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**NATIONAL STANDARD OF THE
PEOPLE'S REPUBLIC OF CHINA**

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**Road vehicles - Vehicle test methods for electrical disturbances
from narrowband radiated electromagnetic energy - Part 4:
Harness excitation methods**

道路车辆 车辆对窄带辐射电磁能的抗扰性试验方法 第4部分：线束激励法
(English Translation)

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1 Scope

This document describes the harness excitation method for testing the immunity of vehicles to continuous narrowband radiated electromagnetic energy.

This document applies to vehicles of categories M, N and O (regardless of vehicle power train, e.g., spark ignition engine, diesel engine, electric motor).

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. 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 I. General (GB/T 33012.1-2016,

ISO 11451-1:2005, MOD)

3 Terms and definitions

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

4 Test conditions

The Bulk Current Injection (BCI) test method uses a current probe as a transformer and the wiring harness as the secondary winding to inject current into the wire harness.

The Tubular Wave Coupler (TWC) test method is based on the principle of a directional coupler to couple electromagnetic waves into the wire harness. The TWC test method is applicable to the immunity test of automotive electrical/electronic components to radiated disturbances in the GHz range (GSM band, UMTS, ISM 2.4 GHz). This method is most suitable for small (relative to the wavelength) and shielded devices under test (DUTs), because the main coupling path in these cases is the harness.

The applicable frequency range of the BCI test method and the TWC test method is related to the characteristics of the transformer (current probe or tubular wave coupler).

More than one type of transformer may be required to cover the test frequency range.

For automotive electrical/electronic system testing, the typical applicable frequency range is as follows.

-- The BCI test method is applicable to a frequency range of 100 kHz ~ 1 GHz.

In the frequency range of 400 MHz ~ 1 GHz, the BCI test method may be used when other test methods are not feasible. This shall be agreed upon with the user of this document and recorded in the test plan.

-- The TWC test method is applicable to the frequency range of 400 MHz ~ 3 GHz.

The user shall specify the test severity level within the test frequency range.

Recommended test severity levels are shown in Appendix A. The severity level is expressed in terms of the equivalent RMS value of the unmodulated wave.

GB/T 33012.1 provides standard test conditions, including.

- test temperature;
- supply voltage;
- modulation mode;
- dwell time;
- frequency step size;

- definition of test severity levels;
- test signal quality.

5 Test site

The test should be carried out in a shielded room.

The distance between the vehicle and all other conductive structures, such as the walls of the shielded room (except for the ground plane under the vehicle) shall be at least

0.5 m.

The test can be carried out in an outdoor test site. The test equipment shall comply with (national) legal requirements on electromagnetic field transmission.

Note: There may be dangerous voltages and electromagnetic fields in the test area.

It shall be ensured that the human body exposure limit requirements for radio frequency energy are met.

6.1.1 General

The BCI test method uses a current injection probe to directly couple the disturbance signal to the wiring harness for immunity test. The injection probe is a current transformer. During the test, the wiring harness of the device under test (DUT) passes through the probe, and the immunity test is performed by changing the test severity level and the frequency of the induced disturbance signal.

The test equipment used is as follows.

- Current injection probe (probe set);
- Current measurement probe (probe set);
- RF generator with internal or external modulation capability;
- Power amplifier;
- Power measurement equipment, for measuring forward and reverse power;
- Current measurement equipment.

BCI testing shall be performed on each independent system installed in the vehicle.

6.1.2 Injection probe

The BCI test method requires one or a group of injection probe(s) that cover the test frequency range to couple the test signal into the DUT. Regardless of the system load, the probe (probe group) shall be able to withstand the input power corresponding to the highest

test level within the entire test frequency range.

Saturation of the injection probe due to the test level and DUT current should be considered.

6.1.3 Current measurement probe

The current measurement probe (probe set) shall be able to cover the entire test frequency range.

6.1.4 DUT stimulation and monitoring

According to the test plan, the actuator that has the least impact on the electromagnetic characteristics of the DUT shall be selected to operate the DUT, such as. plastic buttons, pneumatic actuators with plastic tubes.

Optical fibers or high-resistance wires can be used to connect to the equipment that monitors the DUT's EMI response. Other types of wires may be used, but special care must be taken to minimize interactions. The direction, length and position of such harnesses shall be carefully recorded to ensure repeatability of the test results.

Any electrical connection between the monitoring equipment and the DUT may cause the DUT to malfunction. Special care shall be taken to avoid this effect.

6.2.1 General

The TWC test method is equivalent to coupling a plane wave into the vehicle wiring harness. To this end, a 50 ohm coaxial short line with two open ends, an internally tubular conductor and its matching terminals shall be used to generate a transverse electromagnetic (TEM) inside the line. The measured line beam passes through the inner conductor of this wave coupler. This forms two disturbance components for the

DUT. one is the TEM component coupled by the cable, and the other is the radiation component generated by the scattering of the TEM main mode inside the connecting cable between the coupler and the DUT.

The equipment used is as follows.

- Tubular wave coupler;
- RF generator with internal or external modulation capability;
- Power amplifier;
- Power measurement equipment, for measuring forward and reverse power.

TWC testing shall be performed on each individual system installed on the vehicle.