

56 Electromagnetic Compatibility

Refer to: R10 02-S2

56.1 Effective date and Scope:

56.1.1 Effective date from 2011/01/01, the new vehicle variants of category symbols L, M1 and N1, and from 2013/01/01 all vehicle variants of category symbols L, M1 and N1, its electromagnetic interference shall comply with this regulation.

56.1.2 For the vehicles used by authorities, organizations、schools or individuals for self-use only could exempt from this regulation of 「Electromagnetic Compatibility」.

56.2 Definitions

56.2.1 "Electromagnetic compatibility" means the ability of a vehicle or component(s) or separate electrical/electronic technical unit(s) to function satisfactorily in an electromagnetic environment without introducing intolerable electromagnetic disturbances to anything in that environment.

56.2.2 "Electromagnetic disturbance" means annoy electromagnetic phenomenon which may degrade the performance of a vehicle or component(s) or separate electrical/electronic technical unit(s). An electromagnetic disturbance may be electromagnetic noise or a change in the propagation medium itself.

56.2.3 "Electromagnetic immunity" means the ability of a vehicle or component(s) or separate technical unit(s) to perform without degradation of performance in the presence of specified electromagnetic disturbances.

56.2.4 "Electromagnetic environment" means the totality of electromagnetic phenomena existing at a given location.

56.2.5 "Reference limit" means the nominal level to which type approval and conformity of production limit values are referenced.

56.2.6 "Reference antenna" for the frequency range 20 to 80 MHz: means a shortened balanced resonant dipole at 80 MHz, and for the frequency range above 80 MHz: means a balanced half-wave resonant dipole tuned to the measurement frequency.

56.2.7 "Broadband electromagnetic disturbances" means electromagnetic disturbances which have a bandwidth greater than the

passband of the receiver used.

56.2.8 "Narrowband electromagnetic disturbances" means electromagnetic disturbances which have a bandwidth less than the passband of the receiver used.

56.2.9 "Electrical/electronic system" means an electrical and or electronic device or set of devices together with any associated electrical wiring which forms part of a vehicle but which is not intended to be type approved separately from the vehicle.

56.2.10 "Electrical/electronic sub-assembly" (ESA) means an electrical and/or electronic device set of devices intended to be part of a vehicle, together with any associated electrical wiring, which performs one or more specialized functions. An ESA may be approved at the request of a manufacturer as either a "component" or a "separate technical unit(STU)".

56.3 Electromagnetic Compatibility shall according to suitable types and range of principle are as below :

56.3.1 If use completed vehicle for testing, which shall according to suitable types and range of principle are as below :

56.3.1.1 The same vehicle category symbol.

56.3.1.2 The same brand and vehicle type series.

56.3.1.3 The same chassis brand.

56.3.1.4 Chassis manufacturers announced that the same chassis vehicle type series.

56.3.1.5 The same type of vehicle propulsion source (internal combustion engine or electric motor).

56.3.2 If use chassis vehicle instead of completed vehicle for testing, which shall according to suitable types and range of principle are as below :

56.3.2.1 The same chassis brand.

56.3.2.2 Chassis manufacturers announced that the same chassis vehicle type series.

56.3.2.3 The same type of vehicle propulsion source (internal combustion engine or electric motor).

56.3.3 If use Electrical/Electronic sub-assembly(ESA) for testing, which shall according to suitable types and range of principle are as

below :

56.3.3.1 The same ESA brand.

56.3.3.2 The same ESA type.

56.3.3.3 The same function performed by the ESA.

56.3.3.4 The same general arrangement of the electrical and/or electronic components,(If applicable).

56.4 Test method descriptions

56.4.1 General specifications

56.4.1.1 A vehicle (and its electrical/electronic system(s) or ESAs) shall be so designed and fitted as to enable the vehicle, in normal conditions of use, to conform to the requirements of this regulation.

56.4.2 Specifications concerning broadband electromagnetic disturbances generated by vehicles fitted with spark ignition.

56.4.2.1 Method of measurement

The electromagnetic disturbances generated by the vehicle representative of its type shall be measured using the method described in annex 4 at either of the defined antenna distances. The choice shall be made by the vehicle manufacturer.

56.4.2.2 Reference limit for broadband electromagnetic disturbances generated by the vehicle.

56.4.2.2.1 If measurements are made using the method described in annex 4 using a vehicle-to antenna spacing of 10.0 +/- 0.2 m, the radiation reference limit shall be 34 dB micro- Volts/m (50 micro-Volts/m) in the 30-75 MHz frequency band, increasing logarithmically (linearly) from 34 to 45 dB micro-Volts/m (50-180 micro-Volts/m) in the 75-400 MHz frequency band, (as shown in appendix 1 to this Regulation), and remaining constant at 45 dB micro-Volts/m (180 micro-Volts/m) in the 400-1,000 MHz frequency band.

56.4.2.2.2 If measurements are made using the method described in annex 4 using a vehicle-toantenna spacing of 3.0 +/- 0.05 m, the radiation reference limit shall be 44 dB micro- Volts/m (160 micro-Volts/m) in the 30-75 MHz frequency band, increasing

logarithmically (linearly) from 44 to 55 dB micro-Volts/m (160-562 micro-Volts/m) in the 75-400 MHz frequency band, (as shown in appendix 2 to this Regulation), and remaining constant at 55 dB micro-Volts/m (562 micro-Volts/m) in the 400-1,000 MHz frequency band.

56.4.2.2.3 On the vehicle presented for approval, the measured values, expressed in dB micro-Volts/m, (micro-Volts/m), shall be at least 2.0 dB, (20%) below the reference limit.

56.4.3 Specifications concerning narrowband electromagnetic disturbances generated by vehicles.

56.4.3.1 Method of measurement

56.4.3.1.1 The electromagnetic disturbances generated by the vehicle type presented for approval shall be measured using the method described in annex 5 at either of the defined antenna distances. The choice shall be made by the vehicle manufacturer.

56.4.3.2 Reference limit for narrowband electromagnetic disturbances generated by the vehicle.

56.4.3.2.1 If measurements are made using the method described in annex 5 using a vehicle-to-antenna spacing of 10.0 +/- 0.2 m, the radiation reference limit shall be 24 dB micro-Volts/m (16 micro-Volts/m) in the 30-75 MHz frequency band, increasing logarithmically (linearly) from 24 to 35 dB micro-Volts/m (16-56 micro-Volts/m) in the 75-400 MHz frequency band, (as shown in appendix 3 to this Regulation), and remaining constant at 35 dB micro-Volts/m (56 micro-Volts/m) in the 400-1,000 MHz frequency band.

56.4.3.2.2 If measurements are made using the method described in annex 5 using a vehicle-to antenna spacing of 3.0 +/- 0.05 m, the radiation reference limit shall be 34 dB micro-Volts/m (50 micro-Volts/m) in the 30-75 MHz frequency band, increasing logarithmically (linearly) from 34 to 45 dB micro-Volts/m (50-180 micro-Volts/m) in the 75-400 MHz frequency band, (as shown in appendix 4 to this Regulation), and remaining constant at 45 dB micro-Volts/m (180 micro-Volts/m) in the 400-1,000 MHz frequency band.

56.4.3.2.3 On the vehicle presented for approval, the measured values, expressed in dB micro- Volts/m (micro-Volts/m), shall be at least 2.0 dB, (20%) below the reference limit.

56.4.3.2.4 Notwithstanding the limits defined in paragraphs 56.4.3.2.1, 56.4.3.2.2. and 56.4.3.2.3. of this Regulation, if, during the initial step described in annex 5, paragraph 56.6. 1.3, the signal strength measured at the vehicle radio antenna is less than 20 dB micro-Volts (10 micro- Volts) over the frequency range 76-108 MHz, then the vehicle shall be deemed to conform to the limits for narrowband electromagnetic disturbances and no further testing will be required.

56.4.4 Specifications concerning broadband electromagnetic disturbances generated by ESAs.

56.4.4.1 Method of measurement

The electromagnetic radiation generated by the ESA representative of its type shall be measured by the method described in paragraph 56.7.

56.4.4.2 ESA broadband reference limit

56.4.4.2.1 If measurements are made using the method described in paragraph 56.7., the radiation reference limit shall decrease logarithmically (linearly) from 64 to 54 dB micro-Volts/ m (1,600-500 micro-Volts/m) in the 30-75 MHz frequency band, and increase logarithmically (linearly) from 54 to 65 dB micro-Volts/m (500-1,800 micro-Volts/m) in the 75-400 MHz band, (as shown in chart 5) and remain constant at 65 dB micro-Volts/m (1,800 micro-Volts/m) in the 400-1,000 MHz frequency band.

56.4.4.2.2 On the ESA representative of its type, the measured values, expressed in dB micro- Volts/m, shall be at least 2.0 dB (20%) below the reference limit.

56.4.5 Specifications concerning narrowband electromagnetic disturbances generated by ESAs.

56.4.5.1 Method of measurement: The electromagnetic disturbances generated by the ESA representative of its type shall be measured by the method described in paragraph 56.8.

56.4.5.2 Reference limits for narrowband electromagnetic disturbances generated by ESAs.

56.4.5.2.1 Reference limit shall decrease logarithmically (linearly) from 54 to 44 dB micro-Volts/ m (500-160 micro-Volts/m) in the 30-75 MHz frequency band, and increase logarithmically (linearly) from 44 to 55 dB micro-Volts/m (160-560 micro-Volts/m) in the 75-400 MHz band, (as shown in appendix 6 to this Regulation), and remain constant at 55 dB micro-Volts/m (560 micro-Volts/m) in the 400-1,000 MHz frequency band.

56.4.5.2.2 On the ESA representative of its type, the measured values, expressed in dB micro- Volts/m, shall be at least 2.0 dB (20%) below the reference limit.

56.4.6 Exceptions

56.4.6.1 Where a vehicle or electrical/electronic system or ESA does not include an electronic oscillator with an operating frequency greater than 9 kHz, it shall be deemed to conform to relevant stipulations.

56.4.6.2 Conducted transients

Since during normal driving, no external electrical connections are made to vehicles, no conducted transients are generated in relation to the external environment. The responsibility of ensuring that equipment can tolerate the conducted transients within a vehicle, e.g. due to load switching and interaction between systems, lies with the manufacturer. No type approval test for conducted transients is deemed necessary.

56.5 Method of measuring broadband electromagnetic disturbances generated by vehicles

56.5.1 General

56.5.1.1 The test method described in this annex shall be applied only to vehicles.

56.5.1.2 Measuring apparatus

The measuring equipment shall comply with the requirements of Publication No. 16-1 (93) of the International Special Committee on Radio Interference (CISPR). A Quasi-Peak Detector shall be used for the measurement of broadband electromagnetic disturbances in this annex or, if a peak detector is used, an appropriate correction factor shall be used

depending on the spark pulse rate.

56.5.1.3 Test method

This test is intended to measure the broadband emissions generated by spark ignition systems. Two alternative reference antenna distances are permissible: 10 metres or 3 metres from the vehicle. In either case, the requirements of paragraph 4.3 of this annex shall be complied with.

56.5.2 Expression of results

The results of measurements shall be expressed in dB micro-Volt/m (micro-volt/m) for 120 kHz bandwidth. If the actual bandwidth B (expressed in kHz) of the measuring apparatus differs from 120 kHz, the readings taken in micro-Volts/m shall be converted to 120 kHz bandwidth through multiplication by a factor $120/B$.

56.5.3 Measuring location

- 56.5.3.1 The test site shall be a level, clear area free of electromagnetic reflecting surfaces within a circle of minimum radius 30 m measured from a point mid-way between the vehicle and the antenna. (see chart 7). Alternatively, for L-category vehicles the test surface may be any location that fulfils the conditions shown in chart 7.
- 56.5.3.2 The measuring set, test hut, or vehicle in which the measurement set is located may be within the test site, but only in the permitted area shown in Figure 1 in appendix 1 to this annex. Where test surface fulfils the conditions stated in chart 7, the measuring equipment must lie outside the part shown in this Figure 2. Other measuring antennae will not be affected.
- 56.5.3.3 Enclosed test facilities may be used if correlation can be shown between the results obtained in the enclosed test facility and those obtained at an outdoor site. Enclosed test facilities are allowed within the test area, at a minimum distance of 10 m from both the receiving antenna and the vehicle under test, provided that it can be shown that the test results do not need to meet the dimensional requirements of Figures 1 and 2 in appendix 1 of this annex other than the distance from the antenna to the vehicle and the height of the antenna. Neither do ambient emissions need to be checked before or after the test as

indicated in paragraph 56. 5.3.4. of this annex.

56.5.3.4 Ambient conditions

To ensure that there is no extraneous noise or signal of a magnitude sufficient to affect materially the measurement, measurements shall be taken before and after the main test. If the vehicle is present when ambient measurements are taken, it will be necessary to ensure that any emissions from the vehicle do not affect significantly the ambient measurements, for example by removing the vehicle from the test area, removing the ignition key, or disconnecting the battery. In both of the measurements, the extraneous noise or signal shall be at least 10 dB below the reference limits given in paragraphs 56.4.2.2.1 or 56.4.2.2.2 of this Regulation, except for intentional narrowband ambient transmissions.

56.5.4 Vehicle state during tests

56.5.4.1 Engine

The engine shall be running at its normal operating temperature and the transmission shall be in neutral. If for practical reasons this cannot be achieved, alternative arrangements mutually agreed between the manufacturer and the test authority may be made. Care shall be taken to ensure that the speed setting mechanism does not influence electromagnetic radiations. During each measurement, the engine shall be operated as follows:

Engine type	Method of measurement	
	Quasi-peak	Peak
Spark ignition	Engine speed	Engine speed
One cylinder	2500 rpm +/- 10%	2500 rpm +/- 10%
More than one cylinder	1500 rpm +/-10%	1500 rpm +/- 10%

56.5.4.2 Testing shall not be conducted while rain or other precipitation is falling on the vehicle or within 10 minutes after such precipitation has stopped.

56.5.5 Antenna type, position and orientation

56.5.5.1 Antenna type

Any antenna may be used provided it can be normalized to the reference antenna. The method described in CISPR publication No. 12, Edition 3, appendix A, may be used to calibrate the antenna.

56.5.5.2 Height and distance of measurement

56.5.5.2.1 Height

56.5.5.2.1.1 10 m test

The phase centre of the antenna shall be 3.00 ± 0.05 m above the plane on which the vehicle rests.

56.5.5.2.1.2 3 m test

The phase centre of the antenna shall be 1.80 ± 0.05 m above the plane on which the vehicle rests.

56.5.5.2.1.3 No part of any antenna's receiving elements shall be closer than 0.25 m to the plane on which the vehicle rests.

56.5.5.2.2 Distance of measurement

56.5.5.2.2.1 10 m test

The horizontal distance from the tip or other appropriate point of the antenna defined during the normalization procedure described in paragraph 5.5.1. of this annex to the outer body surface of the vehicle shall be 10.0 ± 0.2 m.

56.5.5.2.2.2 3 m test The horizontal distance from the tip or other appropriate point of the antenna defined during the

normalization procedure described in paragraph 5. 5.1. of this annex to the outer body surface of the vehicle shall be 3.00 +/- 0.05 m.

56.5.5.2.2.3 If the test is carried out in a facility enclosed for radio frequency electromagnetic screening purposes, the antenna's receiving elements shall be no closer than 1.0 m to any radio absorbent material and no closer than 1.5 m to the wall of the enclosed facility. There must be no absorbent material between the receiving antenna and vehicle under test.

56.5.5.3 Antenna location relative to vehicle

The antenna shall be located successively on the left-hand and right-hand sides of the vehicle, with the antenna parallel to the plane of longitudinal symmetry of the vehicle and in line with the engine mid-point. (See chart 9 and 10.)

56.5.5.4 Antenna position

At each of the measuring points, readings shall be taken with the antenna in both horizontal and vertical polarizations. (See chart 9 and 10.)

56.5.5.5 Readings

The maximum of the four readings taken in accordance with paragraphs 56.5. 5.3. and 56. 5. 5.4. at each spot frequency shall be taken as the characteristic reading.

56.5.6 Frequencies

56.5.6.1 Measurements

Measurements shall be made throughout the 30 to 1,000 MHz frequency range. To confirm that the vehicle meets the requirements of this annex, the testing authority shall test at up to 13 frequencies in the range, e.g.: 45, 65, 90, 120, 150, 190, 230, 280, 380, 450, 600, 750, 900 MHz. In the event that the limit is exceeded during the test, investigations shall be conducted to ensure that this is due to the vehicle and not to background radiation.

56.5.6.1.1 The limits shall apply throughout the frequency range 30 MHz - 1,000 MHz.

56.5.6.1.2 Measurements can be performed with either quasi-peak or peak detectors. The limits given in paragraphs 56.6.2 and 56.6.5 of this Regulation are for quasi-peak. If a peak detector is used, add 38 dB for 1 MHz bandwidth or subtract 22 dB for 1 kHz bandwidth.

56.5.6.2 Tolerance

Spot frequency (MHz)	Tolerance (MHz)
45, 65, 90, 120, 150, 190 and 230	+/- 5
280, 380, 450, 600, 750 and 900	+/- 20

The tolerances apply to frequencies quoted and are intended to avoid interference from transmissions operating on or near the nominal spot frequencies during the time of measurement.

56.6 Method of measuring narrowband electromagnetic disturbances generated by vehicles

56.6.1 General

56.6.1.1 The test method described in this annex shall be applied only to vehicles.

56.6.1.2 Measuring apparatus

The measuring equipment shall conform to the requirements of Publication No. 16-1 (93), of the International Special Committee on Radio Interference (CISPR). An average detector or a peak detector shall be used for measuring the narrowband electromagnetic disturbances covered by 56.6.

56.6.1.3 Test method

56.6.1.4 This test is intended to measure narrowband electromagnetic disturbances such as might emanate from a microprocessor-based system or other narrowband source. First, the emission levels in the FM band (76-108 MHz) are measured at the vehicle radio antenna using the apparatus described in paragraph 56. 1.2. If the level specified in paragraph 56. 6.3.2.4. of this Regulation is not exceeded, the vehicle shall be declared to conform to the limit for electromagnetic disturbances prescribed in this annex and the full test need not be carried out. In the full test procedure, two alternative antenna distances are permissible: 10 metres or 3 metres from the vehicle. In either case, the requirements of paragraph 56. 5. 3.

56.6.2 Expression of results

The results of measurements shall be expressed in dB micro-Volts/m (micro-Volts/m).

56.6.3 Measuring location

The test site shall be a level, clear area free of electromagnetic reflecting surfaces within a circle of minimum radius 30 m measured from a point midway between the vehicle and the antenna (see chart 7 and 8).

56.6.3.1 The measuring set, test hut, or vehicle in which the measurement set is located may be within the test site, but only in the permitted area shown in see chart 7 and 8. Other measuring antennae may be allowed within the test area, at a minimum distance of 10 m from both the receiving antenna and the vehicle under test, provided that it can be shown that the test results will not be affected.

56.6.3.2 Enclosed test facilities may be used if a correlation can be shown between the results obtained in the enclosed test facility and those obtained at an outdoor site. Enclosed test facilities do not need to meet the dimensional requirements of see chart 7 and 8, other than the distance from the antenna to the vehicle and the height of the antenna. Neither do ambient emissions need to be checked before or after the test, as indicated in paragraph 56. 6.3.3..

56.6.3.3 Ambient conditions

To ensure that there is no extraneous noise or signal of a magnitude sufficient to materially affect the measurement, measurements of

ambient conditions shall be taken before and after the main test. When ambient measurements are taken, it will be necessary to ensure that any emissions from the vehicle do not affect significantly the ambient measurements, for example by removing the vehicle from the test area, removing the ignition key, or disconnecting the battery. In both of the measurements, the extraneous noise or signal shall be at least 10 dB below the reference limits given in paragraphs 56.4.3.2.1 or 56.4.3.2.2. of this regulation, except for intentional narrowband ambient transmissions.

56.6.4 Vehicle state during tests

56.6.4.1 All the vehicle's electronic systems shall be in normal operating mode, with the vehicle stationary.

56.6.4.2 The ignition shall be switched on. The engine must not be running.

56.6.4.3 Testing shall not be conducted while rain or other precipitation is falling on the vehicle or within 10 minutes after such precipitation has stopped.

56.6.5 Antenna type, position and orientation

56.6.5.1 Antenna type

Any antenna may be used provided it can be normalized to the reference antenna. The method described in CISPR publication No. 12, Edition 3, appendix A, may be used to calibrate the antenna.

56.6.5.2 Height and distance of measurement

56.6.5.2.1 Height

56.6.5.2.1.1 10 m test

The phase centre of the antenna shall be 3.00 +/- 0.05 m above the plane on which the vehicle rests.

56.6.5.2.1.2 3 m test

The phase centre of the antenna shall be 1.80 +/- 0.05 m above the plane on which the vehicle rests.

56.6.5.2.1.3 No part of any antenna's receiving elements shall be closer than 0.25m to the plane on which the vehicle

rests.

56.6.5.2.2 Distance of measurement

56.6.5.2.2.1 10 m test

The horizontal distance from the tip or other appropriate point of the antenna defined during the normalization procedure described in paragraph 56.6.5.1. of this annex to the outer body surface of the vehicle shall be 10.0 +/- 0.2 m.

56.6.5.2.2.2 3 m test

The horizontal distance from the tip or other appropriate point of the antenna defined during the normalization procedure described in paragraph 56. 6.5.1. of this annex to the outer body surface of the vehicle shall be 3.00 +/- 0.05 m.

56.6.5.2.2.3 If the test is carried out in a facility enclosed for radio frequency electromagnetic screening purposes, the antenna's receiving elements shall be no closer than 1.0 m to any radio absorbent material and no closer than 1.5 m to the wall of the enclosed facility. There must be no absorbent material between receiving antenna and vehicle under test.

56.6.5.3 Antenna location relative to vehicle

The antenna shall be located successively on the left-hand and right-hand sides of the vehicle, with the antenna parallel to the plane of longitudinal symmetry of the vehicle and in line with the engine mid-point. (See chart 9 and 10.)

56.6.5.4 Antenna position

At each of the measuring points, readings shall be taken with the antenna in both horizontal and vertical polarizations. . (See chart 9 and 10.)

56.6.5.5 Readings

The maximum of the four readings taken in accordance with paragraphs 56. 6.5.3. and 56. 6.5.4. at each spot frequency shall be taken as the characteristic reading.

56.6.6 Frequencies

56.6.6.1 Measurements

Measurements shall be made throughout the 30 to 1,000 MHz frequency range. This range shall be divided into 13 bands. In each band one spot frequency may be tested to demonstrate that the required limits are satisfied. To confirm that the vehicle meets the requirements of this annex, the testing authority shall test at one such point in each of the following 13 frequency bands: 30-50, 50-75, 75-100, 100-130, 130-165, 165-200, 200-250, 250-320, 320-400, 400-520, 520-660, 660-820, 820-1,000 MHz. In the event that the limit is exceeded during the test, investigations shall be made to ensure that this is due to the vehicle and not to background radiation.

56.7 Method of measuring broadband electromagnetic disturbances generated by electrical/electronic sub-assemblies

56.7.1 General

56.7.1.1 The test method described in this annex shall be applied to ESAs which may be subsequently fitted to vehicles conforming to paragraph 56. 4.

56.7.1.2 Measuring apparatus

The measuring equipment shall conform to the requirements of Publication No. 16-1 (93) of the International Special Committee on Radio Interference (CISPR). A quasi-peak detector shall be used for the measurement of broadband electromagnetic disturbances covered by this annex or, if a peak detector is used, an appropriate correction factor shall be used depending on the interference pulse rate.

56.7.1.3 Test method

This test is intended to measure broadband electromagnetic disturbances generated by ESAs.

56.7.2 Expression of results

The results of measurements shall be expressed in dB micro-Volts/in (micro-Volts/m), for 120 kHz bandwidth. If the actual bandwidth B (expressed in kHz) of the measuring apparatus differs from 120 kHz, the readings taken in micro-Volts/m shall be converted to 120 kHz bandwidth through multiplication by a factor of 120/B.

56.7.3 Measuring location

56.7.3.1 The test site shall conform to the requirements of Publication No.16 of the International Special Committee on Radio Interference (CISPR) (see chart 11).

56.7.3.2 The measuring set, test hut or vehicle in which the measurement set is located may be inside the test site, but only in the permitted area shown in appendix 1 to this annex.

56.7.3.3 Enclosed test facilities may be used if a correlation can be shown between the results obtained in the enclosed test facility and those obtained at an approved outdoor site. Enclosed test facilities do not need to meet the dimensional requirements of chart 11 other than the distance from the antenna to the ESA under test and the height of the antenna, (see chart 12 and 13) .

56.7.3.4 Ambient conditions

To ensure that there is no extraneous noise or signal of a magnitude sufficient to affect materially the measurement, measurements shall be taken before and after the main test. In both of these measurements, the extraneous noise or signal shall be at least 10 dB below the reference limits given in paragraph 56.4.5.2.1. of this Regulation, except for intentional narrowband ambient transmissions.

56.7.4 ESA STATE DURING TESTS

56.7.4.1 The ESA under test shall be in normal operation mode.

56.7.4.2 Measurements shall not be made while rain or other precipitation is falling on the ESA under test or within 10 minutes after

such rain or other precipitation has stopped.

56.7.4.3 Test arrangements

56.7.4.3.1 The ESA under test and its wiring harness shall be supported 50 +/- 5 mm above a wooden or equivalent non-conducting table. However, if any part of the ESA under test is intended to be electrically bonded to a vehicle's metal bodywork, that part shall be placed on a ground plane and shall be electrically bonded to the ground plane. The ground plane shall be a metallic sheet with a minimum thickness of 0.5 mm. The minimum size of the ground plane shall depend on the size of the ESA under test but shall allow for the distribution of the ESA's wiring harness and components. The ground plane shall be connected to the protective conductor of the earthing system. The ground plane shall be situated at a height of 1.0 +/- 0.1 m above the test facility floor and shall be parallel to it.

56.7.4.3.2 The ESA under test shall be arranged and connected according to its requirements. The power supply harness shall be positioned along, and within 100 mm of, the edge of the ground plane/table closest to the antenna.

56.7.4.3.3 The ESA under test shall be connected to the grounding system according to the manufacturer's installation specification, no additional grounding connections shall be permitted.

56.7.4.3.4 The minimum distance between the ESA under test and all other conductive structures, such as walls of a shielded area (with the exception of the ground plane/table underneath the test object) must be 1.0 m.

56.7.4.4 Power shall be applied to the ESA under test via a 5 microH/50 ohm artificial network (AN) which shall be electrically bonded to the ground plane. The electrical supply voltage shall be maintained at +/- 10 % of its nominal system operating voltage. Any ripple voltage shall be less than 1.5 % of the nominal system operating voltage measured at the AN monitoring port.

56.7.4.5 If the ESA under test consists of more than one unit, the interconnecting cables should ideally be the wiring harness as intended for use in the vehicle. If these are not available, the length between the main unit and the AN shall be 1,500 +/- 75 mm. All cables in the loom should be terminated as realistically as possible and preferably with real loads and actuators. If extraneous

equipment is required for the correct operation of the ESA under test, compensation shall be made for the contribution it makes to the disturbances measured.

56.7.5 Antenna type, position and orientation

56.7.5.1 Antenna type

Any linearly polarized antenna may be used provided it can be normalized to the reference antenna.

56.7.5.2 Height and distance of measurement

56.7.5.2.1 Height

The phase centre of the antenna shall be 150 +/- 10 mm above the ground plane.

56.7.5.2.2 Measuring distance

The horizontal distance from the phase centre or other suitable point on the antenna, to the edge of the ground plane shall be 1.00 +/- 0.05 m. No part of the antenna shall be closer than 0.5 m to the ground plane. The antenna shall be placed parallel to a plane which is perpendicular to the ground plane and coincident with the edge of the ground plane along which the principal portion of the harness runs.

56.7.5.2.3 If the test is carried out in a facility enclosed for radio frequency electromagnetic screening purposes, the antenna's receiving elements shall be no closer than 0.5 m to any radio absorbent material and no closer than 1.5 m to the wall of the enclosed facility. There must be no absorbent material between the receiving antenna and the ESA under test.

56.7.5.3 Antenna orientation and polarization

At the measuring point, readings shall be taken with the antenna in both vertical and horizontal polarizations.

56.7.5.4 Readings. The maximum of the two readings taken (in accordance with paragraph 7.5.3.) at each spot frequency shall be deemed to be the characteristic reading.

56.7.6 Frequences

56.7.6.1 Measurements shall be made throughout the 30 MHz to 1,000 MHz frequency range. An ESA is considered as very likely to satisfy the required limits over the whole frequency range if it satisfies them at the following 13 frequencies in the range, e.g.: 45, 65, 90, 120, 150, 190, 230, 280, 380, 450, 600, 750, 900 MHz. In the event that the limit is exceeded during the test, investigations shall be made to ensure that the disturbance is due to the ESA and not to background radiation.

56.7.6.1.1 The limits shall apply throughout the frequency range 30 MHz-1,000 MHz.

56.7.6.1.2 Measurements may be performed with either quasi-peak or peak detectors. The limits given in paragraphs 56. 4.2.and 56.4.4. are for quasi-peak. If peak is used, add 38 dB for 1 MHz bandwidth or subtract 22 dB for 1 kHz bandwidth.

56.7.6.2 Tolerances

Spot Frequency (MHz)	Tolerance (MHz)
45, 65, 90, 120, 150, 190 and 230	+/- 5
280, 380, 450, 600, 750 and 900	+/-20

The tolerances apply to frequencies quoted and are intended to avoid interference from transmissions operating on or near the nominal spot frequencies during the time of measurement.

56.8 Method of measuring narrowband electromagnetic disturbances generated by electrical/electronic sub-assemblies

56.8.1 General

56.8.1.1 The test method described in this annex shall apply to ESAs.

56.8.1.2 Measuring apparatus

The measuring equipment shall conform to the requirements of Publication No. 16-1 (93) of the International Special

Committee on Radio Interference (CISPR). An average detector or a peak detector shall be used for the measurement of narrowband electromagnetic disturbances for the purposes of this annex.

56.8.1.3 Test method

This test is intended to measure the narrowband electromagnetic disturbances such as might emanate from a microprocessor-based system. As a short (2-3 minutes) initial step, choosing one antenna polarization, it is permitted to make sweeps of the frequency range identified in paragraph 56.8.6.1. of this annex using a spectrum analyser to indicate the existence and/or whereabouts of peak emissions. This may assist in the choice of frequencies to be tested (see paragraph 56.8.6).

56.8.2 Expression of results

The results of measurements shall be expressed in dB micro-Volts/m (micro-Volts/m).

56.8.3 Measuring location

56.8.3.1 The test site shall conform to the requirements of Publication No. 16-1 (93) of the International Special Committee on Radio Interference (CISPR) (see chart 11).

56.8.3.2 The measuring set, test hut or vehicle in which the measurement set is located shall be outside the boundary shown in see chart 11.

56.8.3.3 Enclosed test facilities may be used if correlation can be shown between the results obtained in the enclosed test facility and those obtained in an outdoor site. Enclosed test facilities do not need to meet the dimensional requirements of a see chart 11 other than the distance from the antenna to the ESA under test and the height of the antenna (see chart 12 and 13).

56.8.3.4 Ambient conditions

To ensure that there is no extraneous noise or signal of a magnitude sufficient to affect materially the measurement, measurements shall be taken before and after the main test. In both of these measurements, the extraneous noise or signal

shall be at least 10 dB below the reference limits given in paragraph 56. 4.5.2.1. of this Regulation, except for intentional narrowband ambient transmissions.

56.8.4 ESA state during tests

56.8.4.1 The ESA under test shall be in normal operation mode.

56.8.4.2 Measurements shall not be made while rain or other precipitation is falling on the ESA under test or within 10 minutes after such rain or other precipitation has stopped.

56.8.4.3 Test arrangements

56.8.4.3.1 The ESA under test and its wiring harness shall be supported 50 +/- 5 mm above a wooden or equivalent non-conducting table. However, if any part of the ESA under test is intended to be electrically bonded to a vehicle's metal bodywork, that part shall be placed on a ground plane and shall be electrically bonded to the ground plane. The ground plane shall be a metallic sheet with a minimum thickness of 0.5 mm. The minimum size of the ground plane depends on the size of the ESA under test but shall allow for the distribution of the ESA's wiring harness and components. The ground plane shall be connected to the protective conductor of the earthing system. The ground plane shall be situated at a height of 1.0 +/- 0.1 m above the test facility floor and shall be parallel to it.

56.8.4.3.2 The ESA under test shall be arranged and connected according to its requirements. The power supply harness shall be positioned along, and within 100 mm of, the edge of the ground plane/table closest to the antenna.

56.8.4.3.3 The ESA under test shall be connected to the grounding system according to the manufacturer's installation specification, no additional grounding connections shall be permitted.

56.8.4.3.4 The minimum distance between the ESA under test and all other conductive structures, such as walls of a shielded area (with the exception of the ground plane/table underneath the test object) must be 1.0 m.

56.8.4.4 Power shall be applied to the ESA under test via a 5 microH/50 ohm resistance artificial network (AN) which shall be

electrically bonded to the ground plane. The electrical supply voltage shall be maintained to within $\pm 10\%$ of its nominal system operating voltage. Any ripple voltage shall be less than 1.5% of the nominal system operating voltage measured at the AN monitoring port.

56.8.4.5 If the ESA under test consists of more than one unit, the interconnecting cables should ideally be the wiring harness as intended for use in the vehicle. If these are not available, the length between the electronic control unit and the AN shall be 1,500 ± 75 mm. All cables in the loom should be terminated as realistically as possible and preferably with real loads and actuators. If extraneous equipment is required for the correct operation of the system under test, compensation shall be made for the contribution it makes to the emissions measured.

56.8.5 Antenna type, position and orientation

56.8.5.1 Antenna type

Any linearly polarized antenna may be used provided it can be normalized to the reference antenna.

56.8.5.2 Height and distance of measurement

56.8.5.2.1 Height

The phase centre of the antenna shall be 150 ± 10 mm above the ground plane.

56.8.5.2.2 56.7.5.2.2. Distance of measurement

56.8.5.2.3 The horizontal distance from the phase centre, or tip of the antenna as appropriate, to the edge of the ground plane shall be 1.00 ± 0.05 m. No part of the antenna shall be closer than 0.5 m to the ground plane. The antenna shall be placed parallel to a plane which is perpendicular to the ground plane and coincident with the edge of the ground plane along which the principal portion of the harness runs.

56.8.5.2.4 If the test is carried out in a facility enclosed for radio frequency electromagnetic screening purposes, the antenna's receiving elements shall be no closer than 0.5 m to any radio absorbent material and no closer than 1.5 m

to the wall of the enclosed facility. There must be no absorbent material between the receiving antenna and the ESA under test.

56.8.5.3 Antenna orientation and polarization

At the measuring point, readings shall be taken with the antenna in both vertical and horizontal polarizations.

56.8.5.4 Readings

The maximum of the two readings taken (in accordance with paragraph 56. 8.5.3.) at each spot frequency shall be taken as the characteristic reading.

56.8.6 Frequencies

56.8.6.1 Measurements

Measurements shall be made throughout the 30 to 1,000 MHz frequency range. This range shall be divided into 13 bands. In each band one spot frequency may be tested to demonstrate that the required limits are satisfied. To confirm that the ESA under test meets the requirements of this annex, the testing authority shall test one such point in each of the following 13 frequency bands: 30-50, 50-75, 75-100, 100-130, 130-165, 165-200, 200-250, 250-320, 320-400, 400-520, 520-660, 660-820, 820-1,000 MHz. In the event that the reference limit is exceeded during the test, investigations shall be made to ensure that this is due to the ESA under test and not to background radiation.

56.8.6.2 If during the initial step which may have been carried out as described in paragraph 56.8.1.3. of this annex, the radiated narrowband disturbances for any of the bands identified in paragraph 56.7.6.1. are at least 10 dB below the reference limit, then the ESA shall be deemed to conform to the requirements of this annex in respect of that frequency band.

Figure 1

Vehicle broadband reference limits
Antenna-vehicle separation: 10 m

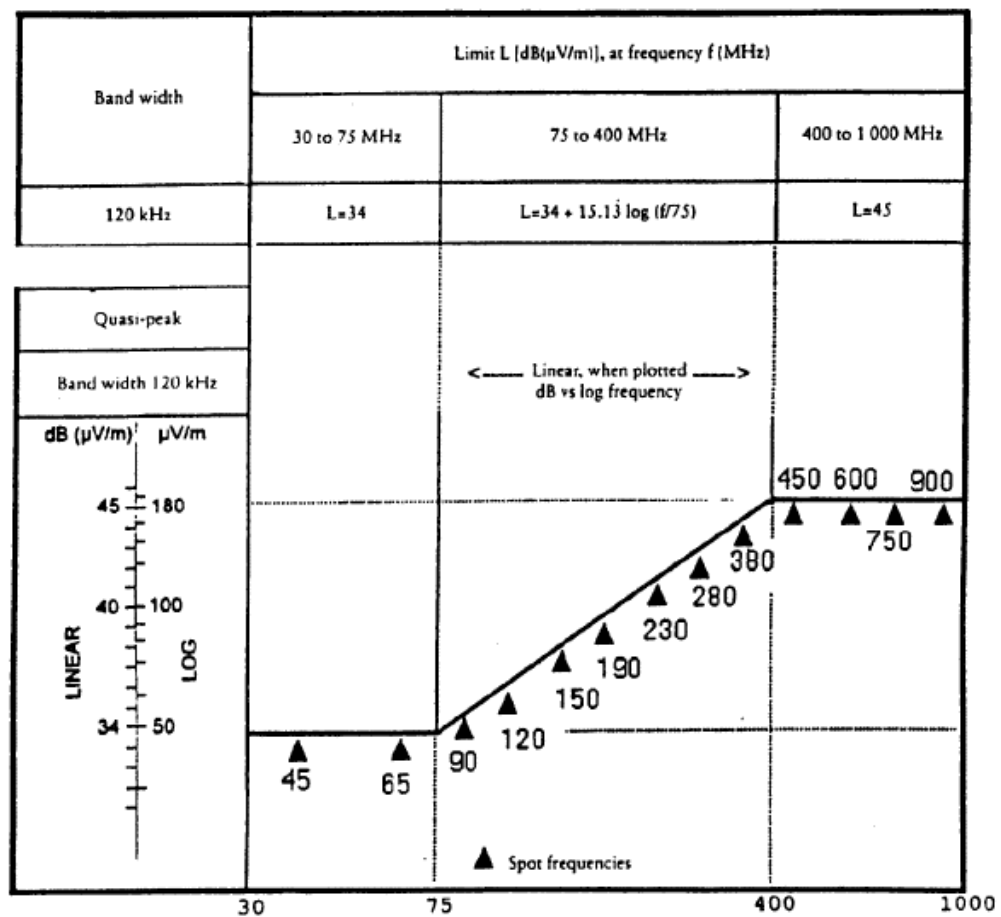


Figure 2

Vehicle broadband reference limits
Antenna-vehicle separation: 3 m

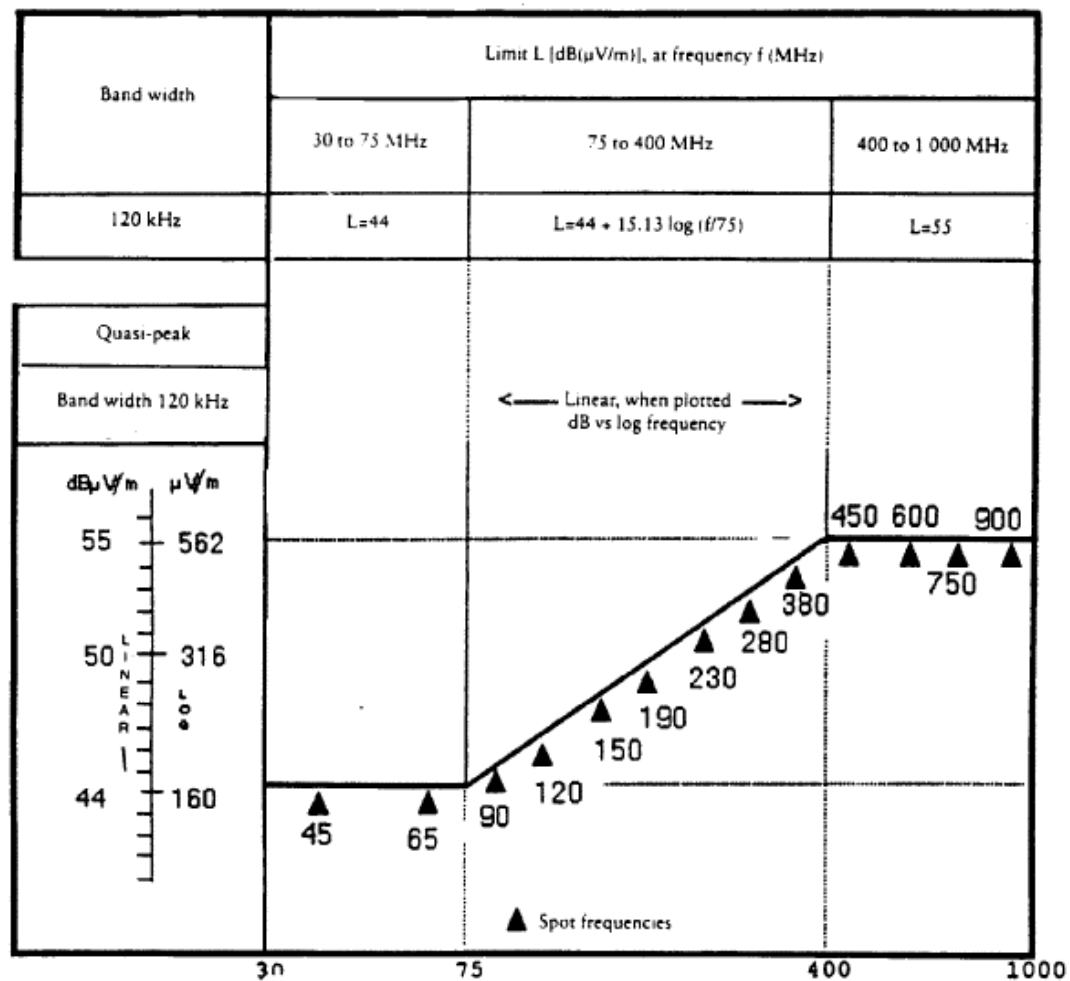


Figure 3

Vehicle narrowband reference limits
Antenna-vehicle separation: 10 m

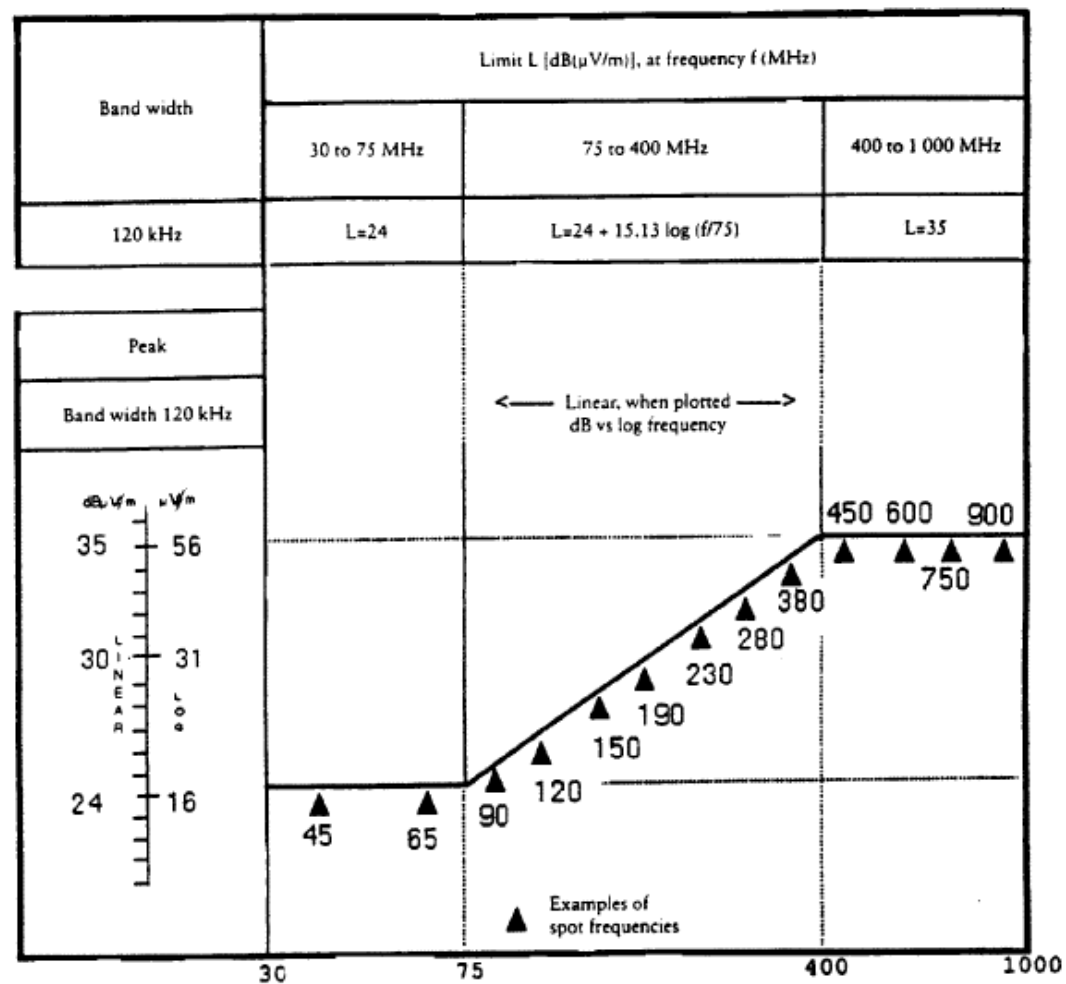


Figure 4

Vehicle narrowband reference limits
Antenna-vehicle separation: 3m

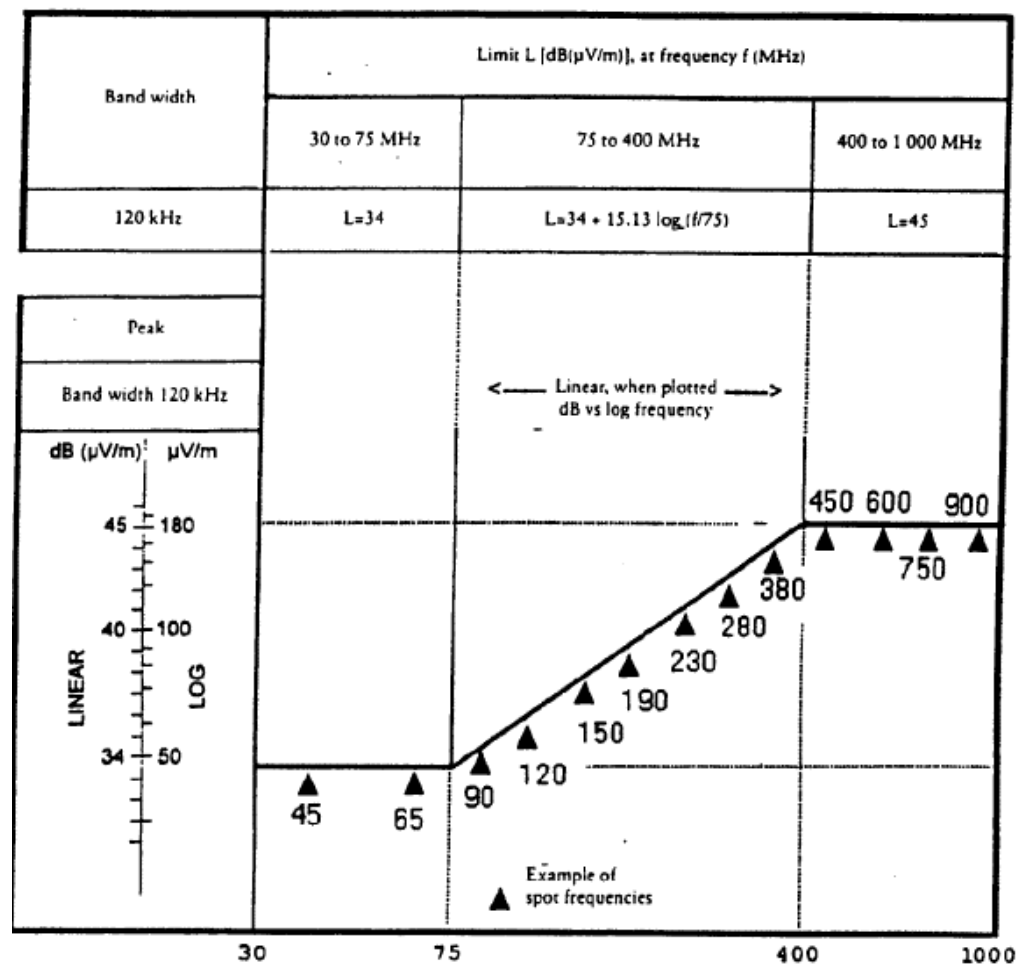


Figure 5

Electrical/electronic sub-assembly
Broadband reference limits

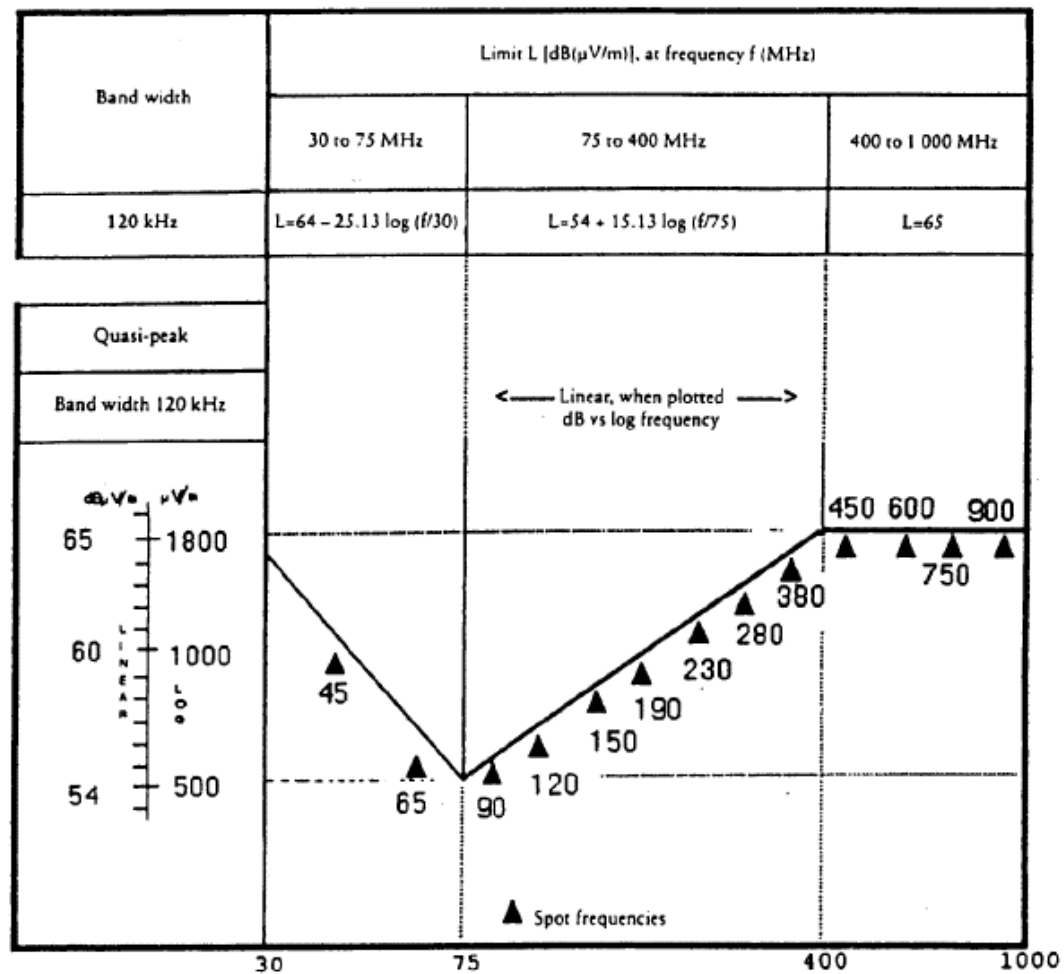


Figure 6

Electrical/electronic sub-assembly
Narrowband reference limits

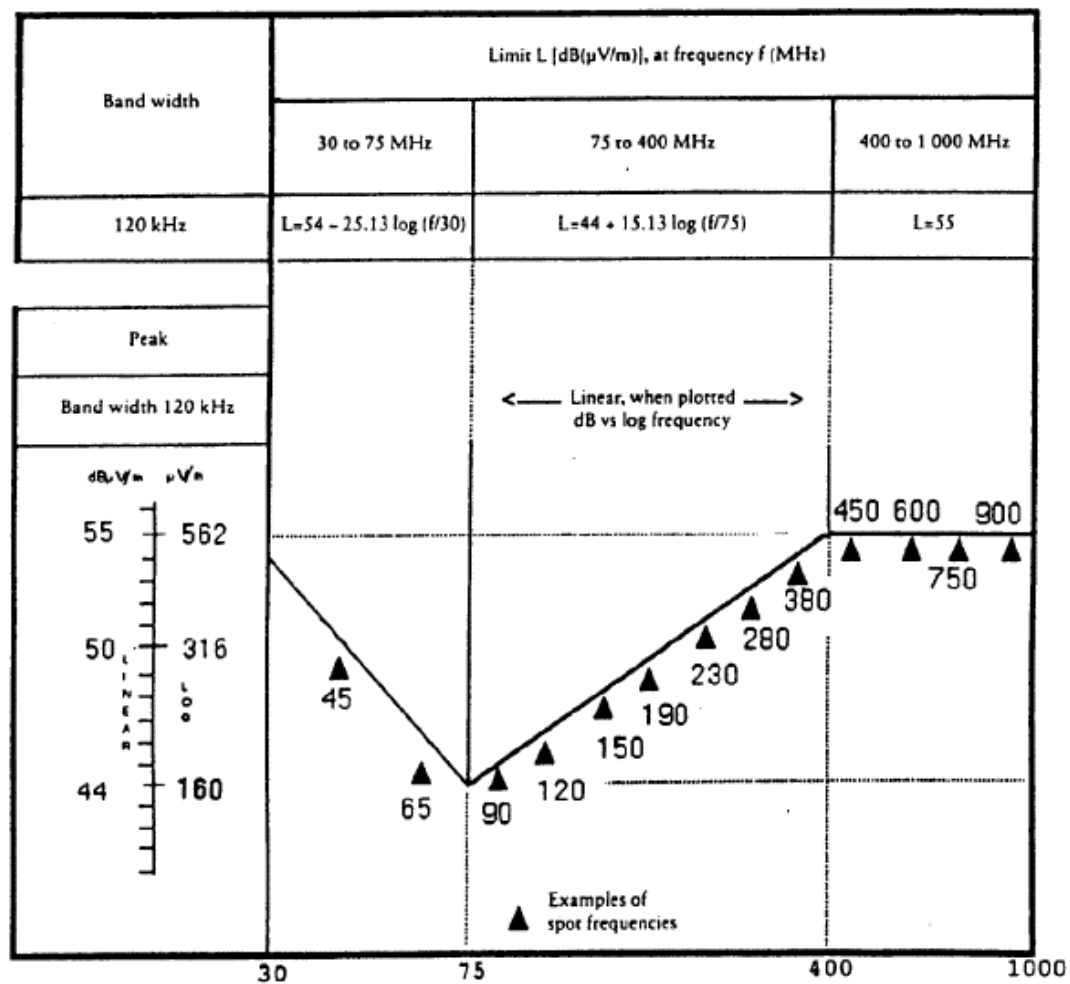


Figure 7

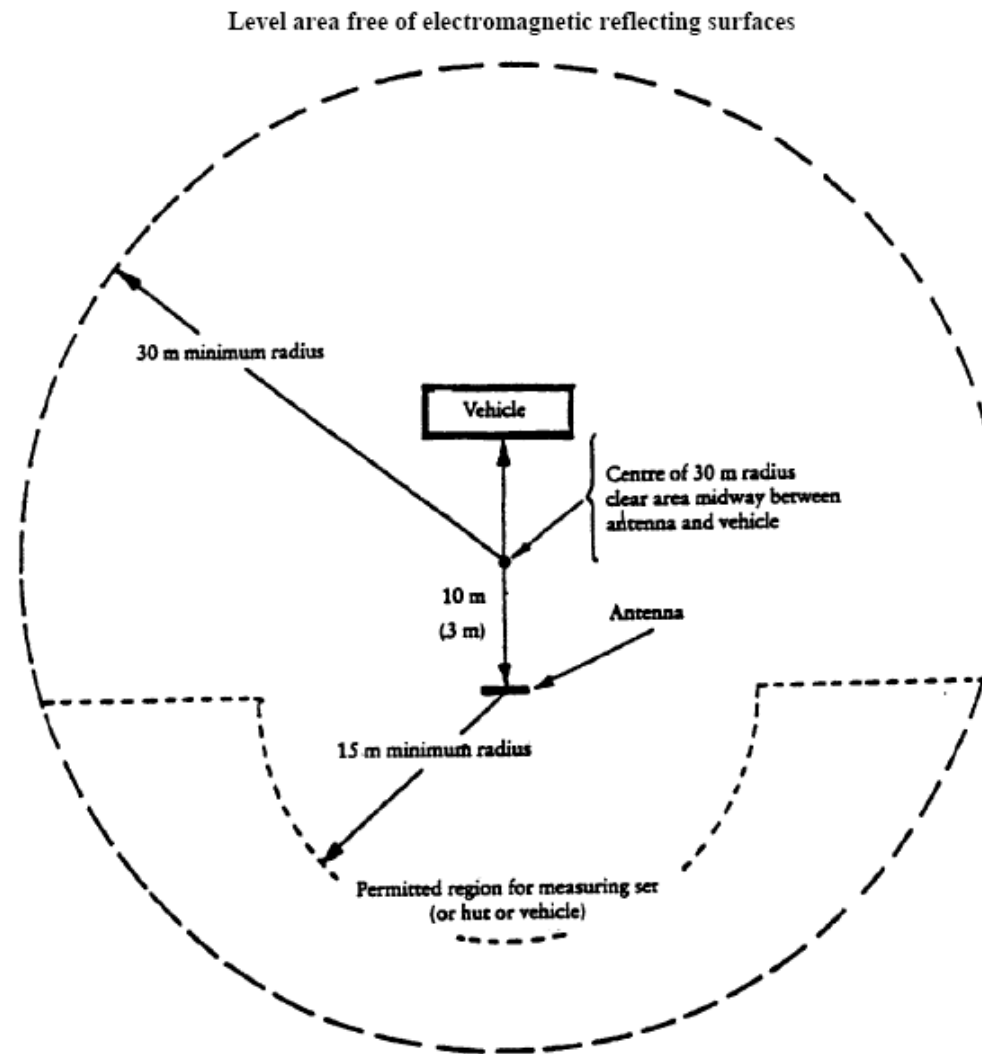


Figure 8

Clear horizontal surface free of electromagnetic reflection
 Delimitation of the surface defined by an ellipse
 (see CISPR 12, Edition 4, and CISPR 16-1)

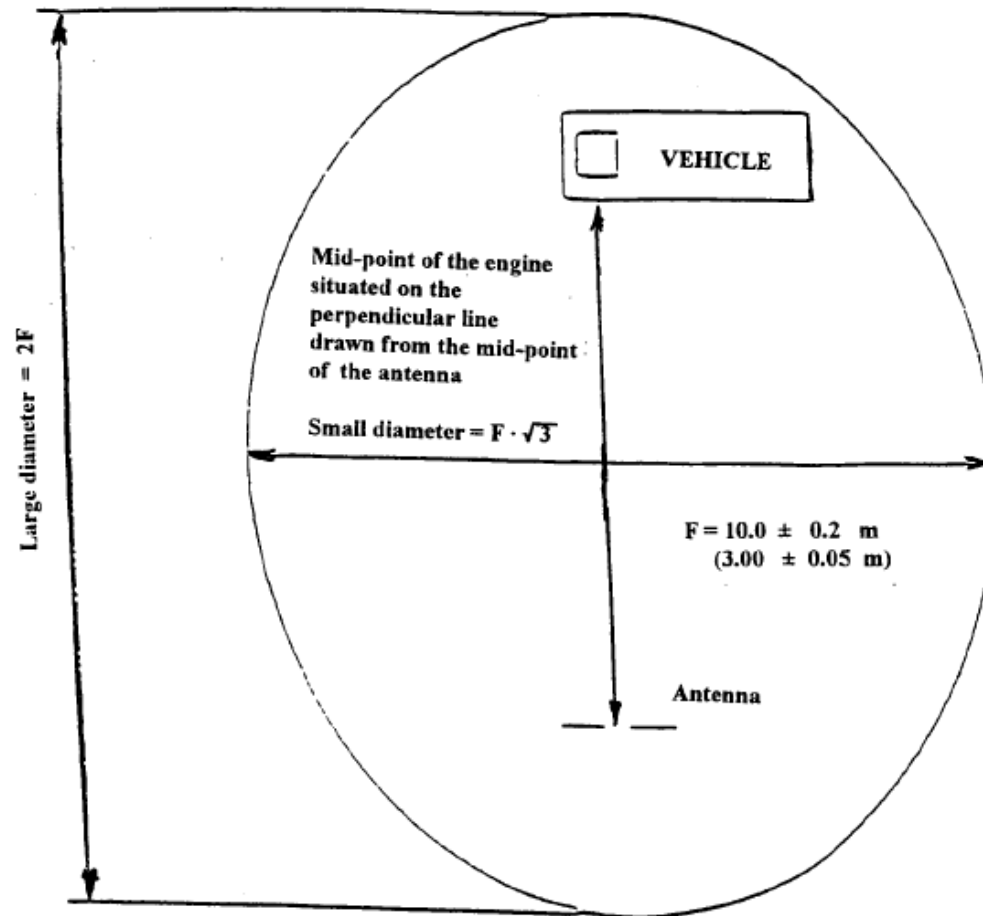
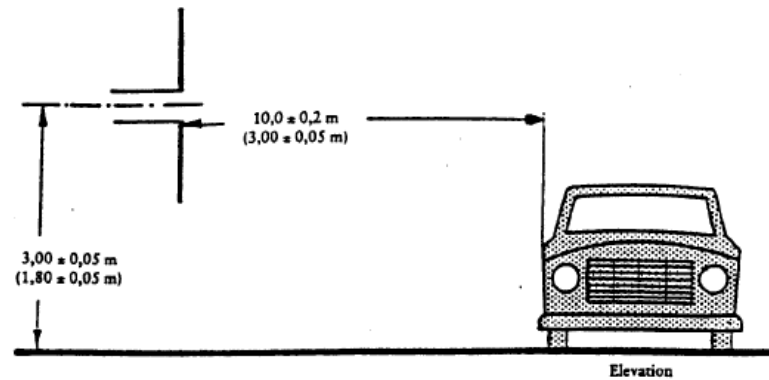
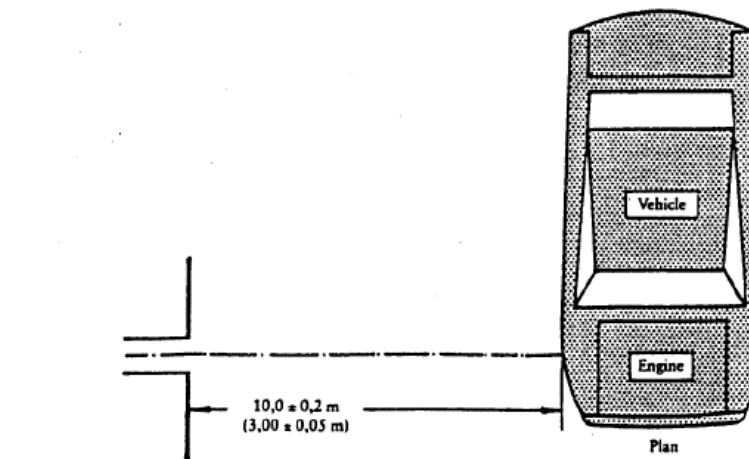


Figure 9

Antenna location relative to vehicle

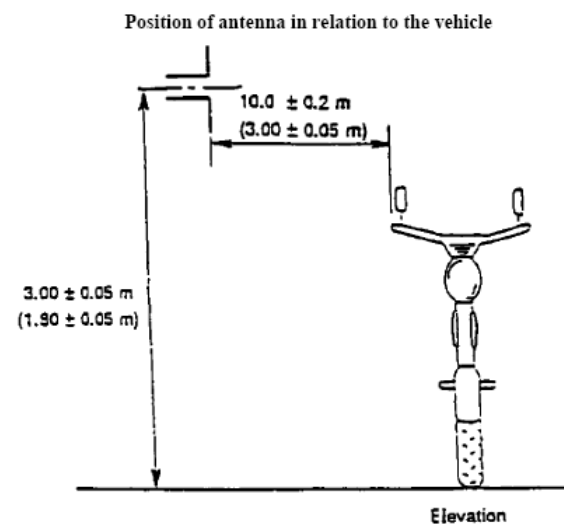


Dipole antenna in position to measure vertical component of radiation

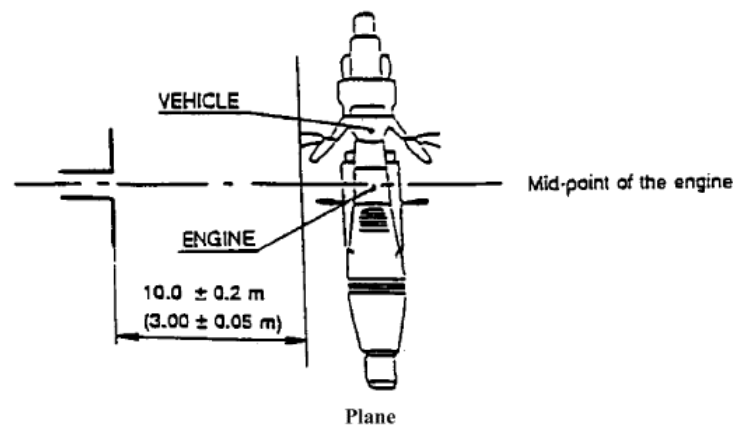


Dipole antenna in position to measure horizontal component of radiation

Figure 10



Dipole antenna in position to measure the vertical radiation components



Dipole antenna in position to measure the horizontal radiation components

Figure 11

Electrical/electronic sub-assembly test site
Level area free of electromagnetic reflecting surfaces

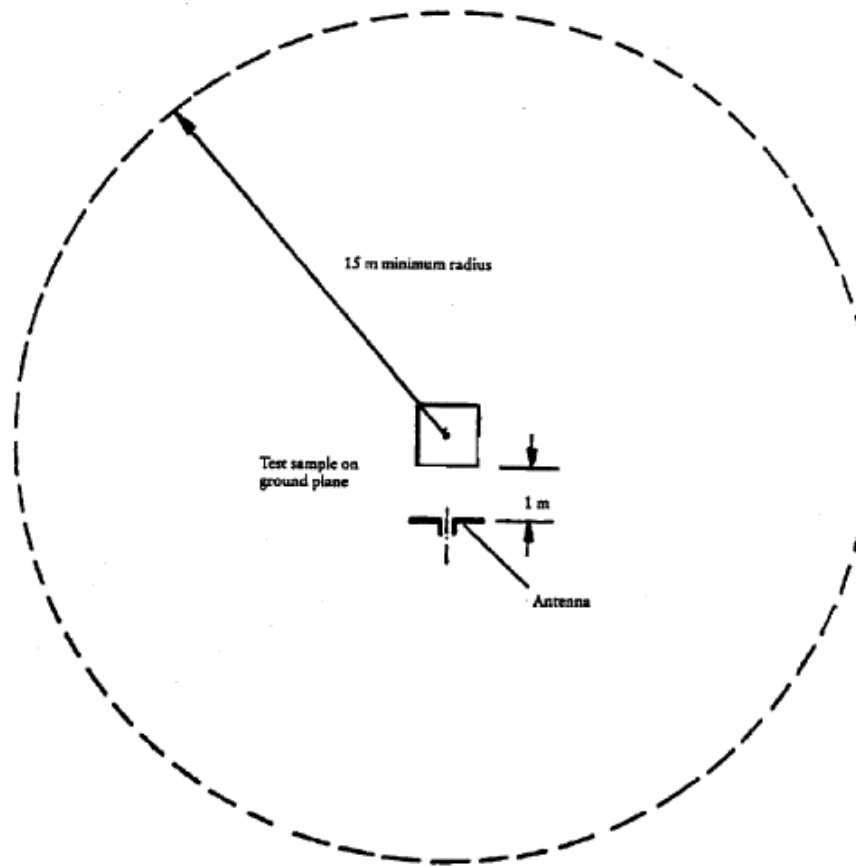


Figure 12

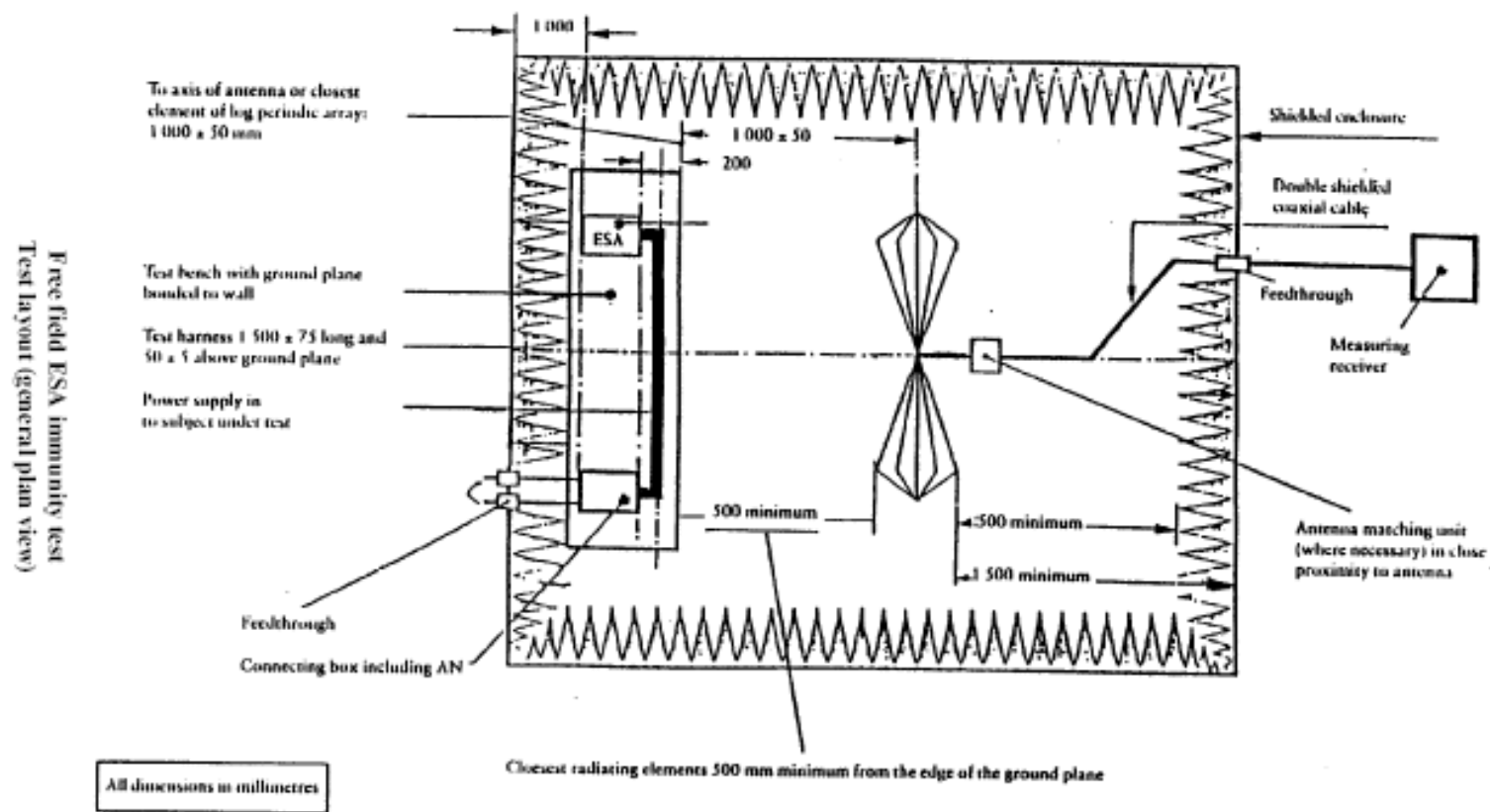


Figure 13

