Informal Document GRE-93-20
Submitted by the experts from CLEPA and OICA
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Agenda item 8.(a.)

The changes from GRE/2025/25 are highlighted in yellow

Proposal for a Supplement 2 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). The modifications to the current text of the 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

Content, amend to read:

"Contents

Annexes

"

Footnote 1 in paragraph 1.1., 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.6, ~~para.~~**paragraph** 2."

Paragraphs 2.16. to 2.19., amend to read:

"2.16. "*Mode 1 Charging Mode"* means charging mode as defined in IEC 61851-1**,** ~~sub-clause~~**Subclause** 6.2.1 where the vehicle is connected directly to AC 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~~**Subclause** 6.2.2 where the vehicle is connected to AC 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~~**Subclause** 6.2.3 where the vehicle is connected to an EVSE (e.g charging station, wallbox) providing AC 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~~**Subclause** 6.2.4 where the vehicle is connected to an EVSE providing DC 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)**.**"

Paragraphs 2.29. and 2.30., amend to read:

"2.29. "*Residential environment"* refers to **C**~~c~~lause 3.1.14 of IEC 61000-6-3: 2020.

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

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

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

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

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

2.30. *"Non-residential environment"* refers to **C**~~c~~lause 3.1.12 of IEC 61000-6-4: 2018.

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

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

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

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

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

Insert a new paragraph 2.34., to read:

"2.34. "*Lowest usable frequency (LUF)"* means lowest frequency for which the field uniformity requirements are met."

Paragraph 3.2.8., amend to read:

"3.2.8. ESA which are brought to the market as replacement parts **do not** need ~~no~~ **a** type approval if they are obviously marked as a replacement part by an identification number and if they are identical and from the same manufacturer as the corresponding ~~O~~**o**riginal ~~E~~**e**quipment.

Paragraph 4.1.1.2., amend to read:

"4.1.1.2. Approval of vehicle type by testing of individual ESAs.

A vehicle manufacturer may obtain approval for the vehicle by demonstrating to the Type Approval Authority that all the relevant (see ~~para.~~**paragraph** 3.1.3. of this Regulation) electrical/electronic systems or ESAs have been approved in accordance with this Regulation and have been installed in accordance with any conditions attached thereto."

Paragraph 5.2.2., amend to read:

"5.2.2. **Electrical/electronic s~~S~~ub-assembly (ESA)**

An approval mark described in paragraph 5.3. below shall be affixed to every ESA conforming to a type approved under this Regulation.

No marking is required for electrical/electronic systems built into vehicles which are approved as units."

Paragraph 6.1.1., amend to read:

"6.1.1. A vehicle and its electrical/electronic system(s) or ESA(s) shall be ~~so~~ designed, constructed and fitted **in such a way** as to enable the vehicle, in normal conditions of use, to comply with the requirements of this Regulation."

Paragraph 6.4.2.1., amend to read:

"6.4.2.1. If tests are made using the method described in Annex 6, in accordance with ISO 11451-2, the field strength shall be 30 volts/m ~~rms (root mean squared)~~ in over 90 per cent of the 20 to 2,000 MHz frequency band and a minimum of 25 volts/m ~~rms~~ over the whole 20 to 2,000 MHz frequency band. The field strength shall be 10 volts/m ~~rms~~ in over 90 per cent of the 2,000 to 6,000 MHz frequency band and a minimum of 8 volts/m ~~rms~~ over the whole 2,000 to 6,000 MHz frequency band.

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

Paragraph 6.7.1., 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."

Paragraph 6.8.2.1., amend to read:

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

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

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

Table 2a

	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*
Frequency range below 2 GHz	**20 to 400 MHz**	**20 to 200 MHz**	**20 to 400 MHz**	**80 to 2,000 MHz**	**LUF to 2,000 MHz**

~~20 to 2,000 MHz~~ **Test level below 2 GHz**	60 V/m	75 V/m	60 mA	30 V/m	21 V/m
Frequency range above 2 GHz	**Not applicable**	**Not applicable**	**Not applicable**	**2,000 to 6,000 MHz**	**2,000 to 6,000 MHz**
~~2,000 to 6,000 MHz~~ **Test level above 2 GHz**	Not applicable	Not applicable	Not applicable	10 V/m	7 V/m

Table 2b

	Minimum Test Level over the whole 20 to 6,000 MHz frequency band				
Frequency range	*Stripline*	*TEM cell*	*BCI*	*ALSE*	*Reverberation chamber*
Frequency range below 2 GHz	**20 to 400 MHz**	**20 to 200 MHz**	**20 to 400 MHz**	**80 to 2,000 MHz**	**LUF to 2,000 MHz**
~~20 to 2,000 MHz~~ **Test level below 2 GHz**	50 V/m	62,5 V/m	50 mA	25 V/m	18 V/m
Frequency range above 2 GHz	**Not applicable**	**Not applicable**	**Not applicable**	**2,000 to 6,000 MHz**	**2,000 to 6,000 MHz**
~~2,000 to 6,000 MHz~~ **Test level above 2 GHz**	Not applicable	Not applicable	Not applicable	8 V/m	6 V/m

"

Paragraph 6.9.1., amend to read:

"6.9.1. Method of testing

The immunity of ESA representative of this type shall be tested by the method(s) according to ISO ~~7637-2:2004~~**16750-2** for ~~pulse 4~~**starting profile** and ISO 7637-2~~:2011~~ for pulses 1, 2a, 2b, 3a and 3b, as described in Annex 10, with the test levels given in Tables 3a and 3b. ~~Pulse 4~~**Starting profile** shall be tested according to the functional status **classification** as defined in ISO ~~7637-2:2004~~**16750-1**. Functional Performance Status Classification (FPSC) as in ISO 7637-1 shall be applied for pulses 1, 2a, 2b, 3a and 3b.

Immunity of ESA

Table 3a

Test pulse ~~number~~	*Immunity test level*		***Number of pulses***	*Functional status **classification** for ESA:*	
	12 V system	***24 V system***		*Related to immunity related functions*	*Not related to immunity related functions*
~~4~~ **Starting profile**	~~III~~ **II**	~~III~~ **II**	**10 pulses**	B (for ESA which shall be operational during engine start phases) C (for other ESA)	D

Table 3b

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

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

Paragraph 7.1.4., amend to read :

"7.1.4. Artificial networks

AC Power mains shall be applied to the vehicle / ESA through 50 µH/50 Ω AMN(s) as defined in Appendix 8**,** ~~clause~~**paragraph** 4.

DC Power mains shall be applied to the vehicle / ESA through 5 µH/50 Ω DC-charging-AN(s) as defined in Appendix 8**,** ~~clause~~**paragraph** 3.

High voltage power line shall be applied to the ESA through a 5 µH/50 Ω HV-AN(s) as defined in Appendix 8**,** ~~clause~~**paragraph** 2.

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

Paragraph 7.3.2.1., amend to read :

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

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

Harmonic number *n*	*Maximum authorized harmonic current* *A*
Odd harmonics	
3	2.3
5	1.14
7	0.77
9	0.40
11	0.33
13	0.21
15 ≤ n ≤ 39	0.15x15/n
Even harmonics	
2	1.08
4	0.43
6	0.30
8 ≤ n ≤ 40	0.23x8/n

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

Paragraphs 7.4.2.1. and 7.4.2.2., amend to read:

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

- The value of P~~st~~$_{st}$ shall not be greater than 1.0;
- The value of P~~lt~~$_{lt}$ 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, d~~c~~$_{c}$, shall not exceed 3.3 per cent;
- The maximum relative voltage change d~~max~~$_{max}$, shall not exceed 6 per cent.

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

- The value of P~~st~~$_{st}$ shall not be greater than 1.0;
- The value of P~~lt~~$_{lt}$ 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, d~~c~~$_{c}$, shall not exceed 3.3 per cent;
- The maximum relative voltage change d~~max~~$_{max}$, shall not exceed 6 per cent."

Table 8, amend to read:

"Table 8
Maximum allowed radiofrequency conducted disturbances on AC power lines

~~*Frequency (MHz)*~~	~~*Limits and detector*~~
~~0.15 to 0.5~~	~~66 to 56 dBµV (quasi-peak) 56 to 46 dBµV (average) (linearly decreasing with logarithm of frequency)~~
~~0.5 to 5~~	~~56 dBµV (quasi-peak) 46 dBµV (average)~~
~~5 to 30~~	~~60 dBµV (quasi-peak) 50 dBµV (average)~~

Frequency (MHz)	***Quasi-Peak limit***	***Average limit***
0.15 to 0.5	**66 to 56 dBµV**	**56 to 46 dBµV**
	(linearly decreasing with logarithm of frequency)	
0.5 to 5	**56 dBµV**	**46 dBµV**
5 to 30	**60 dBµV**	**50 dBµV**

"

Table 9, amend to read:

"Table 9
Maximum allowed radiofrequency conducted disturbances on DC power lines

~~*Frequency (MHz)*~~	~~*Limits and detector*~~
~~0.15 to 0.5~~	~~79 dBµV (quasi-peak) 66 dBµV (average)~~
~~0.5 to 30~~	~~73 dBµV (quasi-peak) 60 dBµV (average)~~

Frequency (MHz)	***Quasi-Peak limit***	***Average limit***
0.15 to 0.5	**79 dBµV**	**66 dBµV**
0.5 to 30	**73 dBµV**	**60 dBµV**

"

Table 10, amend to read:

"Table 10
Maximum allowed radiofrequency conducted disturbances on AC power lines

~~*Frequency (MHz)*~~	~~*Limits and detector*~~
~~0.15 to 0.5~~	~~79 dBµV (quasi-peak) 66 dBµV (average)~~
~~0.5 to 30~~	~~73 dBµV (quasi-peak) 60 dBµV (average)~~

Frequency (MHz)	***Quasi-Peak limit***	***Average limit***
0.15 to 0.5	**79 dBµV**	**66 dBµV**
0.5 to 30	**73 dBµV**	**60 dBµV**

"

Table 11, amend to read:

"Table 11
Maximum allowed radiofrequency conducted disturbances on DC power lines

~~*Frequency (MHz)*~~	~~*Limits and detector*~~
~~0.15 to 0.5~~	~~89 dBµV (quasi-peak)~~ ~~76 dBµV (average)~~
~~0.5 to 30~~	~~83 dBµV (quasi-peak)~~ ~~70 dBµV (average)~~

Frequency (MHz)	***Quasi-Peak limit***	***Average limit***
0.15 to 0.5	**89 dBµV**	**76 dBµV**
0.5 to 30	**83 dBµV**	**70 dBµV**

"

Paragraph 7.7.2.1., amend to read:

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

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

Paragraph 7.8.2.1., amend to read:

"7.8.2.1. If tests are made using the methods described in Annex 15, the immunity test levels, for AC or DC power lines, shall be: ±2 kV test voltage in open circuit, with a rise time (T~~r~~r) of 5 ns, and a hold time (T~~h~~h) of 50 ns and a repetition rate of 5 kHz for at least 1 minute."

Paragraph 7.9.2.1., amend to read:

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

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

(b) For DC power lines: ±0.5 kV test voltage in open circuit between line and earth and ±0.5 kV between lines with a rise time (T~~r~~r) of 1.2 µs, and a hold time (T~~h~~h) of 50 µs. Each surge shall be applied five times with a maximum delay of 1 minute."

Paragraphs 7.12.2.1. and 7.12.2.2., amend to read:

"7.12.2.1. If measurements are made using the method described in Annex 18, the limits for rated current ≤ 16 A per phase and not subjected to conditional connection are those defined in IEC 61000-3-3, ~~paragraph~~**Clause** 5~~.~~**:**

- **The value of P_{st} shall not be greater than 1.0;**
- **The value of P_{lt} 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, d_c, shall not exceed 3.3 per cent;**
- **The maximum relative voltage change d_{max}, shall not exceed 6 per cent.**

7.12.2.2. If measurements are made using the method described in Annex 18, the limits for rated current > 16 A and ≤ 75 A per phase and subjected to conditional connection are those defined in IEC 61000-3-11, ~~paragraph~~**Clause** 5.**:**

- **The value of P_{st} shall not be greater than 1.0;**
- **The value of P_{lt} 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, d_c, shall not exceed 3.3 per cent;**
- **The maximum relative voltage change d_{max}, shall not exceed 6 per cent."**

Table 16, amend to read:

"Table 16
Maximum allowed radiofrequency conducted disturbances on AC power lines

~~*Frequency (MHz)*~~	~~*Limits and detector*~~
~~0.15 to 0.5~~	~~66 to 56 dBµV (quasi-peak)~~ ~~56 to 46 dBµV (average)~~ ~~(linearly decreasing with logarithm of frequency)~~
~~0.5 to 5~~	~~56 dBµV (quasi-peak)~~ ~~46 dBµV (average)~~
~~5 to 30~~	~~60 dBµV (quasi-peak)~~ ~~50 dBµV (average)~~

Frequency (MHz)	***Quasi-Peak limit***	***Average limit***
0.15 to 0.5	**66 to 56 dBµV**	**56 to 46 dBµV**
	(linearly decreasing with logarithm of frequency)	
0.5 to 5	**56 dBµV**	**46 dBµV**
5 to 30	**60 dBµV**	**50 dBµV**

"

Table 17, amend to read:

"Table 17
Maximum allowed radiofrequency conducted disturbances on DC power lines

~~*Frequency (MHz)*~~	~~*Limits and detector*~~
~~0.15 to 0.5~~	~~79 dBµV (quasi-peak)~~ ~~66 dBµV (average)~~
~~0.5 to 30~~	~~73 dBµV (quasi-peak)~~ ~~60 dBµV (average)~~

Frequency (MHz)	***Quasi-Peak limit***	***Average limit***
0.15 to 0.5	**79 dBµV**	**66 dBµV**
0.5 to 30	**73 dBµV**	**60 dBµV**

"

Paragraph 7.15.2.1., amend to read:

"7.15.2.1. If tests are made using the methods described in Annex 21, the immunity test levels, for AC or DC power lines, shall be: ± 2 kV test voltage in open circuit, with a rise time (T~~r~~r) of 5 ns, and a hold time (T~~h~~h) of 50 ns and a repetition rate of 5 kHz for at least 1 minute."

Paragraph 7.16.2.1., amend to read:

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

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

(b) For DC power lines: ±0.5 kV test voltage in open circuit between line and earth and ±0.5 kV between lines with a rise time (T~~r~~r) of 1.2 µs, and a hold time (T~~h~~h) of 50 µs. Each surge shall be applied five times with a maximum delay of 1 minute."

Tables 19a and 19b, amend to read:

"**Table 19a**

	Test Level in over 90 per cent of the 20 to 6,000 MHz frequency band	
Frequency range	*BCI*	*ALSE*
Frequency range below 2 GHz	**20 to 400 MHz**	**80 to 2,000 MHz**
~~20 to 2,000 MHz~~ **Test level below 2 GHz**	60 mA	30 V/m
Frequency range above 2 GHz	**Not applicable**	**2,000 to 6,000 MHz**
~~2,000 to 6,000 MHz~~ **Test level above 2 GHz**	Not applicable	10 V/m

Table 19b

	Minimum Test Level over the whole 20 to 6,000 MHz frequency band	
Frequency range	*BCI*	*ALSE*
Frequency range below 2 GHz	**20 to 400 MHz**	**80 to 2,000 MHz**
~~20 to 2,000 MHz~~ **Test level below 2 GHz**	50 mA	25 V/m
Frequency range above 2 GHz	**Not applicable**	**2,000 to 6,000 MHz**
~~2,000 to 6,000 MHz~~ **Test level above 2 GHz**	Not applicable	8 V/m

"

Paragraph 7.19.1., amend to read:

"7.19.1 Method of testing

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

Table 20
Immunity of ESA

Test pulse number	*Immunity test level*		*Test duration / Number of pulses*	*FPSC for ESA:*	
	12V system	*24V system*		*Related to immunity related functions*	*Not related to immunity related functions*
1	-75 V	-450 V	500 pulses	III	III

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

"

Paragraphs 7.20.1 and 7.20.2., amend to read:

"7.20.1. 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 paragraphs 7.5., 7.8., 7.9., 7.13., 7.15., **and** 7.16.

In this case, the manufacturer shall provide a statement that the vehicle and/or ESA can be used in "REESS charging mode coupled to the power grid" only with cables shorter than 30 m. This information shall be made publicly available following the type approval.

7.20.2. 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 paragraphs 7.5., 7.8., 7.9., 7.13., 7.15., **and** 7.16.

In this case, the manufacturer shall provide a statement that the vehicle and / or ESA can be used in "REESS charging mode coupled to the power grid" only with a local/private DC charging station without additional participants. This information shall be made publicly available following the type approval."

Appendix 1,

paragraph 4., amend to read:

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

Part 1: Definitions and general considerations~~,~~ (ISO 7637-1, Third edition 2015);

Part 2: Electrical transient conduction along supply lines only, (ISO 7637-2, Third edition 2011).

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

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

Paragraphs 6. and 7., amend to read:

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

Part 1: General principles and terminology (ISO 11451-1, ~~Fourth~~**Fifth** edition ~~2015~~**2025**);

Part 2: Off-vehicle radiation sources (ISO 11451-2, ~~Fourth~~**Fifth** edition ~~2015~~**2025**);

Part 4: Harness excitation methods (ISO 11451-4, ~~f~~**F**ourth edition 2022).

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

Part 1: General principles and terminology (ISO 11452-1, ~~Fourth~~**Fifth** edition ~~2015~~**2025**);

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

Part 3: Transverse electromagnetic (TEM) cell (ISO 11452-3, Fourth edition 2024);

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

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

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

Insert a new paragraph 23., to read:

"23. ISO 16750 "Road vehicles - Environmental conditions and testing for electrical and electronic equipment":

Part 1: General (ISO 16750-1, Fourth edition 2023);

Part 2: Electrical loads (ISO 16750-2, Fifth edition 2023)."

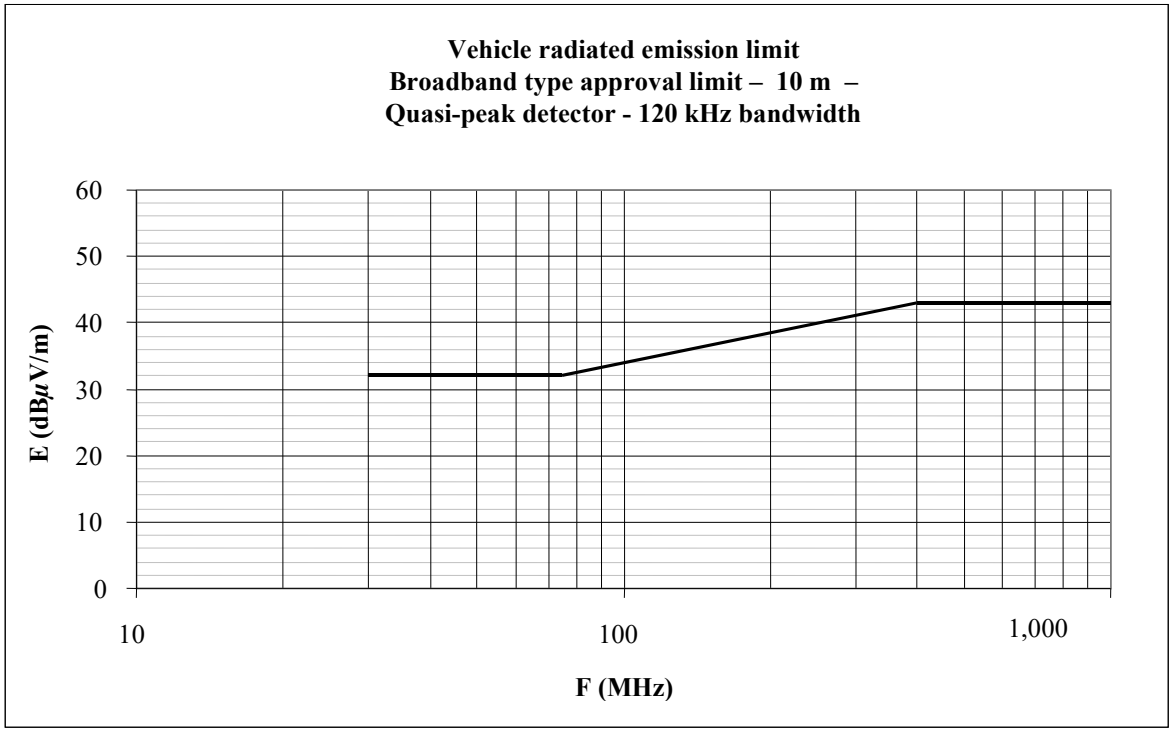
Appendix 2, amend to read :

"Appendix 2

Vehicle broadband reference limits - Antenna-vehicle separation: 10 m

Frequency - megahertz - logarithmic
(See paragraphs 6.2.2.1. and 7.2.2.1. of this Regulation)

Limit E (dBµV/m) at frequency F (MHz) ***for a 120 kHz bandwidth***		
30-75 MHz	75-400 MHz	400-1,000 MHz
E = 32	E = 32 + 15.13 log (F/75)	E = 43



~~Frequency - megahertz - logarithmic~~
~~(See paragraphs 6.2.2.1. and 7.2.2.1. of this Regulation)~~"

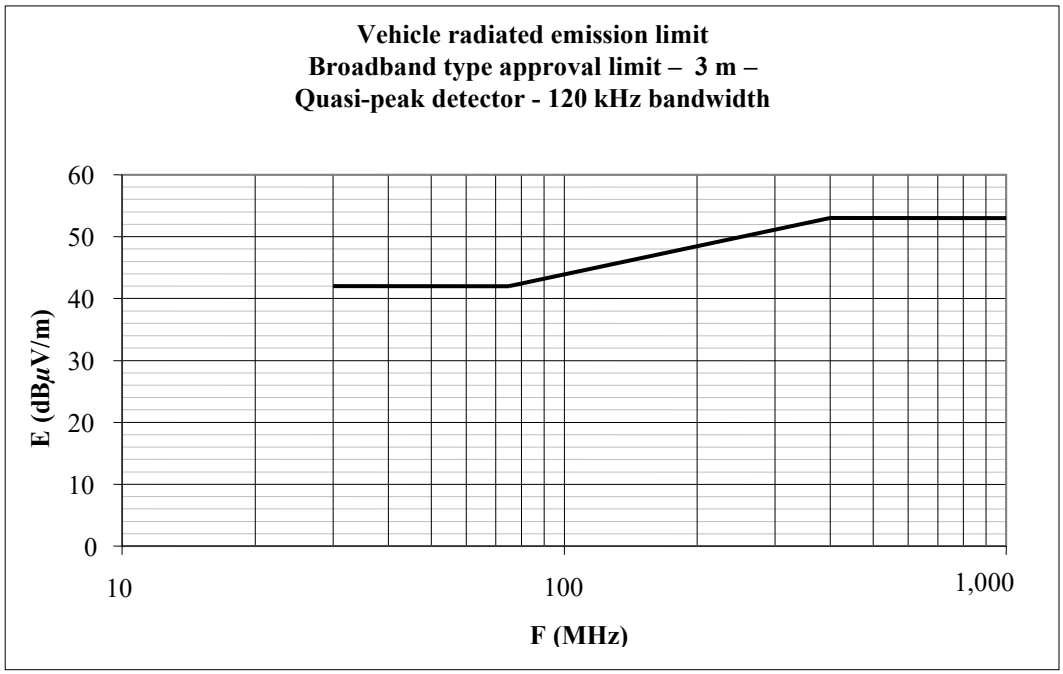
Appendix 3, amend to read :

"Appendix 3

Vehicle broadband reference limits - Antenna-vehicle separation: 3 m

Frequency - megahertz - logarithmic
(See paragraphs 6.2.2.2. and 7.2.2.2. of this Regulation)

Limit E (dBµV/m) at frequency F (MHz) ***for a 120 kHz bandwidth***		
30-75 MHz	75-400 MHz	400-1,000 MHz
E = 42	E = 42 + 15.13 log (F/75)	E = 53



~~Frequency - megahertz - logarithmic~~
~~(See paragraphs 6.2.2.2. and 7.2.2.2. of this Regulation)~~"

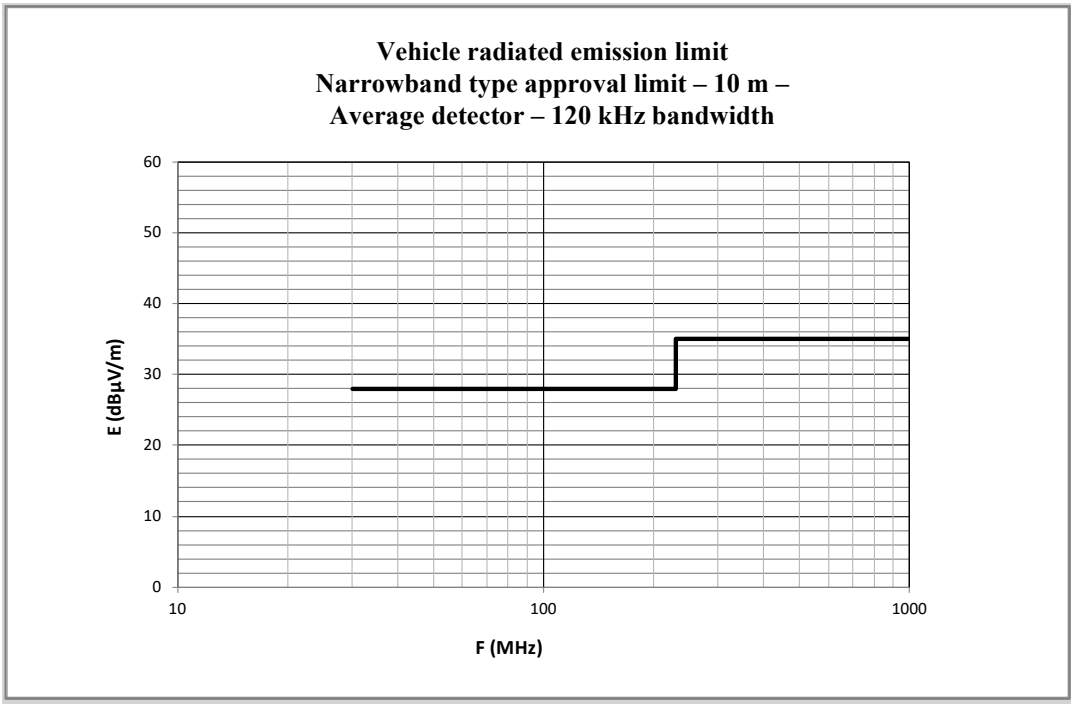
Appendix 4, amend to read :

"Appendix 4

Vehicle narrowband reference limits - Antenna-vehicle separation: 10 m

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

Limit E (dBµV/m) at frequency F (MHz) ***for a 120 kHz bandwidth***	
30-230 MHz	230-1,000 MHz
E = 28	E = 35
The limits shall be measured with a 120 kHz bandwidth.	



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

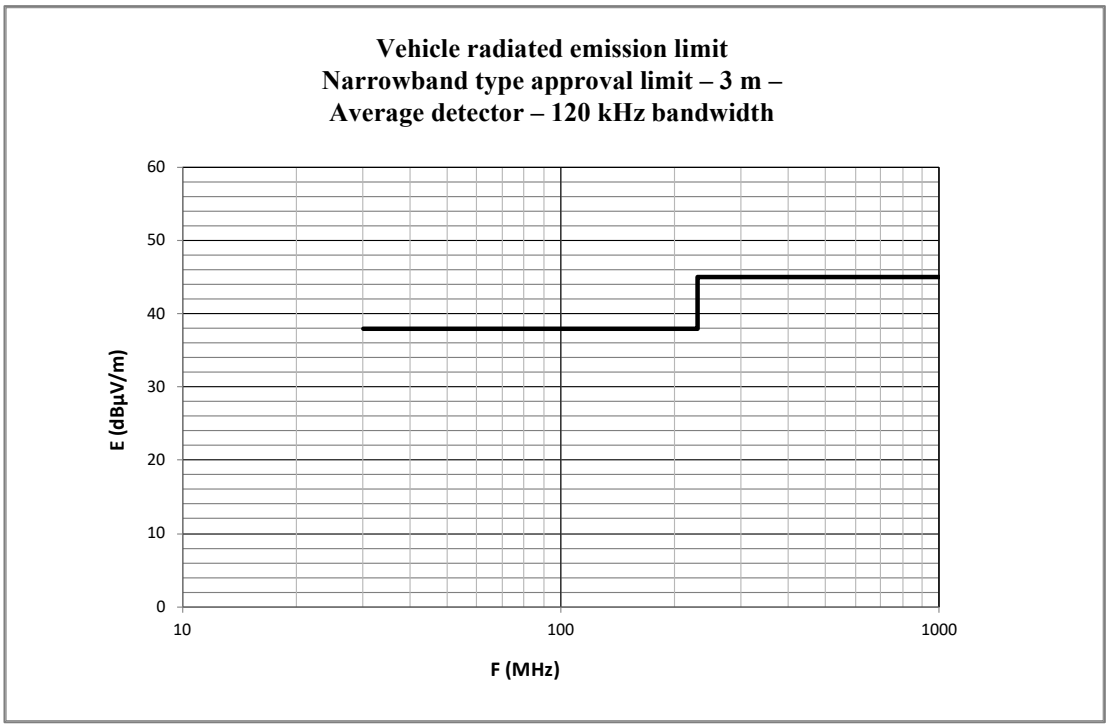
Appendix 5, amend to read :

"Appendix 5

Vehicle narrowband reference limits - Antenna-vehicle separation: 3 m

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

Limit E (dBµV/m) at frequency F (MHz) ***for a 120 kHz bandwidth***	
30-230 MHz	230-1,000 MHz
E = 38	E = 45



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

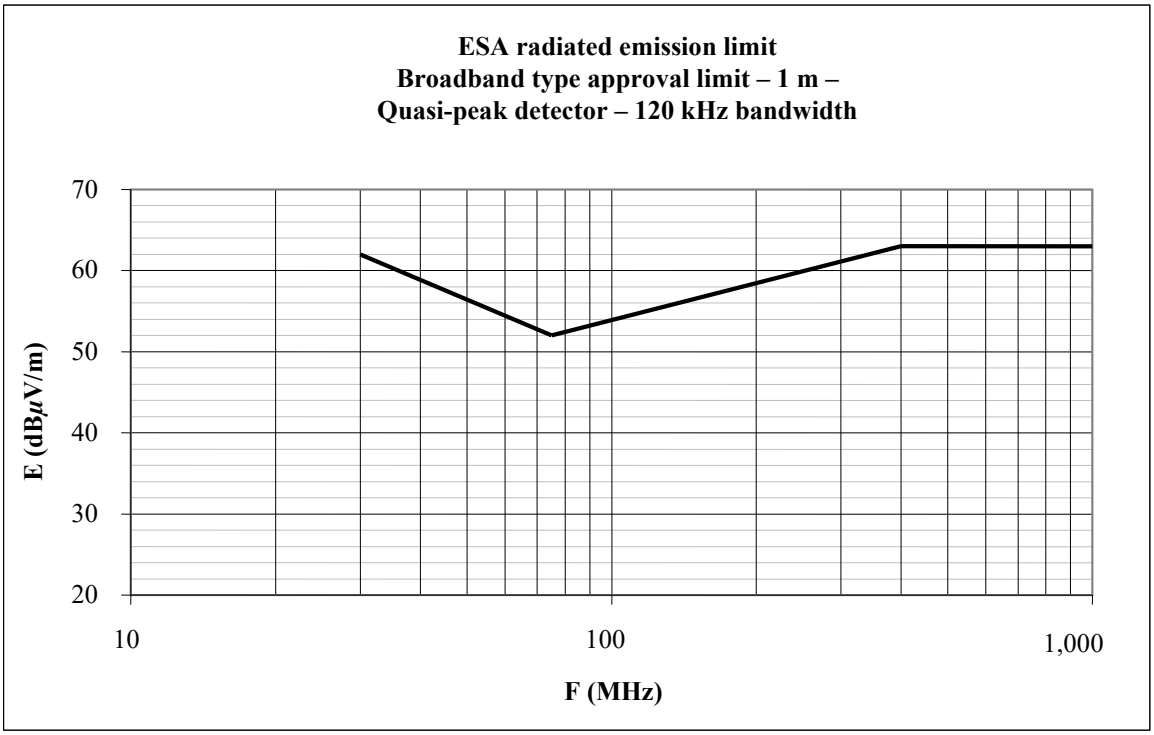
Appendix 6, amend to read :

"Appendix 6

Electrical/electronic sub-assembly (ESA) - Broadband reference limits

Frequency - megahertz - logarithmic
(See paragraphs 6.5.2.1. and 7.10.2.1. of this Regulation)

Limit E (dBµV/m) at frequency F (MHz) ***for a 120 kHz bandwidth***		
30-75 MHz	75-400 MHz	400-1,000 MHz
E = 62 - 25.13 log (F/30)	E = 52 + 15.13 log (F/75)	E = 63



~~Frequency - megahertz - logarithmic~~
~~(See paragraphs 6.5.2.1. and 7.10.2.1. of this Regulation))~~"

Appendix 7, amend to read :

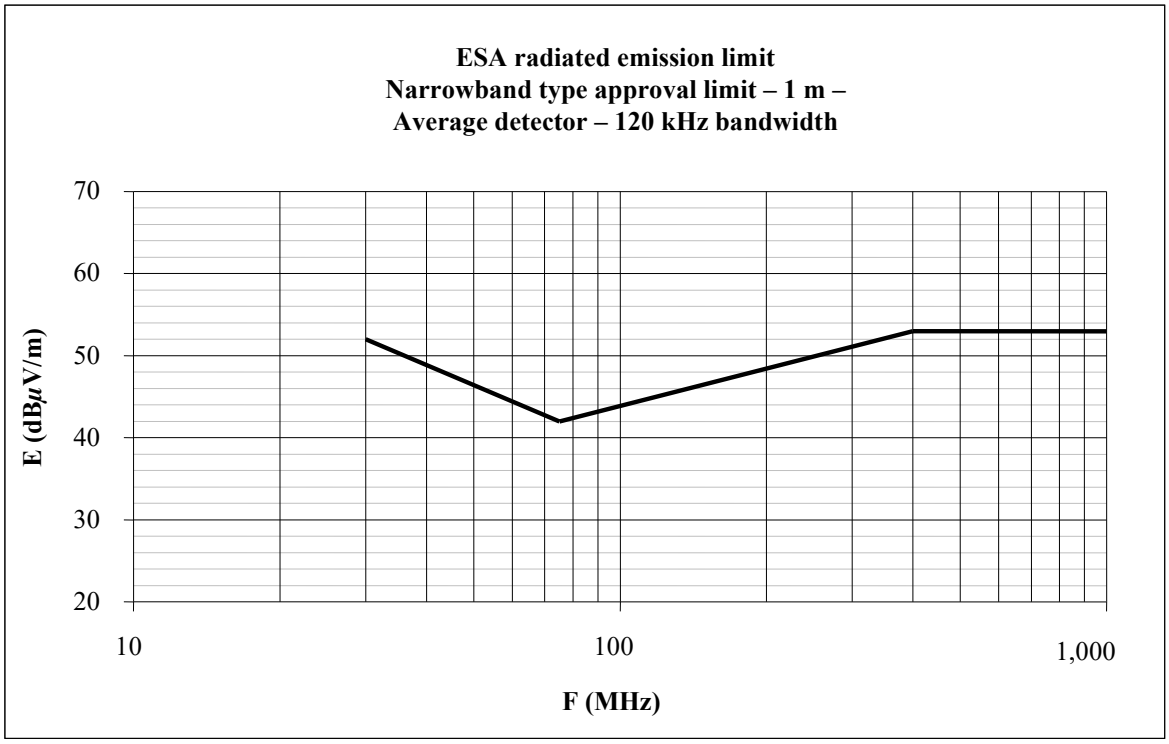
"Appendix 7

Electrical/electronic sub-assembly (ESA) - Narrowband reference limits

Frequency - megahertz - logarithmic
(See paragraph 6.6.2.1. of this Regulation)

~~*Limit E (dBµV/m) at frequency F (MHz)*~~		
~~30-75 MHz~~	~~75-400 MHz~~	~~400-1,000 MHz~~
~~E = 52 - 25.13 log (F/30)~~	~~E = 42 + 15.13 log (F/75)~~	~~E = 53~~

Limit E (dBµV/m) at frequency F (MHz) for a 120 kHz bandwidth		
30-75 MHz	**75-400 MHz**	**400-1,000 MHz**
E = 52 - 25.13 log (F/30)	**E = 42 + 15.13 log (F/75)**	**E = 53**

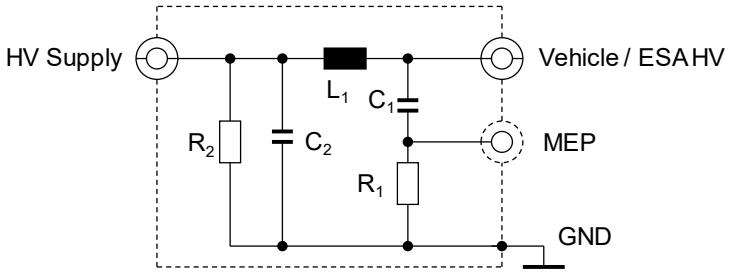


~~Frequency - megahertz - logarithmic~~
~~(See~~ paragraph ~~6.6.2.1. of this Regulation)~~"

Appendix 8,

figure 6, amend to read:

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



~~Key~~Key

L_1	5 µH	HV supply high voltage power supply
C_1	0,1 µF	Vehicle / ESA HV high voltage of vehicle or ESA
C2	1 µF (default value, if another value is used, it shall ~~to~~ be justified)	MEP measuring port
R_1	1 kΩ	GND ground
R_2	1 MΩ (discharging C_2 to > 50 V_{dc} within 60 s)"	

Paragraphs 4., 5., to 5.1., amend to read:

"4. Artificial Mains networks (AMN)

For a vehicle/ESA in charging mode connected to an AC power mains, a 50 µH / 50 Ω-AMN as defined in CISPR 16-1-2**, C**~~c~~lause 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/ESA. Therefore, a distinction between some specific signal/control port lines and/or wired network port lines (for example, control pilot line, CAN lines) is necessary.

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

AANs that are defined in **paragraphs** 5.1., 5.2., 5.3. and 5.4. **of this appendix** 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 auxiliary equipment (AE) used to simulate communication is defined in CISPR 16-1-2 Annex E**, C**~~c~~lause E.2 (T network circuit) (see example in Figure 8).

…"

Paragraph 5.3., amend to read:

"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~~**shall** be used as defined in Figure 10.

…"

Paragraph 5.4., amend to read:

"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~~**shall** be used as defined in Figure 11.

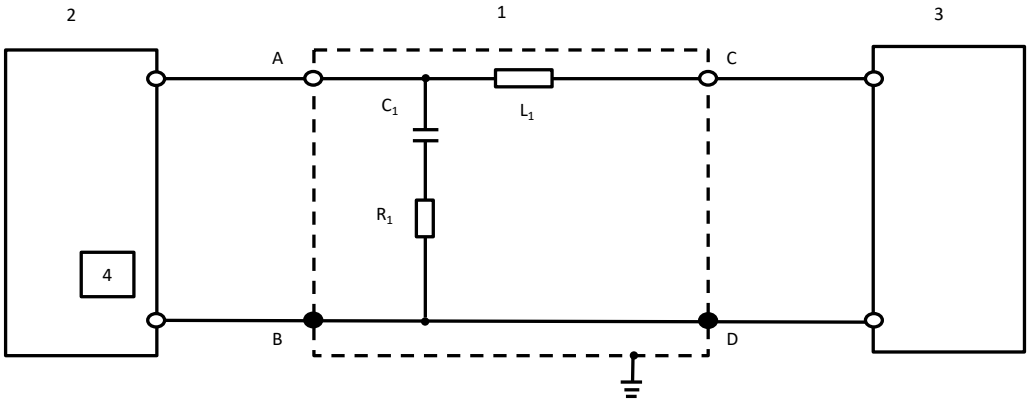
It provides a common mode impedance of 150 Ω ± 20 Ω (150 kHz to 30 MHz) on the control pilot line (between A and B/D).

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.

Figure 11
Example of AAN circuit for pilot line



Key

1 AAN	C_1 1,1 nF
2 ~~V~~**v**ehicle	L_1 100 µH
3 ~~C~~**c**harging station	A ~~C~~**c**ontrol pilot line (vehicle side)
4 ~~C~~**c**ontrol pilot (in vehicle)	B/D ~~P~~**p**rotective earth
R_1 150 Ω	C ~~C~~**c**ontrol pilot line (charging station side)

"

Annex 2B, title amend to read:

"Annex 2B

Information document for type approval of an electric/electronic sub-assembly (ESA) with respect to electromagnetic compatibility"

Annex 3A, title amend to read:

"Annex 3A

Communication concerning the approval or extension or refusal or withdrawal of approval or production definitively discontinued of a type of vehicle/component/separate technical unit with regard to Regulation No. 10"

Annex 3B, title amend to read:

"Annex 3B

Communication concerning the approval or extension or refusal or withdrawal of approval or production definitively discontinued of a type of electrical/electronic sub-assembly (ESA) with regard to Regulation No. 10"

Annex 4,

Paragraph 2.2., amend to read:

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

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

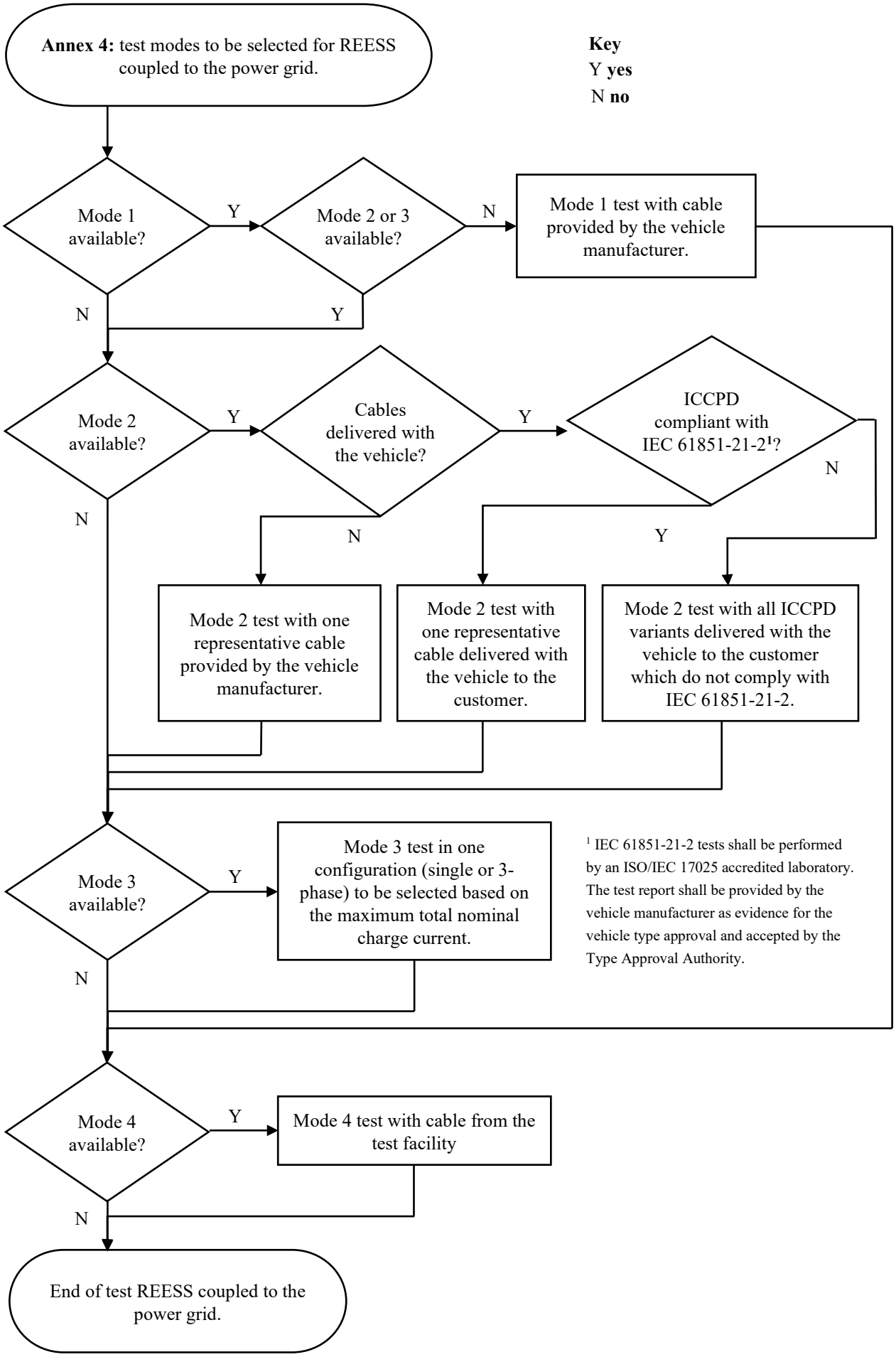

Annex 4: test modes to be selected for REESS coupled to the power grid.
Key
Y **yes**
N **no**
Mode 1 available?
Y
Mode 2 or 3 available?
N
Mode 1 test with cable provided by the vehicle manufacturer.
N
Y
Mode 2 available?
Y
Cables delivered with the vehicle?
Y
ICCPD compliant with IEC 61851-21-2[1]?
N
N
N
Y
Mode 2 test with one representative cable provided by the vehicle manufacturer.
Mode 2 test with one representative cable delivered with the vehicle to the customer.
Mode 2 test with all ICCPD variants delivered with the vehicle to the customer which do not comply with IEC 61851-21-2.
Mode 3 available?
Y
Mode 3 test in one configuration (single or 3-phase) to be selected based on the maximum total nominal charge current.
N
Mode 4 available?
Y
Mode 4 test with cable from the test facility
N
End of test REESS coupled to the power grid.
[1] IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

Figure 1
Charging mode configuration for Annex 4

In case of multiple batteries the average state of charge ~~must~~**shall** 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 **A**~~a~~nnex."

Paragraphs 2.3. to 2.3.3., renumber and amend to read:

"~~2.3.~~**2.2.1**. Vehicle in charging mode 1 or mode 2 (AC power charging without communication).

~~2.3.1.~~**2.2.1.1.** Charging station / Power mains

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

- The socket(s) shall be placed on the ground plane (ALSE) or floor (OTS);
- 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;
- The harness shall be placed as close as possible to the ground plane (ALSE) or floor (OTS).

~~2.3.2.~~**2.2.1.2.** Artificial network

Power mains shall be applied to the vehicle through 50 µH/50 Ω artificial networks (AMN(s)) (see ~~a~~**A**ppendix 8**,** ~~clause~~**paragraph** 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.~~**2.2.1.3.** Power charging harness

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

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

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

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

Paragraphs 2.4. to 2.4.4., renumber and amend to read:

"~~2.4.~~**2.2.2.** Vehicle in charging mode 3 (AC power charging with communication) or mode 4 (DC power charging with communication).

~~2.4.1.~~**2.2.2.1.** 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 AC 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:

- The socket(s) shall be placed on the ground plane (ALSE) or floor (OTS);
- 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;
- 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:

- The harness at charging station side shall hang vertically down to the ground plane (ALSE) or floor (OTS);
- 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.~~**2.2.2.2.** Artificial network

AC power mains shall be applied to the vehicle through 50 µH/50 Ω AMN(s) (see Appendix 8, ~~clause~~**paragraph** 4.).

DC power mains shall be applied to the vehicle through 5 µH/50 Ω High Voltage Artificial Networks (DC-charging-AN(s)) (see Appendix 8, ~~clause~~**paragraph** 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.~~**2.2.2.3.** 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~~**paragraph** 5.:

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

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

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

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

~~2.4.4.~~**2.2.2.4.** Power charging / local/private communication harness

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

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

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

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

Paragraph 3.1., amend to read:

"3.1. As an alternative to the requirements of CISPR 12 for vehicles of category L, the test surface may be any location that fulfils the conditions shown in ~~the~~ Figure **2** of the **A~~a~~**ppendix to this **A~~a~~**nnex. In this case the measuring equipment shall lie outside the part shown in Figure 1 of Appendix 1 to this **A~~a~~**nnex."

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 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."

Paragraph 4.3., Tables 1 and 2, amend to read:

"Table 1
Spectrum analyser parameters

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

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

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

Table 2
Scanning receiver parameters

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

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

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

Paragraph 4.6., amend to read:

"4.6. Antenna position

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

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

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

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

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

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

~~W~~**w**ith:

N: ~~N~~**n**umber of antenna positions;

D: ~~M~~**m**easurement 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: ~~T~~**t**otal vehicle length covers the whole dimensions including tires, bumpers and lights, etc.

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

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

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

Annex 5,

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A**~~a~~nnex shall only be applied to vehicles. This method concerns only the configuration of the vehicle other than "REESS charging mode coupled to the power grid

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 **A**~~a~~nnex**,** the test shall be performed according to CISPR 12."

Paragraph 2.1., amend to read:

"2.1. The ignition switch shall be switched on. The engine shall not be operating.

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

Paragraph 4.3., Tables 1 and 2, amend to read:

"Table 1
Spectrum analyser parameters

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

Frequency range MHz	***Average detector***	
	RBW at -3 dB	***Minimum scan time***
30 to 1,000	**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*~~		
	~~*BW at -6 dB*~~	~~*Maximum step size*[a]~~	~~*Minimum dwell time*~~	~~*BW at -6 dB*~~	~~*Maximum step size*[a]~~	~~*Minimum dwell time*~~
~~30 to 1,000~~	~~120 kHz~~	~~60 kHz~~	~~5 ms~~	~~120 kHz~~	~~60 kHz~~	~~1 s~~

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

"

Paragraph 4.6., amend to read:

"4.6. Antenna position

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

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

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

- if the length of the vehicle is smaller than the 3 dB beamwidth of the antenna, only one antenna position is necessary. The antenna shall be aligned with the middle of the total vehicle (see Figure 1)

- If the length of the vehicle is greater than the 3 dB beamwidth of the antenna, multiple antenna positions are necessary in order to cover the total length of the vehicle (see Figure 2). The number of antenna positions shall allow to meet the following condition-:

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

~~W~~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 covers the whole dimensions including tires, bumpers and lights, etc.

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

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

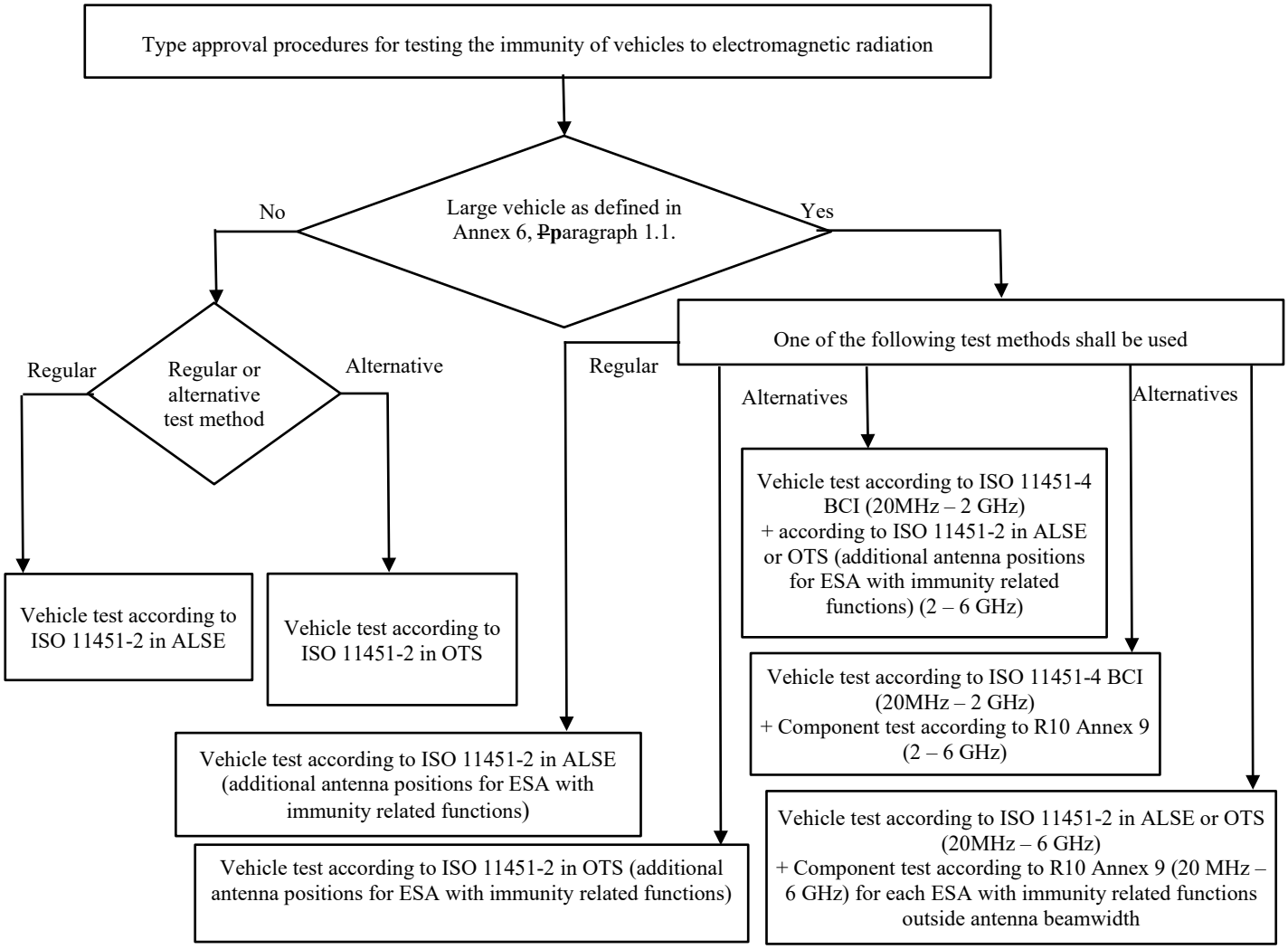
if N>1 (more than one antenna position is necessary) ~~,and~~ multiple antenna positions are necessary in order to cover the total length of the vehicle (see

Figure 2). The antenna positions shall be symmetric in regard to the vehicle perpendicular axis."

Annex 6,

paragraph 1.4., Figure 1, amend to read:

"Figure 1



"

Paragraph 2., amend to read:

"2. Vehicle state during tests

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

Paragraph 2.1.3., amend to read:

"2.1.3. Only non-perturbing equipment shall be used while monitoring the vehicle. The vehicle exterior and the passenger compartment shall be monitored to determine whether the requirements of this ~~A~~annex are met (e.g. by using (a) video camera(s), a microphone, etc.)."

Paragraph 2.2.1.1., amend to read:

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

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of ~~f~~**F**igure 2**.**

…"

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.

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

"

Paragraphs 2.2.2. and 2.2.3., amend to read:

"2.2.2. Only non-perturbing equipment shall be used while monitoring the vehicle. The vehicle exterior and the passenger compartment shall be monitored to determine whether the requirements of this **A**~~a~~nnex are met (e.g. by using (a) video camera(s), a microphone, etc.).

2.2.3. The test set-up for the connection of the vehicle in configuration "REESS charging mode coupled to the power grid" is shown in Figures 4a to 4h (depending of AC or DC power charging mode, location of charging plug and charging with or without communication) of Appendix 1 to this **A**~~a~~nnex."

Paragraphs 2.3.2. and 2.3.3., amend to read:

"2.3.2. Artificial network

Power mains shall be applied to the vehicle through 50 µH/50 Ω artificial networks (AMN(s)) (see ~~a~~**A**ppendix 8, ~~clause~~**paragraph** 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 5a and Figure 5c). The projected

harness length from the side of the AMN(s) to the side of the vehicle shall be 0,8 (+0,2 / -0) m as shown in Figure 5b and Figure 5d.

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

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

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

Paragraphs 2.4.2. to 2.4.4., amend to read:

"2.4.2. Artificial network

AC power mains shall be applied to the vehicle through 50 µH/50 Ω AMN(s) (see Appendix 8, ~~clause~~**paragraph** 4.).

DC power mains shall be applied to the vehicle through 5 µH/50 Ω High Voltage Artificial Networks (DC-charging-AN(s)) (see Appendix 8, ~~clause~~**paragraph** 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~~**paragraph** 5.:

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

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

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

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

2.4.4. Power charging / local/private communication harness

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

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

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

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

Paragraph 3.1., amend to read:

"3.1. For the purposes of this **A**~~a~~nnex, the reference point is the point at which the field strength shall be established and shall be defined as follows:"

Paragraphs 3.3.4. and 3.3.5., amend to read:

"3.3.4. Either at 1.0 ± 0.2 m behind the vertical centreline of the vehicle's front wheel (s) (point C in Figure 1 of Appendix 1 to this **A**~~a~~nnex) in the case of three-wheeled vehicles or four-wheeled vehicles.

Or at 0.2 ± 0.2 m behind the vertical centreline of the vehicle's front wheel (point D in Figure 2 of Appendix 1 to this **A**~~a~~nnex) in the case of two-wheeled vehicles.

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 **A**~~a~~nnex."

Paragraph 4.1., amend to read:

"4.1. Frequency range, dwell times, polarization.

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

The test signal modulation shall be:

(a) AM (amplitude modulation), with 1 kHz modulation and 80 per cent modulation depth in the 20 to 400 MHz frequency range; and

(b) PM2 (pulse modulation type 2), T~~on~~$_{on}$ 3 µs, period 3,333 µs in the 2,700 to 3,100 MHz frequency range; and

(c) PM3 (pulse modulation type 3), T~~on~~$_{on}$ 500 µs, period 1,000 µs in the 380 to 2,700 MHz and the 3,100 to 6,000 MHz frequency ranges."

Paragraph 5.1.2., amend to read:

"5.1.2. Calibration

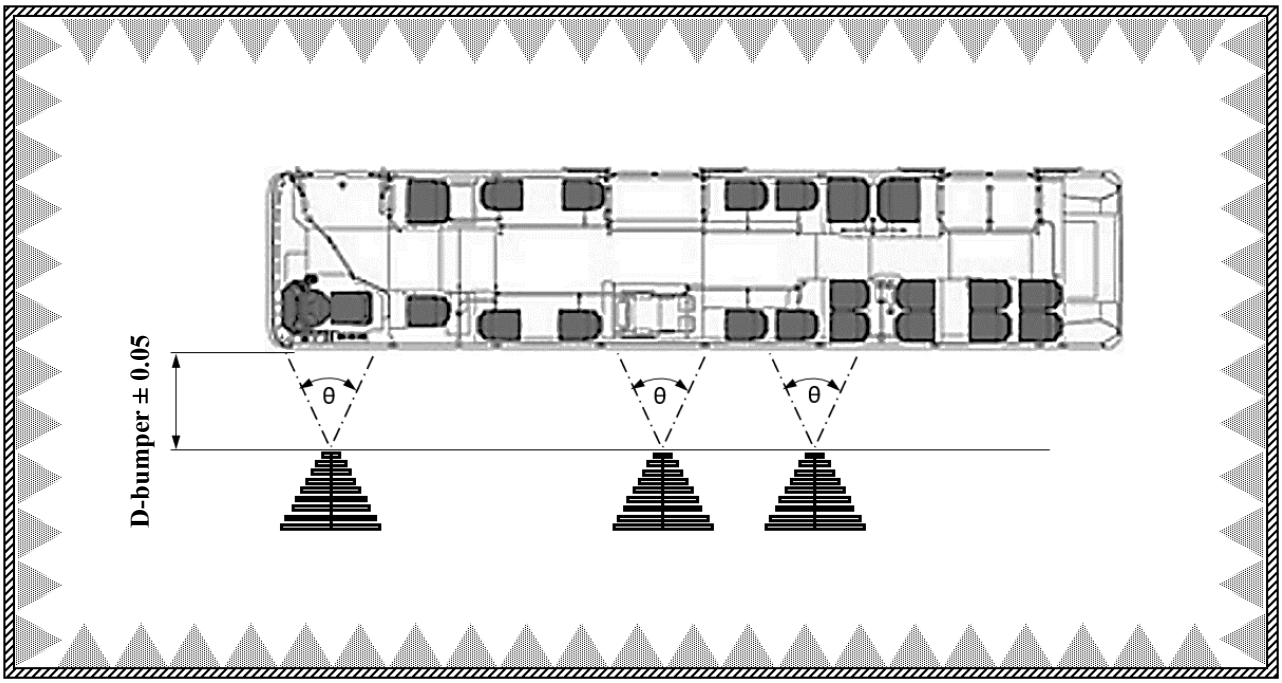
For TLS ~~one~~**four horizontal** field probe**s** ~~at the vehicle reference point~~ shall be used.

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

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

Dimensions in metres



Key
θ 3 dB antenna beamwidth

D-**bumper** 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 7,

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A~~a~~**nnex may be applied to ESAs, which may be subsequently fitted to vehicles, which comply with Annex 4.

This method concerns both kinds of ESA:

(a) Other ESAs than involved in "REESS charging mode coupled to the power grid".

(b) ESAs involved in "REESS charging mode coupled to the power grid.

1.2. Test method

This test is intended to measure broadband electromagnetic emissions from ESAs (e.g. ignition systems, electric motor, onboard battery charging unit, etc.).

If not otherwise stated in this **A~~a~~**nnex**,** the test shall be performed according CISPR 25."

Paragraphs 3.1. to 3.2., amend to read:

"3.1. For ESA other than involved in "REESS charging mode coupled to the power grid" the test shall be performed according to the ALSE method described in ~~paragraph~~**Clause** 6.4~~.~~ of CISPR 25.

3.2. For ESAs in configuration "REESS charging mode coupled to the power grid" the test arrangement shall be according to Figure 2 of the appendix to this **A**~~a~~nnex."

Paragraph 3.2.2., amend to read:

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

DC HV supply shall be applied to the ESA via a 5 µH/50 Ω HV-AN (see Appendix 8**,** ~~clause~~**paragraph** 2.).

AC supply shall be applied to the ESA via a 50 µH/50 Ω AMN (see Appendix 8**,** ~~clause~~**paragraph** 4.)."

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 **A**~~a~~nnex). "

Paragraph 4.3., Tables 1 and 2, amend to read:

"Table 1
Spectrum analyser parameters

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

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

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

Table 2
Scanning receiver parameters

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

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

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

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

Paragraph 4.4., amend to read:

"4.4. Measurements

Unless otherwise specified**,** the configuration with the LV harness closer to the antenna shall be tested.

The phase centre of the antenna shall be in line with the centre of the longitudinal part of the wiring harnesses for frequencies up to 1,000 MHz.

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

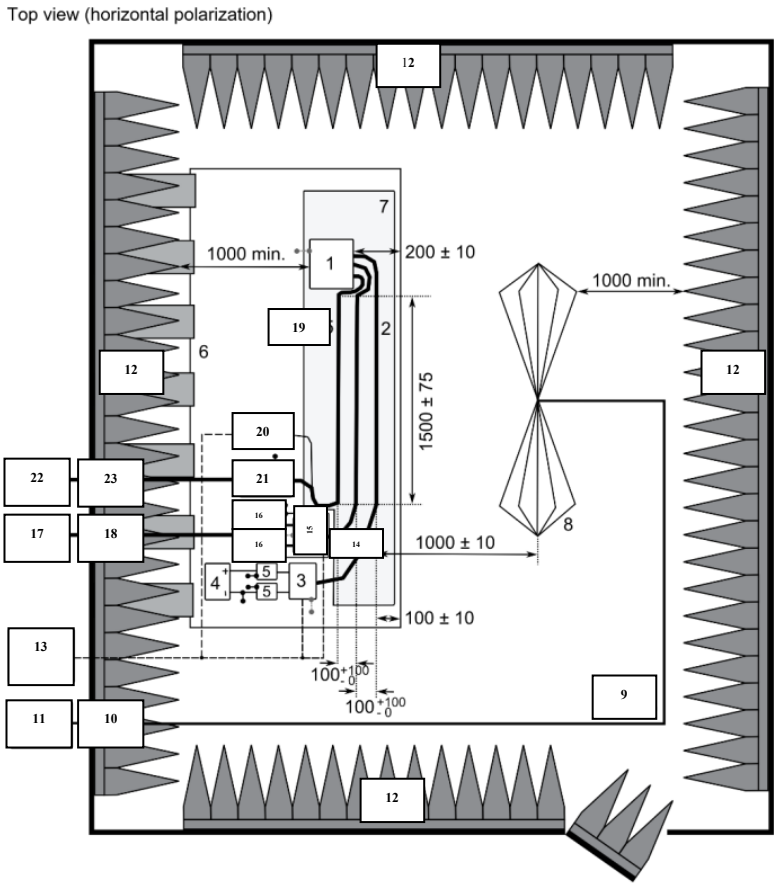
Alternatively, if the manufacturer provides measurement to data for the whole frequency band from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type Approval Authority, the Technical Service may divide the frequency range in 14 frequency bands 30–34, 34–45, 45–60,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

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

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



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~~**Clause** 6.4.2.5)
4 power supply (location optional)
5 LV Artificial network (AN)
6 ground plane (bonded to shielded enclosure)
7 low relative permittivity support ($\varepsilon_r \leq 1.4$)
8 biconical antenna
9 high-quality coaxial cable e.g. double-shielded (50 Ω)
10 bulkhead connector
11 measuring instrument
12 RF absorber material
13 stimulation and monitoring system
14 HV harness
15 HV load simulator
16 HV AN
17 HV power supply
18 HV feed-through
19 AC/DC charger harness
20 AC/DC load simulator (e.g. Programmable Logic Controller (PLC))
21 AMN(s) or DC-charging-AN(s)
22 AC/DC power supply
23 AC/DC feed-through"

Annex 8,

Title, amend to read:

"Annex 8

Method of measurement of radiated narrowband electromagnetic emissions from electrical/electronic sub-assemblies (ESAs)"

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A**~~a~~nnex may be applied to ESAs, which may be subsequently fitted to vehicles, which comply, with Annex 5.

This method concerns only ESA other than those involved in "REESS charging mode coupled to the power grid".

1.2. Test method

This test is intended to measure the narrowband electromagnetic emissions such as might emanate from a microprocessor-based system.

If not otherwise stated in this **A**~~a~~nnex the test shall be performed according to CISPR 25."

Paragraphs 4.3., Tables 1 and 2, amend to read:

"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~~

Frequency range MHz	***Average detector***	
	RBW at -3 dB	***Minimum scan time***
30 to 1,000	**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 step size*~~	~~*Minimum dwell time*~~	~~*BW at -6 dB*~~	~~*Maximum step size*~~	~~*Minimum dwell time*~~
~~30 to 1,000~~	~~120 kHz~~	~~60 kHz~~	~~5 ms~~	~~120 kHz~~	~~60 kHz~~	~~5 ms~~

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

"

Paragraph 4.4., amend to read:

"4.4. Measurements

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

Alternatively, if the manufacturer provides measurement to data for the whole frequency band from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type Approval Authority, the Technical Service may divide the frequency range in 14 frequency bands 30–34, 34–45, 45–60, 60–80, 80–100, 100–130, 130–170, 170–225, 225–300, 300–400, 400–525, 525–700, 700–850 and 850–1,000 MHz and perform tests at the 14 frequencies giving the highest emission levels within each band to confirm that the ESA meets the requirements of this **A**~~a~~nnex. In the event that the limit is exceeded during the test, investigations shall be made to ensure that this is due to the ESA and not to background radiation including broadband radiation from the ESA."

Annex 9,

Title, amend to read:

"Annex 9

Method(s) of testing for immunity of electrical/electronic sub-assemblies (ESAs) to electromagnetic radiation"

Paragraph 1.1., amend to read:

"1.1. The test method(s) described in this **A**~~a~~nnex applies to ESAs. "

Paragraph 2.1., amend to read:

"2.1. The test conditions shall be according **to** ISO 11452-1."

Paragraph 2.3., amend to read:

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

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

"

Paragraph 3.1., amend to read:

"3.1. Frequency range, dwell times

Measurements shall be made in the 20 to 6,000 MHz frequency range with frequency steps according to ISO 11452-1.

The test signal modulation shall be:

(a) AM (amplitude modulation), with 1 kHz modulation and 80 per cent modulation depth in the 20 to 400 MHz frequency range; and

(b) PM2 (pulse modulation type 2), T~~on~~$_{on}$ 3 µs, period 3,333 µs in the 2,700 to 3,100 MHz frequency range; and

(c) PM3 (pulse modulation type 3), T~~on~~$_{on}$ 500 µs, period 1,000 µs in the 380 to 2,700 MHz and the 3,100 to 6,000 MHz frequency ranges.

If not otherwise agreed between Technical Service and ESA manufacturer.

Frequency step size and dwell time shall be chosen according to ISO 11452-1."

Paragraph 3.3., amend to read:

"3.3. If an ESA fails the tests defined in this **A**~~a~~nnex, it shall be verified as having failed under the relevant test conditions and not as a result of the generation of uncontrolled fields."

Paragraphs 4.1.2. to 4.1.2.1., amend to read:

"4.1.2. Test methodology

The "substitution method" shall be used to establish the test field conditions according **to** ISO 11452-2.

The test shall be performed with vertical polarization.

4.1.2.1. For ESAs in configuration "REESS charging mode coupled to the power grid" the test arrangement shall be according to Appendix 3 to this **A**~~a~~nnex."

Paragraph 4.2.2., amend to read:

"4.2.2. Test methodology

The test shall be performed according **to** ISO 11452-3.

Depending on the ESA to be tested the Technical Service shall chose the method of maximum field coupling to the ESA or to the wiring harness inside the TEM-cell."

Paragraph 4.3.2.1., amend to read:

"4.3.2.1. For ESAs in configuration "REESS charging mode coupled to the power grid", an example of test arrangement (for substitution method) is given in Appendix 3 to this Annex (~~f~~**F**igure 1 for substitution method and ~~f~~**F**igure 2 for closed loop method)."

Paragraph 4.5.2., amend to read:

"4.5.2. Test methodology

The test shall be performed according **to** ISO 11452-11.

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

Annex 9, Appendix 3, Keys of Figure 1,-amend to read:

"

Key

1	ESA	14	additional shielded box
2	ground plane	15	HV power supply (should be shielded if placed inside ALSE)
3	low relative permittivity support ($\varepsilon_{r} \leq 1{,}4$); 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	AC lines
12	HV supply lines	25	AMN for AC power mains
13	LV power supply 12 V / 24 V / 48 V (should be placed on the bench)	26	AC charging load simulator

"

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

"

Key

1	ESA	15	HV power supply (should be shielded if placed inside ALSE)
2	ground plane	16	power line filter
3	low relative permittivity support ($\varepsilon_{r} \leq 1{,}4$); 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,

Title, amend to read:

"Annex 10

Method(s) of testing for immunity to and emission of transients of electrical/electronic sub-assemblies (ESAs)"

Paragraphs 2. and 3., amend to read:

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

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

Apply the ~~test pulses 4~~**starting profile** according to the International Standard ISO ~~7637-2:2004~~**16750-2** 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~~**starting profile**.

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

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

Annex 11,

Title, amend to read:

"Annex 11

Method(s) of testing for emission of harmonics generated on AC power lines from vehicles"

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A**~~a~~nnex shall be applied to vehicles in configuration "REESS charging mode coupled to the power grid"

1.2. Test method

This test is intended to measure the level of harmonics generated by vehicle in configuration "REESS charging mode coupled to the power grid" through its AC power lines in order to ensure it is compatible with residential, commercial and light industrial environments.

If not otherwise stated in this **A**~~a~~nnex the test shall be performed according to:

(a) IEC 61000-3-2 for input current in charging mode ≤ 16 A per phase for class A equipment;

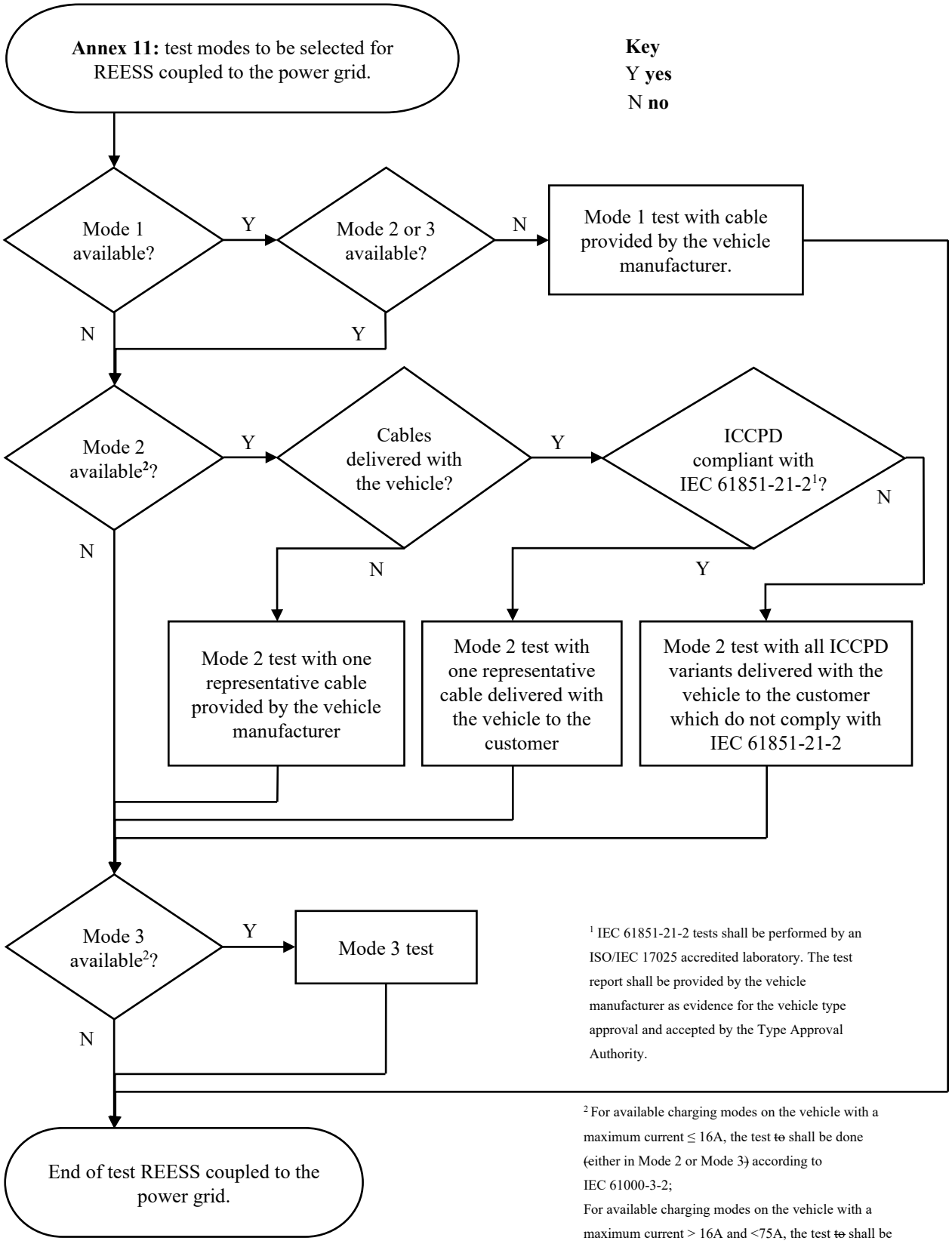
(b) IEC 61000-3-12 for input current in charging mode > 16 A and ≤ 75 A per phase."

Paragraph 2.1., amend to read:

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

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

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of ~~f~~**F**igure 1**.**



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

[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.

Figure 1
Charging mode configuration for Annex 11

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

In case of multiple batteries the average state of charge ~~musts~~**shall** be considered.

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

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

Paragraph 3.2., 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 **A**~~a~~nnex."

Paragraph 4.5., amend to read:

"4.5. For three-phase "REESS charging mode coupled to the power grid" with input current > 16 A and ≤ 75 A per phase, when at least one of the three conditions a), b) or c) described in ~~paragraph~~**Clause** 5.2.~~.~~ of IEC 61000-3-12 is fulfilled, then the limits given in Table 7 of paragraph 7.3.2.2. of this Regulation can be applied."

Annex 12,

Title, amend to read:

"Annex 12

Method(s) of testing for emission of voltage changes, voltage fluctuations and flicker on AC power lines from vehicles"

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A**~~a~~nnex shall be applied to vehicles in configuration "REESS charging mode coupled to the power grid".

1.2. Test method

This test is intended to measure the level of voltage changes, voltage fluctuations and flicker generated by vehicle in configuration "REESS charging mode coupled to the power grid" through its AC power lines in order to ensure it is compatible with residential, commercial and light industrial environments.

If not otherwise stated in this **A**~~a~~nnex the test shall be performed according to:

(a) IEC 61000-3-3 for rated current in "REESS charging mode" ≤ 16 A per phase and not subjected to conditional connection;

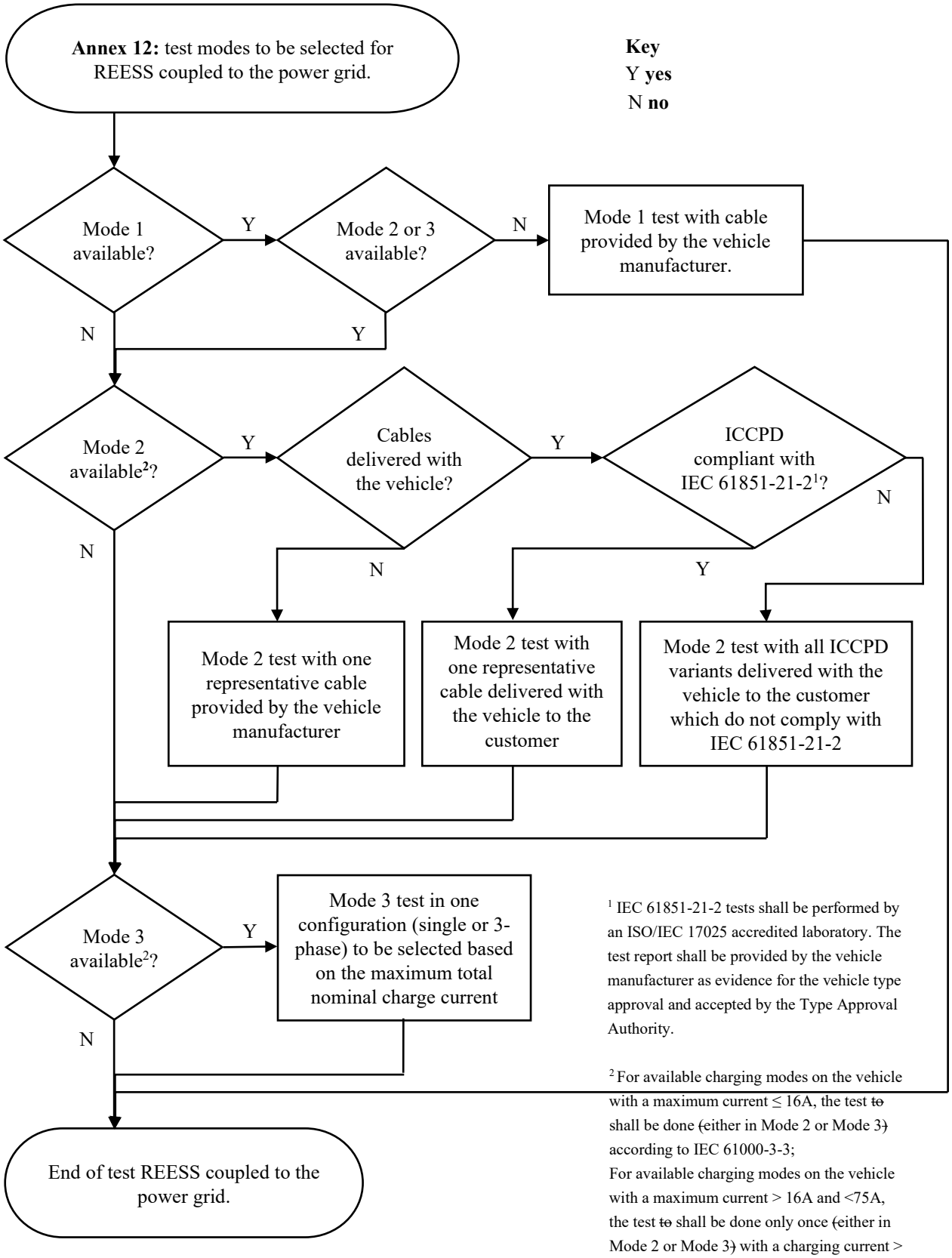
(b) IEC 61000-3-11 for rated current in "REESS charging mode" > 16 A and ≤ 75 A per phase and subjected to conditional connection."

Paragraph 2.1., amend to read:

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

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

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of ~~f~~**F**igure 1**.**



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

[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.

Figure 1
Charging mode configuration for Annex 12

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

In case of multiple batteries the average state of charge ~~musts~~**shall** be considered.

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

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

Paragraphs 3.1. to 3.3., 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~~**Clause** 6.~~.~~ of IEC 61000-3-3.

3.2. The tests for vehicle in configuration "REESS charging mode coupled to the power grid" with rated current > 16 A and ≤ 75 A per phase and subjected to conditional connection shall be performed according to ~~paragraph~~**Clause** 6.~~.~~ of IEC 61000-3-11.

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 of Appendix 1 to this **A**~~a~~nnex."

Annex 13,

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A**~~a~~nnex shall be applied to vehicles in configuration "REESS charging mode coupled to the power grid".

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 AC or DC power lines in order to ensure it is compatible with residential, commercial and light industrial environments.

If not otherwise stated in this **A**~~a~~nnex the test shall be performed according to CISPR 16-2-1."

Paragraph 2.1., amend to read:

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

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

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of ~~f~~**F**igure 1**.**

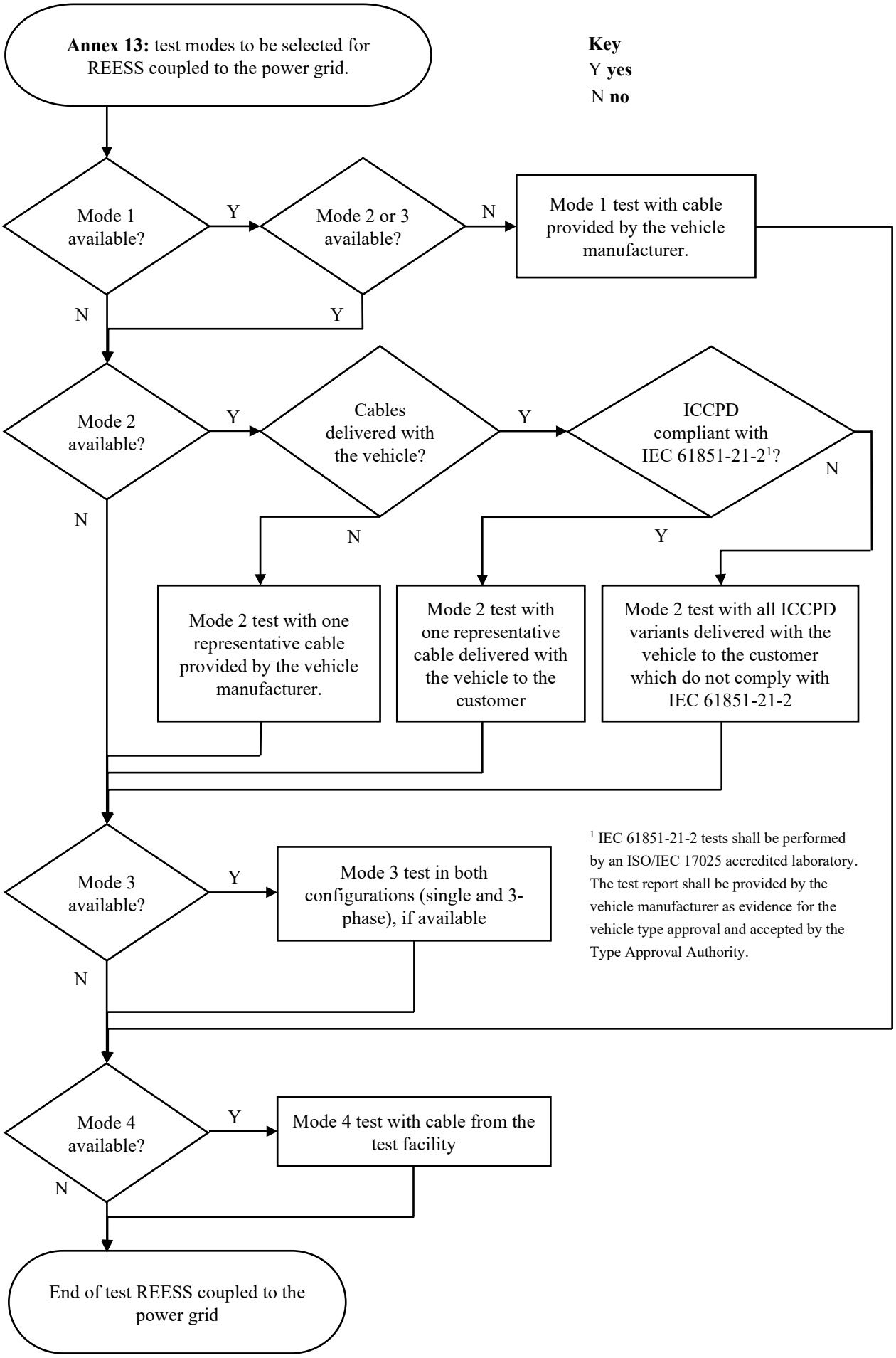

Annex 13: test modes to be selected for REESS coupled to the power grid.
Key
Y **yes**
N **no**
Mode 1 available?
Y
Mode 2 or 3 available?
N
Mode 1 test with cable provided by the vehicle manufacturer.
N
Y
Mode 2 available?
Y
Cables delivered with the vehicle?
Y
ICCPD compliant with IEC 61851-21-2[1]?
N
N
N
Y
Mode 2 test with one representative cable provided by the vehicle manufacturer.
Mode 2 test with one representative cable delivered with the vehicle to the customer
Mode 2 test with all ICCPD variants delivered with the vehicle to the customer which do not comply with IEC 61851-21-2
Mode 3 available?
Y
Mode 3 test in both configurations (single and 3-phase), if available
N
Mode 4 available?
Y
Mode 4 test with cable from the test facility
N
End of test REESS coupled to the power grid
[1] IEC 61851-21-2 tests shall be performed by an ISO/IEC 17025 accredited laboratory. The test report shall be provided by the vehicle manufacturer as evidence for the vehicle type approval and accepted by the Type Approval Authority.

Figure 1
Charging mode configuration for Annex 13

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

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

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

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

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

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

Paragraph 3.1., amend to read:

"3.1. The test shall be performed according to ~~paragraph~~**Clause** 7.4.1~~.~~ of CISPR 16-2-1 as floor-standing equipment."

Paragraphs 3.3. and 3.4., amend to read:

"3.3. The artificial network(s) to be used for the measurement on vehicle are

(a) The AMN(s) defined in Appendix 8**,** ~~clause~~**paragraph** 4**.** for AC power lines;

(b) The DC-charging-AN(s) defined in Appendix 8**,** ~~clause~~**paragraph** 3. for DC power lines.

Artificial networks

The AMN(s)/DC-charging-AN(s) shall be mounted directly on the ground plane. The cases of the 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 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 AMN(s)/DC-charging-AN(s) shall be placed as defined in Figures 1a to 1d. of Appendix 1 to this **A**~~a~~nnex.

3.4. The test set-up for the connection of the vehicle in configuration "REESS charging mode coupled to the power grid" is shown in Figure 1a to 1d of Appendix 1 to this **A**~~a~~nnex."

Annex 15,

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A**~~a~~nnex shall only be applied to vehicles. This method concerns only the configuration of the vehicle with "REESS charging mode coupled to the power grid".

1.2. Test method

This test is intended to demonstrate the immunity of the vehicle electronic systems. The vehicle shall be subject to electrical fast transient/burst disturbances conducted along AC and DC power lines of the vehicle as described in this **A~~a~~**nnex. The vehicle shall be monitored during the tests.

If not otherwise stated in this **A~~a~~**nnex**,** the test shall be performed according to IEC 61000-4-4."

Paragraph 2., amend to read:

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

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of ~~f~~**F**igure 1**.**

…"

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.

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

"

Paragraph 2.2., amend to read:

"2.2. Only non-perturbing equipment shall be used while monitoring the vehicle. The vehicle exterior and the passenger compartment shall be monitored to determine whether the requirements of this **A~~a~~**nnex are met (e.g. by using (a) video camera(s), a microphone, etc.)."

Paragraphs 3.2. and 3.3., amend to read:

"3.2. The transient/burst generator shall meet the condition defined in ~~paragraph~~**Clause** 6.1~~.~~ of IEC 61000-4-4.

3.3. The Coupling/Decoupling Network shall meet the condition defined in ~~paragraph~~**Clause** 6.2~~.~~ of IEC 61000-4-4. When the Coupling/Decoupling Network cannot be used on AC or DC power lines, the capacitive coupling clamp defined in ~~paragraph~~**Clause** 6.3~~.~~ of IEC 61000-4-4 can be used."

Paragraphs 4.1. to 4.3., amend to read:

"4.1. The vehicle test setup is based on the laboratory type setup as described in ~~paragraph~~**Clause** 7.2~~.~~ of IEC 61000-4-4.

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

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

4.3. The Technical Service shall perform the test as specified in paragraph 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 **A~~a~~**nnex."

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 Figure 1a to 1d of Appendix 1 to this **A~~a~~**nnex.

The test set-up shall be noted in the test report."

Annex 16,

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A~~a~~**nnex shall only be applied to vehicles. This method concerns only the configuration of the vehicle with "REESS charging mode coupled to the power grid".

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 **A~~a~~**nnex. The vehicle shall be monitored during the tests.

If not otherwise stated in this **A~~a~~**nnex**,** the test shall be performed according to IEC 61000-4-5**, Clause 4.2** for lightning transients ~~(clause 4.2)~~**.**"

Paragraph 2., amend to read:

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

The vehicle shall be tested in the charging mode configuration (if available on vehicle) as defined in flowchart of ~~f~~**F**igure 1**.**

…"

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.

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

"

Paragraph 2.2., amend to read:

"2.2. Only non-perturbing equipment shall be used while monitoring the vehicle. The vehicle exterior and the passenger compartment shall be monitored to determine whether the requirements of this **A**~~a~~nnex are met (e.g. by using (a) video camera(s), a microphone, etc.)."

Paragraphs 3.2. and 3.3., amend to read:

"3.2. The surge generator shall meet the condition defined in ~~paragraph~~**Clause** 6.1.~~.~~ of IEC 61000-4-5.

3.3. The Coupling/Decoupling Network shall meet the condition defined in ~~paragraph~~**Clause** 6.3.~~.~~ of IEC 61000-4-5."

Paragraphs 4.1. to 4.3., amend to read:

"4.1. The vehicle test setup is based on the setup described in ~~paragraph~~**Clause** 7.2.~~.~~ of IEC 61000-4-5.

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

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

4.3. The Technical Service shall perform the test as specified in paragraph 7.9.2.1. 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 **A**~~a~~nnex."

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 **A**~~a~~nnex,

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

Paragraph 6., amend to read:

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

Annex 17,

Title, amend to read:

"Annex 17

Method(s) of testing for emission of harmonics generated on AC power lines from ~~an~~electrical/electronic sub-assemblies (ESAs)"

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A~~a~~**nnex shall be applied to ESAs in configuration "REESS charging mode coupled to the power grid"**.**

1.2. Test method

This test is intended to measure the level of harmonics generated by an ESA in configuration "REESS charging mode coupled to the power grid" through its AC power lines in order to ensure it is compatible with residential, commercial and light industrial environments.

If not otherwise stated in this **A~~a~~**nnex the test shall be performed according to:

(a) IEC 61000-3-2 for input current in charging mode ≤ 16 A per phase for class A equipment;

(b) IEC 61000-3-12 for input current in charging mode > 16 A and ≤ 75 A per phase."

Paragraphs 3.2. and 3.3., amend to read:

"3.2. The test set-up for single phase ESA in configuration "REESS charging mode coupled to the power grid" is shown in Figure 1 of Appendix 1 to this **A~~a~~**nnex.

3.3. The test set-up for three-phase ESA in configuration "REESS charging mode coupled to the power grid" is shown in Figure 2 of Appendix 1 to this **A~~a~~**nnex."

Paragraphs 4.4. and 4.5., 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 Table 14 of **paragraph** 7.11.2.2. of this Regulation.

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

Annex 18,

Title, amend to read:

"Annex 18

Method(s) of testing for emission of voltage changes, voltage fluctuations and flicker on AC power lines from ~~an~~electrical/electronic sub-assemblies (ESAs)"

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A~~a~~**nnex shall be applied to ESAs in configuration "REESS charging mode coupled to the power grid"**.**

1.2. Test method

This test is intended to measure the level of voltage changes, voltage fluctuations and flicker generated by ESA in configuration "REESS charging mode coupled to the power grid" through its AC power lines in order to ensure it is compatible with residential, commercial and light industrial environments.

If not otherwise stated in this **A~~a~~**nnex the test shall be performed according to:

(a) IEC 61000-3-3 for rated current in "REESS charging mode" ≤ 16 A per phase and not subjected to conditional connection;

(b) IEC 61000-3-11 for rated current in "REESS charging mode" > 16 A and ≤ 75 A per phase and subjected to conditional connection"

Paragraphs 3.1. to 3.3., amend to read:

"3.1. The tests for ESA 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~~**Clause** ~~4.~~ of IEC 61000-3-3.

3.2. The tests for ESA in configuration "REESS charging mode coupled to the power grid" with rated current > 16 A and ≤ 75 A per phase and subjected to conditional connection shall be performed according to ~~paragraph~~**Clause** ~~6.~~ of IEC 61000-3-11.

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

Annex 19,

Title, amend to read:

"Annex 19

Method(s) of testing for emission of radiofrequency conducted disturbances on AC or DC power lines from ~~an~~electrical/electronic sub-assemblies (ESAs)"

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A~~a~~**nnex shall be applied to ESAs in configuration "REESS charging mode coupled to the power grid".

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 AC or DC power lines in order to ensure it is compatible with residential, commercial and light industrial environments.

If not otherwise stated in this **A**~~a~~nnex the test shall be performed according to CISPR 16-2-1."

Paragraph 3.1., amend to read:

"3.1 The artificial-network(s) to be used for the measurement on vehicle are

(a) The AMN(s) defined in Appendix 8**,** ~~clause~~**paragraph 4.** for AC power lines;

(b) The DC-charging-AN(s) defined in Appendix 8**,** ~~clause~~**paragraph 3.** for DC power lines.

Artificial networks

The AMN(s)/DC-charging-AN(s) shall be mounted directly on the ground plane. The cases of the 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 AMN/DC-charging-AN. The measuring port of the AMN/DC-charging-AN inserted in the other power lines shall be terminated with a 50 Ω load.

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

CISPR 16-1-4 may be used."

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 **A**~~a~~nnex."

Paragraph 3.4., Tables 1 and 2, amend to read:

"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~~

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 step size*~~	~~*Minimum dwell time*~~	~~*BW at -6 dB*~~	~~*Maximum step size*~~	~~*Minimum dwell time*~~	~~*BW at -6 dB*~~	~~*Maximum Step size*~~	~~*Minimum dwell time*~~
~~0.15 to 30~~	~~9 kHz~~	~~5 kHz~~	~~50 ms~~	~~9 kHz~~	~~5 kHz~~	~~1 s~~	~~9 kHz~~	~~5 kHz~~	~~50 ms~~

Frequency range MHz	***Peak detector***			***Quasi-peak detector***			***Average detector***		
	BW at -6 dB	***Maximum step size***	***Minimum dwell time***	***BW at -6 dB***	***Maximum step size***	***Minimum dwell time***	***BW at -6 dB***	***Maximum 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 21,

Title, amend to read:

"Annex 21

Method of testing for immunity of ~~an~~electrical/electronic sub-assemblies (ESAs) to ~~E~~electrical ~~F~~fast ~~T~~transient/~~B~~burst disturbances conducted along AC and DC power lines"

Paragraphs 1.1.and 1.2., amend to read:

"1.1. The test method described in this **A~~a~~**nnex shall only be applied to ESAs. This method applies only to ESA in configuration "REESS charging mode coupled to the power grid".

1.2. Test method

This test is intended to demonstrate the immunity of the ESA. The ESA shall be subject to Electrical Fast Transient/Burst disturbances conducted along AC and DC power lines of the ESA as described in this annex. The ESA shall be monitored during the tests.

If not otherwise stated in this **A~~a~~**nnex the test shall be performed according to IEC 61000-4-4."

Paragraph 2.2., amend to read:

"2.2. Only non-perturbing equipment shall be used while monitoring the ESA. The ESA shall be monitored to determine whether the requirements of this **A~~a~~**nnex are met (e.g. by using (a) video camera(s), a microphone, etc.)."

Paragraphs 3.2. and 3.3., amend to read:

"3.2. The transient/burst generator shall meet the condition defined in ~~paragraph~~**Clause** 6.1~~.~~ of IEC 61000-4-4.

3.3. The Coupling/Decoupling Network shall meet the condition defined in ~~paragraph~~**Clause** 6.2~~.~~ of IEC 61000-4-4. When the Coupling/Decoupling Network cannot be used on AC or DC power lines, the capacitive coupling clamp defined in ~~paragraph~~**Clause** 6.3~~.~~ of IEC 61000-4-4 can be used."

Paragraph 4.1., amend to read:

"4.1. The ESA test setup is based on the laboratory type set-up as described in ~~paragraph~~**Clause** 7.2~~.~~ of IEC 61000-4-4."

Paragraph 4.3., amend to read:

"4.3. The Technical Service shall perform the test as specified in paragraph 7.15.2.1. 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 ESA meets the requirements of this **A~~a~~**nnex."

Paragraph 5.1.2., amend to read:

"5.1.2. Test phase

The ESA shall be positioned on the ground plane. The Electrical Fast Transient/Burst (EFT/B) shall be applied on the ESA on the AC/DC power lines in common modes by using CDN as described in Figure 1 of Appendix 1 to this **A~~a~~**nnex.

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

Annex 22,

Title, amend to read:

"Annex 22

Method of testing for immunity of electrical/electronic sub-assemblies (ESAs) to surges conducted along AC and DC power lines"

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this **A~~a~~**nnex shall only be applied to ESAs. This method applies only to ESAs in configuration "REESS charging mode coupled to the power grid".

1.2. Test method

This test is intended to demonstrate the immunity of the ESA. The ESA shall be subject to surges conducted along AC and DC power lines of the ESA as described in this **A~~a~~**nnex. The ESA shall be monitored during the tests.

If not otherwise stated in this **A~~a~~**nnex the test shall be performed according to IEC 61000-4-5."

Paragraph 2.2., amend to read:

"2.2. Only non-perturbing equipment shall be used while monitoring the ESA. The ESA shall be monitored to determine whether the requirements of this **A~~a~~**nnex are met (e.g. by using (a) video camera(s), a microphone, etc.)."

Paragraphs 3.2. and 3.3., amend to read:

"3.2. The surge generator shall meet the condition defined in ~~paragraph~~**Clause** 6.1~~.~~ of IEC 61000-4-5.

3.3. The Coupling/Decoupling Network shall meet the condition defined in ~~paragraph~~**Clause** 6.3~~.~~ of IEC 61000-4-5."

Paragraph 4.1., amend to read:

"4.1. The ESA test set-up is based on the set-up described in ~~paragraph~~**Clause** 7.2~~.~~ of IEC 61000-4-5."

Paragraph 4.3., amend to read:

"4.3. The Technical Service shall perform the test as specified in paragraph 7.16.2.1. 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 ESA meets the requirements of this **A~~a~~**nnex."

Paragraph 5.1.2., amend to read:

"5.1.2. Test phase

The ESA shall be positioned on the ground plane. The electrical surge shall be applied on the ESA on the AC/DC power lines between each line and earth and between lines by using CDN as described in Figures 1 to 4 of Appendix 1 to this **A~~a~~**nnex.

The test set-up shall be noted in the test report**."**

Annex 22, Appendix 1, Title, amend to read:

"Annex 22 – Appendix 1

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

II. Justification

1. Tables 2a/b in paragraph 6.8.2.1. and Tables 19a/b in paragraph 7.18.2.1. currently summarize ESA test methods and distinguish only between the frequency range below and above 2 GHz. This may be misleading as some test methods - e.g., Stripline, TEM cell and BCI - are not suitable for higher frequency ranges as indicated by the according international standard developed by technical experts.

2. To avoid any misunderstanding, the frequency allocation for each test method should be specified more precisely, in accordance with current international standardization requirements.

3. Additionally, for the reverberation chamber method, a definition of “Lowest usable frequency (LUF)” should be added to clearly indicate the valid starting frequency. This is an editorial clarification and does not involve technical changes.

4. Mentions of ‘rms (root mean squared)’ should be removed from paragraphs 6.4.2.1 and 7.7.2.1., as they may lead to confusion. According to ISO 11451-1, the test severity level is defined based on the peak value of the modulated signal. UN Regulation No. 10 also requires modulated signals with a constant peak test level, making the use of rms not suitable in this context. This is an editorial clarification and does not imply any technical changes.

5. The following paragraphs should be amended:

- Paragraph 6.7.1.
- Paragraph 6.9.1.
- Paragraph 4 of Appendix 1.

- Paragraphs 2 and 3 of Annex 10.

6. Pulse 4 in ISO 7637-2:2004 refers to a standard that is over twenty years old, which increasingly complicates the calibration, maintenance, and repair of pulse generators. To reflect the latest international standards, IWG EMC decided to replace 'Pulse 4' with the 'Starting profile' defined in ISO 16750-2.

7. Level 2, which represents cold crank conditions with a good battery at cold temperature, was considered the most comparable to the previously applied pulse 4. Although not technically identical, it offers a suitable approximation within current testing practice.

8. The functional status classification used in ISO 16750-1 remains closely aligned with that in ISO 7637-2:2004; therefore, the criteria remain unchanged.

9. In addition, since ISO 7637-2:2004 has been removed as a reference standard, the associated year designations in the affected paragraphs have also been deleted to ensure clarity and consistency.

10. Paragraph 7.12.2. specifies the flicker requirement for ESA. However, unlike paragraph 7.4.2., which defines clear flicker limits for vehicle, paragraph 7.12.2. does not provide a specific limit value for ESA.

11. In particular, the maximum relative voltage change (d_{max}) may vary depending on the test conditions. To align the requirements for ESA with those for vehicle and avoid misinterpretation, paragraph 7.12.2. has been revised to explicitly define the flicker limit based on the criteria used in paragraph 7.4.2.

12. Appendix 1, paragraphs 6 and 7 have been amended to update the referenced standards as follows:

- ISO 11451-1:2015 → ISO 11451-1:2025
- ISO 11451-2:2015 → ISO 11451-2:2025
- ISO 11452-1:2015 → ISO 11452-1:2025

13. The 07 series of amendments to UN Regulation No. 10 extended the immunity test frequency range from 2 GHz to 6 GHz. The reference standard ISO 11451-2 defines the number of field probes required for calibration based on the frequency range. ISO 11451-2:2015 requires only a single field probe above 2 GHz, whereas the updated ISO 11451-2:2025 mandates the use of four probes up to 6 GHz.

14. In the 07 series of amendments to UN Regulation No. 10, Annex 6 currently requires four field probes regardless of frequency. Since the regulation still refers to ISO 11451-2:2015, this inconsistency may lead to confusion in the calibration procedure for the 2–6 GHz range.

15. Therefore, the reference to ISO 11451-2 should be updated from the 2015 to the 2025 edition to align with the latest calibration requirements and avoid misinterpretation.

16. In addition, although the 07 series of amendments to UN Regulation No. 10 introduced updated pulse modulation methods – removal of PM1 and introduction of PM2 and PM3 – the relevant ISO standards had not yet been published at the time of adoption. Now that ISO 11451-2:2025 and ISO 11452-2:2025 have been officially published, the references to these standards should also be updated to reflect the latest standards.

17. Annex 6, Figure 4 illustratess the antenna placements for lateral illumination of a large vehicle. In the figure, the antenna distance is defined as "D". However, the dimension and tolerance of "D" were not previously specified.

18. To improve clarity of the test setup, the dimension and tolerance of "D-bumper" have now been defined.

19. The other modifications in this proposal are mainly some editorial corrections or format aspects to provide a good based document for the development of the 08 series of amendments to UN Regulation No. 10.