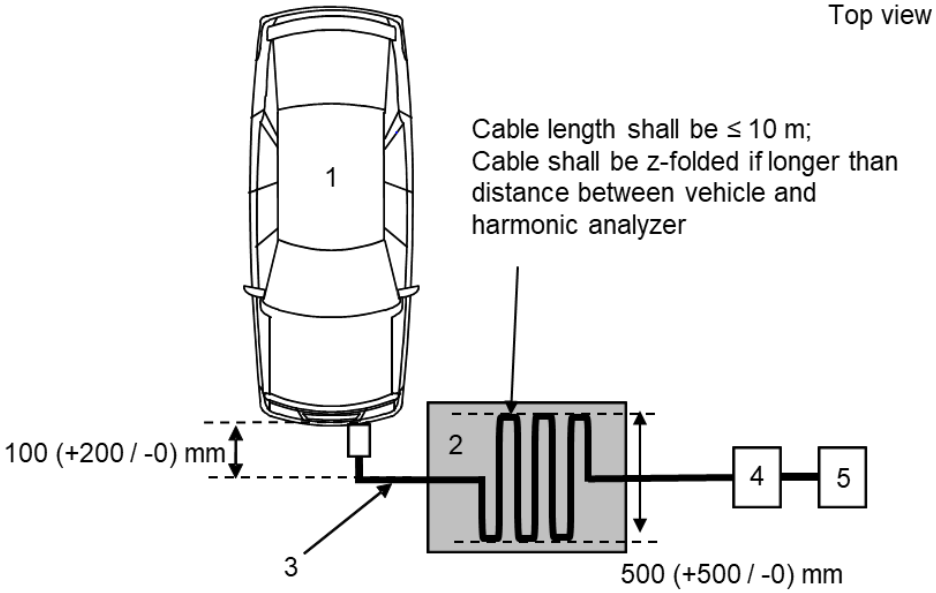
"Figure 1b



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 ~~H~~**h**armonic analyzer
5 ~~P~~**p**ower supply"

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

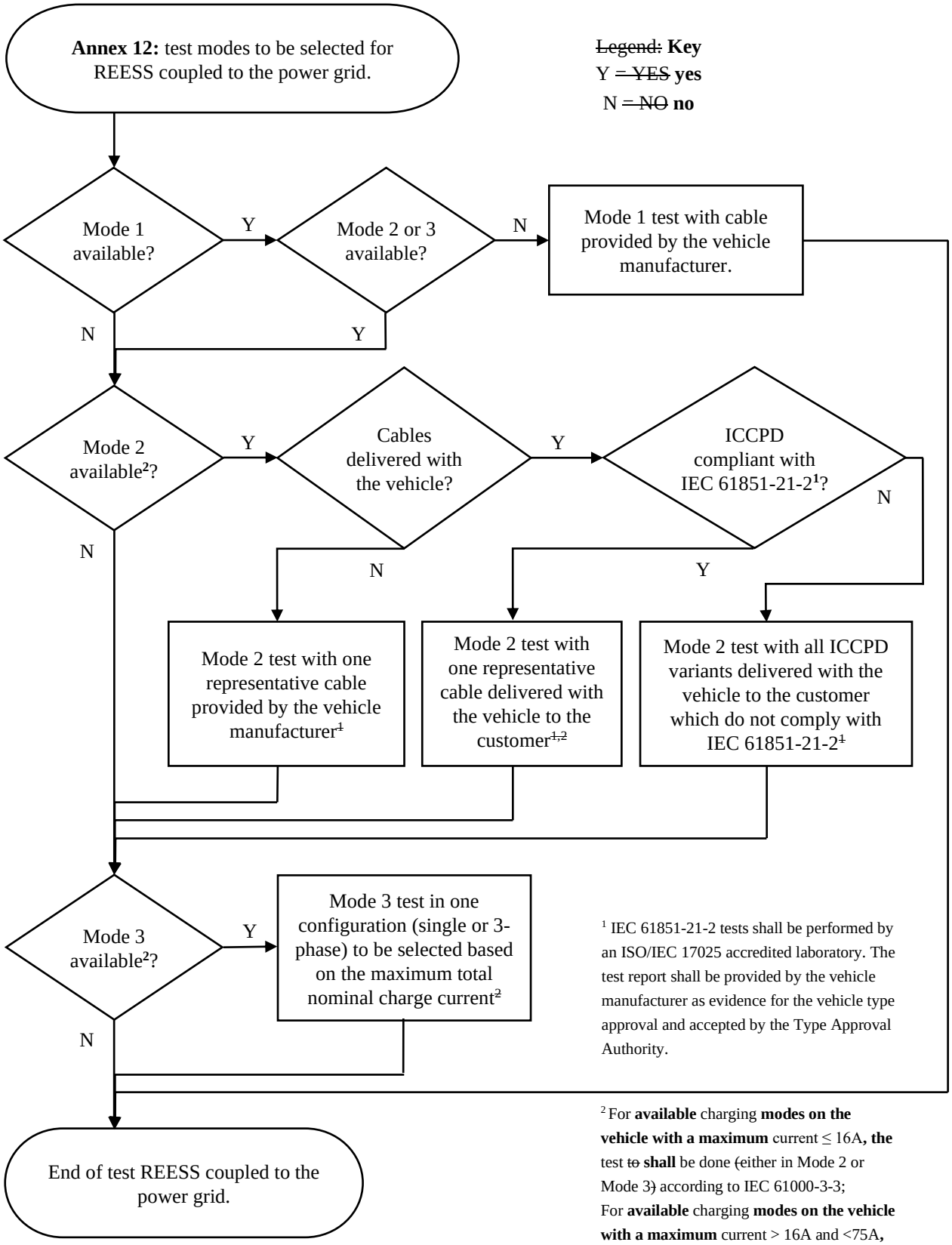
"Figure 1d



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 ~~H~~**h**armonic analyzer
5 ~~P~~**p**ower supply"

Annex 12, Paragraph 2.1., Figure 1

"Figure 1
Charging mode configuration for Annex 12



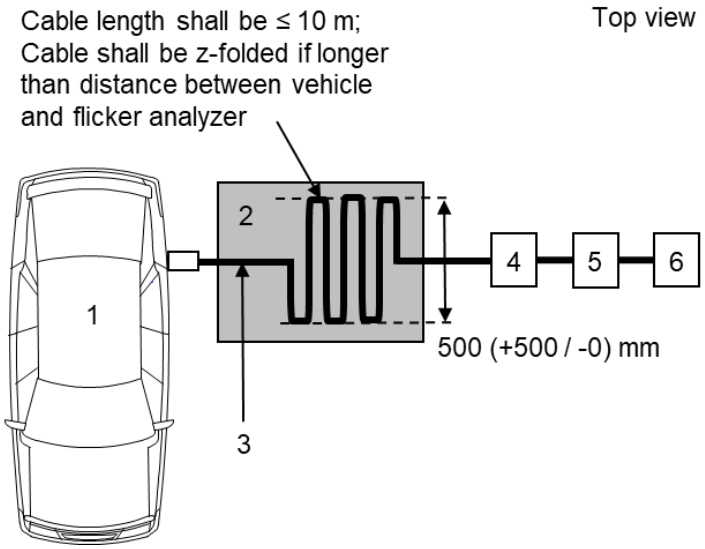
[1] IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

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

"

Annex 12, Appendix 1, Figure 1b, amend to read:

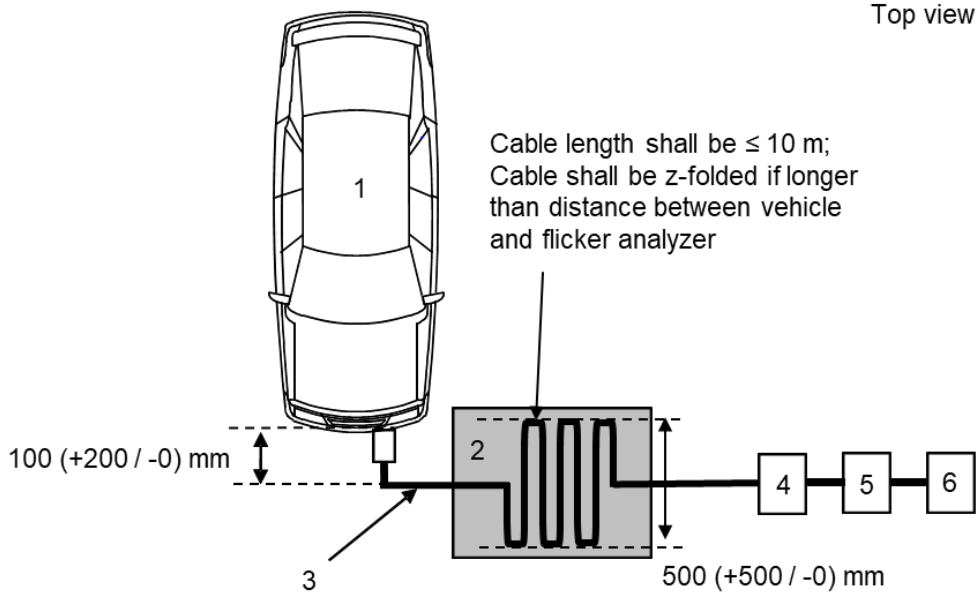
"Figure 1b



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 ~~F~~**f**licker analyzer
5 ~~I~~**i**mpedance simulator
6 ~~P~~**p**ower supply"

Annex 12, Appendix 1, Figure 1d, amend to read:

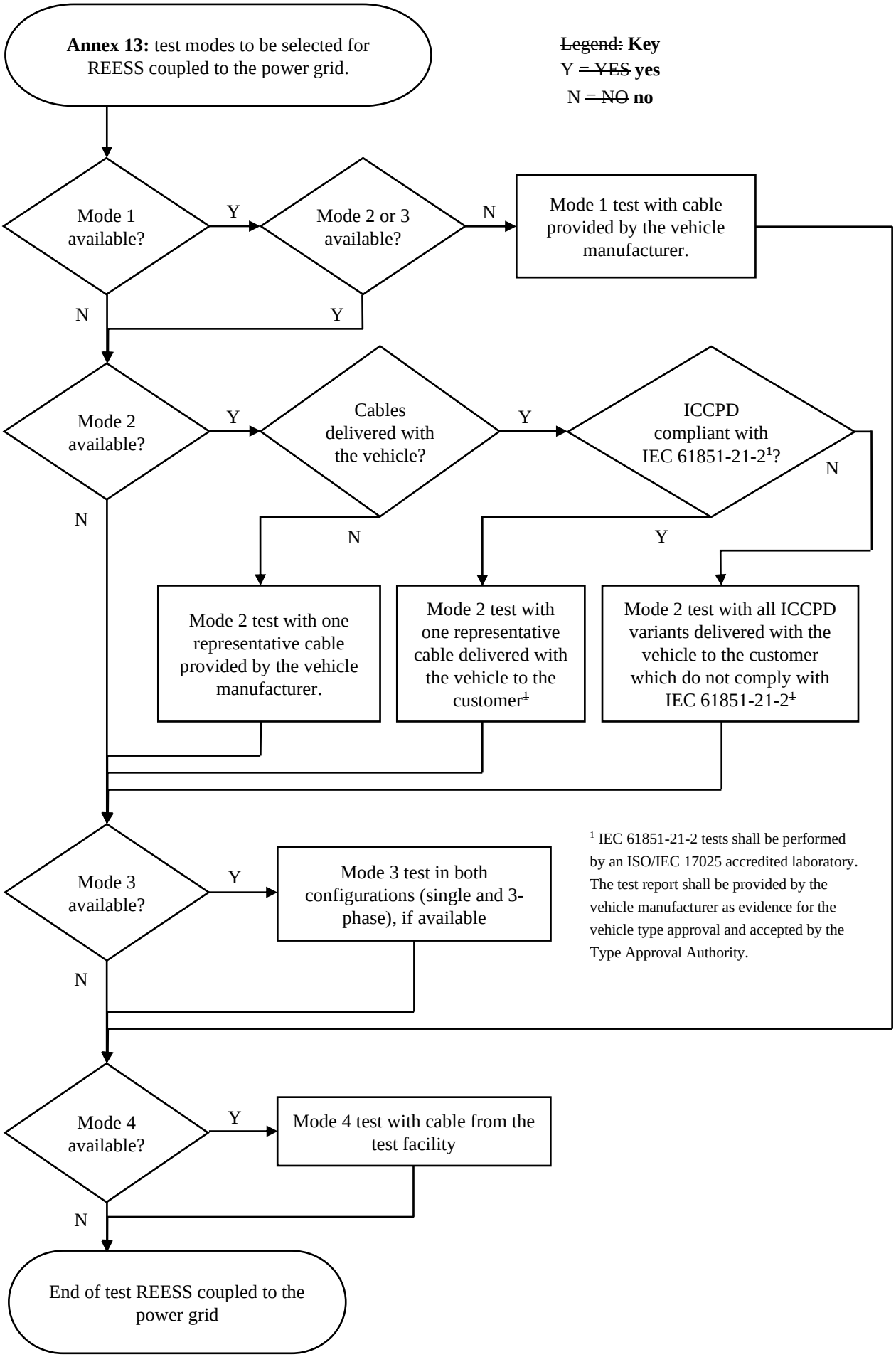
"Figure 1d



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 ~~F~~**f**licker analyzer
5 ~~I~~**i**mpedance simulator
6 ~~P~~**p**ower supply"

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

"Figure 1
Charging mode configuration for Annex 13



"

Annex 13, Paragraph 3.5., amend to read:

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

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

Table 1
Spectrum analyser parameters

	Peak detector		*Quasi-peak detector*		*Average detector*	
Frequency range MHz	*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)."

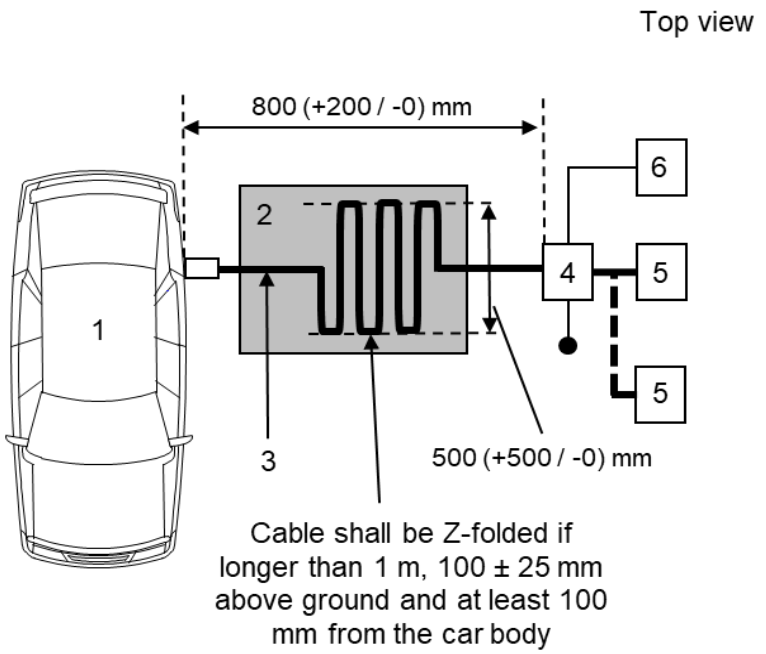
Table 2
Scanning receiver parameters

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

"

Annex 13, Appendix 1, Figure 1b, amend to read:

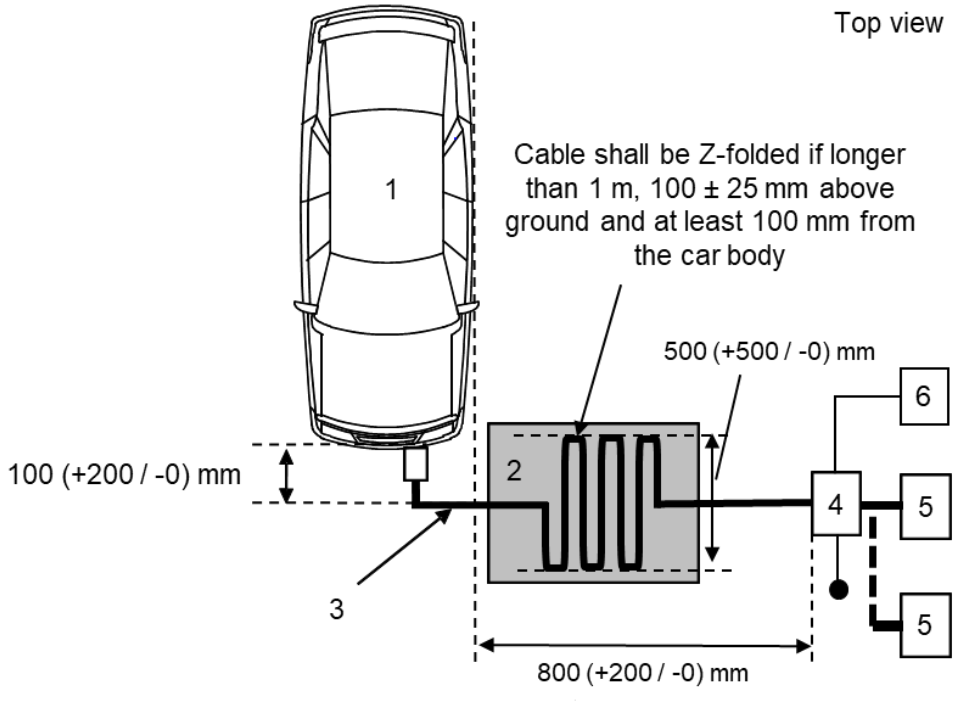
"Figure1b



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 AMN(s) or DC-charging-AN(s) grounded
5 ~~P~~**p**ower mains socket
6 ~~M~~**m**easuring receiver"

Annex 13, Appendix 1, Figure 1d, amend to read:

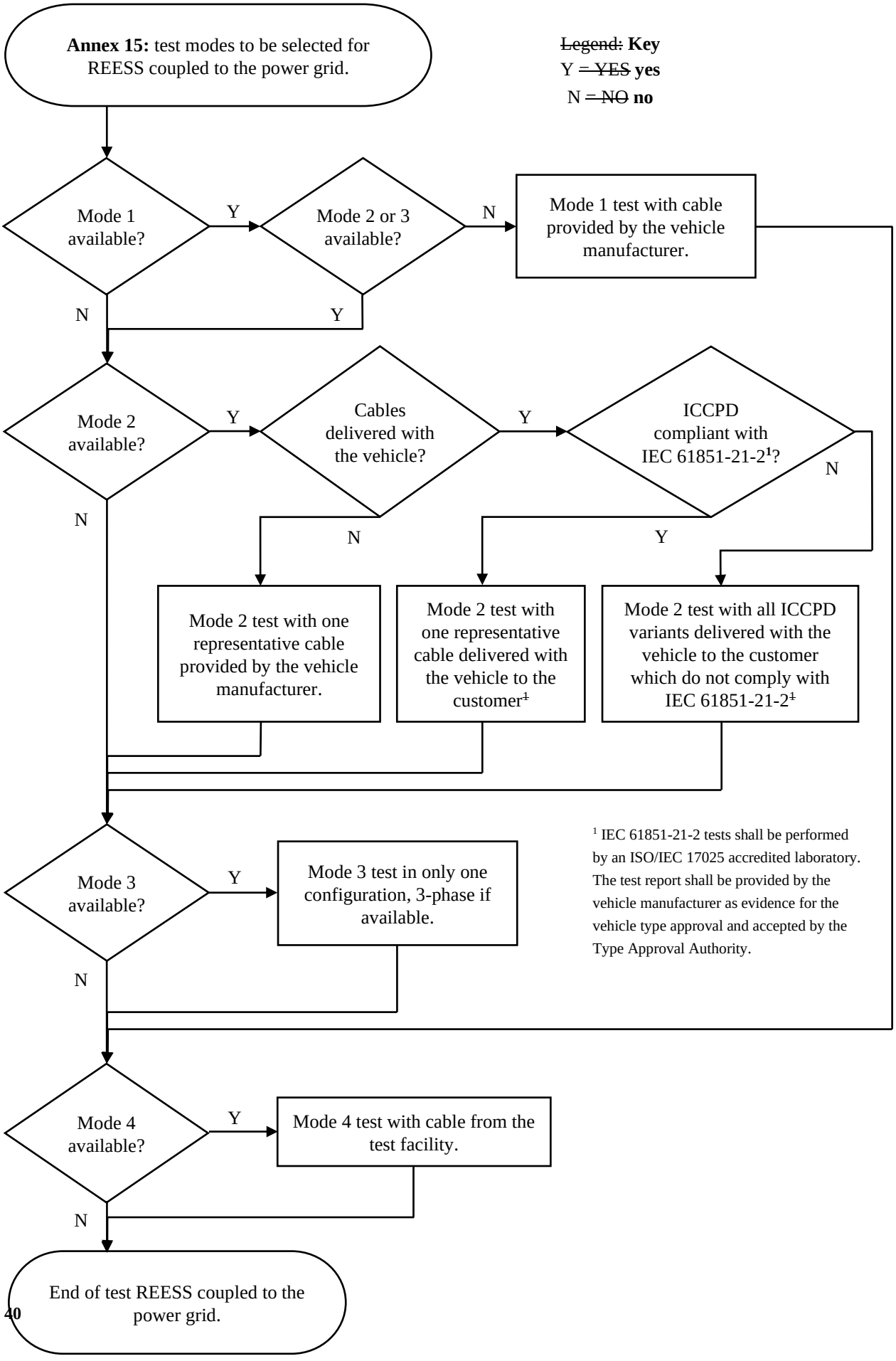
"Figure 1d



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 AMN(s) or DC-charging-AN(s) grounded
5 ~~P~~**p**ower mains socket
6 ~~M~~**m**easuring receiver"

Annex 15, Paragraph 2., Figure 1, amend to read:

"Figure 1
Charging mode configuration for Annex 15

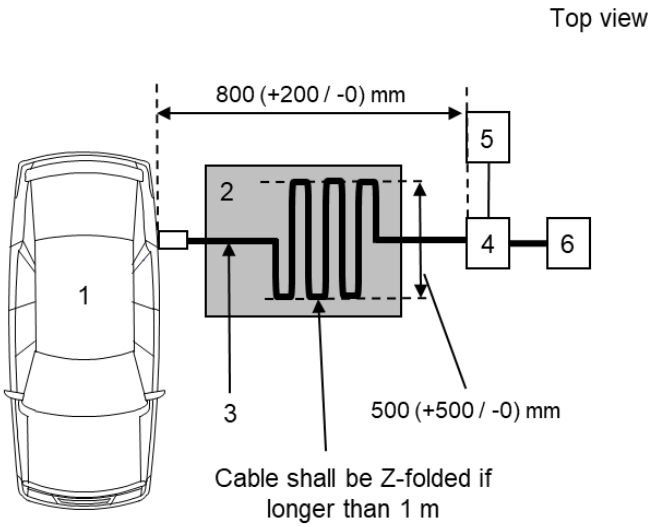


[1] IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

"

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

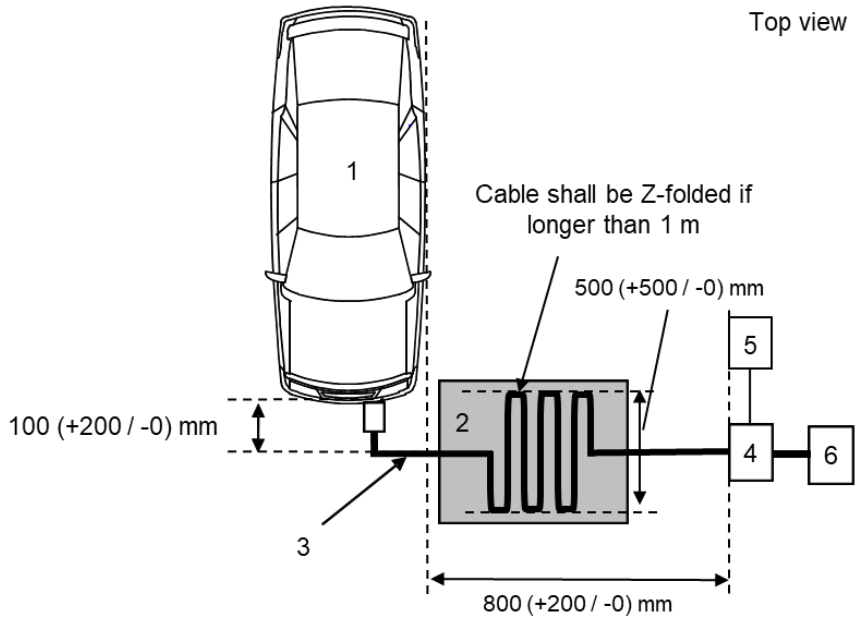
"Figure 1b



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 CDN
5 ~~F~~**f**ast Transients / ~~B~~**b**urst generator
6 ~~P~~**p**ower supply"

Annex 15, Appendix 1, Figure 1d, amend to read:

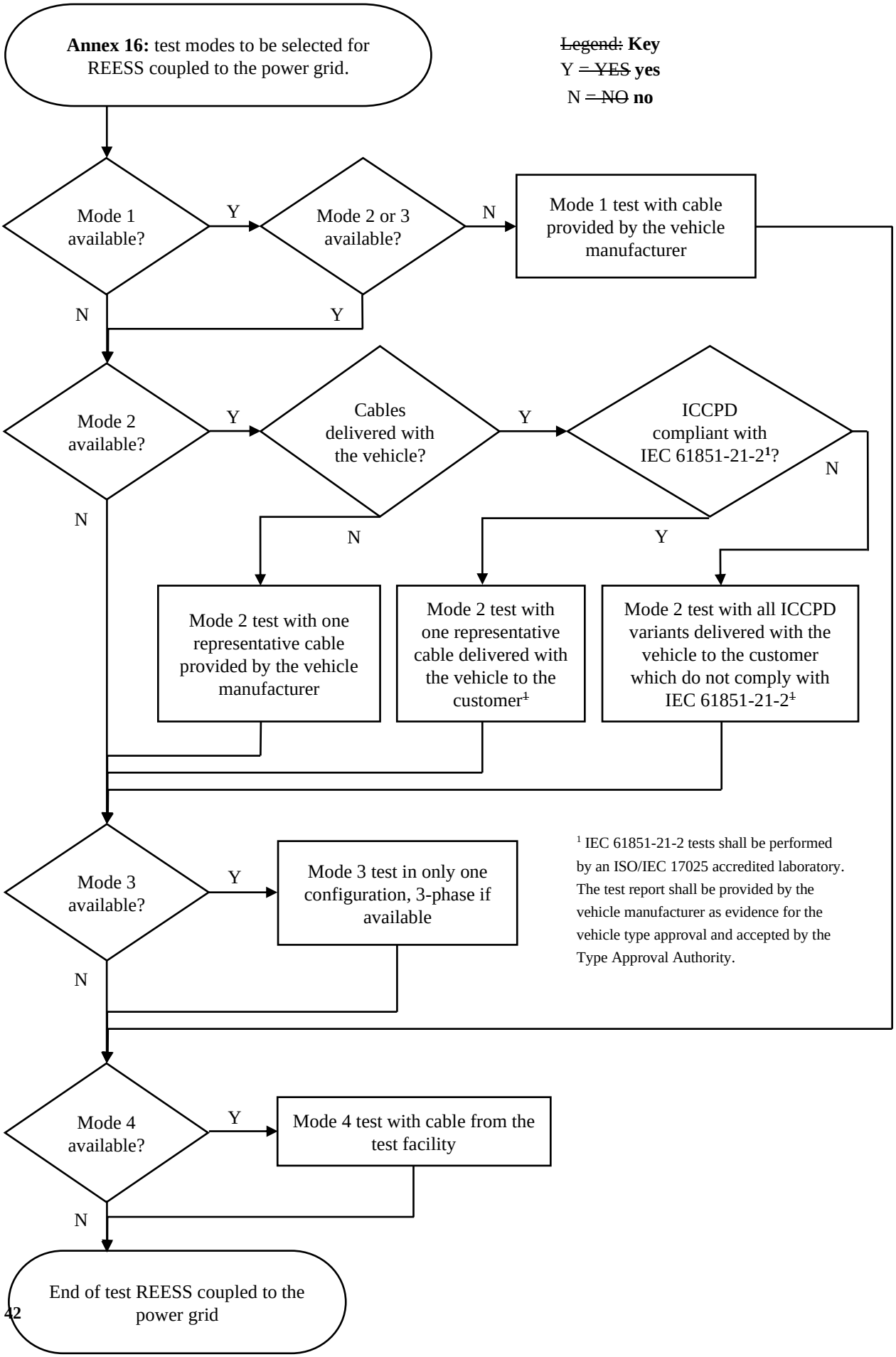
"Figure 1d



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 CDN
5 ~~F~~**f**ast Transients / ~~B~~**b**urst generator
6 ~~P~~**p**ower supply"

Annex 16, Paragraph 2., Figure 1, amend to read:

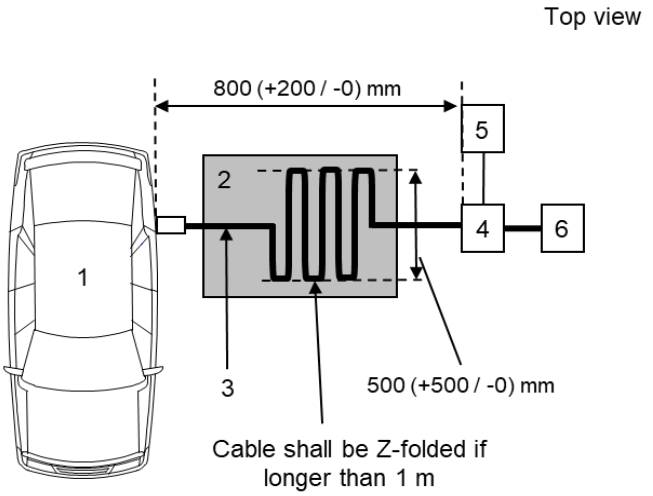
"Figure 1
Charging mode configuration for Annex 16



"

Annex 16, Appendix 1, Figure 1b, amend to read:

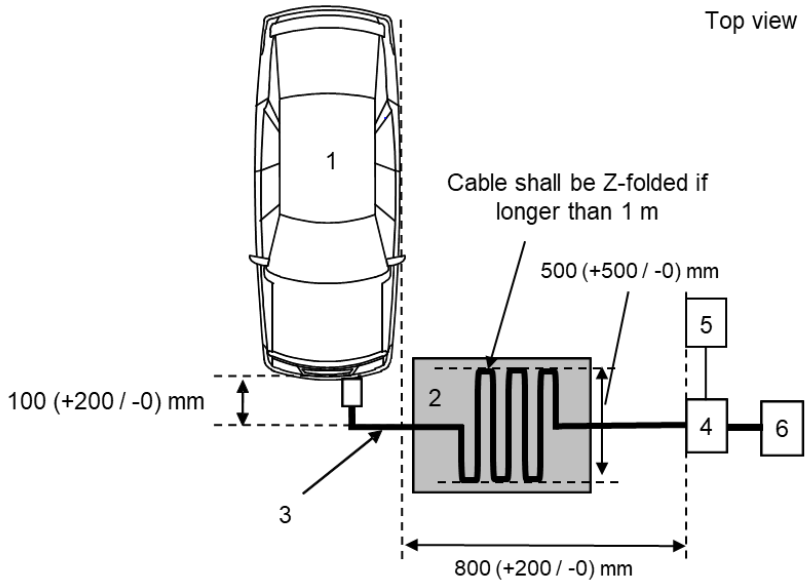
"Figure 1b



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 CDN
5 ~~S~~**s**urge generator
6 ~~P~~**p**ower supply"

Annex 16, Appendix 1, Figure 1d, amend to read:

"Figure 1d



~~Legend~~**Key:**
1 ~~V~~**v**ehicle under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 CDN
5 ~~S~~**s**urge generator
6 ~~P~~**p**ower supply"

Annex 19, Paragraph 3.4., amend to read:

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

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

Table 1
Spectrum analyser parameters

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

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

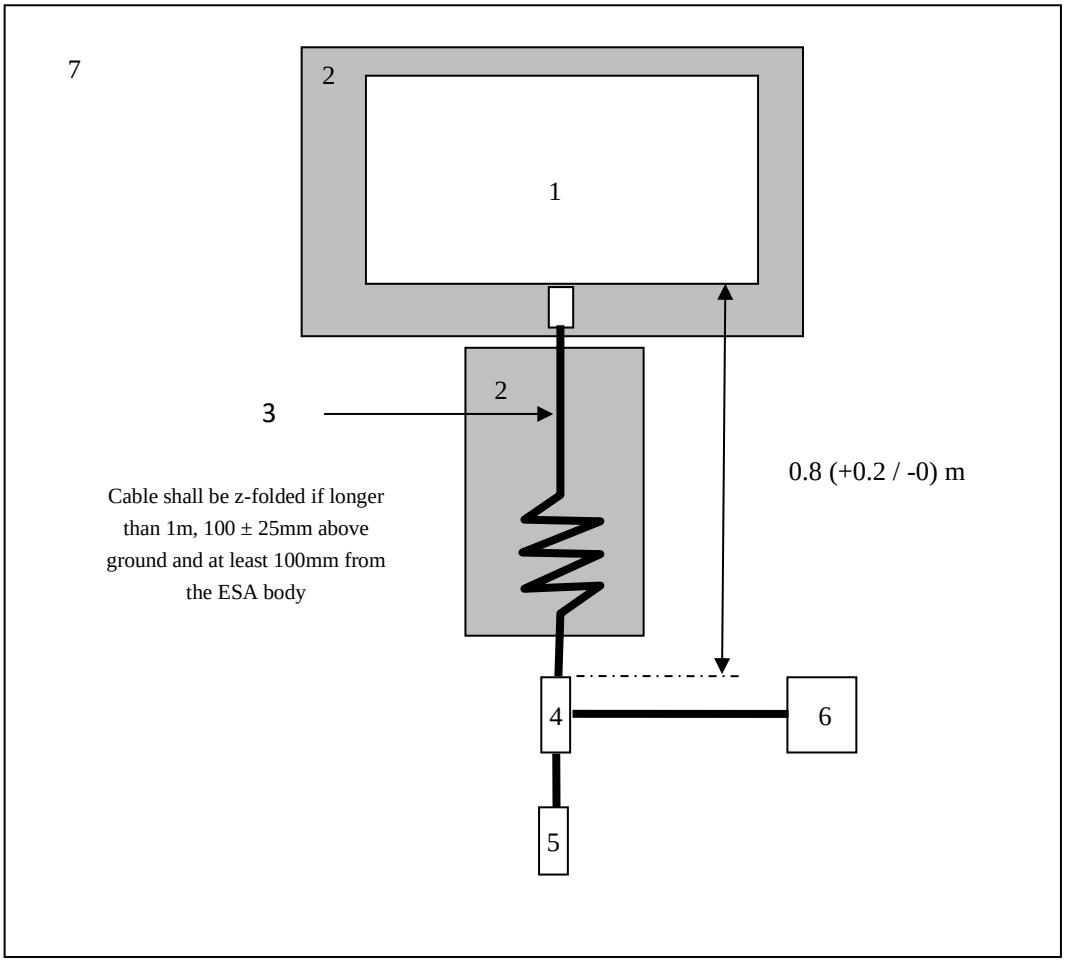
Table 2
Scanning receiver parameters

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

"

Annex 19, Appendix 1, Figure 1, amend to read:

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



~~Legend~~**Key:**
1 ESA under test
2 ~~I~~**i**nsulating support
3 ~~C~~**c**harging harness
4 AMN(s) or DC-charging-AN(s) grounded
5 ~~P~~**p**ower mains socket
6 ~~M~~**m**easuring receiver
7 ~~G~~**g**round plane"

Annex 22, Paragraph 5.1.1., amend to read:

"5.1.1. Test shall be conducted in accordance with IEC 61000-4-45. Test shall be performed only at the severity levels given in 7.16.2.1."

II. Justification

1. The proposed modifications to the current text of the UN Regulation are marked in bold for new or strikethrough for deleted characters in comparison to ECE/TRANS/WP.29/2024/90 and E/ECE/324/Add.9/Rev.6 - E/ECE/TRANS/505/Add.9/Rev.6. Each change is justified in this section.

2. In formal regulatory language, ‘shall’ is more appropriate than ‘have to’, because it avoids any ambiguity. While ‘have to’ can technically express a necessity, it is less precise in legal contexts, and ‘shall’ should be used for mandatory obligations. In paragraphs 7.9.2.1. and 7.16.2.1., 'has to' was changed to 'shall’. Therefore, in paragraphs 6.1.2. and 7.1.2., 'has to' should be revised to 'shall’ as well.

Reference to ISO 7637-2 in paragraphs 6.7.1., 7.17.1., 7.19.1. and in Annex 10.

3. Appendix 1 references two versions of ISO 7637-2. The references in the main body and Annex 10 shall clearly reference the required version of the standard. Therefore, each reference should be extended with the year of publication. All references in the main body and Annex 10 were aligned in the same way. Paragraph 6.9.1. was changed but omitted to make the same change in other paragraphs of the document. If this change is not made, the users of the Regulation will not know which version to use. This is an essential change.

4. UN Regulation No. 10 currently distinguishes the following types of electrical/electronic sub-assembly:

- ESA “other than [in] rechargeable energy storage system (REESS) charging mode coupled to the power grid” in paragraphs 6.5. to 6.9.
- ESA “in the configuration REESS charging mode coupled to the power grid” in paragraphs 7.10 to 7.19.

As per Annex 9, paragraph 1.2.1., ESA “in the configuration REESS charging mode coupled to the power grid” shall only be tested acc. to ISO 11452-2 (Absorber Lined Shielded Enclosure- ALSE) and ISO 11452-4 (Bulk Current Injection - BCI). Therefore, listing the transversal electromagnetic (TEM) cell, strip line and reverb chamber methods in Tables 19a and 19b of paragraph 7.18.2.1. is wrong or misleading, while Tables 2a and 2b in paragraph 6.8.2.1. shall of course remain unchanged. For ESA “other than in REESS charging mode coupled to the power grid” Annex 9, paragraph 1.2.1. does not provide any restrictions.

5. In specification 6.9.1., Table 3a and 3b, ‘system’ was changed to ‘ESA’, but this change was not applied to 7.19.1. Therefore, in 7.19.1. Table 20 ‘system’ should be revised to ‘ESA’.

Appendix 1

6. As part of the evolution of EMC standards, not only the Edition changes (including any additional amendment or corrigendum), but also the title may be modified. As this has been the case for several standards, their titles should be updated accordingly. The indication of the Edition of a standard should be in line with its issuing organization:

- Item 7: update of ISO 11452-3 to Fourth Edition 2024: the new Edition corrects only a mistake in a formula.
- Item 12: the reference to IEC 61000-3-12 was updated without revising 7.3., 7.1.1., Annex 11 and Annex 17. The test method and evaluation of test results have changed significantly and are not consistent with the present wording of the 07 series of amendments. The update of the standard will be considered after thorough revision of the concerned paragraphs (later supplement or new series of amendments).
- Item 22: the modification of Appendix 1, update of International Special Committee on Radio Interference (CISPR) standard 6-1-1, was included in an earlier draft and not taken over in the draft phase of the latest documents. This basic standard defines the requirements of measuring apparatus which should be state-of-the art. Referencing the latest publication of this standard reduces the effort for laboratories and simplifies

the calibration process of apparatus which could also be applied for other regulations and standards than UN Regulation No. 10.

7. In diagrams or figures, Revision 6 of UN Regulation No. 10 and the preliminary changes for Revision 7 currently use both “legend” and “key” to provide further information. Additionally, the numbers in the keys of some diagrams are occasionally followed by a colon (“:”) and an explanation starting with a capital letter. For the sake of formal consistency, the keys of figures should be homogeneously aligned. Typically, e.g. in international standards, the term “key” is used. In addition to that, the numbers in the enumeration are in chronological order, not followed by a colon (“:”) and completed with an explanation starting with a lower case.

8. According to paragraphs 1., 2., and 3. of Appendix 8, the impedance of artificial network is labelled as ZPB and should be corrected to ZPB.

9. According to paragraph 2. of Appendix 8, a High Voltage Artificial Network (HV-AN) is only applied to ESA, so the "Vehicle" has been removed from Figure 3. Therefore, the term "Vehicle" should also be deleted from the main text.

10. Figure 11 of Appendix 8, paragraph 5.4., has been adopted from CISPR 25:2021 (Edition 5). The value of C1 should be corrected to 1,1 nF in order to avoid deviating setups in standardization and type-approval.

11. In Annex 1, the approval mark for Model A has been updated to version 07. Model B also required an update to version 07.

Flowcharts on charging modes

12. The footnotes should be moved to the decision boxes, to improve readability of the flow charts for applying the Regulation. Footnote 1 is only applicable for the references to IEC 61851-21-1. Footnote 2 indicates that a decision must be made between modes 2 and 3. The above concerns:

- Annex 4, Figure 1
- Annex 11, Figure 1
- Annex 12, Figure 1
- Annex 13, Figure 1
- Annex 15, Figure 1
- Annex 16, Figure 1

13. A fixed step size requirement of exactly 50 kHz is not in line with CISPR 16-2-3. This basic standard defines the radiated disturbance measurement method, which includes a frequency step size of 50 % of the resolution bandwidth used or less. For this reason, in the latest draft of CISPR 12 Edition 7 (Committee Draft for Vote (CDV) positive vote in 2024) it was agreed to require a maximum step size of 60 kHz. OICA members have received feedback from a manufacturer of EMI measuring receivers that a fixed step size requirement of exactly 50 kHz cannot be fulfilled in Fast Fourier Transform (FFT) mode with all kinds and brands of FFT based measuring receivers. Affected receivers are using a frequency step size of 50 % of the resolution bandwidth or less, i.e. 60 kHz for a resolution bandwidth of 120 kHz as required in Regulation No. 10 or 30 kHz in the high dynamic mode with improved level accuracy. Furthermore, such receivers do not allow the adjustment of the step size by the user. OICA members propose to align Regulation No. 10 requirements with the requirements in CISPR 16-2-3, which is equal to the latest CISPR 12 draft. Otherwise, the latest included FFT mode is not applicable with the majority of the commercially available FFT based measuring receivers. Annex 4 and Annex 7 shall be applied to measure the broadband emission from vehicle and ESA. Therefore, only Peak and Quasi-Peak detector shall be applied. The average detector can be suppressed in Table 1 and Table 2 for consistency.

14. Annex 4, Figures 3b, 3d, 3f, 3h, Key 5 contains a wrong reference: 7.3.3.2. is not existing in Regulation No. 10. This is a purely editorial error, due to copy & paste from draft ISO 11451-2.

15. Annex 4, Figure 3h, Key 11: purely editorial error forced by late changes.

16. In Annex 5, the method for measuring emission levels in the frequency modulation (FM) band at the vehicle antenna has been removed. Therefore, CISPR 25 which is the reference standard for that test method should consequently be removed from Annex 5 as well.

17. For the “Regular test method” in Annex 6, paragraph 1.2., both a specification of rear irradiation and REESS charging mode have been added. These specifications are missing for the “Alternative test methods” in Annex 6, paragraph 1.3. and should be added as well.

18. In Annex 6, paragraph 1.4., applicable vehicle immunity test methods are provided in a flowchart. Since the definition of a "Large vehicle" is already given in the main text, it should be sufficient to simply refer to "Large vehicle” with the according reference in the flowchart.

19. In Annex 6, paragraph 2.1.1.2. includes a table outlining the basic vehicle conditions. The Advanced Driving System (ADS) is listed under the "50 km/h mode" and "Brake mode" vehicle test conditions. However, the failure criteria for ADS, as revised in informal document GRE-90-19, have not been applied to the "Brake mode" vehicle test conditions.

20. In Annex 11, Footnote 2 of Figure 1 includes a reference standard. However, the standard number following 'IEC' has not been specified. Therefore, it needs to be clearly stated as 'IEC 61000-3-12.'. Additionally, the charging current is already given to be > 16A and < 75A. A repetition of the charging current > 16A is therefore not necessary before referencing the IEC standard 61000-3-12.

21. In Annex 12, Figure 1, Footnote 2, the charging current is already given to be > 16A and < 75A. A repetition of the charging current > 16A is therefore not necessary before referencing the IEC standard 61000-3-11.

22. Annex 22 addresses surges conducted along alternate current (AC) and direct current (DC) power lines for ESAs. Therefore, the reference standard should be updated to IEC 61000-4-5. The erroneously cited standard IEC 61000-4-4 addresses fast transients/bursts.