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### Economic Commission for Europe

#### Inland Transport Committee

#### World Forum for Harmonization of Vehicle Regulations

##### Sixty-fourth session

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Item 9 of the provisional agenda

#### Regulation No. 10 (Electromagnetic compatibility)

### **Proposal for the 04 series of amendments to Regulation No. 10**

#### **Submitted by the experts from France and Germany\***

The text reproduced below was prepared by the experts from France and Germany in order to extend the scope of the present Regulation to all types of power train systems above a certain working voltage level, when they are connected to the main, in charging mode. The modifications to the existing text of the Regulation are marked in bold for new or strikethrough for deleted characters.

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\* In accordance with the programme of work of the Inland Transport Committee for 2006–2010 (ECE/TRANS/166/Add.1, programme activity 02.4), the World Forum will develop, harmonize and update Regulations in order to enhance the performance of vehicles. The present document is submitted in conformity with that mandate.

## I. Proposal

### *Contents*

*Paragraph 6*, amend to read:

“6. **Specifications in the configurations other than “RESS charging mode coupled to the power grid”** .....

*Insert a new paragraph 7*, to read:

“7. **Additional specifications in the configuration “RESS charging mode coupled to the power grid”** .....

*Paragraphs 7 to 13*, renumber as paragraphs 8 to 14

- “8. Amendment or extension of a vehicle type approval following electrical/electronic sub-assembly (ESA) addition or substitution .....
- 9. Conformity of production .....
- 10. Penalties for non-conformity of production .....
- 11. Production definitely discontinued .....
- 12. Modification and extension of type approval of a vehicle or ESA .....
- 13. Transitional provisions .....
- 14. Names and addresses of Technical Services conducting approval tests, and of Administrative Departments .....

*Annexes*, insert new Annexes 11 to 16, to read:

“Annexes

...

- 11. **Method(s) of testing for emission of transients of harmonics generated on AC power lines from vehicle**
- 12. **Method(s) of testing for emission of voltage changes, voltage fluctuations and flicker on AC power lines from vehicle**
- 13. **Method(s) of testing for emission of radiofrequency conducted disturbances on AC or DC power lines from vehicle**
- 14. **Method(s) of testing for emission of radiofrequency conducted disturbances on network and telecommunication access from vehicle**
- 15. **Method(s) of testing for immunity of vehicles to electrical fast transient / burst disturbances conducted along AC and DC power lines**
- 16. **Method(s) of testing for immunity of vehicles to surges conducted along AC and DC power lines”**

Paragraph 1.2., amend to read:

“1.2. components and separate technical units intended to be fitted in these vehicles with the limitation given in paragraph 3.2.1. with regard to electromagnetic compatibility.

1.3. It covers:

- (a) requirements regarding the immunity to radiated and conducted disturbances for functions related to direct control of the vehicle, related to driver, passenger and other road users' protection, ~~and~~ related to disturbances, which would cause confusion to the driver or other road users, **related to vehicle data bus functionality, related to disturbances, which would affect vehicle statutory data;**
- (b) ...
- (c) **additional requirements for vehicles providing coupling systems for charging the RESS regarding the control of emissions and immunity from this connection between vehicle and power grid.”**

Paragraph 2.7., amend to read:

“2.7. *“Electrical/electronic system”* means (an) electrical and/or electronic device(s) or set(s) of devices together with any associated electrical connections which form part of a vehicle but which are not intended to be type approved separately from the vehicle. **Both RESS and Coupling system for charging the RESS are considered electrical / electronic systems.”**

Paragraph 2.12., amend to read:

“2.12. *“Immunity related functions”* are:

- (a) Functions related to the direct control of the vehicle:
  - (i) by degradation or change in: e.g. engine, gear, brake, suspension, active steering, speed limitation devices;
  - (ii) by affecting drivers position: e.g. seat or steering wheel positioning;
  - (iii) by affecting driver's visibility: e.g. dipped beam, windscreen wiper.
- ...
- (f) **Function related to the RESS in charging mode coupled to the power grid:**
  - (i) **by leading to unexpected vehicle motion.”**

Insert new paragraphs 2.13. and 2.14., to read:

“2.13. **“RESS” means the rechargeable energy storage system that provides electric energy for electric propulsion of the vehicle.**

2.14. **“Coupling system for charging the RESS” means the electrical circuit installed in the vehicle used for charging the RESS.”**

Paragraph 3.1.3., amend to read:

“3.1.3. The vehicle manufacturer shall draw up a schedule describing all relevant vehicle electrical/electronic systems or ESAs, body styles, variations in body material, general wiring arrangements, engine variations, left-hand/right-hand

drive versions and wheelbase versions. Relevant vehicle electrical/electronic systems or ESAs are those which may emit significant broadband or narrowband radiation and/or those which are involved in immunity related functions of the vehicle (see paragraph 2.12.) **and those which provide coupling systems for charging the RESS.**”

*Insert a new paragraph 3.1.9., to read:*

**“3.1.9. Vehicle type approval shall be applied for both RESS and Coupling system for charging the RESS as they are considered as electrical / electronic systems.”**

*Paragraph 5.1., amend to read:*

“5.1. An approval number shall be assigned to each vehicle or ESA type approved. The first two digits of this number (~~at present 03~~) shall indicate the series of amendments corresponding to the most recent essential technical amendments made to the Regulation at the date of approval. A Contracting Party may not assign the same approval number to another type of vehicle or ESA.”

*Paragraph 6., amend to read:*

## **“6. Specifications in configurations other than “RESS charging mode coupled to the power grid””**

*Paragraph 6.4.2.2., amend to read:*

“6.4.2.2. The vehicle representative of its type shall be considered as complying with immunity requirements if, during the tests performed in accordance with Annex 6, there shall be no degradation of performance of “immunity related functions”, **according to paragraph 2.1. of Annex 6.**”

*Paragraph 6.2.7.1., amend to read:*

“6.7.2.1. If tests are made using the methods described in Annex 9, the immunity test levels shall be 60 volts/m **root-mean-square (rms)** for the 150 mm stripline testing method, 15 volts/m **rms** for the 800 mm stripline testing method, 75 volts/m **rms** for the Transverse Electromagnetic Mode (TEM) cell testing method, 60 mA **rms** for the bulk current injection (BCI) testing method and 30 volts/m **rms** for the free field testing method in over 90 per cent of the 20 to 2,000 MHz frequency band, and to a minimum of 50 volts/m **rms** for the 150 mm stripline testing method, 12.5 volts/m **rms** for the 800 mm stripline testing method, 62.5 volts/m **rms**, for the TEM cell testing method, 50 mA **rms** for the bulk current injection (BCI) testing method and 25 volts/m **rms** for the free field testing method over the whole 20 to 2,000 MHz frequency band.”

*Paragraph 6.8., amend to read:*

“6.8. Specifications concerning the immunity **of ESAs** to transient disturbances conducted along **12/ 24 V** supply lines.”

*Paragraph 6.9., amend to read:*

“6.9. Specifications concerning the emission of **transient** conducted disturbances **generated by ESAs on 12/ 24 V** supply lines.”

Paragraph 6.10.5., amend to read:

- “6.10.5. ~~Conducted~~ Emission of transient conducted disturbances generated by ESAs on 12/ 24 V supply lines.  
...”

Insert new paragraphs 7. to 7.10.1., to read:

**“7. Additional Specifications in the Configuration  
“RESS charging mode coupled to the power grid.”**

**7.1. General specifications**

7.1.1. A vehicle and its electrical/electronic system(s) shall be so designed, constructed and fitted as to enable the vehicle, in configuration “RESS charging mode coupled to the power grid”, to comply with the requirements of this Regulation.

7.1.2. A vehicle in configuration “RESS charging mode coupled to the power grid” shall be tested for radiated emissions, immunity to radiated disturbances, conducted emissions and immunity to conducted disturbances.

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

**7.2. Specifications concerning broadband electromagnetic radiation from vehicles**

**7.2.1. Method of measurement**

The electromagnetic radiation generated by the vehicle representative of its type shall be measured using the method described in Annex 4. The method of measurement shall be defined by the vehicle manufacturer in accordance with the Technical Service.

**7.2.2. Vehicle broadband type approval limits**

7.2.2.1. If measurements are made using the method described in Annex 4 using a vehicle-to-antenna spacing of  $10.0 \pm 0.2$  m, the limits shall be 32 dB microvolts/m in the 30 to 75 MHz frequency band and 32 to 43 dB microvolts/m in the 75 to 400 MHz frequency band, this limit increasing logarithmically with frequencies above 75 MHz as shown in Appendix 2. In the 400 to 1,000 MHz frequency band the limit remains constant at 43 dB microvolts/m.

7.2.2.2. If measurements are made using the method described in Annex 4 using a vehicle-to-antenna spacing of  $3.0 \pm 0.05$  m, the limits shall be 42 dB microvolts/m in the 30 to 75 MHz frequency band and 42 to 53 dB microvolts/m in the 75 to 400 MHz frequency band, this limit increasing logarithmically with frequencies above 75 MHz as shown in Appendix 3. In the 400 to 1,000 MHz frequency band the limit remains constant at 53 dB microvolts/m.

On the vehicle representative of its type, the measured values, expressed in dB microvolts/m shall be below the type approval limits.

**7.3. Specifications concerning emission of harmonics on AC power lines from vehicles**

**7.3.1. Method of measurement**

The harmonics emission on AC power lines generated by the vehicle representative of its type shall be measured using the method described in Annex 11. The method of measurement shall be defined by the vehicle manufacturer in accordance with the Technical Service.

**7.3.2. Vehicle type approval limit**

**7.3.2.1. If measurements are made using the method described in Annex 11, the limits for input current  $\leq 16$  A per phase are those defined in IEC 61000-3-2 (edition 3.2 - 2009) and given in table 3.**

**Table 3**  
**Maximum allowed harmonics (input current  $\leq 16$  A per phase)**

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

**7.3.2.2. If measurements are made using the method described in Annex 11, the limits for input current  $> 16$  A and  $\leq 75$  A per phase are those defined in IEC 61000-3-12 (edition 1.0 - 2004) and given in table 4, 5 and 6.**

**Table 4**

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

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

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

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

**Table 5**

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

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

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

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

**Table 6**

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

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

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

**7.4. Specifications concerning emission of voltage changes, voltage fluctuations and flicker on AC power lines from vehicles.**

**7.4.1. Method of measurement**

The emission of voltage changes, voltage fluctuations and flicker on AC power lines generated by the vehicle representative of its type shall be measured using the method described in Annex 12. The method of measurement shall be defined by the vehicle manufacturer in accordance with the Technical Service.

**7.4.2. Vehicle type approval limit**

**7.4.2.1.** If measurements are made using the method described in Annex 12, the limits for rated current  $\leq 16$  A per phase and not subjected to conditional connection are those defined in IEC 61000-3-3 (edition 2.0 - 2008) and given in table 7.

**Table 7**

Maximum allowed voltage changes, voltage fluctuations and flicker (rated current  $\leq 16$  A per phase and not subjected to conditional connection)

<i>Limits</i>
Values given in 61000-3-3 clause 5

**7.4.2.2.** If measurements are made using the method described in Annex 12, the limits for rated current  $> 16$  A and  $\leq 75$  A per phase and subjected to conditional connection are those defined in IEC 61000-3-11 (edition 1.0 - 2000) and given in table 8.

**Table 8**

Maximum allowed voltage changes, voltage fluctuations and flicker (rated current  $> 16$  A and  $\leq 75$  A per phase and subjected to conditional connection)."

<i>Limits</i>
Values given in IEC 61000-3-11 clause 5

**7.5. Specifications concerning emission of radiofrequency conducted disturbances on AC or DC power lines from vehicles**

**7.5.1. Method of measurement**

The emission of radiofrequency conducted disturbances on AC or DC power lines generated by the vehicle representative of its type shall be measured using the method described in Annex 13. The method of measurement shall be defined by the vehicle manufacturer in accordance with the Technical Service.

**7.5.2. Vehicle type approval limit**

**7.5.2.1.** If measurements are made using the method described in Annex 13, the limits on AC power lines are those defined in IEC 61000-6-3 (edition 2.0 – 2006) and given in table 9.



**Table 9**  
**Maximum allowed radiofrequency conducted disturbances on AC power lines**

<i>Frequency (MHz)</i>	<i>Limits and detector</i>
0.15 to 0.5	66 to 56 dB $\mu$ V (quasi-peak) 56 to 46 dB $\mu$ V (average) (linearly decreasing with logarithm of frequency)
0.5 to 5	56 dB $\mu$ V (quasi-peak) 46 dB $\mu$ V (average)
5 to 30	60 dB $\mu$ V (quasi-peak) 50 dB $\mu$ V (average)

7.5.2.2. If measurements are made using the method described in Annex 13, the limits on DC power lines are those defined in IEC 61000-6-3 (edition 2.0 - 2006) and given in table 10.

**Table 10**  
**Maximum allowed radiofrequency conducted disturbances on DC power lines**

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

7.6. Specifications concerning emission of radiofrequency conducted disturbances on network and telecommunication access from vehicles

7.6.1. Method of measurement

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

7.6.2. Vehicle type approval limit

7.6.2.1. If measurements are made using the method described in Annex 14, the limits on network and telecommunication access are those defined in IEC 61000-6-3 (edition 2.0 - 2006) and given in table 11.

**Table 11**  
**Maximum allowed radiofrequency conducted disturbances on network and telecommunication access**

<i>Frequency (MHz)</i>	<i>Limits and detector</i>	
0.15 to 0.5	84 to 74 dB $\mu$ V (quasi-peak) 74 to 64 dB $\mu$ V (average) (linearly decreasing with logarithm of frequency)	40 to 30 dB $\mu$ A (quasi-peak) 30 to 20 dB $\mu$ A (average) (linearly decreasing with logarithm of frequency)
0.5 to 30	74 dB $\mu$ V (quasi-peak) 64 dB $\mu$ V (average)	30 dB $\mu$ A (quasi-peak) 20 dB $\mu$ A (average)

7.7. Specifications concerning immunity of vehicles to electromagnetic radiation

- 7.7.1. Method of testing**  
The immunity to electromagnetic radiation of the vehicle representative of its type shall be tested by the method described in Annex 6.
- 7.7.2. Vehicle immunity type approval limits**
- 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.
- 7.7.2.2.** The vehicle representative of its type shall be considered as complying with immunity requirements if, during the tests performed in accordance with Annex 6, there shall be no degradation of performance of “immunity related functions”, according to paragraph 2.2. of Annex 6.
- 7.8. Specifications concerning the immunity of vehicles to electrical fast transient/burst disturbances conducted along AC and DC power lines.**
- 7.8.1. Method of testing**
- 7.8.1.1.** The immunity to electrical fast transient/burst disturbances conducted along AC and DC power lines of the vehicle representative of its type shall be tested by the method described in Annex 15.
- 7.8.2. Vehicle immunity type approval limits**
- 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 :  $\pm 2$  kV test voltage in open circuit, with a rise time (Tr) of 5 ns, and a hold time (Th) of 50 ns and a repetition rate of 5 kHz for at least 1 minute.
- 7.8.2.2.** The vehicle representative of its type shall be considered as complying with immunity requirements if, during the tests performed in accordance with Annex 15, there shall be no degradation of performance of “immunity related functions”, according to paragraph 2.2. of Annex 6.”
- 7.9. Specifications concerning the immunity of vehicles to surge conducted along AC or DC power lines.**
- 7.9.1. Method of testing**
- 7.9.1.1.** The immunity to surge conducted along AC / DC power lines of the vehicle representative of its type shall be tested by the method described in Annex 16.
- 7.9.2. Vehicle immunity type approval limits**
- 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:  $\pm 2$  kV test voltage in open circuit between line and earth and  $\pm 1$  kV between lines, with a rise time (Tr) of 1,2  $\mu$ s, and a hold time (Th) of 50  $\mu$ s. Each surge shall be applied 5 times at 1 minute delay for each of following phases: 0, 90, 180 and 270°,
  - (b) for DC power lines:  $\pm 0,5$  kV test voltage in open circuit between line and earth and  $\pm 0,5$  kV between lines, with a rise time (Tr) of

1,2  $\mu$ s, and a hold time (Th) of 50  $\mu$ s. Each surge shall be applied 5 times at 1 minute delay.

**7.9.2.2.** The vehicle representative of its type shall be considered as complying with immunity requirements if, during the tests performed in accordance with Annex 16, there shall be no degradation of performance of “immunity related functions”, according to paragraph 2.2. of Annex 6.

**7.10.** Exceptions

**7.10.1.** When network and telecommunication access of the vehicle uses power line Transmission (PLT) on its AC/DC power lines, annex 14 shall not be applied.”

*Paragraph 7. to 8.3., renumber as paragraph 8. to 9.3.*

*Paragraphs 8.3.1. and 8.3.2.(former), renumber as paragraphs 9.3.1. and 9.3.2. and amend to read:*

“9.3.1. When the conformity of a vehicle, component or ESA taken from the series ...in paragraphs 6.2.2.1., 6.2.2.2., 6.3.2.1., ~~and~~6.3.2.2., **7.2.2.1. and 7.2.2.2.** (as appropriate).”

9.3.2. When the conformity of a vehicle, component or ESA taken from the series is being verified, production shall be deemed to conform to the requirements of this ...in paragraphs 6.4.2.1. **and 7.7.2.1.** above.”

*Paragraphs 9 to 13 (former), renumbered as paragraphs 10 to 14.*

*Appendix 1, insert new items 10 to 19 to read:*

**10.** IEC 61000-3-2 “Electromagnetic Compatibility (EMC) – Part 3-2 – Limits for harmonic current emissions (equipment input current  $\leq$  16 A per phase)”, edition 3.2 – 2005 +A1:2008+A2:2009.

**11.** IEC 61000-3-3 “Electromagnetic Compatibility (EMC) – Part 3-3 – Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage systems for equipment with rated current  $\leq$  16 A per phase and not subjected to conditional connection”, edition 2.0 - 2008.

**12.** IEC 61000-3-11 “Electromagnetic Compatibility (EMC) – Part 3-11 – Limits – Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage systems - Equipment with rated current  $\leq$  75 A per phase and subjected to conditional connection”, edition 1.0 - 2000.

**13.** IEC 61000-3-12 “Electromagnetic Compatibility (EMC) – Part 3-12 – Limits for harmonic current emissions produced by equipment connected to public low-voltage systems with input current  $>$  16 A and  $\leq$  75 A per phase”, edition 1.0 - 2004.

**14.** IEC 61000-4-4 “Electromagnetic Compatibility (EMC) – Part 4-4 – Testing and measurement techniques – Electrical fast transients/burst immunity test”, edition 2.0 - 2004.

**15.** IEC 61000-4-5 “Electromagnetic Compatibility (EMC) – Part 4-5 – Testing and measurement techniques – Surge immunity test”, edition 2.0 - 2005.

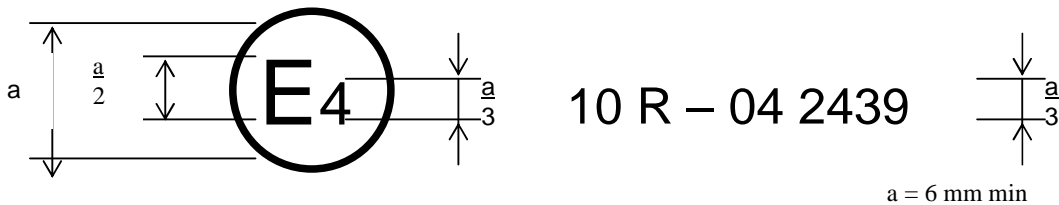
16. IEC 61000-6-2 “Electromagnetic Compatibility (EMC) – Part 6-2 – Generic standards Immunity for industrial environments”, edition 2.0 - 2005.
17. IEC 61000-6-3 “Electromagnetic Compatibility (EMC) – Part 6-3 – Generic standards Emission standard for residential, commercial and light-industrial environments”, edition 2.0 - 2006.
18. CISPR 16-2-1 “Specification for radio disturbances and immunity measuring apparatus and methods – Part 2-1 – Methods of measurement of disturbances and immunity – Conducted disturbances measurement”, edition 2.0 – 2008.
19. CISPR 22 “Information Technology Equipment – Radio disturbances characteristics – Limits and methods of measurement”, edition 6.0 - 2008.”

Annex 1, amend to read:

## “Examples of Approval Marks

### Model A

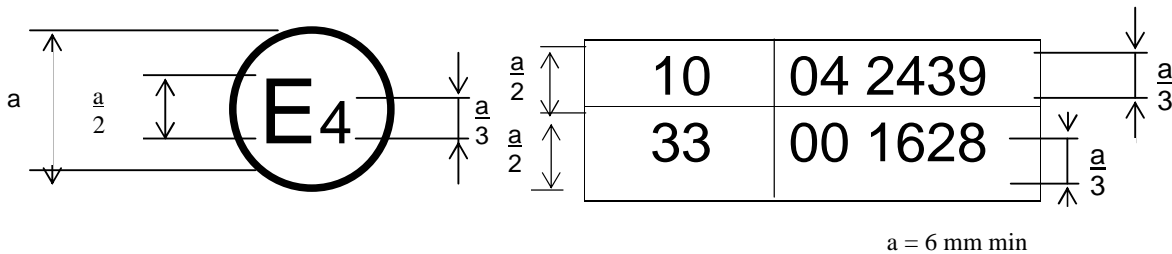
(See paragraph 5.2. of this Regulation)



The above approval mark affixed to a vehicle or ESA shows that the vehicle type concerned has, with regard to electromagnetic compatibility, been approved in the Netherlands (E 4) pursuant to Regulation No. 10 under approval No. **042439**. The approval number indicates that the approval was granted according to the requirements of Regulation No. 10 as amended by the **04** series of amendments.

### Model B

(See paragraph 5.2. of this Regulation)



The above approval mark affixed to a vehicle or ESA shows that the vehicle type concerned has, with regard to electromagnetic compatibility, been approved in the Netherlands (E 4) pursuant to Regulations Nos. 10 and 33. \*

The approval numbers indicate that, at the date when the respective approvals were given, Regulation No. 10 included the **04** series of amendments and Regulation No. 33 was still in its original form.”

*Annex 4*

*Paragraph 1.1.*, amend to read:

- “1.1. The test method described in this annex shall only be applied to vehicles.  
**This method concerns both configurations of the vehicle:**
- (a) **other than “RESS in charging mode coupled to the power grid”.**
  - (b) **“RESS in charging mode coupled to the power grid”.**”

*Insert new paragraph 2.1.*, to read:

- “2.1. **Vehicle in configuration other than “RESS in charging mode coupled to the power grid.”**”

*Paragraphs 2.1. and 2.2: renumber as paragraphs 2.1.1. and 2.1.2. to read*

*Insert new paragraph 2.2.*, to read:

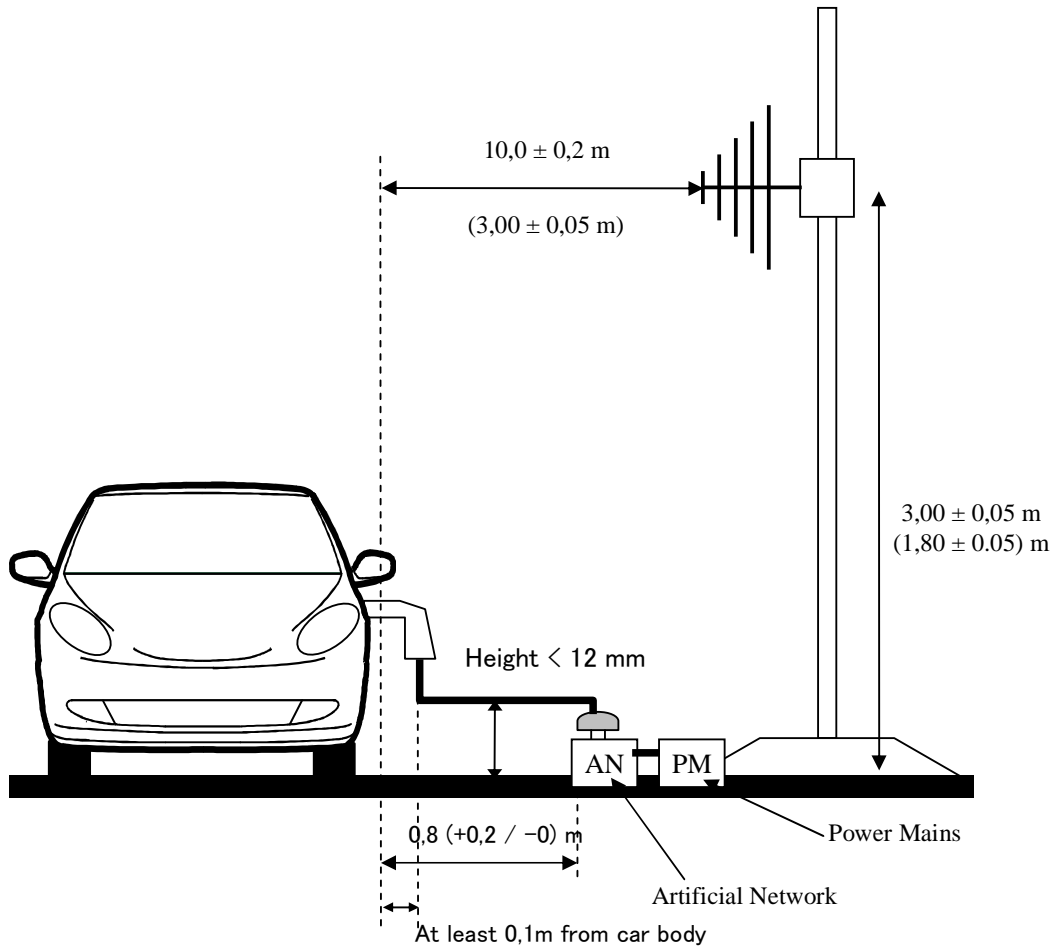
- “2.2. **Vehicle in configuration “RESS in charging mode coupled to the power grid.**
- This vehicle shall be in battery charging mode at rated power until the AC or DC current reached at least 80 per cent of its initial value. The test set-up for the connection of the vehicle in configuration “RESS in charging mode coupled to the power grid” is shown in figure 3 of Appendix 1 to this annex.”**

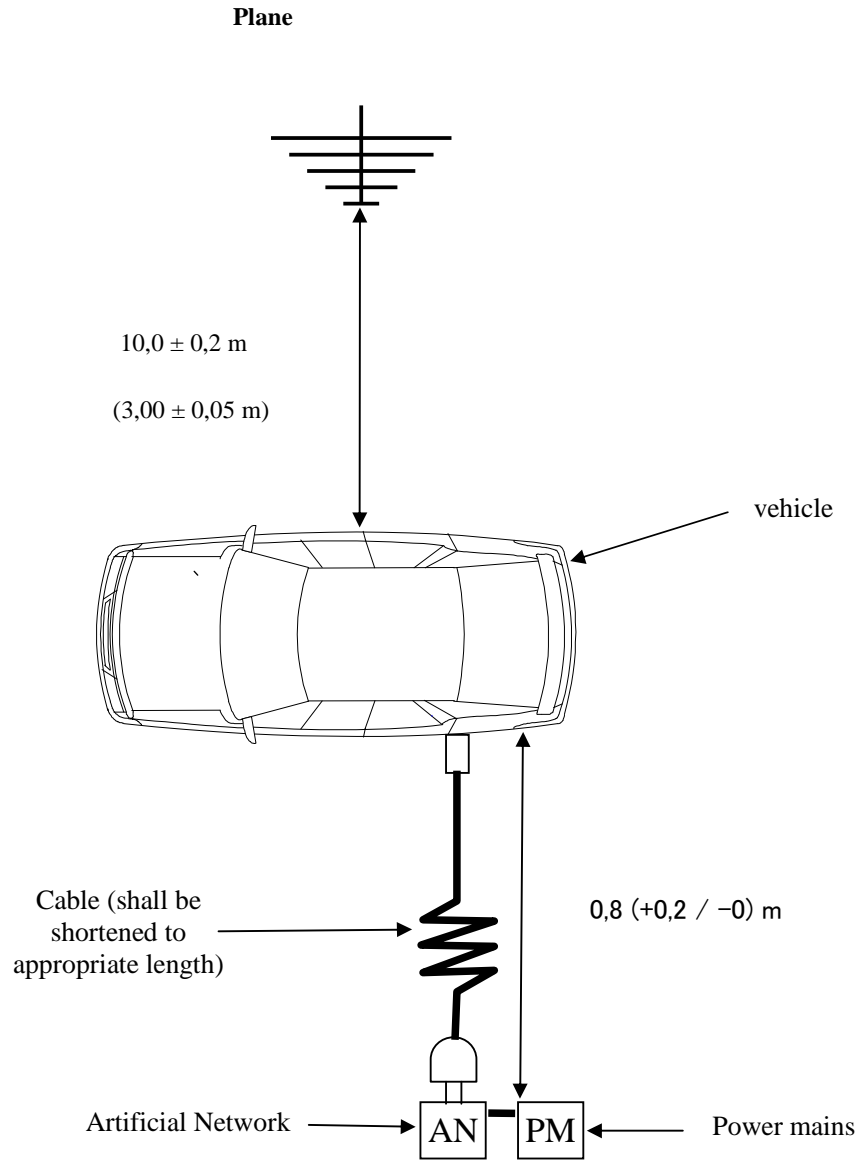
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\* The second number is given merely as an example.

Insert new figure 3, to read:

**“Figure 3**  
**Vehicle in configuration “RESS charging mode” coupled to the power grid Elevation**





Annex 5,

Paragraph 1.1., 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 other than “RESS in charging mode coupled to the power grid.”**”

Annex 6,

Paragraph 1.1., amend to read:

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

- (a) **other than “RESS in charging mode coupled to the power grid”.**
- (b) **“RESS in charging mode coupled to the power grid”**

Paragraph 2.1., amend to read:

“2.1. **Vehicle in configuration other than “RESS in charging mode coupled to the power grid”.**”

Paragraph 2.1., renumber as paragraph to 2.1.1.

Paragraphs 2.1.1. to 2.1.4., renumbered as paragraphs 2.1.1.1. to 2.1.1.4.

Paragraphs 2.2. to 2.3., renumber as 2.1.2. to 2.1.3., respectively

Insert new paragraphs 2.2. to 2.2.2., to read:

“2.2. **Vehicle in configuration “RESS in charging mode coupled to the power grid”.**

2.2.1. **The vehicle shall be in an unladen condition except for necessary test equipment.**

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

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, must be tested in a way to be agreed between manufacturer and Technical Service.**

“RESS in charging mode” vehicle test conditions	Failure criteria
The RESS shall be in charging mode. The RESS state of charge shall be agreed in between the manufacturer and the Technical Service.	Vehicle sets in motion

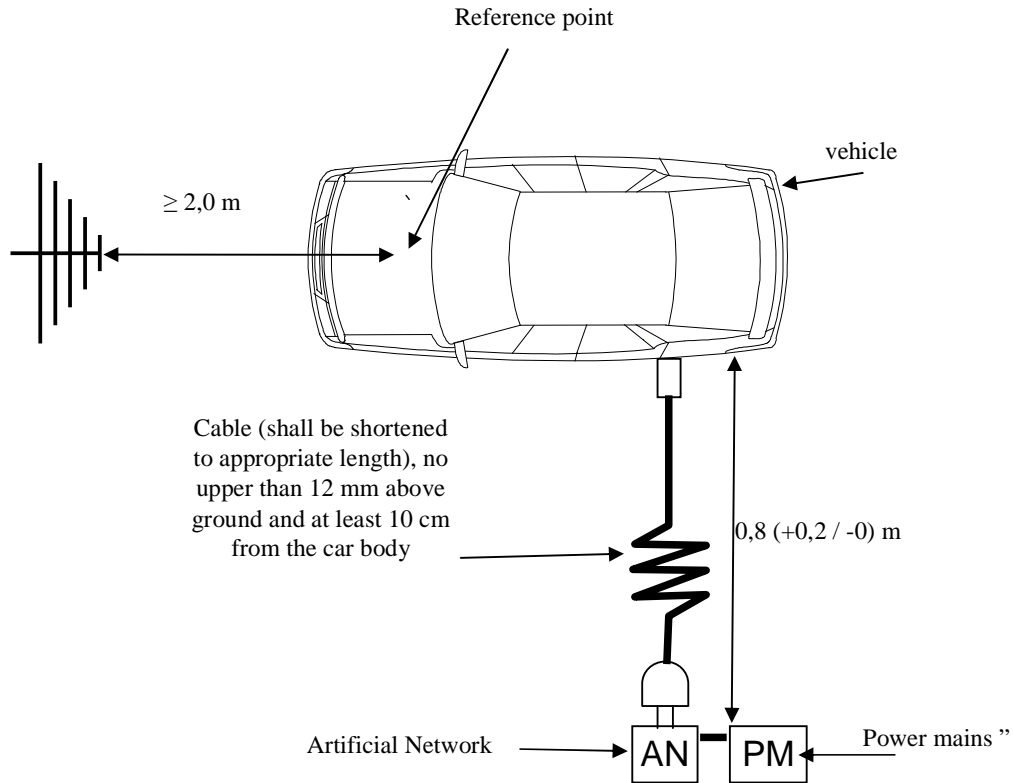
2.2.1.3. **All other equipment which can be switched on permanently by the driver or passenger should be OFF.**

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 annex are met (e.g. by using (a) video camera(s), a microphone, etc.).”**



Insert new figure 4, to read:

**“Figure 4  
Vehicle in configuration “RESS in charging mode coupled to the power grid”**



Annex 7,

paragraph 4.3., amend to read:

“4.3. The Technical Service shall perform the test at the intervals specified in the ~~CISPR 25 (second edition 2002)~~ **CISPR 12 (amendment 1, 5<sup>th</sup> edition 2005)** 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 (first edition 1999) and recognized by the 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, 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 annex.

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.”

Paragraph 4.4., amend to read:

“4.4. Readings

The maximum of the readings relative to the limit (horizontal/vertical polarization) in each of the **14** frequency bands shall be taken as the characteristic reading at the frequency at which the measurements were made.”

*Annex 8,*

*paragraph 4.3.,* amend to read:

“4.3.           Measurements

The Technical Service shall perform the test at the intervals specified in the CISPR 12 (amendment 1, 5<sup>th</sup> edition 2005) 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 (first edition 1999) and recognized by the 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, 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 annex. 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.”

*Paragraph 4.4.,* amend to read:

“4.4.           Readings

The maximum of the readings relative to the limit (horizontal/vertical polarisation) in each of the **14** frequency bands shall be taken as the characteristic reading at the frequency at which the measurements were made.”

*Annex 10,*

*paragraph 2,* amend to read:

“2.           Immunity against transient disturbances conducted along 12/ **24 V** Supply Lines”

*Paragraph 3,* amend to read:

“3.           Emission of **transient** conducted disturbances **generated by ESAS on 12/24 V ~~Along~~** Supply Lines”

*Insert new Annex 11 to 16 and their Appendices, to read:*

## **“Annex 11**

### **Method(S) of Testing for Emission of Harmonics generated on AC power lines from vehicle**

- 1. General**
  - 1.1. The test method described in this annex shall be applied to vehicles in configuration “RESS 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 “RESS 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.

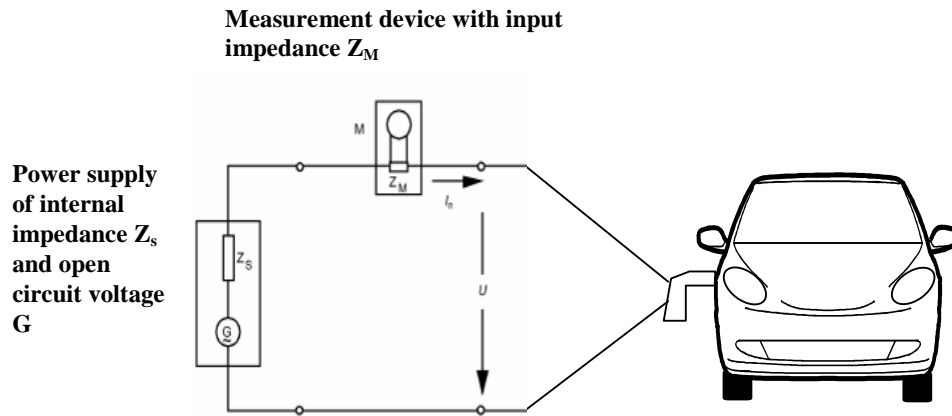
If not otherwise stated in this annex the test shall be performed according to:

    - (a) IEC 61000-3-2 for input current in charging mode  $\leq 16$  A per phase for class A equipment,
    - (b) IEC 61000-3-12 for input current in charging mode  $> 16$  A and  $\leq 75$  A per phase.
- 2. Vehicle State during Tests**
  - 2.1. The vehicle shall be in configuration “RESS charging mode coupled to the power grid” at rated power until the AC current reached at least 80 per cent of its initial value.**
- 3. Test Arrangements**
  - 3.1. The observation time to be used for the measurements shall be as for quasi-stationary equipment as defined in IEC 61000-3-2 table 4.**
  - 3.2. The test set-up for single phase vehicle in configuration “RESS charging mode coupled to the power grid” is shown in figure 1 of Appendix 1 to this annex.**
  - 3.3. The test set-up for three-phase vehicle in configuration “RESS charging mode coupled to the power grid” is shown in figure 2 of Appendix 1 to this annex.**
- 4. Test Requirements**
  - 4.1. The measurements of even and odd current harmonics shall be performed up to the fortieth harmonic.**
  - 4.2. The limits for single phase or three-phase “RESS charging mode coupled to the power grid” with input current  $\leq 16$  A per phase are given in paragraph 7.3.2.1. table 3.**
  - 4.3. The limits for single phase “RESS charging mode coupled to the power grid” with input current  $> 16$  A and  $\leq 75$  A per phase are given in paragraph 7.3.2.2. table 4.**

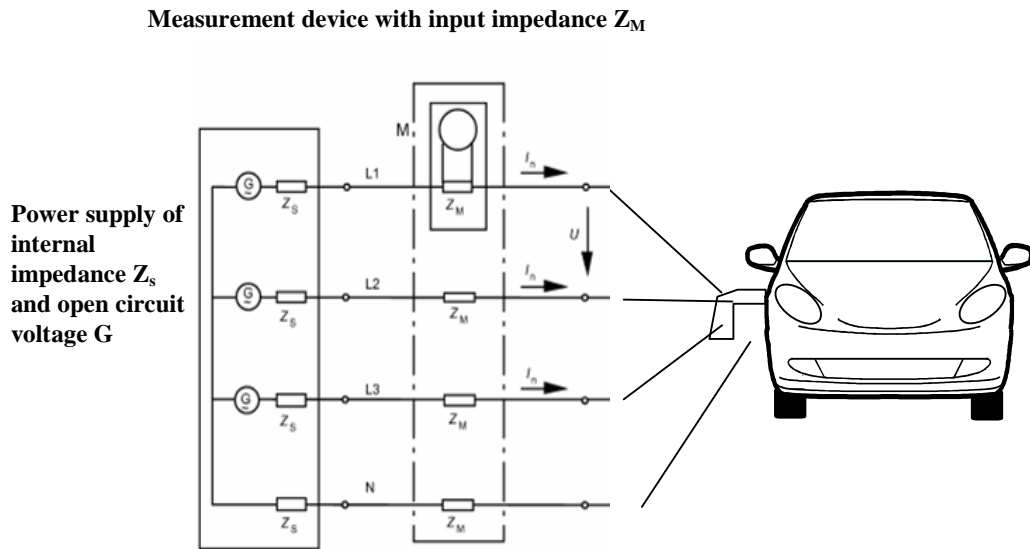
- 4.4. The limits for three-phase “RESS charging mode coupled to the power grid” with input current  $> 16 \text{ A}$  and  $\leq 75 \text{ A}$  per phase are given in paragraph 7.3.2.2. table 5.
- 4.5. For three-phase “RESS charging mode coupled to the power grid” with input current  $> 16 \text{ A}$  and  $\leq 75 \text{ A}$  per phase, when at least one of the three conditions a), b), c) described in IEC 61000-3-12 clause 5.2, is fulfilled then the limits given in paragraph 7.3.2.2. table 6 can be applied.

**Annex 11 - Appendix 1**

**Figure 1**  
 Vehicle in configuration “RESS charging mode coupled to the power grid” - Single phase charger test set-up



**Figure 2**  
 Vehicle in configuration “RESS charging mode coupled to the power grid” - Three-phase charger test set-up



## Annex 12

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

1. General
  - 1.1. The test method described in this annex shall be applied to vehicles in configuration “RESS 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 “RESS 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 annex the test shall be performed according to:

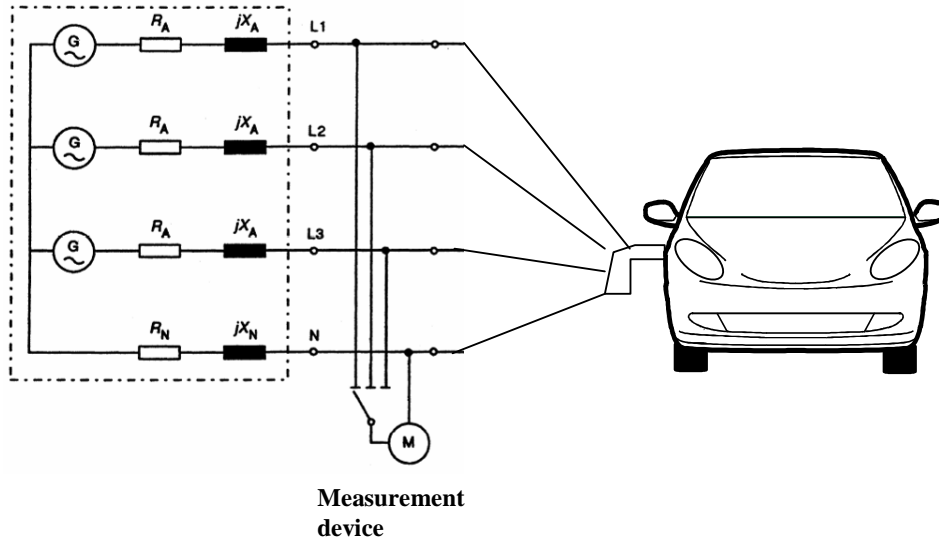
    - (a) IEC 61000-3-3 for rated current in “RESS charging mode”  $\leq 16$  A per phase and not subjected to conditional connection,
    - (b) IEC 61000-3-11 for rated current in “RESS charging mode”  $> 16$  A and  $\leq 75$  A per phase and subjected to conditional connection.
2. Vehicle State during Tests
  - 2.1. The vehicle shall be in configuration “RESS charging mode coupled to the power grid” at rated power until the AC current reached at least 80 per cent of its initial value.
3. Test Arrangements
  - 3.1. The tests for vehicle in configuration “RESS charging mode coupled to the power grid” with rated current  $\leq 16$  A per phase and not subjected to conditional connection shall be performed according IEC 61000-3-3 paragraph 4.
  - 3.2. The tests for vehicle in configuration “RESS charging mode coupled to the power grid” with rated current  $> 16$  A and  $\leq 75$  A per phase and subjected to conditional connection shall be performed according IEC 61000-3-11 paragraph 6.
  - 3.3. The test set-up for vehicle in configuration “RESS charging mode coupled to the power grid” is shown in figure 1 of Appendix 1 to this annex.
4. Test Requirements
  - 4.1. The parameters to be determined in the time-domain are “short duration flicker value”, “long duration flicker value” and “voltage relative variation”.

- 4.2. The limits for vehicle in configuration “RESS charging mode coupled to the power grid” with input current  $\leq 16$  A per phase and not subjected to conditional connection are given in paragraph 7.4.2.1. table 7.
- 4.3. The limits for vehicle in configuration “RESS charging mode coupled to the power grid” with input current  $> 16$  A and  $\leq 75$  A per phase and subjected to conditional connection are given in paragraph 7.4.2.2. table 8.

**Annex 12–Appendix 1**

**Figure 1**  
**Vehicle in configuration “RESS charging mode coupled to the power grid”**

Power supply with open circuit  
 voltage  $G$  and  $(R_p + j X_p)$   
 impedance



## Annex 13

### Method(s) of Testing for Emission of Radiofrequency conducted disturbances on AC or DC power lines from vehicle

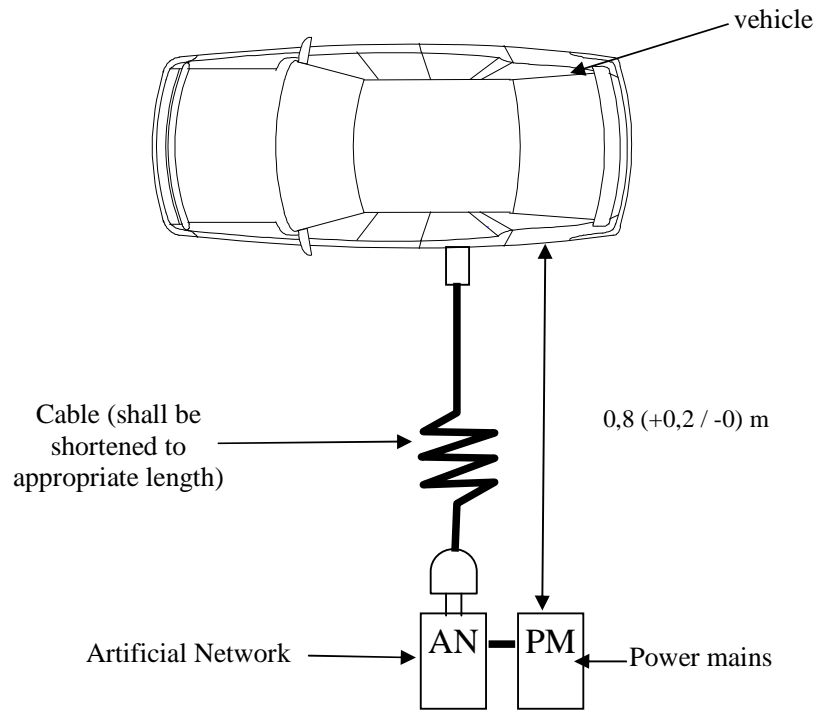
1. **General**
  - 1.1. The test method described in this annex shall be applied to vehicles in configuration “RESS charging mode coupled to the power grid”.
  - 1.2. **Test method**

This test is intended to measure the level of radio frequency conducted disturbances generated by vehicle in configuration “RESS 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 annex the test shall be performed according to CISPR 16-2-1.
2. **Vehicle state during tests**
  - 2.1. The vehicle shall be in configuration “RESS charging mode coupled to the power grid” at rated power until the AC or DC current reached at least 80 per cent of its initial value.
3. **Test Arrangements**
  - 3.1. The test shall be performed according to CISPR 16-2-1 clause 7.4.1. as floor-standing equipments.
  - 3.2. The artificial mains network to be used for the measurement on vehicle is defined in CISPR 16-1-2 clause 4.3.
  - 3.3. The test set-up for the connection of the vehicle in configuration “RESS charging mode coupled to the power grid” is shown in figure 2 of Appendix 1 to this annex.
  - 3.4. The measurements shall be performed with a spectrum analyser or a scanning receiver. The parameters to be used are respectively defined in CISPR 25 edition 3 clause 4.4.1. (table 1) and 4.4.2 (table 2).
4. **Test Requirements**
  - 4.1. The limits apply throughout the frequency range 0,15 to 30 MHz for measurements performed in a semi anechoic chamber or an outdoor test site.
  - 4.2. Measurements shall be performed with average and either quasi-peak or peak detectors. The limits are given in paragraph 7.5. table 9 for AC lines and table 10 for DC lines. If peak detectors are used a correction factor of 20 dB as defined in CISPR 12 (fifth edition, 2001) shall be applied.

### Annex 13–Appendix 1

**Figure 1**  
Vehicle in configuration “RESS charging mode coupled to the power grid”





## Annex 14

### Method(s) of Testing for Emission of Radiofrequency conducted disturbances on Network and Telecommunication access from Vehicle

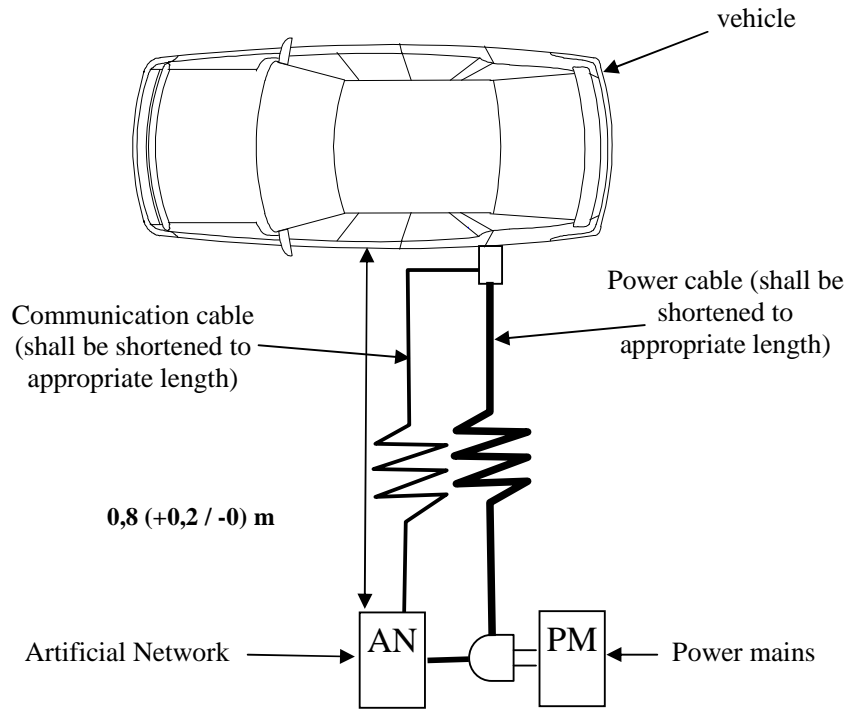
1. **General**
  - 1.1. The test method described in this annex shall be applied to vehicles in configuration “RESS charging mode coupled to the power grid”.
  - 1.2. **Test method**

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

If not otherwise stated in this annex the test shall be performed according to CISPR 22.
2. **Vehicle/ ESA State during Tests**
  - 2.1. The vehicle shall be in configuration “RESS charging mode coupled to the power grid” at rated power until the AC or DC current reached at least 80 per cent of its initial value.
3. **Test Arrangements**
  - 3.1. The test set-up shall be performed according to CISPR 22 paragraph 5 for conducted emissions.
  - 3.2. The impedance stabilisation to be used for the measurement on vehicle is defined in CISPR 22 paragraph 9.6.2.
  - 3.3. The test set-up for the connection of the vehicle in configuration “RESS charging mode coupled to the power grid” is shown in figure 1 of Appendix 1 to this annex.
  - 3.5. The measurements shall be performed with a spectrum analyser or a scanning receiver. The parameters to be used are respectively defined in CISPR 25 edition 3 clause 4.4.1 (table 1) and 4.4.2 (table 2).
4. **Test Requirements**
  - 4.1. The limits apply throughout the frequency range 0,15 to 30 MHz for measurements performed in a semi anechoic chamber or an outdoor test site.
  - 4.2. Measurements shall be performed with average and either quasi-peak or peak detectors. The limits are given in paragraph 7.6. table 11. If peak detectors are used a correction factor of 20 dB as defined in CISPR 12 (fifth edition 2001) shall be applied.

Annex 14–Appendix 1

Figure 1  
Vehicle in configuration “RESS charging mode coupled to the power grid”



## Annex 15

### Method of Testing for immunity of vehicles to electrical fast transient / burst disturbances conducted along AC and DC power lines

#### 1. General

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 “RESS in 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 annex. The vehicle shall be monitored during the tests.

If not otherwise stated in this annex the test shall be performed according to IEC 61000-4-4: 2<sup>nd</sup> edition 2004.

2. Vehicle state during tests in configuration “RESS in charging mode coupled to the power grid”

2.1. The vehicle shall be in an unladen condition except for necessary test equipment.

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

2.1.2. Basic vehicle conditions

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

<i>“RESS in charging mode” vehicle test conditions</i>	<i>Failure criteria</i>
The RESS shall be in charging mode. The RESS state of charge shall be agreed in between the manufacturer and the Technical Service.	Vehicle sets in motion

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

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.).

3. Test Equipments

- 3.1. The test equipments is composed of a reference ground plane (a shielded room is not required), a transient / burst generator, coupling / decoupling network (CDN) and capacitive coupling clamp.
- 3.2. The transient / burst generator shall meet the condition defined in paragraph 6.1 of IEC 61000-4-4: 2<sup>nd</sup> edition, 2004.
- 3.3. The coupling / decoupling network shall meet the condition defined in paragraph 6.2. of IEC 61000-4-4: 2<sup>nd</sup> edition, 2004. When the coupling/decoupling network cannot be used on AC or DC power lines, the capacitive coupling clamp defined in paragraph 6.3. of IEC 61000-4-4: 2<sup>nd</sup> edition, 2004, can be used.
4. Test Setup
  - 4.1. The vehicle test setup is based on the laboratory type setup as described in paragraph 7.2. of IEC 61000-4-4 : 2<sup>nd</sup> edition, 2004.
  - 4.2. The vehicle shall be placed directly on the ground plane.
  - 4.3. The Technical Service shall perform the test as specified in paragraph 7.7.2.1.

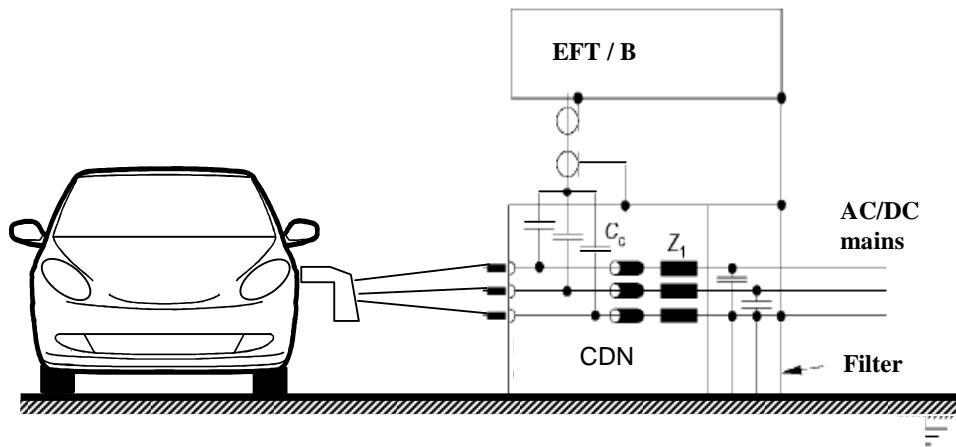
Alternatively, if the manufacturer provides measurement from a test laboratory accredited to the applicable parts of ISO 17025 (1<sup>st</sup> edition 1999) and recognized by the Approval Authority, the Technical Service may choose not to perform the test to confirm that the vehicle meets the requirements of this annex.
5. Generation of required Test Level
  - 5.1. Test methodology
    - 5.1.1. The test method according to IEC 61000-4-4: 2<sup>nd</sup> edition, 2004 shall be used to establish the test level requirements.
    - 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 appendix 1, figure 1 of this annex,

The test setup must be noted in the test report.

## Annex 15--Appendix 1

**Figure 1**  
Vehicle in configuration "RESS charging mode" coupled to the power grid coupling on AC/DC power lines



## Annex 16

### Method(s) of testing for immunity of vehicles to surges conducted along AC and DC power lines

1. General
  - 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 “RESS in 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: 2<sup>nd</sup> edition 2005.
2. Vehicle state during tests in configuration “RESS in charging mode coupled to the power grid”
  - 2.1. The vehicle shall be in an unladen condition except for necessary test equipment.
    - 2.1.1. The vehicle shall be immobilized, engine OFF and in charging mode.
    - 2.1.2. Basic vehicle conditions
 

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

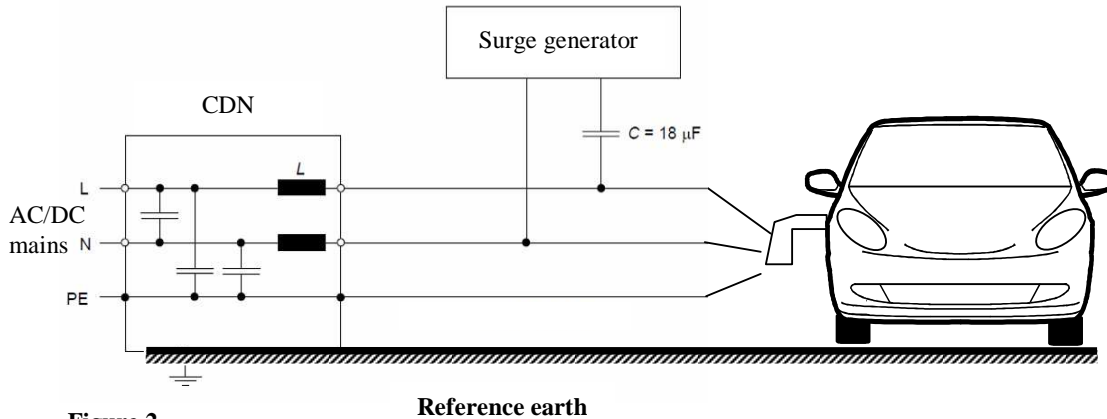
<i>“RESS in charging mode” vehicle test conditions</i>	<i>Failure criteria</i>
The RESS shall be in charging mode. The RESS state of charge shall be agreed in between the manufacturer and the Technical Service.	Vehicle sets in motion

- 2.1.3. All other equipment which can be switched on permanently by the driver or passenger should be OFF.
- 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.).
3. Test Equipments
  - 3.1. The test equipments is composed of a reference ground plane (a shielded room is not required), a surge generator and a coupling / decoupling network (CDN).

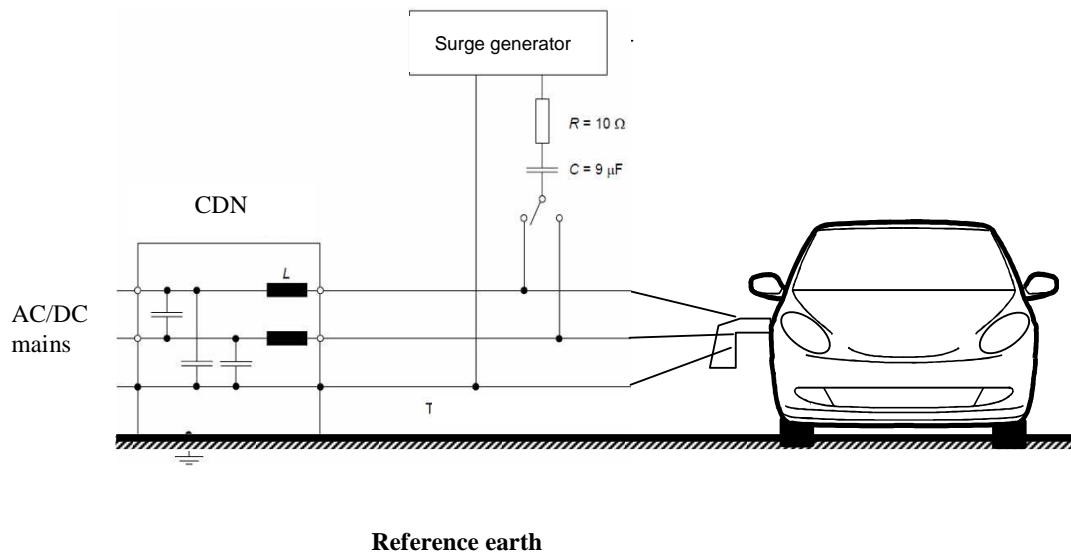
- 
- 3.2. The surge generator shall meet the condition defined in paragraph 6.1 of IEC 61000-4-5: 2<sup>nd</sup> edition, 2005.
- 3.3. The coupling / decoupling network shall meet the condition defined in paragraph 6.3. of IEC 61000-4-5: 2<sup>nd</sup> edition, 2005.
4. Test Setup
- 4.1. The vehicle test setup is based on the setup described in paragraph 7.2. of IEC 61000-4-5: 2<sup>nd</sup> edition, 2005.
- 4.2. The vehicle shall be placed directly on the ground plane.
- 4.3. The Technical Service shall perform the test as specified in paragraph 7.8.2.1.
- Alternatively, if the manufacturer provides measurement from a test laboratory accredited to the applicable parts of ISO 17025 (1<sup>st</sup> edition 1999) and recognized by the Approval Authority, the Technical Service may choose not to perform the test to confirm that the vehicle meets the requirements of this annex.
5. Generation of required Test Level
- 5.1. Test methodology
- 5.1.1. The test method according to IEC 61000-4-5: 2<sup>nd</sup> edition 2005 shall be used to establish the test level requirements.
- 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 Appendix 1 to this annex.

Annex 16--Appendix 1

**Figure 1**  
 Vehicle in configuration “RESS charging mode coupled to the power grid” - Coupling between line and for DC or AC (single phase) power lines

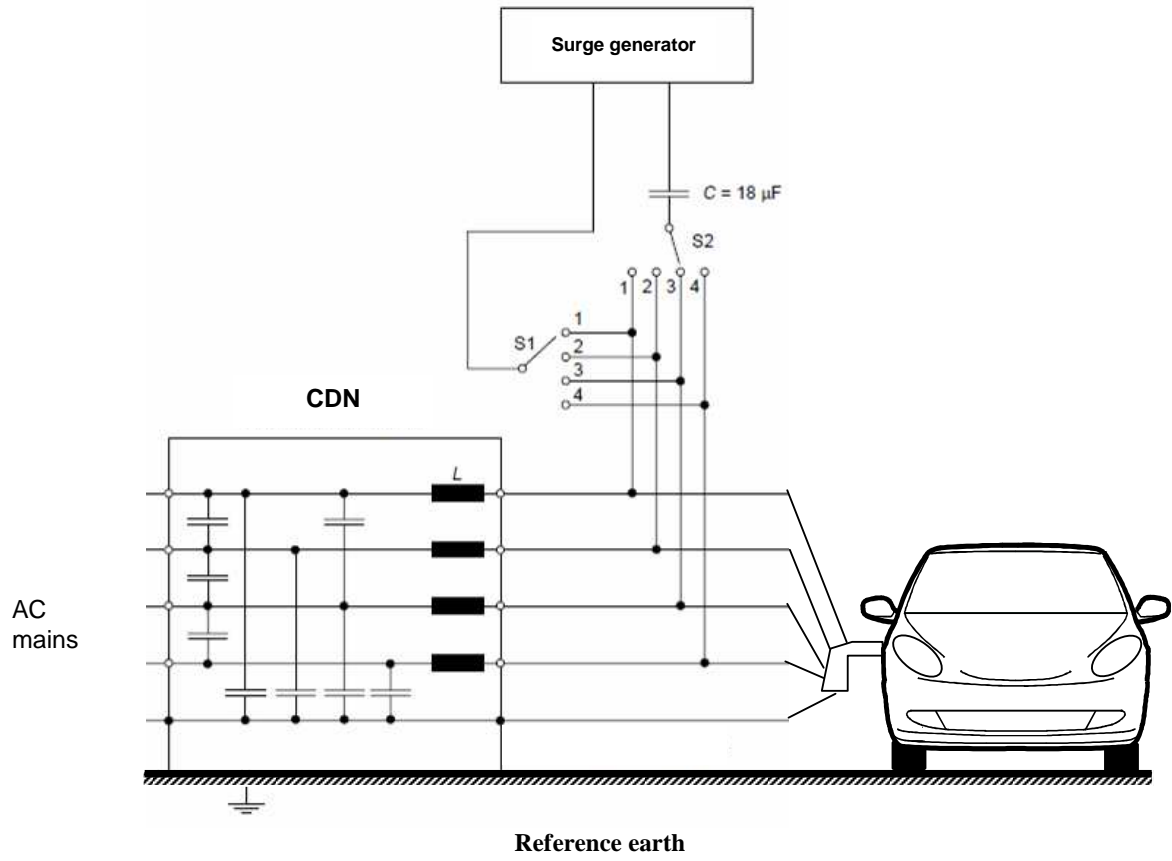


**Figure 2**  
 Vehicle in configuration “RESS charging mode coupled to the power grid” - Coupling between each line and earth for DC or AC (single phase) power lines

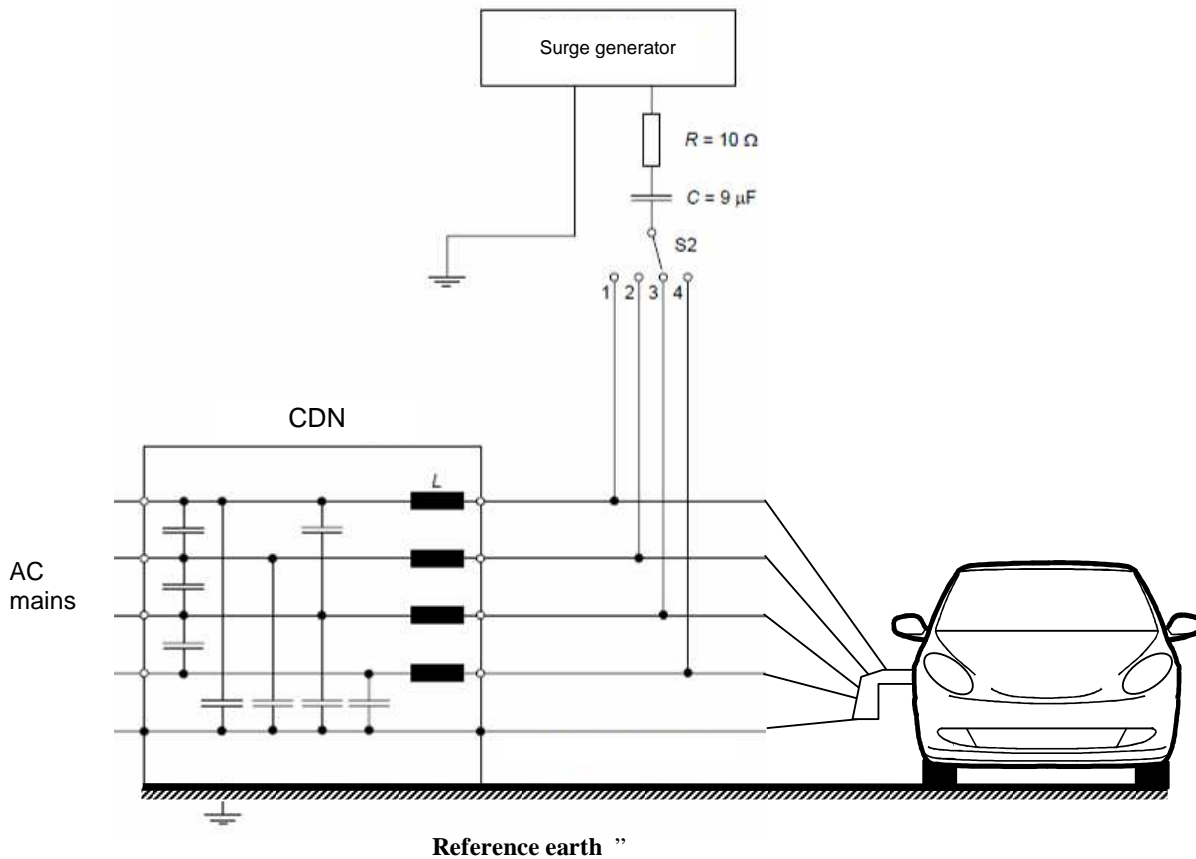


**Figure 3**  
 Vehicle in configuration “RESS charging mode coupled to the power grid” - Coupling between lines for AC (three phases) power lines





**Figure 4**  
**Vehicle in configuration “RESS charging mode coupled to the power grid” - Coupling between each line and earth for AC (three phases) power lines**



## II. Justification

1. The current international legislation in the field of Electromagnetic Compatibility (EMC) for motor vehicles and their trailers is based on directive 72/245/EC, as last amended by directive 2009/19/EC, and on Regulation No. 10, 03 series of amendments. The directive is one of the separate directives within the European vehicle type-approval system. While this directive applies to motor vehicles and their components, two further directives deal with questions of electromagnetic compatibility. The horizontal EMC directive 2004/108/EC, covers almost all other electrical/electronic equipment. The Low Voltage Directive (LVD) directive 2006/95/EC applies also to on board chargers where product standards contain electrical safety requirements and EMC requirements.

2. On board chargers are electronic automotive components which can be incorporate in other electronic modules and which cannot be identified in a vehicle as a separate electronic component. This proposal aims to adapt Regulation No.10 to the technical progress. The main objective is to extend the scope of the Regulation No. 10 to the charging mode of battery electric vehicle to all kinds of power train systems.

3. This amendment takes on-board Regulation No. 10, EMC requirements for emission end immunity for on-board charger when the vehicle is connected to the main for charging.

Reference is made to relevant applicable standards of the International Special Committee on Radio Interference (CISPR), the International Electrotechnical Committee (IEC) applicable standards or equivalent relevant International Organisation for Standardisation (ISO) standards (i.e. immunity).

The test provisions and certain reference limits take into account the work done in international harmonisation;

- (a) When establishing test procedures and methods of measurement the regulation refers to the latest standards available and ISO.
  - (b) Besides the existing requirements in Regulation No. 10, 03 series of amendments, concerning radiated emissions and immunity, the regulation contains amendments relating to the potentially more hazardous conducted and radiated emissions and immunity, when vehicles are connected to the main:
    - (i) Harmonic current emissions;
    - (ii) Conducted emissions;
    - (iii) Voltage changes, voltage fluctuations and flicker in public low-voltage Systems;
    - (iv) Electrical fast transients/burst.
-