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Item 4.10.1 of the provisional agenda
1958 Agreement:
Consideration of draft amendments to existing UN Regulations submitted by GRE

Proposal for Supplement 2 to the 07 series of amendments to UN Regulation No. 10 (Electromagnetic Compatibility)

Submitted by the Working Party on Lighting and Light-Signalling *

The text reproduced below was adopted by the Working Party on Lighting and Light-Signalling (GRE) at its ninety-third session (ECE/TRANS/WP.29/GRE/93, para. 29). It is based on ECE/TRANS/WP.29/GRE/2025/3 as amended by GRE-93-20. It is submitted to the World Forum for Harmonization of Vehicle Regulations (WP.29) and to the Administrative Committee (AC.1) for consideration at their March 2026 sessions.

* In accordance with the programme of work of the Inland Transport Committee for 2026 as outlined in proposed programme budget for 2026 (A/80/6 (Sect. 20), table 20.7), the World Forum will develop, harmonize and update UN Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

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…

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…

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…

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

Appendix 1 - ESAs in configuration "REESS charging mode coupled to the power grid""

Paragraph 1.1., footnote 1, amend to read:

"[1] As defined in the Consolidated Resolution on the Construction of Vehicles (R.E.3) (ECE/TRANS/WP.29/78/Rev.8, paragraph 2)."

Paragraphs 2.16., 2.17., 2.18. and 2.19., for “sub-clause” read “Subclause”.

Paragraphs 2.29. and 2.30., first line, for "clause" read "Clause".

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 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 original equipment."

Paragraph 4.1.1.2., for "para." read "paragraph".

Paragraph 5.2.2., first line, amend to read:

"5.2.2. Electrical/electronic sub-assembly (ESA)

…"

Paragraph 6.1.1., amend to read:

"6.1.1. A vehicle and its electrical/electronic system(s) or ESA(s) shall be 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 in over 90 per cent of the 20 to 2,000 MHz frequency band and a minimum of 25 volts/m over the whole 20 to 2,000 MHz frequency band. The field strength shall be 10 volts/m in over 90 per cent of the 2,000 to 6,000 MHz frequency band and a minimum of 8 volts/m 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 in over 90 per cent of the 20 to 2,000 MHz frequency band and a minimum of 50 mA over the whole 20 to 2,000 MHz frequency band."

Paragraph 6.7.1., for ISO 7637-2:2011 read ISO 7637-2.

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
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
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
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
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 16750-2 for starting profile and ISO 7637-2 for pulses 1, 2a, 2b, 3a and 3b, as described in Annex 10, with the test levels given in Tables 3a and 3b. Starting profile shall be tested according to the functional status classification as defined in ISO 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

	Immunity test level		*Number of pulses*	*Functional status classification for ESA:*	
Test pulse	*12 V system*	*24 V system*		*Related to immunity related functions*	*Not related to immunity related functions*
4 Starting profile	II	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

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, 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, 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, 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, paragraph 5."

Paragraph 7.3.2.1., note below Table 4, amend to read:

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

7.4.2.2. 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, Clause 5:

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

Table 8, amend to read:

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

Frequency (MHz)	*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)	*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)	*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)	*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 in over 90 per cent of the 20 to 2,000 MHz frequency band and a minimum of 25 volts/m over the whole 20 to 2,000 MHz frequency band. The field strength shall be 10 volts/m in over 90 per cent of the 2,000 to 6,000 MHz frequency band and a minimum of 8 volts/m 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 in over 90 per cent of the 20 to 2,000 MHz frequency band and a minimum of 50 mA 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) of 5 ns, and a hold time (T_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) of 1.2 µs, and a hold time (T_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) of 1.2 µs, and a hold time (T_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, 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, 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)	*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)	*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) of 5 ns, and a hold time (T_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) of 1.2 µs, and a hold time (T_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) of 1.2 µs, and a hold time (T_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
Test level below 2 GHz	60 mA	30 V/m
Frequency range above 2 GHz	Not applicable	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
Test level below 2 GHz	50 mA	25 V/m
Frequency range above 2 GHz	Not applicable	2,000 to 6,000 MHz
Test level above 2 GHz	Not applicable	8 V/m

"

Paragraph 7.19.1., for ISO 7637-2:2011 read ISO 7637-2.

Paragraphs 7.20.1 and 7.20.2., first indent, for "7.5., 7.8., 7.9., 7.13., 7.15., 7.16." read "7.5., 7.8., 7.9., 7.13., 7.15., and 7.16.".

Appendix 1,

Paragraph 4., amend to read:

"4. ISO 7637 "Road vehicles - Electrical disturbance from conduction and coupling**":**

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).

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, Fifth edition 2025);

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

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

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

Part 1: General principles and terminology (ISO 11452-1, Fifth edition 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)."

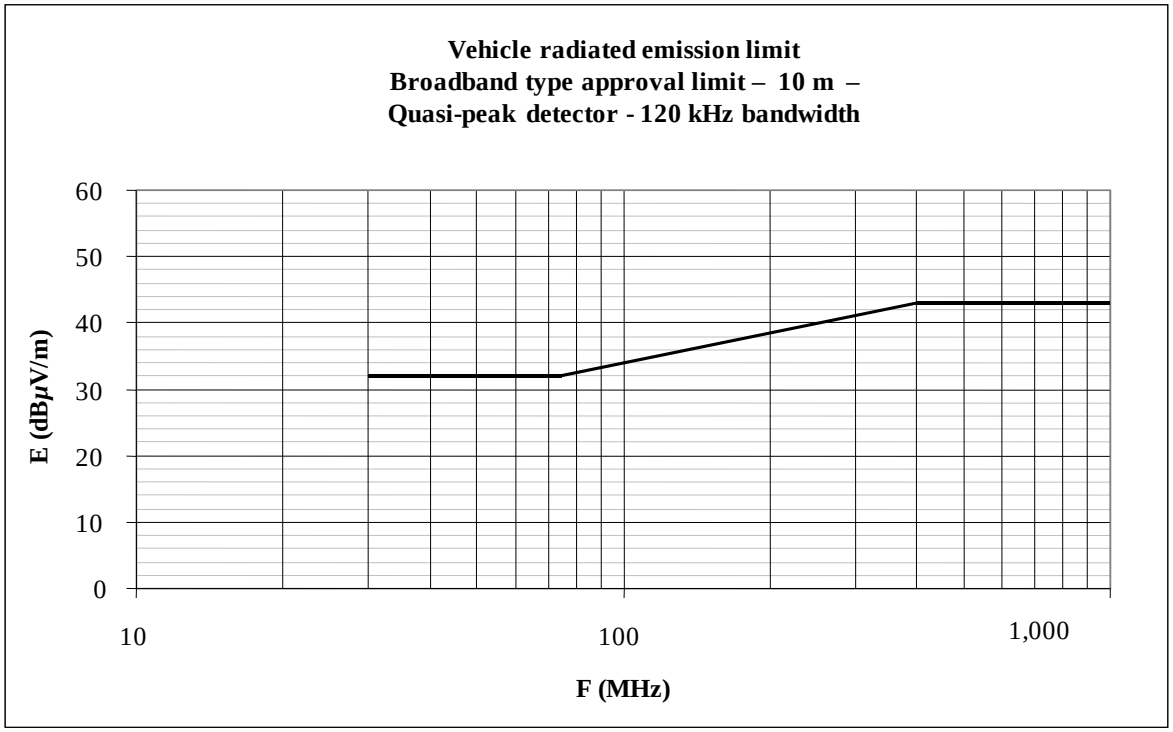
Appendix 2, amend to read :

"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



"

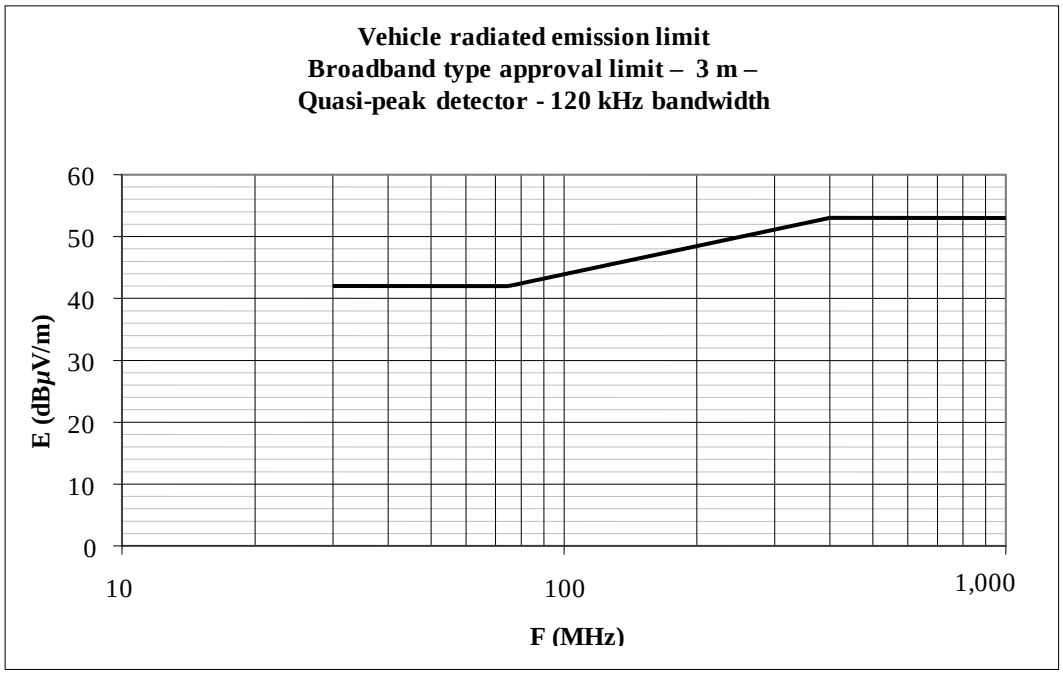
Appendix 3, amend to read :

"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



"

Appendix 4, amend to read :

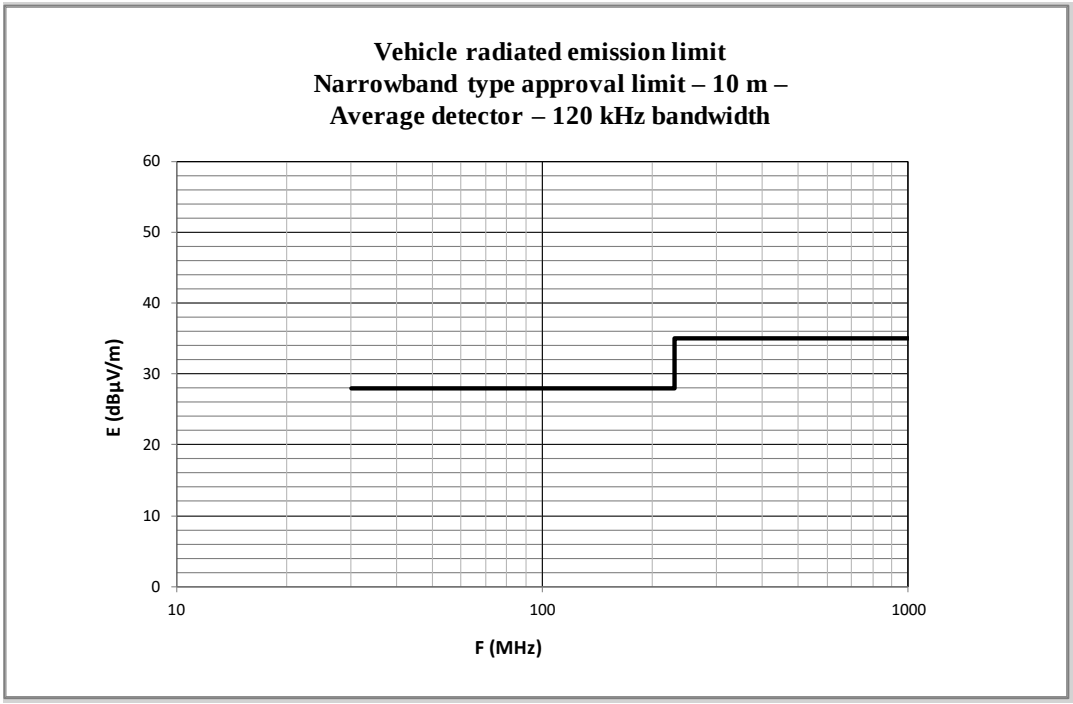
"Appendix 4

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

Limit E (dBµV/m) at frequency F (MHz) for a 120 kHz bandwidth	
E = 28	E = 35
The limits shall be measured with a 120 kHz bandwidth.	



"

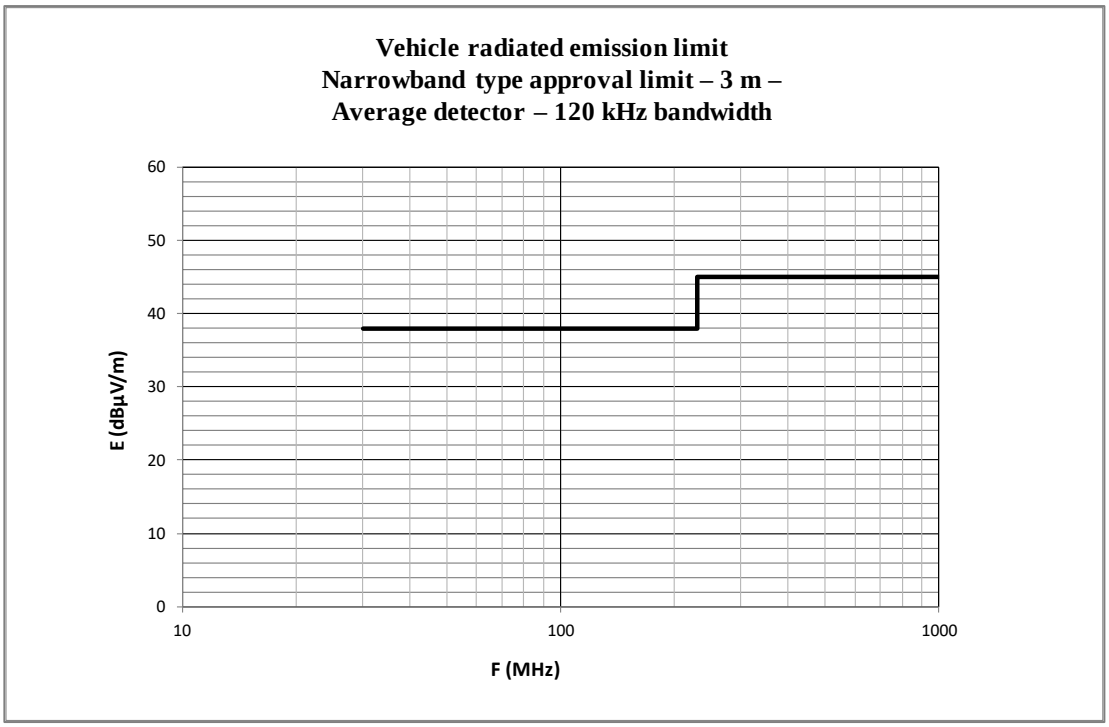
Appendix 5, amend to read :

"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



"

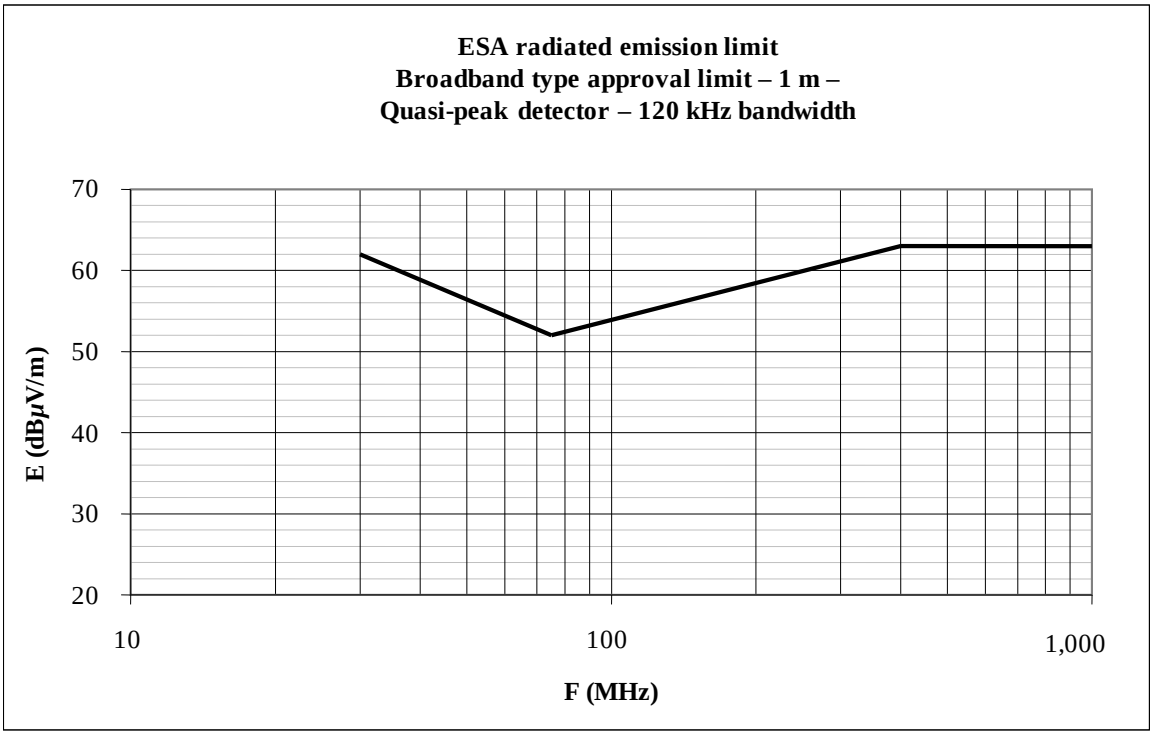
Appendix 6, amend to read:

"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



"

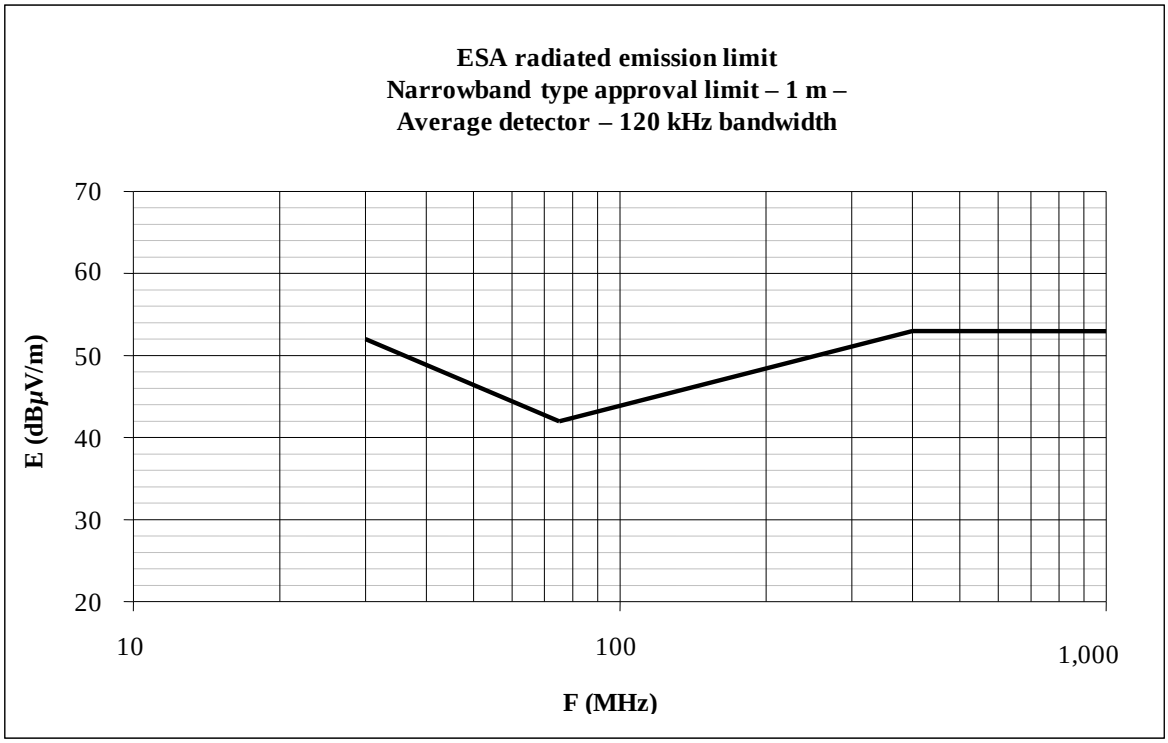
Appendix 7, amend to read:

"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) 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



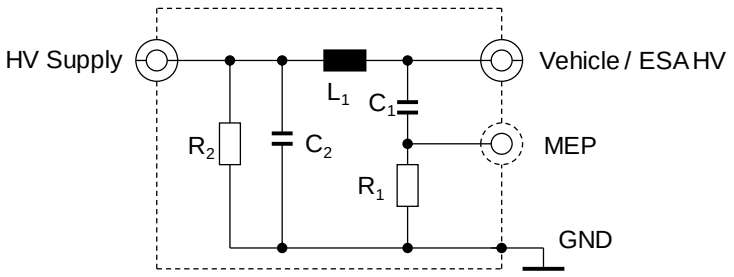
"

Appendix 8,

Figure 6, amend to read:

"Figure 6

Example of 5 µH DC-charging-AN schematic



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 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., for "clause 4.4" read "Clause 4.4".

Paragraph 5., penultimate indent, amend to read:

"5. Asymmetric artificial network (AAN)

…

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.

…"

Paragraphs 5.1., for "clause E.2" read "Clause E.2".

Paragraph 5.3., first indent, last sentence, for "must" read "shall".

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 shall be used as defined in Figure 11.

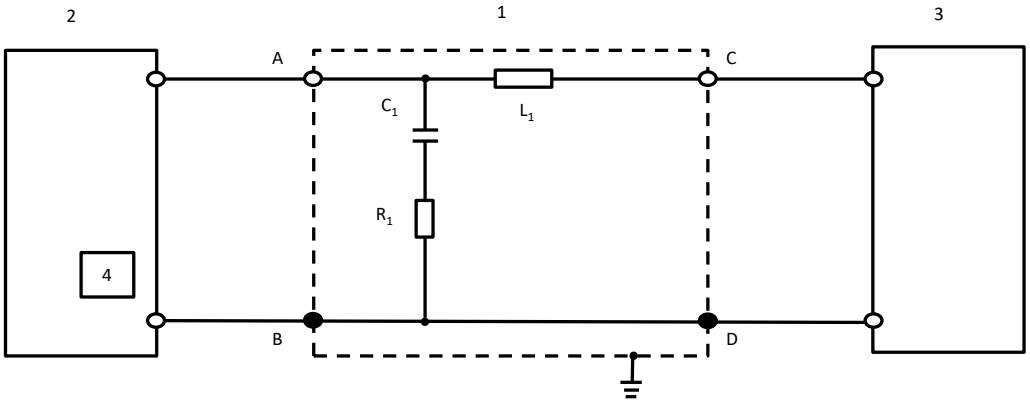
It provides a common mode impedance of 150 Ω ± 20 Ω (150 kHz to 30 MHz) on the control pilot line (between A and B/D).

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 vehicle	L_1 100 µH
3 charging station	A control pilot line (vehicle side)
4 control pilot (in vehicle)	B/D protective earth
R_1 150 Ω	C control pilot line (charging station side) "

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 UN 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 UN Regulation No. 10"

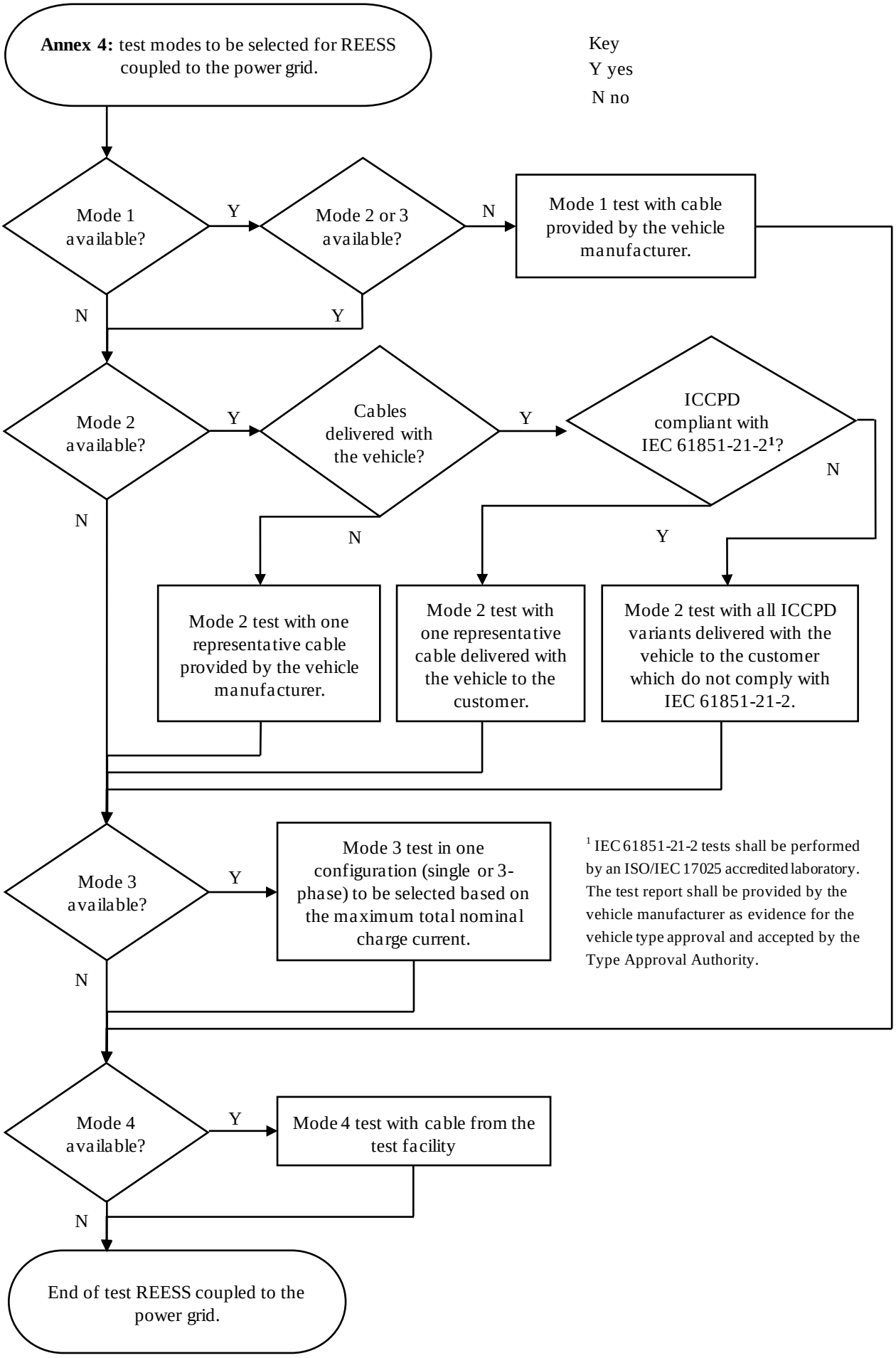
Annex 4,

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.

Figure 1
Charging mode configuration for Annex 4



[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.

In case of multiple batteries the average state of charge 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 Annex."

Paragraphs 2.3., 2.3.1., 2.3.2. and 2.3.3., renumber to 2.2.1., 2.2.1.1., 2.2.1.2. and 2.2.1.3. respectively.

Paragraph 2.2.1.2. (new), first indent, amend to read:

"2.2.1.2. Artificial network

Power mains shall be applied to the vehicle through 50 µH/50 Ω artificial networks (AMN(s)) (see Appendix 8, paragraph 4.).

…"

Paragraph 2.2.1.3. (new), last indent, for εr read ε_r.

Paragraphs 2.4., 2.4.1., 2.4.2., 2.4.3. and 2.4.4., renumber to 2.2.2., 2.2.2.1., 2.2.2.2., 2.2.2.3. and 2.2.2.4., respectively.

Paragraph 2.2.2.2.(new), first two indents, amend to read:

"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, 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, paragraph 3.).

…"

Paragraph 2.2.2.3.(new), amend to read:

"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, paragraph 5.:

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

…"

Paragraph 2.2.2.4. (new), last indent, for εr read ε_r.

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 Appendix to this Annex. In this case the measuring equipment shall lie outside the part shown in Figure 1 of Appendix 1 to this Annex."

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

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

Table 2
Scanning receiver parameters

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

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

Paragraph 4.6., amend to read:

"4.6. Antenna position

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

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

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

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

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

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

with:

N: number of antenna positions;

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

2·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), 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), 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., for annex read Annex.

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	*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	*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-:

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

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:

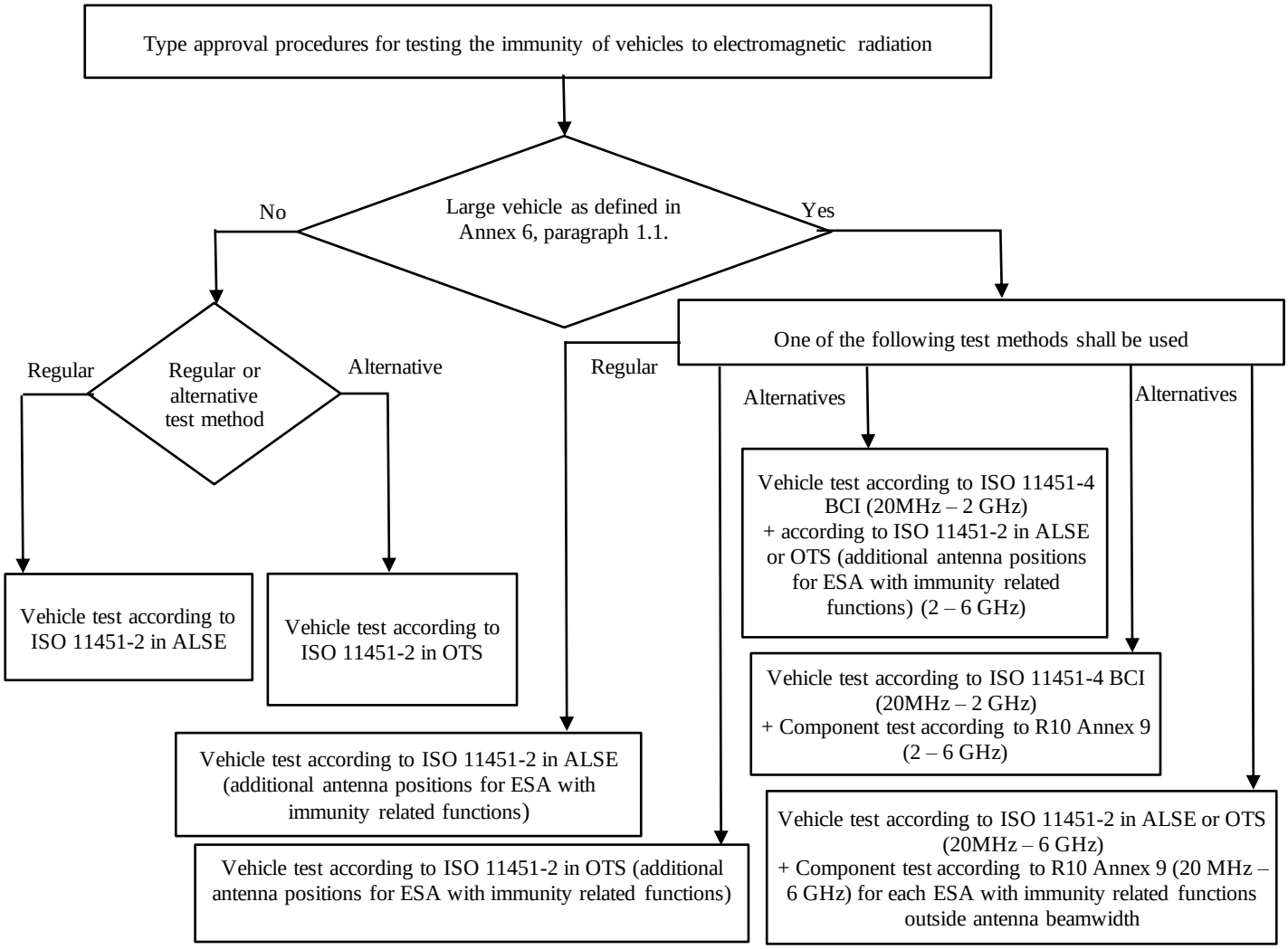
if N=1 (only one antenna position is necessary), the antenna shall be aligned with the middle of the total vehicle length (see Figure 1).

if N>1 (more than one antenna position is necessary), 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., for "annex" read "Annex".

Paragraph 2.2.1.1., for "figure 2" read "Figure 2".

Paragraph 2.2.1.2., table, first column, last sentence, for "must" read "shall". "

Paragraphs 2.2.2. and 2.2.3., for "annex" read "Annex".

Paragraph 2.3.2., 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 Appendix 8, paragraph 4.).

…"

Paragraph 2.3.3., last indent, for εr read ε_r.

Paragraphs 2.4.2. and 2.4.3., 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, 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, paragraph 3.).

…"

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, paragraph 5.:

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

…"

Paragraph 2.4.4., last indent, for εr read ε_r.

Paragraphs 3.1., 3.3.4. (twice) and 3.3.5., for "annex" read "Annex".

Paragraph 4.1., subparagraphs (b) and (c), for Ton read T_{on}.

Paragraph 5.1.2., amend to read:

"5.1.2. Calibration

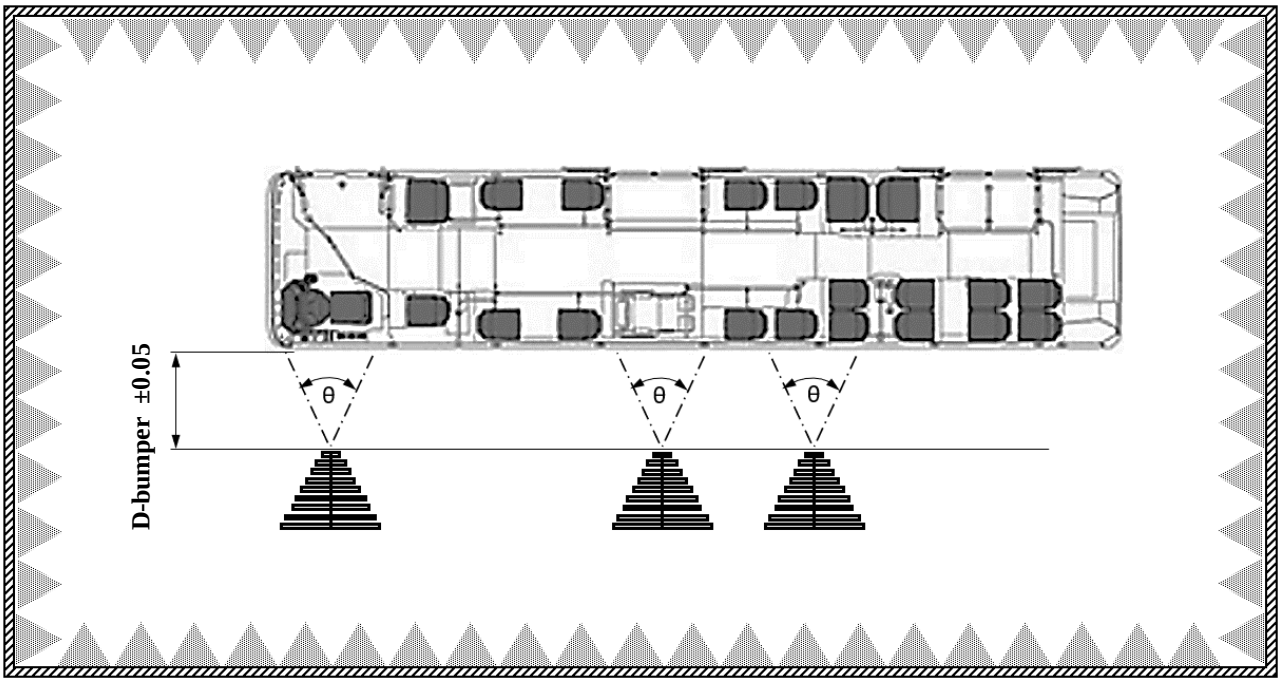
For TLS four horizontal field probes shall be used.

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., for "annex" read "Annex".

Paragraphs 3.1. and 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 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 Annex."

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, paragraph 2.).

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

Paragraph 3.3., for "annex" read "Annex".

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

"Table 1
Spectrum analyser parameters

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

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

Table 2
Scanning receiver parameters

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

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

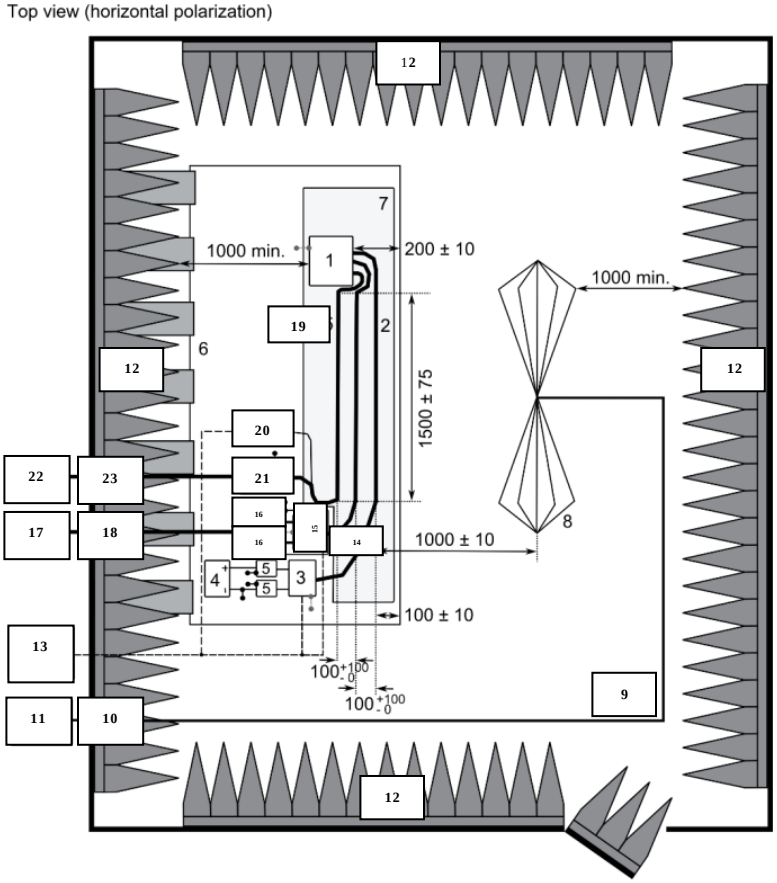
Note: For emissions generated by brush commutator motors without an electronic control unit, the maximum step size may be increased up to five times the bandwidth."

Paragraph 4.4., penultimate indent, for "annex" read "Annex".

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, 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., for "annex" read "Annex".

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

"Table 1
Spectrum analyser parameters

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	*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., for "annex" read "Annex".

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 Annex applies to ESAs. "

Paragraph 2.1., amend to read:

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

Paragraph 2.3., table, first column, last sentence, for "must" read "shall".

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

Paragraph 3.1., subparagraphs (b) and (c), for Ton read T_{on}.

Paragraph 3.3., for "annex" read "Annex".

Paragraphs 4.1.2. and 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 Annex."

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 (Figure 1 for substitution method and Figure 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 Figures 1 and 2, for εr read ε_r.

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 to the supply lines as well as to other connections of ESAs which may be operationally connected to supply lines.

Apply the starting profile according to the International Standard ISO 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 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 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., for “annex” read “Annex”.

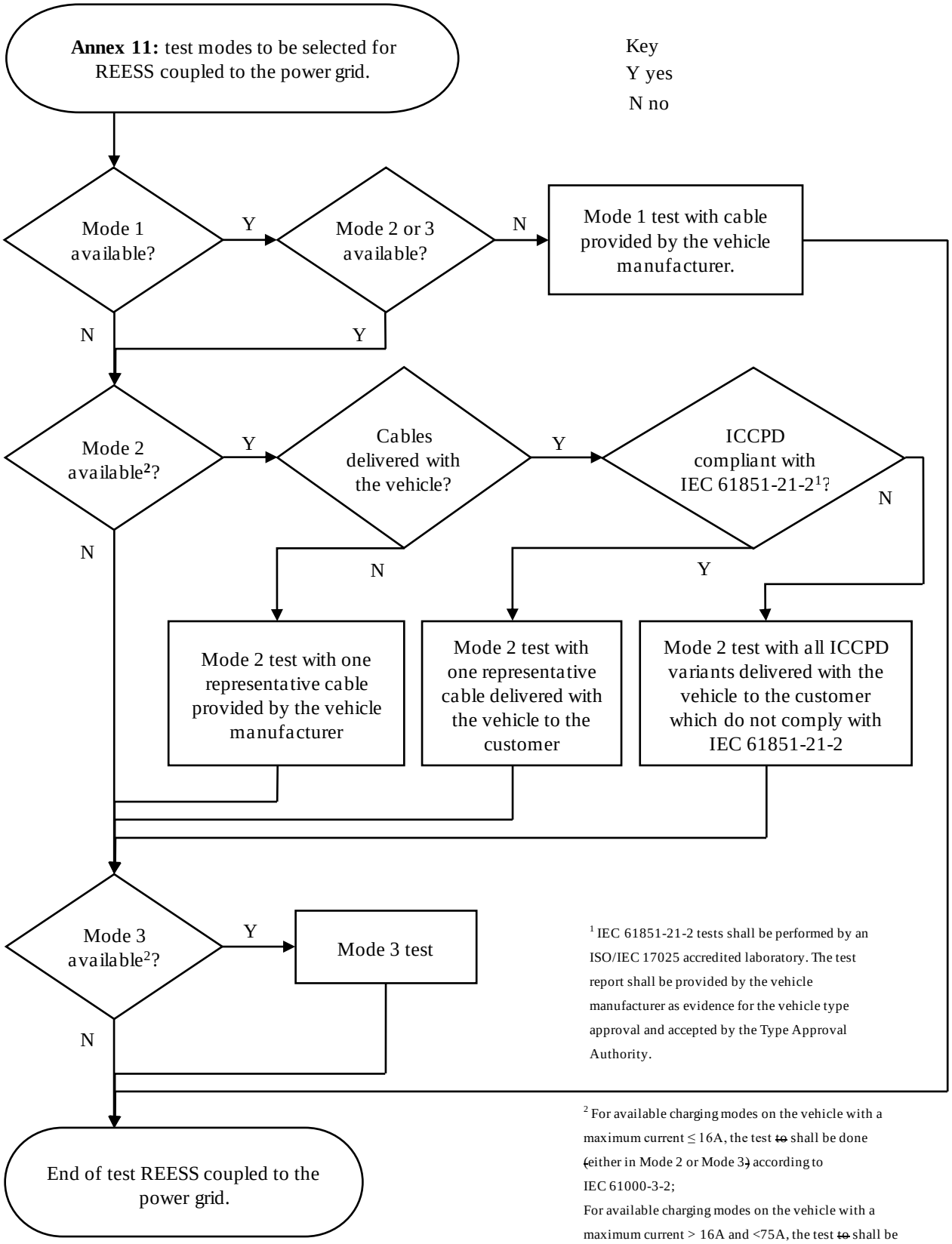
Paragraph 2.1., amend to read:

"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 Figure 1.

Figure 1
Charging mode configuration for Annex 11



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

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

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 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., for "annex" read "Annex".

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 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., for "annex" read "Annex".

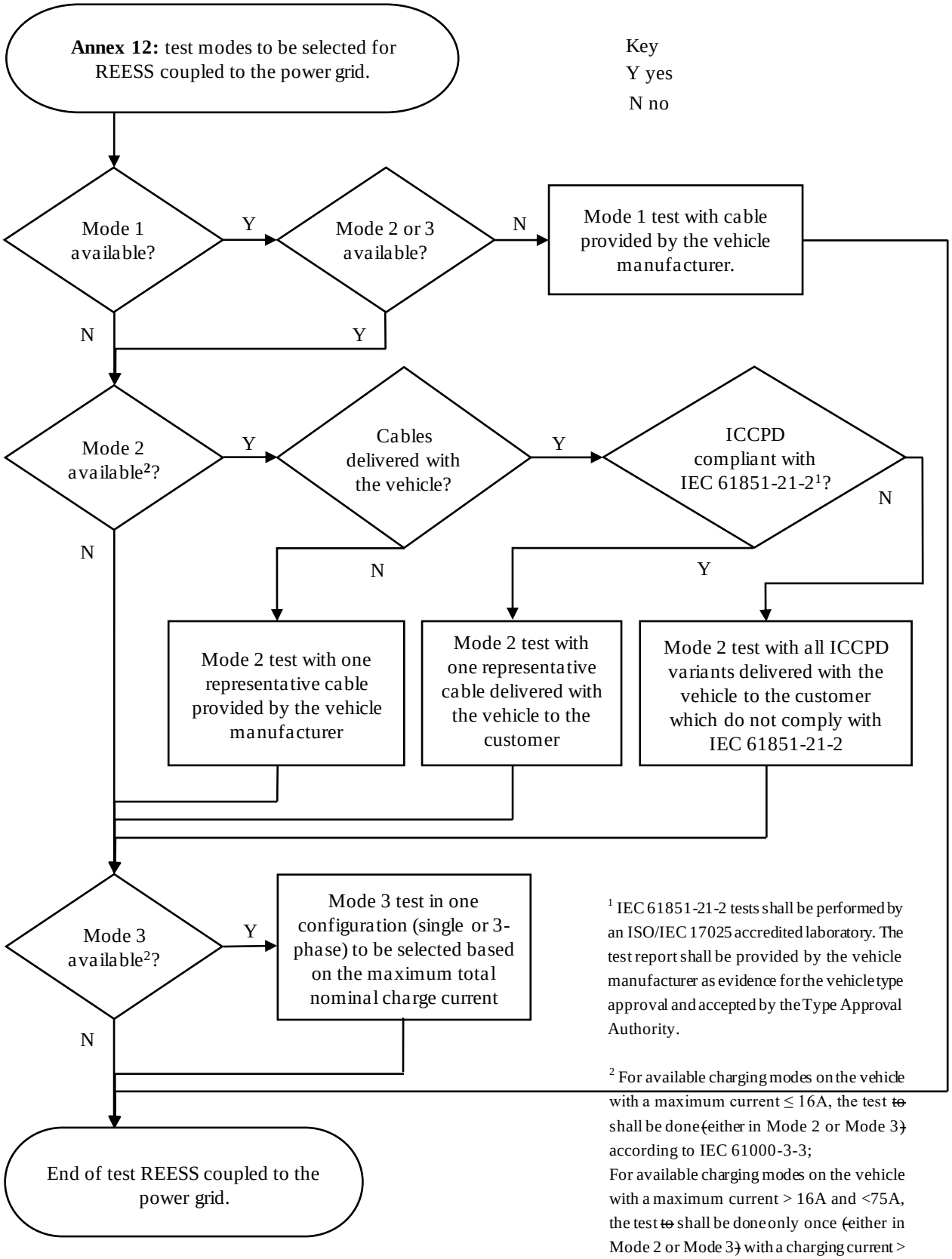
Paragraph 2.1., amend to read:

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

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

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

Figure 1
Charging mode configuration for Annex 12



[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.

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 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 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 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 Annex."

Annex 13,

Paragraphs 1.1. and 1.2., for "annex" read "Annex".

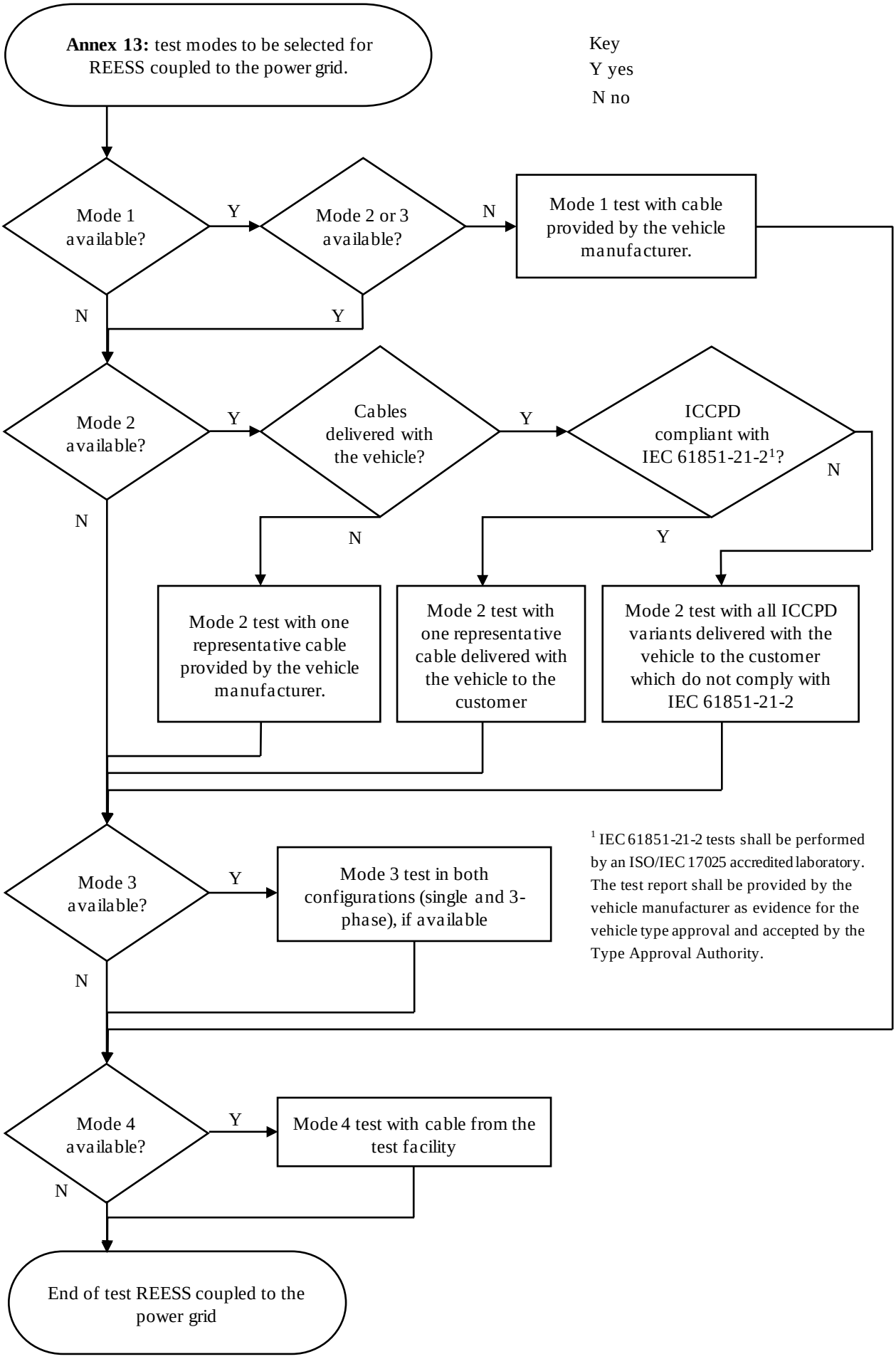
Paragraph 2.1., amend to read:

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

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

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

Figure 1
Charging mode configuration for Annex 13


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.

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 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 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, paragraph 4. for AC power lines;

(b) The DC-charging-AN(s) defined in Appendix 8, 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 Annex.

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 Annex."

Annex 15,

Paragraphs 1.1. and 1.2. (twice), for “annex” read “Annex”.

Paragraph 2., second indent, for “figure 1” read “Figure 1”.

Paragraph 2.1.2., table, first column, last sentence, for “must” read “shall”.

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 Annex 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 Clause 6.1 of IEC 61000-4-4.

3.3. The Coupling/Decoupling Network shall meet the condition defined in 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 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 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 Annex."

Paragraph 5.1.2., for "annex" read "Annex".

Annex 16,

Paragraphs 1.1. and 1.2., amend to read:

"1.1. The test method described in this Annex 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 Annex. The vehicle shall be monitored during the tests.

If not otherwise stated in this Annex, the test shall be performed according to IEC 61000-4-5, Clause 4.2 for lightning transients**.**"

Paragraph 2., second indent, for "figure 1" read "Figure 1".

Paragraph 2.1.2., table, first column, last sentence, for "must" read "shall".

Paragraph 2.2., for "annex" read "Annex".

Paragraphs 3.2. and 3.3., amend to read:

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

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

Paragraph 4.1., amend to read:

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

Paragraph 4.3., for "annex" read "Annex".

Paragraph 5.1.2., for "annex" read "Annex".

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 electrical/electronic sub-assemblies (ESAs)"

Paragraphs 1.1., 1.2., 3.2. and 3.3., for "annex" read "Annex".

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 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 electrical/electronic sub-assemblies (ESAs)"

Paragraphs 1.1. and 1.2., for "annex" read "Annex".

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 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 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 Annex."

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 electrical/electronic sub-assemblies (ESAs)"

Paragraphs 1.1. and 1.2., for "annex" read "Annex".

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, paragraph 4. for AC power lines;

(b) The DC-charging-AN(s) defined in Appendix 8, 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., for "annex" read "Annex".

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

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 ~~S~~step size*	*Minimum dwell time*
0.15 to 30	9 kHz	5 kHz	50 ms	9 kHz	5 kHz	1 s	9 kHz	5 kHz	50 ms

"

Annex 21,

Title, amend to read:

"Annex 21

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

Paragraphs 1.1., 1.2. and 2.2., for "annex" read "Annex".

Paragraphs 3.2. and 3.3., amend to read:

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

3.3. The Coupling/Decoupling Network shall meet the condition defined in 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 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 Clause 7.2 of IEC 61000-4-4."

Paragraph 4.3., for "annex" read "Annex".

Paragraph 5.1.2., for "annex" read "Annex".

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., 1.2. (twice) and 2.2., for "annex" read "Annex".

Paragraphs 3.2. and 3.3., amend to read:

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

3.3. The Coupling/Decoupling Network shall meet the condition defined in 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 Clause 7.2 of IEC 61000-4-5."

Paragraph 4.3., for "annex" read "Annex".

Paragraph 5.1.2., for "annex" read "Annex".

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

"Annex 22 – Appendix 1

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