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# Road vehicles - Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 3: On-board transmitter simulation

道路车辆 车辆对窄带辐射电磁能的抗扰性试验方法

第 3 部分：车载发射机模拟法

(ISO 11451-3:2007, MOD)



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**Standardization Administration of the People's Republic of China.**

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# Foreword

GB/T 33012 “Road vehicles - Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy” consists of four parts:

- Part 1: General;
- Part 2: Off-vehicle radiation sources;
- Part 3: On-board transmitter simulation;
- Part 4: Bulk current injection (BCI).

This Part is Part 3 of GB/T 33012.

This Part is drafted in accordance with the rules given in GB/T 1.1-2009.

This Part uses the re-drafting method to amend and adopt ISO 11451-3:2007 “Road vehicles - Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 3: On-board transmitter simulation”.

Technical differences between this Part and ISO 11451-3:2007 and the causes are as follows:

- Clause 1 is normatively prepared according to the specifications of GB/T 1.1-2009;
- The normative reference ISO 11451-1 is modified to GB/T 33012.1 adopting ISO 11451-1;
- The normative reference ISO 11451-2 is modified to GB/T 33012.2 adopting ISO 11451-1.

The following editorial modifications are also made in This Part:

- DELETE the bibliography of the original international standard.

This Part is proposed by Ministry of Industry and Information Technology of the People’s Republic of China.

This Part is under the jurisdiction of National Technical Committee on Automobiles of Standardization Administration of China (SAC/TC 114).

Drafting organizations of this Part: China Automotive Technology Research Center, Passenger Car Company of SAIC Motor Corporation Limited, Suzhou Tai Site Electronic Technology Co., Ltd., Shanghai Automotive Commercial Vehicle Technology Center, Changchun Automobile Testing Center, Shanghai Volkswagen Automobile Co., Ltd., China Electronics Standardization Institute, Shenzhen Hsac Electronics Co., Ltd.,

# Road vehicles - Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 3: On-board transmitter simulation

## 1 Scope

This Part of GB/T 33012 specifies the test conditions, test location, test equipment and test procedure for vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy - on-board transmitter simulation.

This Part applies to M, N and O vehicles (regardless of the vehicle power system, e.g. spark-ignition engine, diesel engine, electric motor).

NOTE: On-board transmitters include on-board transmitters connected to an external antenna and portable transmitters with integral antennas.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

GB/T 33012.1 Road vehicles - Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 1: General (GB/T 33012.1-2016, ISO 11451-1:2005 + A1: 2008, MOD)

GB/T 33012.2 Road vehicles - Vehicle test methods for electrical disturbances from narrowband radiated electromagnetic energy - Part 2: Off-vehicle radiation sources (GB/T 33012.2-2016, ISO 11451-2:2005, MOD)

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in GB/T 33012.1 and the following apply.

**3.1**

**integral antenna**

### 6.4 Antennas

#### 6.4.1 Transmitters with antenna outside the vehicle

##### 6.4.1.1 Simulated on-board transmitters

When an OEM antenna is not installed on the vehicle, the antenna(s) described below shall be used.

- For frequency ranges lower than 30 MHz, loaded antennas shall be used. Loaded antennas employ lumped or distributed reactive components with a radiating element physically shorter than quarter wave at resonance.

- For frequency ranges higher than 30 MHz, e.g. for the very high frequency (VHF) and ultra-high frequency (UHF) bands, quarter wave antennas shall be given preference over 5/8 wave antennas, since there are higher skin currents created by quarter wave antennas.

All antennas shall be tuned on the vehicle for minimum voltage standing wave ratio (VSWR, typically less than 2:1), unless otherwise specified in the test plan. As a minimum, the VSWR value shall be recorded with the antenna on the vehicle at the lower and upper band edge and at a middle frequency (see Annex B).

NOTE: The resulting VSWR is compatible with the design of the RF source.

When an OEM antenna is actually installed on the vehicle, this antenna shall be used for the test in the appropriate frequency range. In this case, the VSWR shall not be adjusted, but shall be recorded.

##### 6.4.1.2 Commercial on-board transmitters

The vehicle OEM antenna shall be used for the test in the appropriate frequency range. In this case, the VSWR shall not be adjusted.

#### 6.4.2 Transmitters with antenna inside the vehicle

##### 6.4.2.1 Simulated portable transmitter

A passive antenna (e.g. quarter wave antenna with counterpoise, sleeve antenna, patch antenna) shall be used.

All antennas shall be tuned on the vehicle for minimum VSWR (typically less than 2:1), unless otherwise specified in the test plan. The antenna shall be tuned in the laboratory to obtain minimum required VSWR with the counterpoise that is intended to be used with the antenna while testing in the vehicle.

As a minimum, the VSWR value shall be recorded with the antenna in the vehicle at

# 8 Test procedure

### 8.1 General

The general arrangement of vehicle, transmitter(s) and associated equipment represents a standardized test condition. Any deviations from the standard test configuration shall be agreed upon prior to testing and recorded in the test report.

The vehicle shall be made to operate under typical loading and operating conditions. These operating conditions shall be clearly defined in the test plan.

### 8.2 Test plan

Prior to performing the tests, a test plan shall be generated which shall include:

- test set-up;
- frequency range(s) and associated modulation(s);
- duration of transmission;
- antenna location and polarization;
- routing of the coaxial cable to the antenna in the vehicle (for simulated on-board transmitters);
- vehicle orientation;
- vehicle mode of operation;
- vehicle monitoring conditions;
- vehicle acceptance criteria;
- definition of test severity levels;
- maximum antenna VSWR value (if necessary);
- test report content;
- any special instructions and changes from the standard test.

### 8.3 Test method

#### 8.3.1 Transmitters with antenna outside the vehicle

##### 8.3.1.1 Simulated on-board transmitters

When required in the test plan, the immunity threshold shall be determined.

#### 8.3.1.2 Commercial on-board transmitters

The vehicle is installed in the test facility as described in 7.1.2.

The test shall be performed with unmodified commercial on-board transmitter characteristics (power, modulation, etc.) and the unmodified vehicle OEM antenna. Any exception to this practice shall be specified in the test plan. Operate the commercial on-board transmitter connected to the OEM antenna in the configuration(s) indicated in the test plan, noting any anomalies.

Continue testing until all on-board transmitter(s) specified in the test plan are completed.

### 8.3.2 Transmitters with antenna inside the vehicle

#### 8.3.2.1 Simulated portable transmitters

The vehicle, antenna(s) and associated equipment are installed as described in 7.2.2.

The reference parameter for the test is the net power at the simulated portable transmitter feed-point. The adjustment of the net power level shall be performed with the simulated portable transmitter placed outside the vehicle (at a minimum distance of 1 m from any part of the vehicle and from the test enclosure) until the predetermined level is achieved. Record the forward power level.

The simulated portable transmitter shall then be placed in the vehicle for the test (without any change of the forward power level recorded during the determination of the net power). For modulated signals, the peak conservation principle shall be applied as defined in GB/T 33012.1. Perform the test at frequencies within the designed bandwidth of the test antenna (at least at the lower and upper band edge and at a middle frequency and at frequency steps not greater than those defined in GB/T 33012.1). With the power amplifier output connected to the antenna, perform the test at the discrete frequencies defined in Annex A at the power test levels indicated in the test plan, noting any anomalies.

Continue testing until all frequency bands, modulations, polarizations and simulated portable transmitter locations specified in the test plan are completed.

NOTE: Because it is not practical to perform the test at every possible location of a portable transmitter inside the vehicle, the test can be performed as a first step for limited defined locations with power levels higher than the typical one given in Annex A. At test locations on the vehicle where system interactions are observed (changes/degradations in performance), the test can be repeated in a second step with commercial portable transmitters transmitting with the maximum allowed power level, as defined in 8.3.2.2.

| | | | | |
|---|---|---|---|---|
| | | | | is 217 Hz, 50 % duty cycle) or PM (the pulse width is 577 μs, and the cycle is 4 600 μs) |
| GSM900 | 876 ~ 915 | 16 (Peak) or 2 (Peak) | GMSK | PM (the frequency is 217 Hz, 50 % duty cycle) or PM (the pulse width is 577 μs, and the cycle is 4 600 μs) |
| PDC | 893 ~ 898<br>925 ~ 958<br>1 429 ~ 1 453 | 0.8 (Peak) | TDMA | PM (the frequency is 50 Hz 50 % duty cycle) |
| PCS, GSM1800/1900 | 1 710 ~ 1 785<br>1 850 ~ 1 910 | 2 (Peak) or 1 (Peak) | GMSK | PM (the frequency is 217 Hz, 50 % duty cycle) or PM (the pulse width is 577 μs, and the cycle is 4 600 μs) |
| IMT-2000 | 1 885 ~ 2 025 | 1 (Peak) | QPSK | CW and PM (the frequency is 1 600 Hz, 50 % duty cycle) |
| Bluetooth/WLAN | 2 400 ~ 2 500 | 0.5 (Peak) | QPSK | PM (the frequency is 1 600 Hz, 50 % duty cycle) |
| IEEE 802.11a | 5 725 ~ 5 850 | 1 (Peak) | QPSK | PM (the frequency is 1 600 Hz, 50 % duty cycle) |

The explanation of acronyms and numbers in Table A.1 and Table A.2 are shown in Table A.3.

**Table A.3 -- Explanation of acronyms and numbers**

| Acronyms and numbers | Explanation | Example of use |
|---|---|---|
| AM | Amplitude Modulation | Broadcast |
| AMPS | Advanced Mobile Phone System | — |
| BT | Bluetooth | — |

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