

Proposal for amendments to Regulation No. 10 (Electromagnetic compatibility)

Submitted by the experts from the Russian Federation

The text reproduced below was prepared by the experts from the Russian Federation to amend Regulation No. 10 with prescriptions for trolleybuses. It is based on ECE/TRANS/WP.29/GRE/2014/41 and GRE-73-20 introduced at the seventy-second and seventy-third sessions of GRE. The modifications to the existing text of the Regulation are marked in bold for new or strikethrough for deleted characters.

I. Proposal

Paragraph 6.2.1 amend to read:

6.2.1 Method of measurement

The electromagnetic radiation generated by the vehicle representative of its type shall be measured using the method described in Annex 4. **Relating to trolleybuses the measurement shall be made using the method described in Appendix 23.** This method of measurement shall be defined by the vehicle manufacturer in accordance with the Technical Service.

Include new paragraphs 6.2.2.3, 6.2.2.3.1 - 6.2.2.3.6 read as follows:

6.2.2.3 If measurements are made using the method described in Annex 23 using a vehicle-to-antenna spacing of 10.0 ± 0.2 m, the radiation limits shall be:

6.2.2.3.1 for the interference caused by a vehicle in a stationary state 40-15 dB microamperes/m in the 0,009 to 0,150 MHz frequency band, in this respect, in the event with frequencies above 0,009 MHz this limit decreasing logarithmically as shown in Addendum 9 to this Regulation;

6.2.2.3.2 for the interference caused by a vehicle in a driving mode 50-25 dB microamperes/m in the 0,009 to 0,150 MHz frequency band, in this respect, in the event with frequencies above 0,009 MHz this limit decreasing logarithmically as shown in Addendum 10 to this Regulation;

6.2.2.3.3 for the interference caused by a vehicle in a stationary state 45-(-5) dB microamperes/m in the 0,150 to 30 MHz frequency band, in this respect, in the event with frequencies above 0,150 MHz this limit decreasing logarithmically as shown in Addendum 9 to this Regulation;

6.2.2.3.4 for the interference caused by a vehicle in a driving mode 55-5 dB microamperes/m in the 0,150 to 30 MHz frequency band, in this respect, in the event with frequencies above 0,150 MHz this limit decreasing logarithmically as shown in Addendum 10 to this Regulation;

Excess of limit values in a frequency range of 0,15-0,5 MHz no more than 10 dB is allowed when travelling by trolleybus of points of rigid attachment of contact conductors.

6.2.2.3.5 for the interference caused by a vehicle in a stationary state 50 dB microvolts/m in the 30 to 1000 MHz frequency band as shown in Addendum 11 to this Regulation;

6.2.2.3.6 for the interference caused by a vehicle in a driving mode 75-50 dB microvolts/m in the 30 to 1000 MHz frequency band, in this respect, in the event with frequencies above 30 MHz this limit decreasing logarithmically as shown in Addendum 12 to this Regulation;

The previous paragraph 6.2.2.3 shall be numbered as paragraph 6.2.2.4

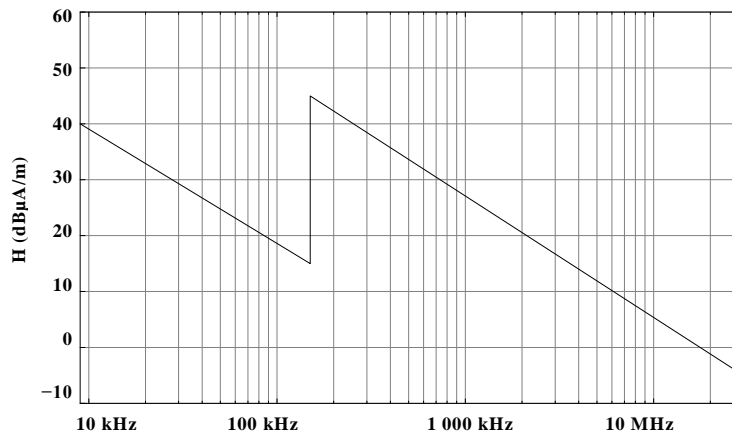
Include new Addendum 9 as follows:

«Addendum 9

Broadband reference limits for the interference created by the trolleybus in a stationary state

Limit H (dB μA/m) at frequency F (MHz):	
0,009–0,150 MHz	0,150–30 MHz
$H = 40 - 20,46 \cdot \log (F/0,009)$	$H = 45 - 21,73 \cdot \log (F/0,15)$

Limit values for interference created by the trolleybus in the stationary state, trolleybus-to-antenna spacing of 10 m
 Quasi-peak detector: bandwidth 200 Hz for f < 150 kHz
 bandwidth 10 kHz for f > 150 kHz



Frequency (logarithmic scale)
 (See paragraphs 6.2.2.3.1 and 6.2.2.3.3 of this Regulation)

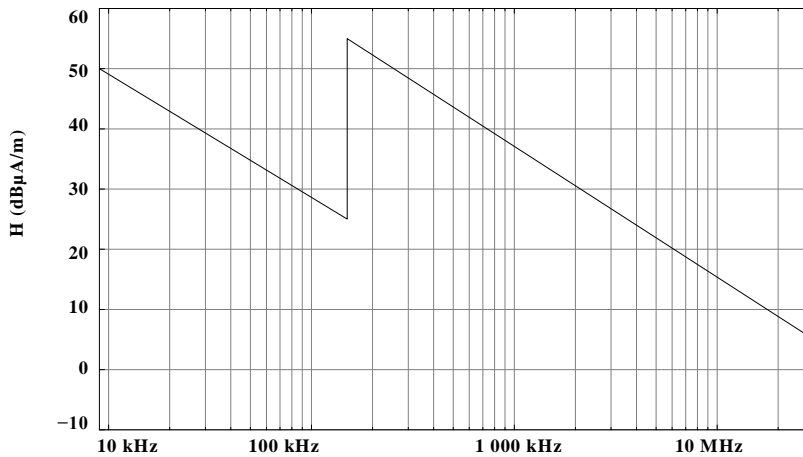
Include new Addendum 10 as follows:

Addendum 10

Broadband reference limits for the interference created by the trolleybus in a driving mode

Limit H (dB μ A/m) at frequency F (MHz):	
0,009–0,150 MHz	0,150–30 MHz
$H = 50 - 20,46 \cdot \log (F/0,009)$	$H = 55 - 21,73 \cdot \log (F/0,15)$

Limit values for interference created by the trolleybus in the driving mode,
trolleybus-to-antenna spacing of 10 m
Peak detector: bandwidth 200 Hz for $f < 150$ kHz
bandwidth 10 kHz for $f > 150$ kHz



Frequency (logarithmic scale)
(See paragraphs 6.2.2.3.2 and 6.2.2.3.4 of this Regulation)

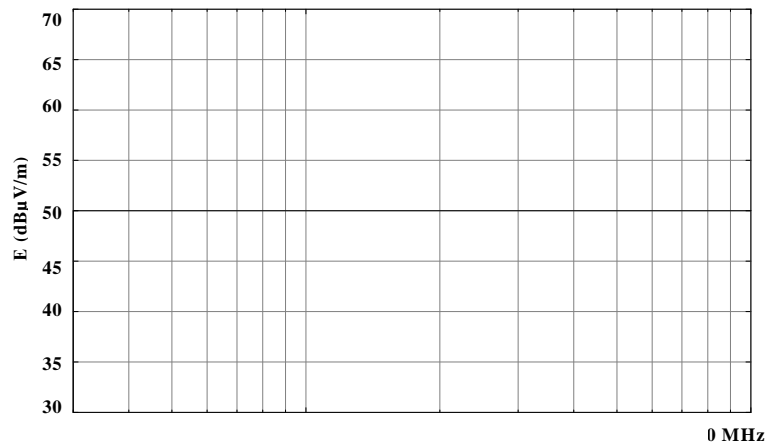
Include new Addendum 11 as follows:

Addendum 11

Broadband reference limits for the interference created by the trolleybus in a stationary state

Limit E (dB μ V/m) at frequency F (MHz):
30–1 000 MHz
$E = 50$

Limit values for interference created by the trolleybus in the stationary state,
 trolleybus-to-antenna spacing of 10 m
 Quasi-peak detector: bandwidth 120kHz



Frequency (logarithmic scale)
 (See paragraph 6.2.2.3.5 of this Regulation)

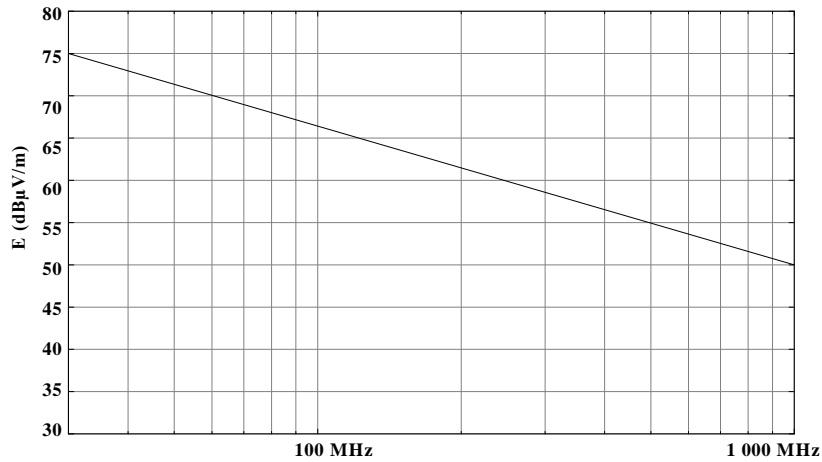
Include new Addendum 12 as follows:

Addendum 12

Broadband reference limits for the interference created by the trolleybus in a driving mode

Limit E (dBµV/m) at frequency F (MHz):
30 – 1 000 MHz
$E = 75 - 16,42 \cdot \log (F/30)$

Limit values for interference created by the trolleybus in a driving mode,
trolleybus-to-antenna spacing of 10 m
Peak detector: bandwidth 120kHz



Frequency (logarithmic scale)
(See paragraph 6.2.2.3.6 of this Regulation)

Include new Appendix 23 as follows:

“Appendix 23

Measurement method for broadband electromagnetic emissions created by the trolleybus”

1. General provisions

1.1 The method described in this Appendix shall be applied only to trolleybuses

1.2 Test method

This test is intended to measure the broadband emissions generated by electrical or electronic systems fitted to the trolleybus.

2. Trolleybus state during tests

The trolleybuses shall be tested in the stationary state as well as at the speed in steady and transit modes. The readings from the interference meter at the moment when the current collector passes by points of rigid attachment of contact conductors are noted separately.

2.1 Operation mode of traction engines

2.1.1 Steady mode – the mode at which the voltage on traction engines of the trolleybus isn't regulated: the traction mode - voltage on engines is given, the run-down mode - voltage is removed from engines.

- 2.1.2 Transit mode – the mode at which there is a voltage commutation of traction engines: start, electrical braking, load shedding.
- 2.2 Others trolleybus systems
 - 2.2.1 In the course of testing in the stationary state, static auxiliary converters (the maximum level of emissions isn't surely noted at the maximum loadings) and systems of pulse regulation (at their existence) have to work, and the traction converter has to be energized, but not operable.
 - 2.2.2 All equipment which can be switched on permanently by the driver or passenger should be in normal operation in maximum load, e.g. wiper motors or fans. Horn and electric window motors are excluded because they are not used continuously.
- 2.3 In the course of testing in the driving mode the speed has to be rather low to avoid sparking in the sliding contact piece or its bouncings, and rather high to allow electric braking. The recommended range of speed makes 35 ± 5 km/h. When passing a zone of antenna measurement the vehicle has to be accelerated or decelerated using about 1/3 from maximum traction force in this speed range.
- 3. Measurement facility
 - 3.1 Area for measurement interference caused by trolley, should be smooth, free from buildings, trees, bushes, foreign air networks and other objects within a radius of at least 25 m
 - 3.2 The antenna shall be positioned between contact line supports in the middle of the passage at a distance of 10 m from the track centre.
 - 3.2.1 The vertical distance from the antenna to the ground:
 - magnetic antenna - 1-2 m;
 - electrical antenna - 2,5-3,5 m
 - 3.3 The measurements shall not be conducted in rainy or snowy weather as well as in case of clear ice and frost on contact system wires.
- 4. Test requirements
 - 4.1 The limits apply throughout the frequency range 0,009 to 0,150 MHz, 0,150 to 30 MHz, 30 to 1000 MHz for measurements performed in an outdoor test site.
 - 4.2 Measurements can be performed with either quasi-peak or peak detectors. If peak detectors are used a correction factor of 20 dB as defined in CISPR 12 shall be applied.

II. Justification

Proposals comprise the updated limits for broadband emissions and description of test methods for trolleybuses, which are based on IEC standards.