भारतीय मानक
Indian Standard

IS 16211 : 2015

स्वचल वाहन से विद्युत चुम्बकीय विकिरण — स्वीकार्य स्तर एवं परीक्षण पद्धतियाँ

Electromagnetic Radiation from Automotive Vehicles — Permissible Levels and Methods of Tests

ICS 43.040.10

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December 2015 **Price Group 8**

Automotive Electrical Equipments and Instruments Sectional Committee, TED 11

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Electrical Equipments and Instruments Sectional Committee had been approved by the Transport Engineering Department Council.

To ensure that the electromagnetic radiation emitted by the vehicle and by its various sub-systems should not cause any undue interference with external systems, this standard has been brought out. The safety standard specifies the maximum limits for the wide (broad) band electromagnetic radiation emitted by the vehicle, in the frequency range 40 to 400 MHz and is generally in line with the EEC directive No. 72/245.

In the formulation of this standard considerable assistance has been drawn from AIS -004(Part 1)/1999

'®Electromagnetic radiation from automotive vehicle — Permissible levels and methods of tests', issued by Automotive Research Association of India on behalf of Automotive Industry Standards Committee.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

ELECTROMAGNETIC RADIATION FROM AUTOMOTIVE VEHICLE — PERMISSIBLE LEVELS AND METHODS OF TESTS

1 SCOPE

This standard lays down the method of measurement and permissible limits of interference voltage caused by automotive vehicles. This standard applies to all types of motor vehicles, including agricultural tractors. This also applies to electric vehicle or vehicles fitted with electric motors and to components or separate technical units intended for fitment in vehicles.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provision of this standard. At the time of publication, the editions indicated were valid. All standard are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standard indicated below:

IS No.	*Title*
6873(Part 1) : 2010/CISPR 12 : 2007	Limits and methods of measurement of radio disturbance characteristics: Part 1 Vehicles, boats and internal combustion engines (*third revision*)
10052 (Part 1) : 1999/CISPR 16-1(1993)	Radio disturbance and immunity measuring apparatus and methods: Part 1 Radio disturbance and immunity measuring apparatus (*first revision*)

3 DEFINITIONS

For the purpose of this standard the following definitions shall apply.

3.1 Electromagnetic Disturbance — This is an electromagnetic phenomenon that may degrade the performance of a vehicle or one of its electronic/ electrical systems or a separate technical unit. An electromagnetic disturbance may be electromagnetic noise, an unwanted signal or a change in the propagation medium itself.

3.2 Electromagnetic Environment — It is the totality of electromagnetic phenomena present in a given location.

3.3 Reference Limit — This is the nominal level, to which the type approval limit values are referenced.

3.4 Reference Antenna — The frequency range of 20 to 80 MHz means a shortened balanced dipole being a half wave 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.

3.5 Broad-Band Emission — It is an emission which has a band width exceeding that of a specific receiver or a particular measuring instrument

3.6 Narrow-Band Emission — Any emission which has a band width less than that of a specific receiver or a particular measuring instrument

3.7 Electronic/Electrical System — An electronic and/or electrical 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.

3.8 Electrical/Electronic Sub-Assembly (ESA) — An electrical and/or electronic device(s) or set(s) of devices intended to be part of a vehicle, together with any associated electrical connections and 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).

3.9 Vehicle Type — In relation to electromagnetic radiation characteristics (compatibility) means vehicles which do not differ essentially in such respects as; the overall size and shape of the engine compartment; the general arrangement of the electrical and/or electronic components and the general wiring arrangements; the primary material of which the body or shell (if applicable) of the vehicle is constructed. The presence of panels of different material does not change the vehicle type provided the primary material of the body is unchanged.

3.10 ESA Type — In relation to electromagnetic radiation characteristic (compatibility) means ESAs which do not differ in such essential respects as the function performed by the ESA; the general arrangement of the electrical and/or electronic components; if applicable.

4 TYPE APPROVALS — APPROVAL OF A VEHICLE TYPE

4.1 The vehicle manufacturer shall draw up a schedule describing all projected combinations of relevant vehicle electronic/electrical systems, or separate technical units, body styles, variations in body material, general wiring arrangement, engine variations, left hand/right hand versions and wheel base versions. Relevant vehicle electrical/electronic systems or ESAs are those which may emit significant narrow band or broad (wide) band radiation and/or those which are involved in the driver's direct control. The driver's direct control of the vehicle is exercised by means of for example, steering braking or engine speed control. Information to be supplied shall contain at least the details given in the format enclosed in Annex A.

4.2 Type Approval of a Vehicle

The following alternative routes to type-approval of a vehicle may be used at the discretion of the vehicle manufacturer.

4.2.1 *Approval of Vehicle Installation*

A vehicle installation may achieve type approval directly by following the provisions laid down in **5.** If this route is chosen by a vehicle manufacturer, no separate testing of electrical/electronic systems or ESAs is required.

4.2.2 *Approval of Vehicle Type by Testing of Individual ESAs*

A vehicle manufacturer may obtain approval of the vehicle by demonstrating to the testing agency that all the relevant (*see* **4.1**) electrical/electronic systems or ESAs have been individually approved in accordance with this standard and have been installed in accordance with any conditions attached thereto.

4.2.3 A manufacturer may obtain approval if the vehicle has no equipment of the type which is subject to emission tests. The vehicle shall have no systems as specified in **4.1** and no spark ignition equipment. Such approvals do not require testing.

4.3 Type Approval of an ESA

An ESA may achieve type approval, by following the provisions laid down in **5**. Type approval may be granted to an ESA to be fitted either to any vehicle type or to a specific vehicle type or types as requested by the manufacturer. ESAs involved in the direct control, as explained in **5.1** of vehicles shall normally receive type approval in conjunction with applicable vehicle. Information to be supplied shall contain at least the details given in the format in Annex B.

4.4 GUIDELINES FOR DECIDING WHETHER TESTING IS NEEDED

Annex C gives factors to be considered for extension of type approval certificate of one model to changes in technical specifications or its variant(s).

5 REQUIREMENTS

5.1 Vehicles

5.1.1 *Broad Band (Wide Band)*

a) This test is intended to measure the broad band (wide band) emissions generated by spark ignition systems.

b) Two, alternate, reference antenna from the vehicle distances are permissible: 10.0 ± 0.2 m or 3.00 ± 0.05 m. The choice of distance can be made upon relation of consistently recorded ambient level with limits specified at the distance.

c) Every vehicle when tested for electromagnetic radiation with the method given in this standard shall meet the requirements of the limits of radiation given in Table 1, Figs. 1 and 2 at the spot frequencies described

Table 1 Limits for Broad Band Emission from Vehicles (Measured with Quasi-Peak Detector)

[*Clauses* 5.1.1 (c) *and* 6.12.3]

Sl No.	Frequency Range	If the Antenna is at 10 m Nominal Distance from the Vehicle		If the Antenna is at 3 m Nominal Distance from the Vehicle	
			Equivalent dB		Equivalent dB
(1)	MHz (2)	µV/m (3)	µV/m (4)	µV/m (5)	µV/m (6)
i)	30 to 75	50	34	160	44
ii)	75 to 400	50 at 75 MHz increasing to 180 at 400 MHz (*see* Fig. 1)	34 at 75 MHz increasing to 45 at 400 MHz (*see* Fig. 1)	160 at 75 MHz increasing to 562 at 400 MHz (*see* Fig. 2)	44 at 75 MHz increasing to 55 at 400 MHz (*see* Fig. 2)
iii)	400 to 1 000	180	45	562	55

NOTE — If a peak detector is used appropriate correction factors given in **7.12.3** shall be used.

VEHICLE BROADBAND REFERENCE LIMITS

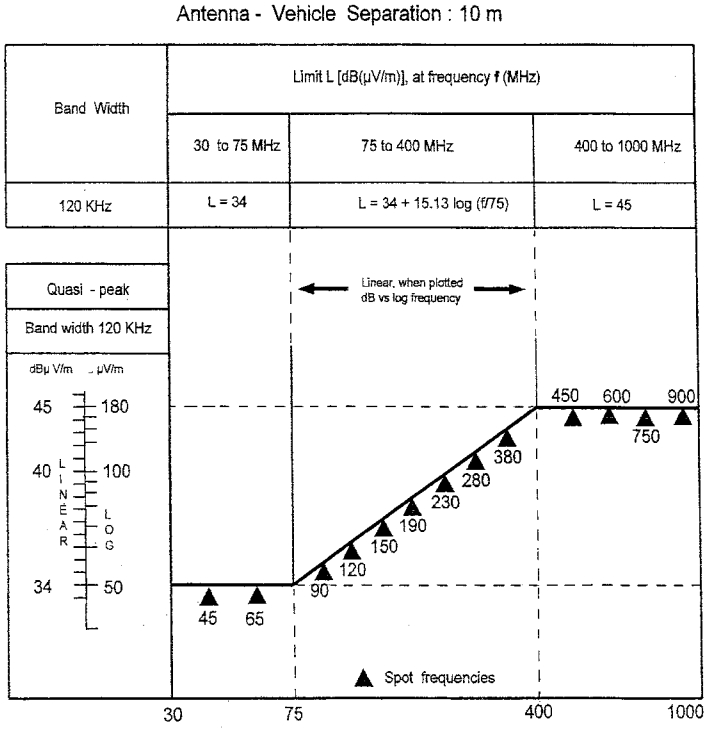


FIG. 1 VEHICLE BROAD BAND REFERENCE LIMITS (ANTENNA-SEPERATION: 10 m)
FREQUENCY - MEGAHERTZ-LOGARITHMIC

VEHICLE BROADBAND REFERENCE LIMITS

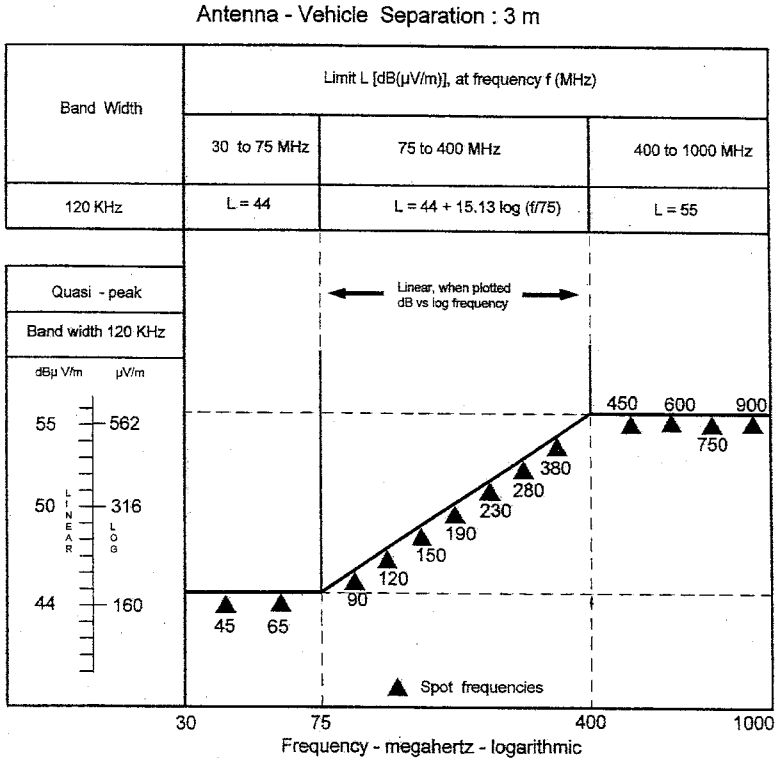


FIG. 2 VEHICLE BROAD BAND REFERENCE LIMITS (ANTENNA-SEPERATION: 3 m)

in **6.12.4**. On the vehicle tested, the measured values, expressed in dB µV/m, shall be at least 2.0 dB (20 percent) below the reference limits.

5.1.2 *Narrow Band*

a) This test is intended, to measure narrow band electromagnetic emissions which might generate from a microprocessor-based system or other narrow band source.

b) Two, alternate, reference antenna from the vehicle distances are permissible: 10.0 ± 0.2 m or 3.00 ± 0.05 m. The choice of distance can be made upon relation of consistently recorded ambient level with limits specified at the distance.

c) Every vehicle when tested for electromagnetic radiation with the method given in this standard shall meet the requirements of limits of radiation given in Table 2, Figs. 3 and 4. On the vehicle tested, the measured values, expressed in dB µV/m, shall be required to be at least 2.0 dB (20 percent) below the reference limits.

Table 2 Maximum Limits for Narrow Band Emission from Vehicles
[Measured with Mean (Average) Detector for Two or Three Wheelers and with Peak or Mean (Average) Detector for Four Wheelers]

[*Clauses* 5.1.2 (c) *and* 6.13]

Sl No.	Frequency Range	If the Antenna is at 10 m Nominal Distance from the Vehicle		If the Antenna is at 3 m Nominal Distance from the Vehicle	
	MHz	µV/m	Equivalent dB µV/m	µV/m	Equivalent dB µV/m
(1)	(2)	(3)	(4)	(5)	(6)
i)	30 to 75	16	24	50	34
ii)	75 to 400	16 at 75 MHz increasing to 56 at 400 MHz (*see* Fig. 3)	24 at 75 MHz increasing to 35 at 400 MHz (*see* Fig. 3)	50 at 75 MHz increasing to 180 at 400MHz (*see* Fig. 4)	34 at 75 MHz increasing to 45 at 400 MHz (*see* Fig. 4)
iii)	400 to 1 000	56	35	180	45

VEHICLE BROADBAND REFERENCE LIMITS

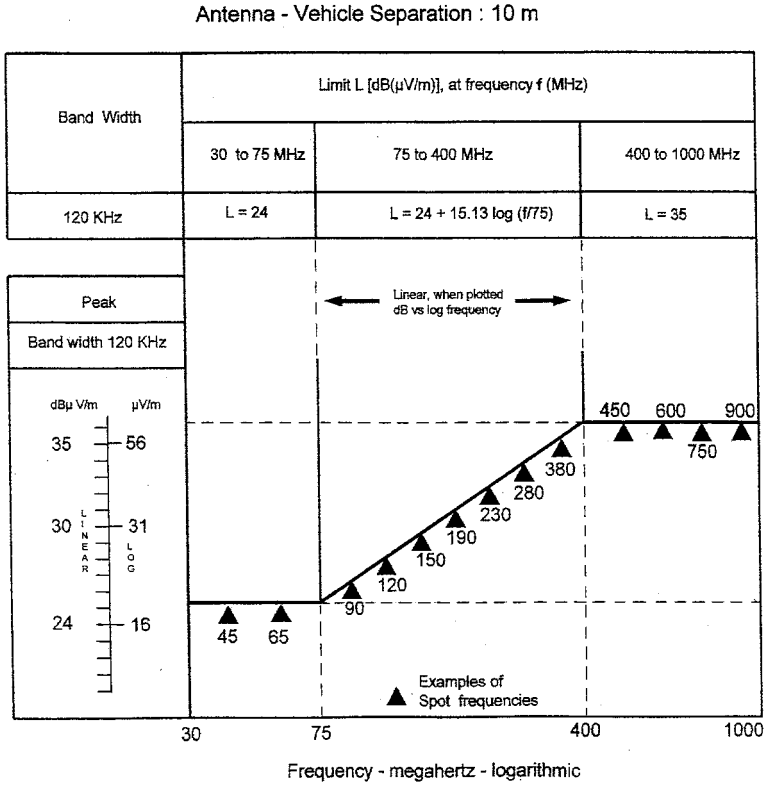


FIG. 3 VEHICLE NARROW BAND REFERENCE LIMITS (ANTENNA-VEHICLE SEPERATION: 10 m)

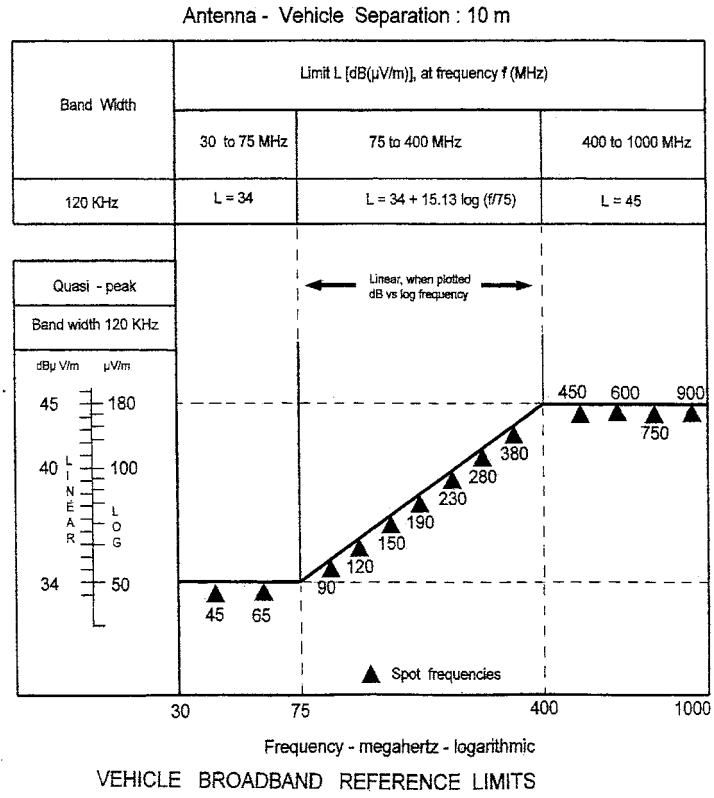


FIG. 4 VEHICLE BRAND BAND REFERENCE LIMITS (ANTENNA-VEHICLE SEPERATION: 10 M)

d) Notwithstanding the limits defined in **5.1.2** b), if during the initial step as described in **6.13** the signal strength measured at the vehicle broadcast radio antenna is less than 20 dB µV (10 µV) over the frequency range from 88 to 108 MHz, then the vehicle shall be deemed to comply with the limits for narrow band emissions and no further testing shall be required.

e) The emission should be measured as per MEAN detection for two or three wheeled vehicles.

f) The emission should be measured as per PEAK detection or AVERAGE detection for four wheeled and other vehicles.

5.2 Electronic Sub-Assemblies (ESA)

5.2.1 *Broad Band (Wide Band)*

5.2.1.1 Every ESA when tested for electromagnetic radiation with the method given in this standard shall meet the limits of radiation given in Table 3, Figs. 5 and 6 at the spot frequencies described at **6.12.4** .

Table 3 Limits of Electromagnetic Emission from Electronic Sub Assemblies (ESA)

(*Clause* 5.2.2.1)

Sl No.	Frequency Range	Broad Band (Wide Band) With Quasi Peak Detector[1)]		Narrow Band	
		µV/m	Equivalent dB µV/m	µV/m	Equivalent dB µV/m
(1)	(2)	(3)	(4)	(5)	(6)
i)	30 to 75	1600 at 30 MHz decreasing to 500 at 75 MHz (*see* Fig. 5)	64 at 30 MHz decreasing to 54 at 75 MHz (*see* Fig. 5)	500 at 30 MHz decreasing to 160 at 75 MHz (*see* Fig. 6)	54 at 30 MHz decreasing to 44 at 75 MHz (*see* Fig. 6)
ii)	75 to 400	500 at 75 MHz increasing to 1 800 at 400 MHz	54 at 75 MHz increasing to 65 at 400 MHz	160 at 75 MHz increasing to 560 at 400 MHz	44 at 75 MHz increasing to 55 at 400 MHz
iii)	400 to 1 000	1 800	65	560	55

[1)] If a peak detector is used appropriate correction factors given in **7.12.3** is to be used.

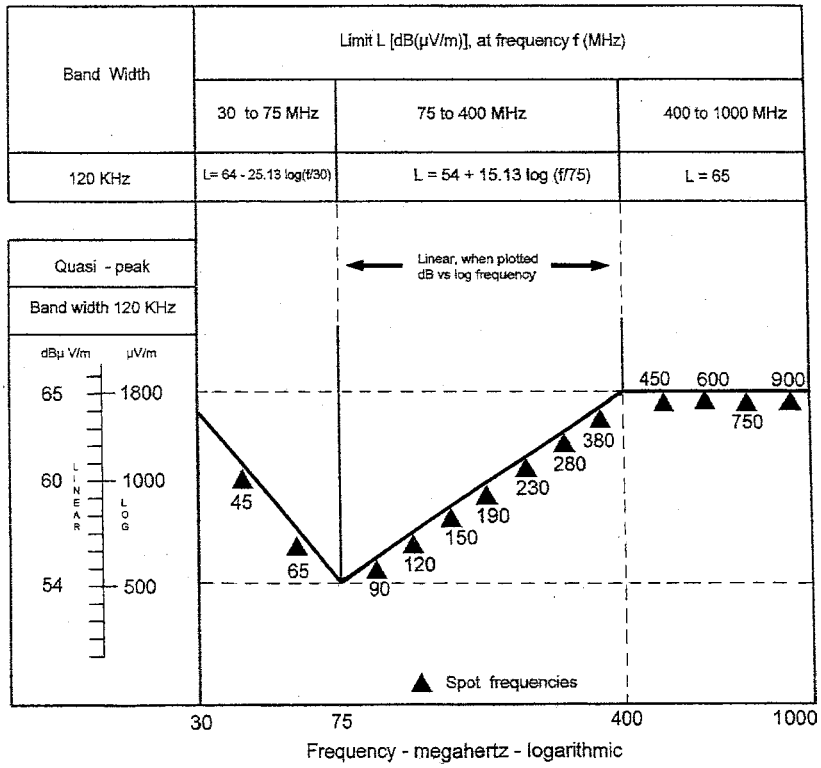


FIG. 5 ELECTROMAGNETIC RADIATION BROAD BAND REFERENCE LIMITS
(FROM ELECTRICAL/ELECTRONIC SUB-ASSEMBLY)

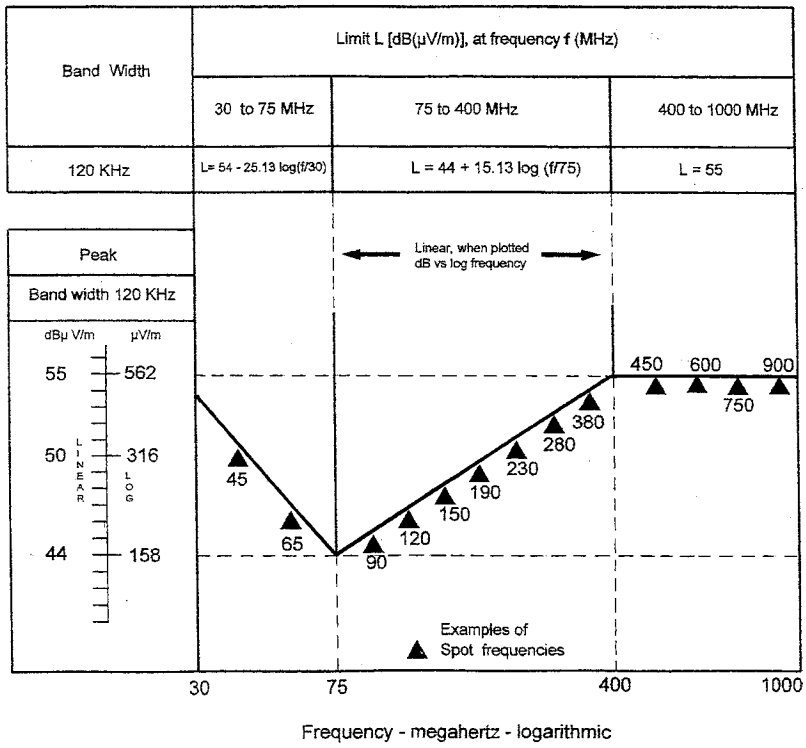


FIG. 6 ELECTROMAGNETIC RADIATION NARROW BAND LIMITS
(FROM ELECTRICAL/ELECTRONIC SUB-ASSEMBLY)

5.2.1.2 On the ESA representative of its type, the measured values, expressed in dB μV/m shall be at least 2.0 dB (20 percent) below the reference limits.

5.2.2 *Narrow Band*

5.2.2.1 Every ESA when tested for electromagnetic radiation with the method given in this standard shall meet the requirements of the limits of radiation given in Table 3 (*see* Figs. 5 and 6).

5.2.2.2 On the ESA representative of its type, the measured values, expressed in dB μV/m, shall be at least 2.0 dB (20 percent) below the reference limits.

5.2.2.3 The emission should be measured as per MEAN detection for ESAs for two or three wheelers.

5.2.2.4 The emission should be measured as per PEAK or AVERAGE detection for ESAs for four wheeled or other vehicles.

5.3 Exceptions

5.3.1 Vehicle or electrical/electronic system or ESA that does not include an electronic oscillator with an operating frequency greater than 9 kHz shall be deemed to comply with the requirements of narrow band emission in **5.1.2** and **5.2.2**.

5.3.2 For vehicles fitted with tyres, the vehicle body/ chassis can be considered to be an electrically isolated structure. Significant electrostatic forces in relation to the vehicle's external environment only occur at the moment of occupant entry into or exit from the vehicle. As the vehicle is stationary at these moments, no type-approval test for electrostatic discharge is deemed necessary.

5.3.3 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, for example due to load switching and interaction between systems lies with manufacturer. No type-approval test for conducted transients is deemed necessary.

5.3.4 Vehicles with compression ignition engine are deemed to comply with the requirements of Broad Band emission as per **5.1.1**. They need to be tested for narrow band for the purpose of establishing compliance as described in **5.1.2**.

6 TEST PROCEDURES

6.1 Measuring Apparatus

6.1.1 The measuring equipment shall meet the conditions laid down in IS 10052 (Part 1).

6.1.2 A quasi-peak detector shall be used to measure broad-band electromagnetic emissions or if a peak detector is used an appropriate correction factor shall be used depending on the spark pulse rate (*see* **6.12.3**).

6.1.3 A mean (average) detector or a peak detector shall be used for the measurement of radiated narrow band electromagnetic emissions.

6.2 Expression of the Results

6.2.1 The measured results are expressed, in dB μV/m (micro volts/m). In the case of broad band (wide band) measurements, this shall be expressed for a band width of 120 kHz.

6.2.2 If the actual bandwidth B (expressed in kHz) does not correspond exactly to 120 kHz, the readings taken in micro volts/m, are converted to a bandwidth of 120 kHz through multiplication by a factor of 120/B.

6.3 Ambient

In order to ensure the absence of any noise or extraneous signals of a level that might materially affect the measurements, such measurements shall be taken before and after the main test. Steps shall be taken to ensure that no emission from the vehicle can significantly affect the measurements (for example the ignition key should be removed or the battery disconnected and or the vehicle is withdrawn from the test surface). For both types of measurements, the noise or extraneous signal shall be at least 10 dB below the limits stated in Tables 1, 2 or 3 except for intentional narrow-band ambient transmissions.

6.4 Measuring Location for Tests on Vehicle

6.4.1 The test surface shall be a level, clear area free of electromagnetic reflective surfaces within a minimum radius of 30 m, measured from a point mid-way between the vehicle and the antenna (*see* Fig. 7).

6.4.2 Both the measuring equipment and the test cab or the vehicle in which the measuring equipment is situated is positioned within the part of the test surface shown in Fig 7. Other measuring antennae are allowed within the test area, at a minimum distance of 10 m both from receiving antenna and the vehicle under test, provided that it can be shown that the test results will not be affected.

6.4.3 Enclosed testing installations may be used for the tests, if correlation can be shown between these installations and the external test site. Such installations are not subject to the conditions laid down in Fig. 7 except for the condition relating to the distance between the vehicle and the antenna and to the height of the latter. Neither do they need to have ambient emissions

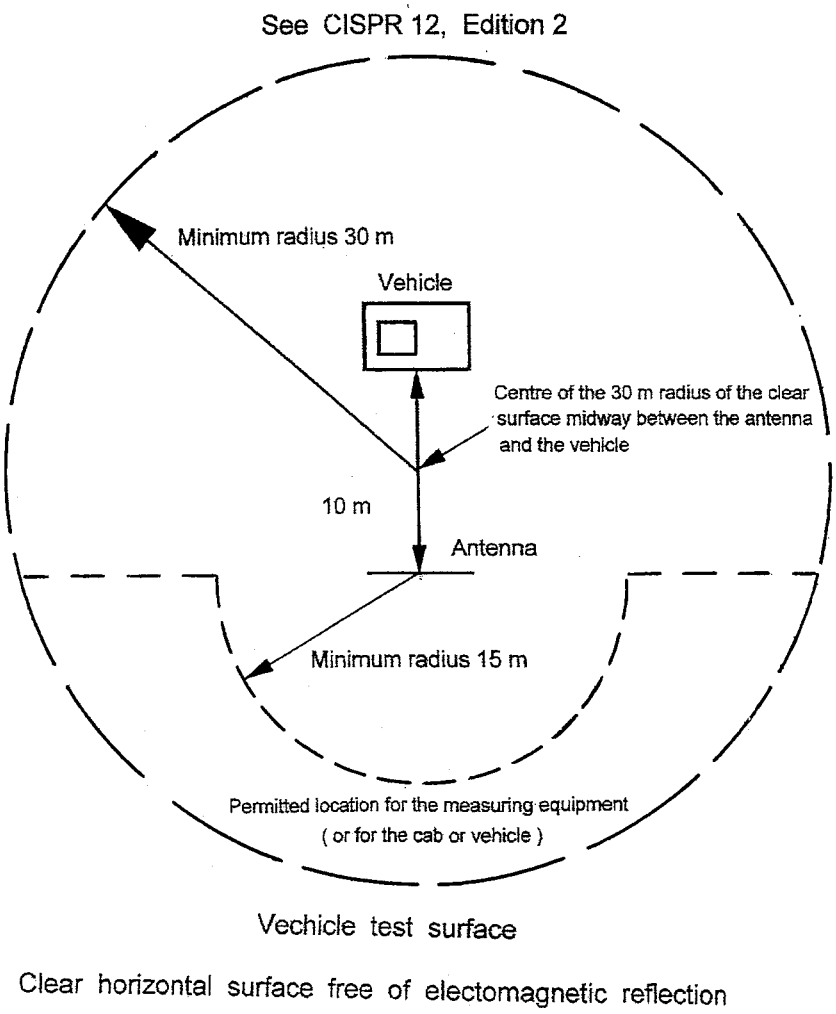


FIG. 7 TEST CAB/TEST SURFACE WITH THE POSITION OF TEST EQUIPMENT

checked before or after the test as indicated in **6.3** of this standard.

6.5 Antenna Type

For test of vehicle any antenna is permitted, provided that it can be normalized with the reference antenna. The method described in Annex C of IS 6873 (Part 1), may be used to calibrate the antenna.

6.6 Antenna Position for Tests of Vehicle

6.6.1 *Height and Distance Measurement*

6.6.1.1 *Height*

a) *10 m test* — The antenna phase centre shall be 3.00 ± 0.05 m above the vehicle resting plane.

b) *3 m test* — The antenna phase centre shall be 1.80 ± 0.05 m above the vehicle resting plane.

No part of the antenna receiving components shall be less than 0.25 m from the vehicle resting plane.

6.6.1.2 *Distance*

a) *10 m test* — The horizontal distance from the tip or other appropriate point of antenna defined during the normalization procedure to the outer body surface of the vehicle shall be 10.0 ± 0.2 m.

b) *3 m test* — The horizontal distance from the tip or other appropriate point of antenna defined during the normalization procedure to the outer body surface of the vehicle shall be 3.00 ± 0.05 m.

6.6.2 *Test in Enclosed Installation*

6.6.2.1 If the test is carried out in an enclosed installation with the object of creating an electromagnetic screen against radio frequencies, the position of the antenna receiving components must not be less than 1.0 m from any type of radio-frequency absorbent material and no closer than 1.5 m to the wall of the enclosed testing installation.

6.6.2.2 There shall be no absorbent material between the receiving antenna and the vehicle under test.

6.6.2.3 *Antenna location relative to vehicle*

6.6.2.3.1 The antenna shall be positioned successively on right and left hand side of the vehicle parallel to the longitudinal median plane of vehicle and in line with the mid-point of the engine (*see* Fig. 8).

6.6.2.3.2 Readings are taken for each measuring point, first with the antenna vertically polarized and also horizontally polarized (*see* Fig. 8).

6.7 Measuring Location for Tests on ESA

6.7.1 The test site shall meet the conditions laid down in Fig. 10 of IS 10052 (Part 1).

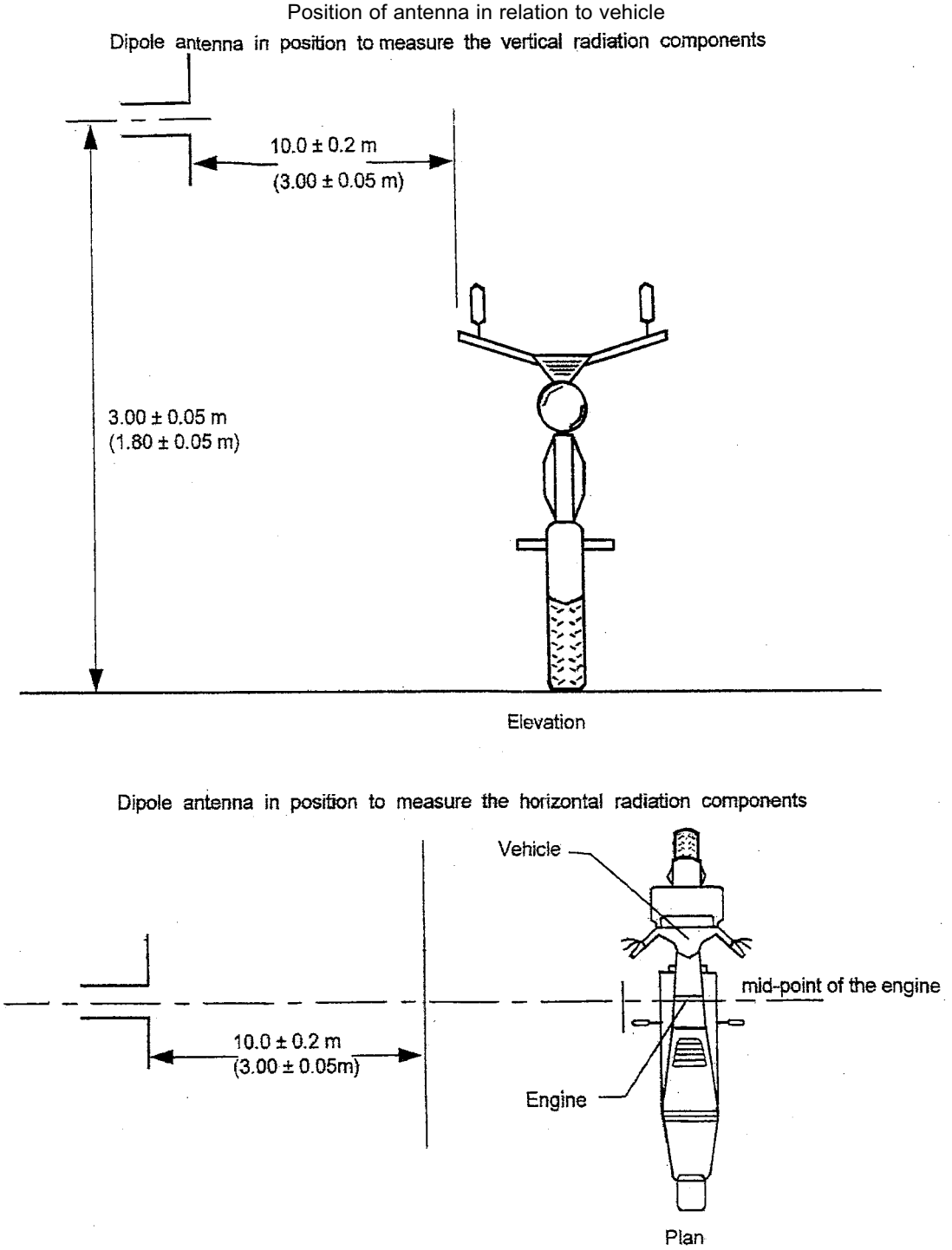
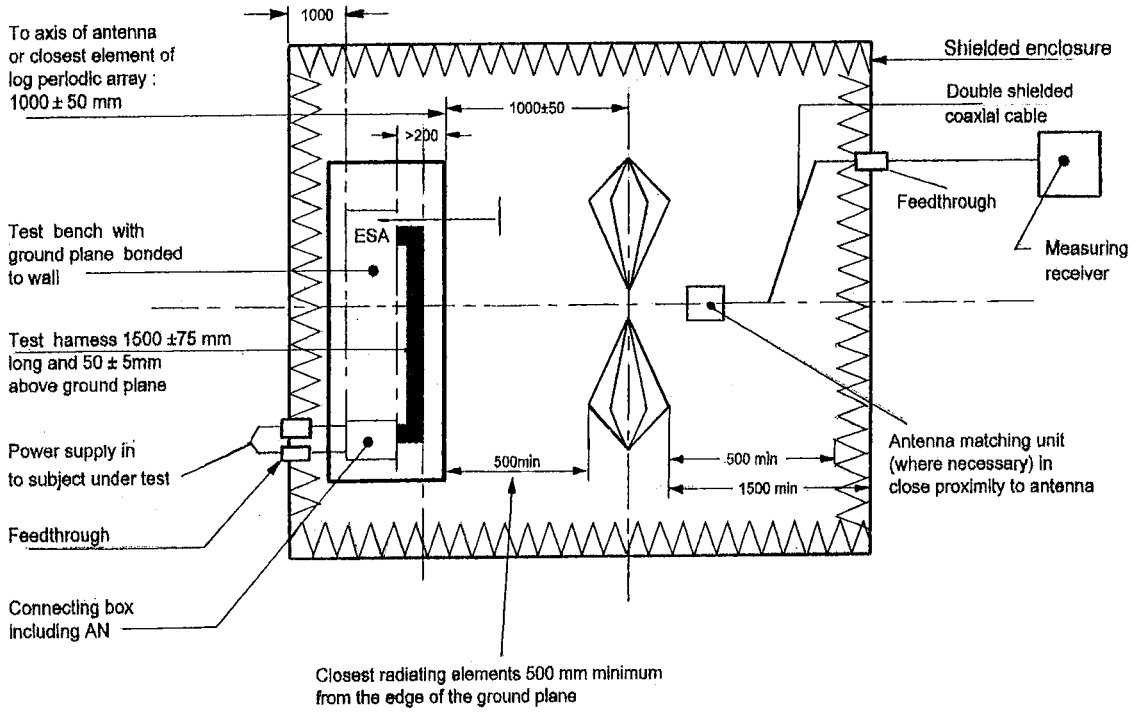


FIG. 8: POSITION OF DIPOLE ANTENNA IN RELATION TO VEHICLE, TO MEASURE VERTICAL AND HORIZONTAL RADIATION COMPONENTS

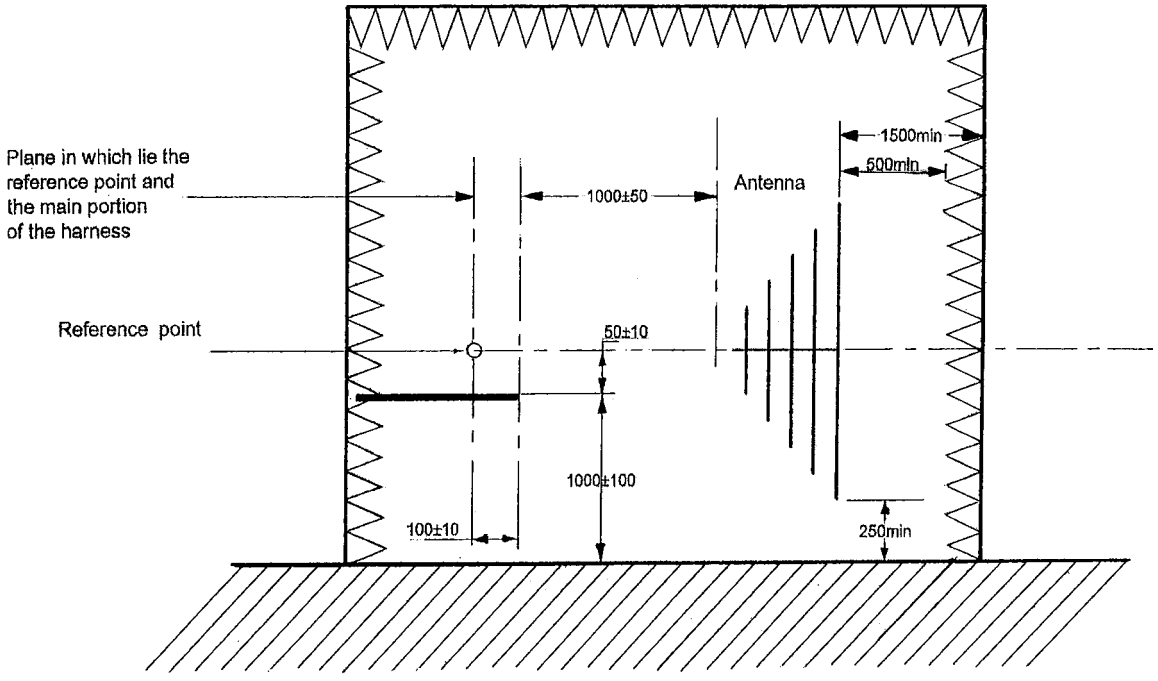


Radiated electromagnetic emissions from an ESA test layout

(General plan view)

All dimensions in millimetres.

FIG. 9A RADIATED ELECTROMAGNETIC EMISSIONS FROM AN ESA TEST LAYOUT (GENERAL PLAN VIEW)



Radiated electromagnetic emissions from an ESA view of test bench plane of longitudinal symmetry.

All dimensions in millimetres.

FIG. 9B RADIATED ELECTROMAGNETIC EMISSIONS EMISSIONS FROM AN ESA VIEW OF TEST BENCH PLANE OF LONGITUDINAL SYMMETRY

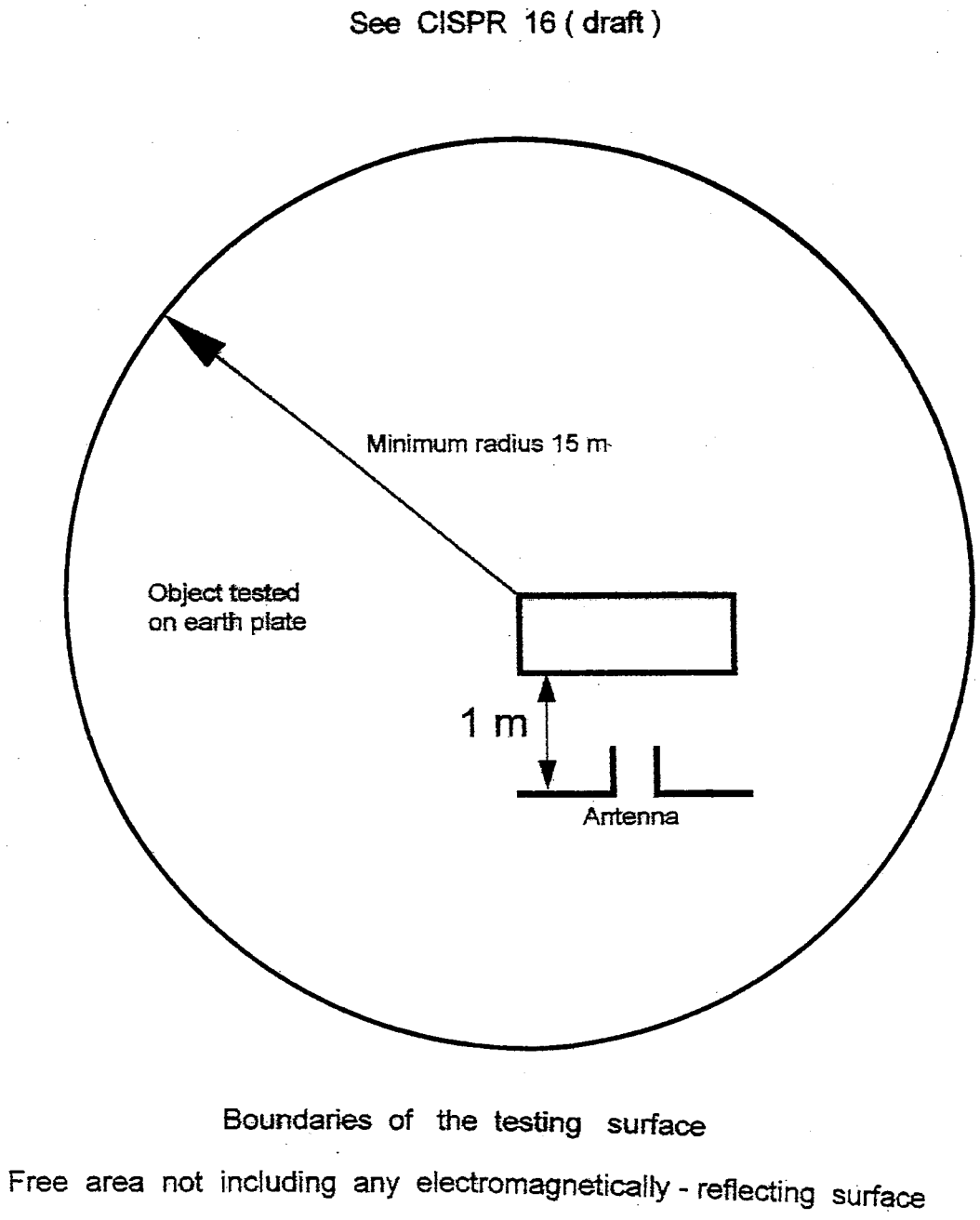


FIG. 10 BOUNDARIES OF THE TESTING SURFACE FREE AREA NOT INCLUDING ANY ELECTROMAGNETICALLY—REFLECTING SURFACE

6.7.2 The measuring set, test hut or vehicle in which the measurement set is located shall be outside the boundary shown in Fig. 10.

6.7.3 Enclosed testing installation may be used for the tests, provided that correlation can, be shown between these installations and the external test site. The testing installations are not subject to the dimensional conditions laid down in Fig. 10 except for condition relating to the distance between the ESA and the antenna and to the height of the latter (*see* Figs. 9A and 9B).

6.8 Antenna Type for Test on ESA

Any linearly polarized antenna shall be permitted, provided that it can be normalized with reference antenna.

6.9 Antenna Position for Tests on ESA

6.9.1 *Height and Distance Measurement*

6.9.1.1 *Height*

The phase centre of the antenna shall be 150 ± 10 mm above the ground plane for broad band (wide band)

measurements. The phase centre of the antenna shall be 50 ± 10 mm above the ground plane for narrow band measurements

6.9.1.2 *Distance of measurement*

a) The horizontal distance measured between the antenna phase centre and the edge of the ground plane shall be 1.00 ± 0.05 m. No part of the antenna shall be less than 0.5 m from the ground plane.
b) The antenna shall lie parallel to a plane that is perpendicular to the ground plane and runs coincident with the edge of the ground plane along which the main portion of the harness is situated.

6.9.2 *General*

6.9.2.1 If the test is carried out in an enclosed testing installation with the object of creating a screen against radio-frequencies, the antenna's components shall not be less than 0.5 m from any type of radio - frequency absorptive material or less than 1.5 m from the wall of the screen in question. There shall be no absorbent material between the receiving antenna and the ESA under test.

6.9.2.2 Readings are to be taken at the measuring point, with the antenna polarized horizontally and also vertically.

6.10 Vehicle State During Test

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

6.10.1 Broad Band (Wide Band) Test

6.10.1.1 The engine shall function at its normal operating temperature and, where a gear box is fitted, it shall be in neutral. If this is not possible for practical reasons, alternative solutions shall be sought by agreement with the manufacturer and the test agency.

6.10.1.2 Steps shall be taken to ensure that the gear-changing mechanism do not exert any influence on electromagnetic radiation from the vehicle. During each measurement, the engine shall operate at a speed within specified range. The same speed shall be used for all the frequencies.

Engine Type - Spark Ignition No. of Cylinders	*Method of Measurement-Quasi-peak/Peak Engine speed*
One	2500 rpm ± 10 percent
More than One	1500 rpm ± 10 percent

6.10.1.3 If the vehicle is provided with air conditioning system then the same shall be in operation with maximum blower speed during testing.

6.10.2 *Narrow Band Test*

6.10.2.1 The vehicle's electronic system shall all be in normal operating mode with the vehicle stationary.

6.10.2.2 The ignition shall be switched on. The engine shall not be operating.

6.11 State of ESA on Test - Arrangement for ESA

6.11.1 The ESA shall be in its normal operating state. Measurement shall not be made while rain or other precipitation is falling on the ESA under test or within 10 min after rain or other precipitation has stopped. The ESA and its cable harnesses shall be supported on wooden or insulated table at 50 ± 5 mm above the table. However, if one of the parts of the ESA is intended to be connected electrically to the metal bodywork of the vehicle that part shall be located on and be connected electrically to the ground plane.

6.11.2 The ground plane shall have to take the form of metal sheet at least 0.5 mm thick. The minimum size of the ground plane shall depend upon the size of the ESA, but it will have to be sufficiently large to receive the vehicle system components and the cable harness. The ground plane shall be connected to the protective earth conductor and shall be located at a height of 1.0 ± 0.1 m above the test facility floor and run parallel to it.

6.11.3 The ESA shall be ready to operate and be connected in accordance with the instructions. The power distribution cables shall run parallel to and lie at the most at 100 mm from the edge of the ground plane/table that is closest to the antenna.

6.11.4 The ESA shall be earthed as specified by the manufacturer; no additional earth connections shall be permitted.

6.11.5 The distance between the ESA and the other conducting structures such as the walls of a shielded area (except for the ground plane/table supporting the test object) shall be at least 1.0 m.

6.11.6 Power shall be applied to the ESA *via* a 5 micro - H/50 ohm resistance artificial network (AN) that is bonded electrically to the ground plane. The electrical supply voltage shall be maintained within ± 10 percent of the nominal operating voltage of the system. Any ripple voltage shall be less than 1.5 percent of the nominal operating voltage of the system measured at the AN monitoring port . If the ESA consists of more than one device the best way of linking these together is to use the cable harness intended for use on the vehicle. If such a harness is not available, the length between the electronic control unit and the AN shall

be 1.500 ± 0.075 m. All cables in the harness shall end in the most realistic way as possible and preferably, receive real loads and actuators. If other equipment is needed for the proper functioning of the ESA it shall be necessary to compensate for its contributions to emission measured.

6.12 Frequencies of Broad Band Tests

6.12.1 Measurements are taken over a range of frequencies from 30 to 1 000 MHz .Compliance with the required limits will be checked at spot frequencies described at **6.12.4.**

A vehicle/ESA is considered as very likely to satisfy the required limits over the whole frequency range if it satisfies them at the spot frequencies described at **6.12.4.** In the event that the limit is exceeded during the tests, steps must be taken to confirm that this is due to the vehicle/ESA and not due to back ground radiation.

6.12.2 The limits apply throughout the frequency range 30 to 1 000 MHz.

6.12.3 Measurements can be performed with either quasi-peak or peak detectors. The limits given in Tables 1 and 3 are for quasi-peak. If peak is used, add 38 dB for 1 MHz band width or subtract 22 dB for 1 kHz bandwidth.

6.12.4 Tolerance on Frequencies

Spot Frequency MHz	*Tolerance* MHz
45, 65, 90,120,150,190 and 230	± 5
280, 380, 450, 600, 750 and 900	± 20

The tolerances are applied to the frequencies stated above with the aim of avoiding interference from transmissions operating at, or close to, the nominal frequencies during the measurements.

6.13 Frequencies for Narrow Band Tests

As an initial step the levels of emissions in the FM frequency band (88 to108 MHz) shall be measured at the vehicle broadcast radio antenna with equipment as specified in **5.1.2** d).

If the level specified in Table 2 is not exceeded, then the vehicle shall be deemed to comply with the requirements of this standard in respect of frequency band and the full test shall not be carried out.

In the case of an ESA, as a short (2 to 3 min) initial step, choosing one antenna polarization, it is permitted to make sweeps of the frequency range identified in **6.13** using a spectrum analyzer to indicate the existence and/or whereabouts of peak emissions. This may assist in the choice of frequencies to be tested.

6.13.1 *Measurement*

Measurements are taken over a range of frequencies from 30 to 1 000 MHz. This range is divided into 13 bands. In each band a test should be carried out at one spot frequency. In order to confirm that the vehicle complies with the requirements of this standard the test agency shall test at one such point in each of the following 13 frequency bands:

30 to 50, 50 to 75, 75 to 100, 100 to 130, 130 to 165, 165 to 200, 200 to 250, 250 to 320, 320 to 400, 400 to 520, 520 to 660, 660 to 820 and 820 to 1 000 MHz

In the event that the limit is exceeded during the tests, steps must be taken to confirm that this is due to the vehicle/ESA and not due to background radiation. If during the initial step described in the case of ESA the radiated narrow band emissions for any of the bands identified above are at least 10dB below reference limit, then the ESA shall be deemed to comply with the requirements of narrow band emission in respect of that frequency band.

6.14 Readings

The maximum of the four readings taken in the case of vehicles or two readings in the case of ESAs at each spot frequency shall be taken as the characteristic reading at the frequency at which the measurements are made.

NOTE — Where compliance of vehicle system has already been certified for SS 21, for establishing compliance to this standard, broad band emissions for frequencies up to 220 MHz need not be measured again.

ANNEX A

(*Clause* 4.1)

TECHNICAL SPECIFICATIONS FOR EMI TEST (VEHICLE)

A-0 GENERAL

a) Type and general commercial description (This covers model and variants)
b) Name of manufacturer
c) Address

A-1 MASS AND DIMENSIONS

a) Overall length
b) Overall width
c) Overall height
d) Wheel base
e) Kerb weight

A-2 ENGINE

a) Type of engine (2 strokes/4 strokes, SI/CI.)
b) No. of cylinders
c) Position and arrangement
d) Bore and Stroke
e) Compression ratio
f) Maximum net power
g) Fuel
h) Lubrication mix
j) No. of carburetors
k) Intake system
m) Position/drawing of air filter
n) Air filter make
p) Air filter type (*see* **4.1**)

A-3 ELECTRICAL EQUIPMENT

a) Nominal voltage
b) Ignition system
c) Make
d) Type (*see* **4.1**)
e) Operating principle
f) Ignition adv. characteristic
g) Point gap
h) Generator:
   1) Type (*see* **4.1**)
   2) Nominal power

A-4 INTERFERENCE SUPPRESSION SYSTEM

a) Spark Plug:
   1) Make
   2) Type (*see* **4.1)**
   3) Point gap
b) HT cable and coil:
   1) Make
   2) Type (*see* **4.1**)
   3) Identification
   4) Length × OD
   5) Resistance of ignition cable
c) Cap (Resistive):
   1) Make
   2) Type (*see* **4.1)**
   3) Part no./Identification
d) Electronic unit:
   1) Make
   2) Type (*see* **4.1)**
   3) Terminology and drawing of
   4) Interference suppression
   5) Equipment
   6) Resistance of ignition cable

Place : Authorised Signatory :

ANNEX B

(*Clause* 4.3)

TECHNICAL SPECIFICATIONS FOR EMI TEST (ESA)

B-0 General

a) Type (General commercial description) :
b) Make (Trade-name of manufacturer) :
c) Name of the manufacturer :
d) Address :

B-1 This ESA shall be approved as a component/STU (*)

(*) Delete which is not applicable

B-2 Any restrictions of use and conditions for:

NOTE — Any drawing must be supplied in appropriate scale and in sufficient detail. Photographs, if any, must show sufficient details. If the systems, components or separate technical units have electronic controls, information concerning their performance must be supplied. The details shall also include description of the ESA chosen to represent the type and relevant test reports, if parts of ESA are already type approved.

ANNEX C

(*Clause* 4.4)

GUIDELINES FOR DECIDING WHETHER TESTING IS NEEDED

C-1 This annex gives factors to be considered for the extension of type approval certificate of one model to changes in technical specifications or its variant(s).

C-2 In general, when changes in technical specifications of vehicle do not affect the performance adversely, and is still within the stipulated limits, the type approval certificates can be extended. The changes in parameters that affect the performance are listed in the table below as a guideline.

C-3 In the case of following changes, with respect to the vehicle tested, in the details submitted as per Annexure A, tests are necessary for establishing compliance as follows:

Sl No.	*Parameter*	*To be Tested/Not Tested*
(1)	(2)	(3)
i)	change in engine power	No test, required, if change in power is within 10 percent
ii)	Compression ratio (SI engines)	No test required, if change in compression ratio is within 10 percent
iii)	Changes in body and cowling	Changes like 2 door to 4 door, shape of fenders or contours of hood, size of wheels or tyres are unlikely to have effect. Other changes need to be tested
iv)	Changes in size and shape of engine compartment.	Test needed
v)	Location of HT coil and consequent change in location of HT cable and high tension harness.	Test needed
vi)	Change in body material such as metal to non-metal and *vice-versa*	Test needed
vii)	Change in the position and general mounting arrangement of engine consequent to situations like front engine to rear engine, LHS steering to RHS steering and *vice-versa*, etc	Test needed
viii)	Change in ignition system components such as magneto/ alternator, CDI/transistorized ignition system, HT cable, HT coil, spark plug, suppressor cap, ECU and/or their makes	Test needed
ix)	Addition of any electronic control unit under driver's direct control as defined in **4.1**	Test needed
x)	Changes in constituents of electronic control units as defined in **5.3.2**	Test needed
xi)	Change in type, location and material of air-cleaner.	No test required
xii)	Addition of air-conditioning equipment	Test needed
xiii)	Significant difference in the clear opening to engine compartment: a) around wheel or b) due to metal radiator construction change.	Test needed

C-4 Above changes are listed for guidance only. It is not practicable to list all the changes that affect EMI.

NOTE — Changes in non-resistive elements of ignition system are considered to have no significant effect in EMI provided the vehicle Manufacturer certifies so (The elements are spark plug, spark plug cap, high tension cable and coil).

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This Indian Standard has been developed from Doc No.: TED 11 (0796).

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Published by BIS, New Delhi