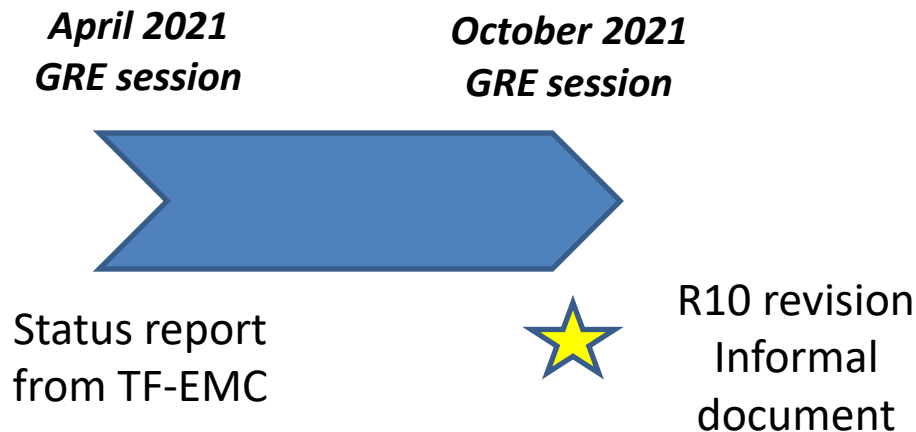


Task Force on Electro-Magnetic Compatibility (TF-EMC)

Status report to GRE-85 October 2021

TF-EMC Status Report - General

- 4 TF-EMC meetings took place since March 2021
- Proposals from OICA EMC-TF and CPs have been issued and discussed.
- As scheduled, an informal document has been prepared for the GRE-85 session with :
 - agreed proposals
 - and/or proposals still under discussion (but with detailed proposed wording)



TF-EMC Status Report – Informal document

- **Proposals in informal document already agreed within TF-EMC (highlighted in green)**
 - **Suppression of FM band CISPR 25 measurement as alternative** to vehicle CISPR 12 measurement for narrowband radiated emission
 - **Suppression of 800 mm Stripline method** for ESA immunity testing
 - **Extension of possible use of simplified measurement for test performed by technical services** to vehicle in charging mode test
 - Note to precise « **link** » between ECE R10 and ISO 26262
 - Addition of **official definitions in regard to autonomous vehicles**
 - **Precision on ESA transient immunity test for charging mode** configuration

TF-EMC Status Report - Informal document

- **Proposals in informal document still under discussion within TF-EMC (highlighted in yellow)**
 - Addition of reverberation chamber method for ESA testing
 - Consideration of non-residential environment for emission of radiofrequency conducted disturbances on AC or DC power lines – Vehicle in charging mode
 - Precision for minimum charging current for vehicle and ESA in DC charging mode emission test
 - Precision in each concerned annex for vehicle in charging mode of the charging modes to be tested and of the charging cables to be used
 - Emission measurement (conducted and radiated) instrumentation – Potential use of FFT (Fast Fourier Transform)
 - Consideration of autonomous vehicles (ADAS functions) for radiated immunity test
 - Precision on e-call testing for vehicle radiated immunity
 - Precision on operating conditions and failure criteria for ESA in charging mode immunity test
 - Precisions for trolleybuses
 - Extension up to 6 GHz of radiated immunity test frequency range
 - Introduction of vehicle ESD test

TF-EMC Status Report – Informal document

- **Suppression of FM band CISPR 25 measurement as alternative to vehicle CISPR 12 measurement for narrowband radiated emission**

Clause 6

~~6.3.2.4. Notwithstanding the limits defined in paragraphs 6.3.2.1., 6.3.2.2. and 6.3.2.3. of this Regulation, if, during the initial step described in paragraph 1.3. of Annex 5, the signal strength measured at the vehicle broadcast radio antenna is less than 20 dB micro volts over the frequency range 76 to 108 MHz measured with an average detector, then the vehicle shall be deemed to comply with the limits for narrowband emissions and no further testing will be required.~~

Annex 5

~~1.3. As an initial step the levels of emissions in the Frequency Modulation (FM) band (76 to 108 MHz) shall be measured at the vehicle broadcast radio antenna with an average detector. If the level specified in paragraph 6.3.2.4. of this Regulation is not exceeded, then the vehicle shall be deemed to comply with the requirements of this annex in respect of that frequency band and the full test shall not be carried out.~~

Suppression of this alternative method (voltage at antenna terminal in FM band) because cannot be considered as representative of vehicle radiated emission in the 30 MHz – 1 GHz frequency band.

TF-EMC Status Report – Informal document

- **ESA immunity test methods : suppression of 800 mm Stripline + potential addition of Reverberation chamber method**

Clause 6

Clause 7

Annex 9

6.8.2.1. 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 and [21] volts/m rms for the reverberation chamber 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, stripline testing method, 62.5 volts/m rms for the bulk current injection rms for the free field testing method and chamber testing method over the whole :

1.2.1. ESAs may comply with the requirements of any combination of the following test methods at the manufacturer's discretion provided that these results in the full frequency range specified in paragraph 3.1. of this annex being covered:

- (a) Absorber chamber test according to ISO 11452-2;
- (b) TEM cell testing according to ISO 11452-3;
- (c) Bulk current injection testing according to ISO 11452-4;
- (d) Stripline testing according to ISO 11452-5;
- ~~(e) 800 mm stripline according to paragraph 4.5. of this annex.~~
- (e) Reverberation chamber test according to ISO 11452-11;

Suppression of 800 mm Stripline test method because test method not standardized and not used anymore.

Potential addition of reverberating chamber test method because standardized (ISO 11452-11) and more representative / robust.

TF-EMC Status Report – Informal document

- ESA immunity test methods : suppression of 800 mm Stripline + potential addition of Reverberation chamber method

Annex 9

4.5. _____	800 mm stripline testing	
4.5.1. _____	Test method	
	The stripline consists of two parallel metallic plates separated by 800 mm. Equipment under test is positioned centrally between the plates and subjected to an electromagnetic field (see Appendix 1 to this annex).	
	This method can test complete electronic systems including sensors and actuators as well as the controller and wiring loom. It is suitable for apparatus whose largest dimension is less than one third of the plate separation.	
4.5.2. _____	Test methodology	
4.5.2.1. _____	Positioning of stripline	
	The stripline shall be housed in a screened room (to prevent external emissions) and positioned 2 m away from walls and any metallic enclosure to prevent electromagnetic reflections. RF absorber material may be used to damp these reflections. The stripline shall be placed on non-conducting supports at least 0.4 m above the floor.	
4.5.2.2. _____	Calibration of the stripline	
	A field measuring probe shall be positioned within the central one third of the longitudinal, vertical and transverse dimensions of the space between the parallel plates with the system under test absent.	
	The associated measuring equipment shall be sited outside the screen room. At each desired test frequency, a level of power shall be fed into the stripline to produce the required field strength at the antenna. This level of forward power, or another parameter directly related to the forward power required to define	
4.6. _____	Reverberation chamber test	
4.6.1. _____	Test method	
	This test method allows the testing of vehicle electrical/electronic systems by exposing an ESA to statistically homogeneous and isotropic electromagnetic fields created by injected and stirred mechanically.	
4.6.2. _____	Test methodology	
	The test shall be performed according ISO 11452-11	

Suppression of 800 mm Stripline test method because test method not standardized and not use anymore
Potential addition of reverberating chamber test method because standardized (ISO 11452-11) and more representative / robust

TF-EMC Status Report – Informal document

- Emission of radiofrequency conducted disturbances on AC or DC power lines – Vehicle in charging mode

Clause 7

7.5.2. Vehicle type approval limit for vehicle charged in residential environment

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 and given in Table 7.

Table 7
Maximum allowed radiofrequency conducted disturbances on AC power lines

Frequency (MHz)	Limits and detector
0.15 to 0.5	66 to 56 dB μ V (quasi-peak) 56 to 46 dB μ V (average) (linearly decreasing with logarithm of frequency)
0.5 to 5	56 dB μ V (quasi-peak) 46 dB μ V (average)
5 to 30	60 dB μ V (quasi-peak) 50 dB μ 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 and given in Table 8.

Table 8
Maximum allowed radiofrequency conducted disturbances on DC power lines

Frequency (MHz)	Limits and detector
0.15 to 0.5	79 dB μ V (quasi-peak) 66 dB μ V (average)
0.5 to 30	73 dB μ V (quasi-peak) 60 dB μ V (average)

7.5.3. Vehicle type approval limit for vehicle charged only in other environment than residential environment

7.5.3.1. For specific vehicles which are charged only with charging stations located in area characterized by a separate power network, supplied from a high or medium voltage transformer, dedicated for the supply of the installation (buses, heavy duty trucks, etc.), it can be appropriate to apply limits from IEC 61000-6-4.

7.5.3.2. In this case, the manufacturer shall provide a statement that the vehicle can be used in "REESS charging mode coupled to the power grid" only in area characterized by a separate power network, supplied from a high or medium voltage transformer, dedicated for the supply of the installation. The manufacturer shall provide a statement that the vehicle shall be charged in non-residential environment only. This information shall be made publicly available following the type approval

7.5.3.2. If measurements are made using the method described in Annex 13, the limits on AC power lines are those defined in IEC 61000-6-4 and given in Table 8.

Table 8
Maximum allowed radiofrequency conducted disturbances on AC power lines

Frequency (MHz)	Limits and detector
0.15 to 0.5	79 dB μ V (quasi-peak) 66 dB μ V (average)
0.5 to 30	73 dB μ V (quasi-peak) 60 dB μ V (average)

7.5.3.3. If measurements are made using the method described in Annex 13, the limits on DC power lines are those defined in IEC 61000-6-4 and given in Table 9.

Table 9
Maximum allowed radiofrequency conducted disturbances on DC power lines

Frequency (MHz)	Limits and detector
0.15 to 0.5	89 dB μ V (quasi-peak) 76 dB μ V (average)
0.5 to 30	83 dB μ V (quasi-peak) 70 dB μ V (average)

Distinction between residential and other environments (less stringent requirement for non-residential environment) in line with IEC 61000-6-3 and 61000-6-4 with associated statement that vehicle can be charged only in non-residential environment.

TF-EMC Status Report – Informal document

- Emission of radiofrequency conducted disturbances on AC or DC power lines
– Vehicle in charging mode

Annex 2A

73. Environment of charging (residential, non-residential)

Annex 3A

3. Environment of charging for EV and PHEV:

Type of vehicle valid for residential environment:

Type of vehicle valid for non-residential environment:

Clause 7

7.5.3.2 In this case, the manufacturer shall provide a statement that the vehicle can be used in "REESS charging mode coupled to the power grid" only in area characterized by a separate power network, supplied from a high or medium voltage transformer, dedicated for the supply of the installation. The manufacturer shall provide a statement that the vehicle shall be charged in non-residential environment only. This information shall be made publicly available following the type approval

Distinction between residential and other environments (less stringent requirement for non-residential environment) in line with IEC 61000-6-3 and 61000-6-4 with associated statement that vehicle can be charged only in non-residential environment.

TF-EMC Status Report – Informal document

- Precision for minimum charging current for vehicle and ESA in charging mode emission test

Annex 4

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

Annex 7

Annex 13

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 20 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.**

Annex 14

Annex 19

Annex 20

Editorial change for « nominal »

Potential technical modification for minimum charging current value in DC charging mode (test facility limitation, no proven impact)

TF-EMC Status Report – Informal document

- Precision in each concerned annex for vehicle in charging mode of the charging modes to be tested and of the charging cables to be used

Annex 4

The vehicle shall be tested in the following charging mode configurations (if available on the vehicle):

Annex 6

- AC mode 1 with only one charging cable provided by the vehicle manufacturer (if there are more than one cable type/length provided by the vehicle manufacturer, then choice of cable to be agreed with TS)

Annex 11

- AC Mode 2 with each ICCPD charging cable provided by the vehicle manufacturer (if there are more than one ICCPD cable type/length provided by the vehicle manufacturer, then choice of cable to be agreed with TS) unless ICCPD charging cable is ESA type-approved.

Annex 12

- AC Mode 3:

Annex 13

single phase if vehicle can be charged only from one phase with only one charging cable provided by the vehicle manufacturer (if there are more than one cable type/length provided by the vehicle manufacturer, then choice of cable to be agreed with TS).

Annex 14

three-phase only if vehicle can be charged from one phase or from three-phase with only one charging cable provided by the vehicle manufacturer (if there are more than one cable type/length provided by the vehicle manufacturer, then choice of cable to be agreed with TS).

Annex 15

Annex 16

- DC Mode 4 with the charging cable from the test facility

The vehicle shall be tested in the following charging mode configurations (if available on the vehicle):

- AC Mode 3:

single phase if vehicle can be charged only from one phase with only one charging cable provided by the vehicle manufacturer (if there are more than one cable type/length provided by the vehicle manufacturer, then choice of cable to be agreed with TS).

three-phase only if vehicle can be charged from one phase or from three-phase with only one charging cable provided by the vehicle manufacturer (if there are more than one cable type/length provided by the vehicle manufacturer, then choice of cable to be agreed with TS).

- DC Mode 4 with the charging cable from the test facility

ECE R10.06 does not states explicitly which charging modes should be tested and with which charging cables in emission and immunity annexes concerning vehicle in charging mode

TF-EMC Status Report – Informal document

- Extension of possible use of simplified measurement for test performed by technical services on vehicle in charging mode test

4.4. Measurements

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

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

For configuration "REESS charging mode coupled to the power grid", if the manufacturer provides measurement data for the whole frequency band from a test laboratory accredited to the applicable parts of ISO 17025 and recognized by the Type Approval Authority for all the available charging modes configurations defined in 2.2, the Technical Service may perform tests only for one of the available charging mode configuration defined in 2.2 and divide the frequency range in 14 frequency bands 30–34, 34–45, 45–60, 60–80, 80–100, 100–130, 130–170, 170–225, 225–300, 300–400, 400–525, 525–700, 700–850 and 850–1,000 MHz and perform tests at the 14 frequencies giving the highest emission levels within each band to confirm that the vehicle meets the requirements of this annex.

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

Annex 4

Annex 6

Annex 13

Annex 14

Annex 15

Annex 16

Use of simplified test method by technical services (under certain conditions) already included in previous R10 versions for vehicle not in charging mode.

TF-EMC Status Report – Informal document

- Emission measurement (conducted and radiated) instrumentation – Potential use of FFT (Fast Fourier Transform)

Annex 4

Annex 5

Annex 7

Annex 8

Annex 13

Annex 14

Annex 19

Annex 20

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

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

Last reference standard CISPR 16-1-1 allows to use FFT for emission measurement. On-going revision of CISPR 12 and CISPR 25 have also included possible use of FFT.

TF-EMC Status Report – Informal document

- Consideration of autonomous vehicles (ADAS functions) for radiated immunity test

Annex 6

Automated driving system shall be operational ⁽¹⁾	Does not remain in a failure safe mode or expected failure operational mode
⁽¹⁾ : Automated driving systems are turned on by the driver but some or all AV functions may revert to a mode where system is monitoring sensors but is not actively 'driving' the vehicle due to plausibility issues caused by the EMC laboratory environment	

2.1.1.5. If the vehicle is equipped with an automated driving system the immunity test shall demonstrate the vehicle stays in a failure safe mode or expected failure operational mode during the test in 50km/h mode or Brake mode. If it is not possible to activate the automated driving system due to another function (e.g. turn lamp, wiper, etc), these function(s) may be turned off. Then additional test run(s) may be necessary to cover untested function(s) (e.g. turn lamp, wiper, etc). Automated steering and braking may be deactivated to ensure a safe test environment.

Autonomous vehicle functions shall be considered for R10 radiated immunity test. Operating conditions still under discussion.

TF-EMC Status Report – Informal document

- Precision on e-call testing for vehicle radiated immunity

Annex 6

<i>"emergency-calling-systems"-vehicle-test-conditions</i> ¶	<i>Failure-criteria</i> ¶
<p>Emergency-calling-systems-functionality-shall-be-tested-before-launching-the-test-and-after-the-test-(either-by-performing-a-functionality-self-test-or-by-a-manually-or-automatically-enabled-call-either-to-emergency-services-or-to-emulated-system) ¶¶</p> <p>An-emergency-calling-(either-by-performing-a-functionality-self-test-or-by-a-manually-or-automatically-enabled-call-either-to-emergency-services-or-to-emulated-system)-shall-be-launched-at-the-beginning-of-the-test-with-field-irradiation. ¶</p>	<p>To-be-defined ¶¶</p> <p>¶</p>

E-call test during immunity to be precise (operating conditions and failure criteria); testing in EMC laboratory to be precised; test level to be confirmed.

TF-EMC Status Report – Informal document

- Precision on operating conditions and failure criteria for ESA in charging mode immunity test

Annex 9

Annex 21

Annex 22

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

"REESS charging mode" ESA test conditions	Failure criteria
<p>The REESS shall be in charging mode. The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole time duration of the measurement (this may lead to the measurement being split into different time slots with the need to discharge the vehicle's traction battery before starting the next time slot). If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal maximum rated charging input current value.</p> <p>In case of multiple batteries the average state of charge must be considered.</p>	<p>Temporary loss of charging function is allowed, provided that there is no incorrect charging condition (e.g. over-current, overvoltage) and the function can be restored by a simple intervention, without the use of tools, such as turning off/on the DUT, after the disturbance is removed.</p>

"REESS charging mode" ESA test conditions	Failure criteria
<p>ESA shall be in configuration "REESS charging mode coupled to the power grid".</p> <p>The state of charge (SOC) of the traction battery shall be kept between 20 per cent and 80 per cent of the maximum SOC during the whole frequency range measurement (this may lead to split the measurement in different sub-bands with the need to discharge the vehicle's traction battery before starting the next sub-bands).</p> <p>If the test is not performed with a REESS the ESA should be tested at rated current. If the current consumption can be adjusted, then the current shall be set to at least 20 per cent of its nominal maximum rated charging input current value.</p>	<p>Incorrect charging condition (e.g. over-current, overvoltage)</p> <p>Temporary loss of charging function is allowed, provided that there is no incorrect charging condition (e.g. over-current, overvoltage) and the function can be restored by a simple intervention, without the use of tools, such as turning off/on the DUT, after the disturbance is removed.</p>

No technical change for operating conditions
Potential change of failure criteria.

TF-EMC Status Report – Informal document

- Extension of frequency range up to 6 GHz

6.4.2.1

6.4.2. Vehicle immunity type approval limits

6.9.2.1

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

7.7.2.1

7.18.2.1

Need to consider new services above 2 GHz (e.g 4G, 5G) for immunity to external sources.

Conditions for testing long vehicle shall be precised, test level above 2 GHz to be precised.

TF-EMC Status Report – Informal document

- Introduction of vehicle ESD test

6.5

6.5. Specifications concerning immunity of vehicles to Electrostatic discharge.”

6.5.1. Method of testing

The method described in ISO10605: 2008/Amd 1:2014 shall be used as the method of measurement of the vehicle in areas where an ESD in standard use is possible (e.g. by touching by the driver or occupants during driving, entry into or exit from the vehicle).

6.5.2. Vehicle immunity type approval limits

Test level II ($\pm 8\text{kV}$) at functional status Class B, according to ISO10605: 2008/Amd 1:2014 applies.”

Topic under discussion.

TF-EMC Status Report – Informal document

- Precision on ESA transient immunity test for charging mode configuration

Annex 10

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

For configuration other than “REESS charging mode coupled to the power grid”, apply the test pulses 1, 2a, 2b, 3a, 3b and 4 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.

For configuration “REESS charging mode coupled to the power grid”, 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.

6.9.1. Method of testing

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

Table 2
Immunity of ESA

Test pulse number	Immunity test level	Functional status for systems:	
		Related to immunity related functions	Not related to immunity related functions
1	III	C	D
2a	III	B	D
2b	III	C	D
3a/3b	III	A	D
4	III	B	D

7.19.1. Method of testing

The immunity of ESA representative of its type shall be tested by the method(s) according to ISO 7637-2, as described in Annex 10 with the test levels given in Table 18.

Table 18
Immunity of ESA

Test pulse number	Immunity test level	Functional status for systems:	
		Related to immunity related functions	Not related to immunity related functions
1	III	C	D
2a	III	B	D
2b	III	C	D
3a/3b	III	A	D

Annex 10 wording is not fully consistent with requirement described in clauses 6 and 7

TF-EMC Status Report – Informal document

- Miscellaneous

Scope

Note: The immunity levels stated in this regulation ensure robustness of vehicle systems in the electromagnetic environment and therefore addresses one of the external environment to be considered for functional safety (e.g. in ISO 26262).

Note to precise « link » between ECE R10 and ISO 26262

Definitions

2.26 “Automated driving system” refers to a vehicle system that uses both hardware and software to exercise dynamic control of a vehicle on a sustained basis.

2.27 “Dynamic control” refers to carrying out all the real-time operational and tactical functions required to move the vehicle. This includes controlling the vehicle’s lateral and longitudinal motion, monitoring the road, responding to events in the road traffic, and planning and signalling for manoeuvres.

Addition of official definitions in regard to autonomous vehicles

TF-EMC Status Report – Informal document

- Miscellaneous

Clause 6

6.10.8. Trolleybuses: AC / DC mains portion of the vehicle propulsion system shall be excluded from this Regulation.

Precision for trolleybuses

TF-EMC Status Report - Revision of R10

- **Proposals still under consideration within TF-EMC (not included in informal document)**
 - Improvement of test set-up figures and descriptions for vehicle in configuration "REESS charging mode coupled to the power grid"
 - Improvement of test set-up figures and descriptions for ESA in configuration "REESS charging mode coupled to the power grid"
 - Update of standards normative references to more recent editions

TF-EMC Status Report - Revision of R10

- **Next steps for R10 revision**

- As proposed and agreed during GRE 84th session the next steps will be to [propose formal working documents for R10 revision](#) at the 2 next GRE sessions

