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Measurement Methods for Electromagnetic Fields of Vehicle with Regard to Human Exposure

车辆电磁场相对于人体曝露的测量方法

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Measurement Methods for Electromagnetic Fields of Vehicle with Regard to Human Exposure

1 Scope

This Standard specifies the measurement methods for low frequency magnetic field emission in automotive environment where human beings are exposed to.

The frequency range involved in this Standard is 10 Hz ~ 400 kHz.

This Standard is applicable to Type-L, Type-M and Type-N vehicle.

This Standard is not applicable to measurement of vehicle under wireless charging status.

2 Normative References

The following documents are indispensable to the application of this Standard. In terms of references with a specified date, only versions with a specified date are applicable to this Standard. The latest version (including all the modifications) of references without a specified date is applicable to this Standard.

GB/T 3730.1 Motor Vehicles and Trailers - Types - Terms and Definitions

GB/T 4365-2003 Electrotechnical Terminology - Electromagnetic Compatibility

GB/T 5337 Nomenclature and Terminology for Automotive Electrical Equipment, Lighting and Instrumentation

GB 8702-2014 Controlling Limits for Electromagnetic Environment

GB/T 15089 Classification of Power-driven Vehicles and Trailers

GB 18285-2005 Limits and Measurement Methods for Exhaust Pollutants from Vehicles Equipped Ignition Engine under Two-speed Idle Conditions and Simple Driving Mode Conditions

GB/T 19596 Terminology of Electric Vehicles

GB/T 29259 Road Vehicle - Electromagnetic Compatibility Terminology

IEC 62311:2008 Assessment of Electronic and Electrical Equipment Related to Human Exposure Restrictions for Electromagnetic Fields (0 Hz ~ 300 GHz)

4 General Regulations

4.1 Ambient Conditions

During the test, ambient temperature shall be -7 °C ~ 35 °C.

4.2 Disturbance Source

The measurement in this Standard is applicable to long-term disturbance sources (such as front wiper motor and warm air motor). It is not applicable to short-term disturbance sources (electric rearview mirror, electric window, electric horn and hazard warning lamp).

4.3 Limit Requirements

Reference limit requirements of the measurement shall refer to Table A.1, Table A.2 and Table A.3 in Appendix A.

4.4 Measurement Site

The measurement can be conducted with indoor dynamometer or outdoor flat and dry pavement. The gradient of outdoor pavement shall be -2% ~ +2%. In the measurement site environment, magnetic induction strength shall be lower than 10% of the limit value in Appendix B. If the measurement is conducted with dynamometer, road load shall be set up in accordance with vehicle's reconditioning quality.

4.5 Measurement Instruments

Measurement instruments shall be able to conduct magnetic field measurement. The frequency range shall satisfy the requirement of 10 Hz ~ 400 kHz. Magnetic field probe shall be isotropic; the external diameter shall not exceed 13 cm.

When measurement instruments conduct the measurement in the time domain, they shall be able to conduct weighted procedure of the measurement data in accordance with the time domain measurement method in IEC 62311:2008 and output the weighted measurement value of magnetic induction strength. When the measurement instruments are conducting the measurement within the frequency domain, frequency domain measurement result of 10 Hz ~ 400 kHz magnetic field can be output. Please refer to Table 1 for the minimum requirements of frequency domain measurement instrument data acquisition frequency resolution.

NOTE: in order to satisfy the requirement of narrow part measurement, measuring probes with equivalent performance and relatively small volume can also be adopted for measurement.

---Vehicle's headlight shall be set up as distance light;

---Instrument light (maximum illumination);

---Front wiper motor shall work at the maximum speed;

---Air conditioner shall be working;

---Radio shall be turned on at medium volume.

Vehicle's measurement state is as follows:

---The state of charge (SOC) of battery electric vehicle (BEV) shall be 20% ~ 80%; driving motor system shall be in standby state;

---The state of charge (SOC) of hybrid electric vehicle (HEV) shall be 20% ~ 80%; vehicle's driving motor system shall be in standby state and the engine shall be in idle state. If it is impossible for vehicle to implement this, measurement shall be conducted in the engine's idle state or the driving motor system's standby state. Moreover, a declaration of this shall be added to the test report.

---Internal combustion engine automobile (ICEV) shall be measured respectively in power-on state, and the engine's non-operating and idle state.

---Gearbox shall be in neutral gear (Gear N or Gear P).

6.1.2 Measurement methods

6.1.2.1 Measurement methods of time domain

Please see the measurement methods and steps of time domain below:

a) In accordance with the requirement in Figure 5, adjust seat's position;

b) Set up vehicle's state;

c) Select standard and limit value; adjust measuring instrument to corresponding time domain weighted measurement mode;

d) Place the measuring probe in the fixed test-spots of seat and foot space area test-spots stipulated in Chapter 5;

e) Wait till the reading becomes stable, adopt the function of "maximum hold" to record the weighted measurement value of magnetic induction strength (expressed in percentage) of various test-spots;

f) Repeat Step d) to Step e) to complete the measurement of all the test-spots.

6.1.2.2 Measurement methods of frequency domain

Vehicle's driving state includes uniform speed, accelerated speed and decelerated speed state:

---Uniform speed state: vehicle's driving speed shall be 40 km/h;

---Accelerated speed state: vehicle accelerates from static state to 90 km/h at the accelerated speed that is more than or equals to 2.5 m/s^2, or till it reaches the maximum speed. In terms of vehicle whose accelerated speed cannot reach 2.5 m/s^2, measure at the maximum attainable accelerated speed. Moreover, a declaration of this shall be added to the test report;

---Decelerated speed state: vehicle decelerates from 90 km/h or the maximum speed at the decelerated speed that is more than or equals to 2.5 m/s^2, till the vehicle stops. In terms of vehicle whose decelerated speed cannot reach 2.5 m/s^2, measure at the maximum attainable decelerated speed. Moreover, a declaration of this shall be added to the test report.

6.2.2 Measurement methods

Same as 6.1.2.

6.3 Measurement in Charging State

6.3.1 Vehicle state

Vehicle shall be in OFF gear. Shut down all the vehicle-mounted electrical appliances that can be manually opened by driver or passenger.

Vehicle's SOC shall be 20% ~ 80%. If there are multiple conductive charging states, measure respectively; under the various charging states, charging current shall be more than 80% of the rated charging current.

6.3.2 Measurement methods

Same as 6.1.2.

6.4 Measurement Procedure

The typical measurement procedure of measurement methods stipulated in this Standard is shown in Figure 11.

limit value standard for measurement, proceed in accordance with the time domain measurement methods in 6.1.2.1. Specifically speaking, time domain weighted evaluation method shall take IEC 62311:2008 as a reference (please refer to Appendix B for the principle of time domain weighted measurement). When the measured value of time domain is smaller than 100%, the measurement result shall satisfy the requirement of selected limit value; in terms of measurement position whose time domain measurement result is larger than 100%, frequency domain measurement mode can be adopted for frequency spectrum analysis, so as to determine the excessive disturbance sources.

8 Test Report

In order to guarantee the repeatability of the above test, test report shall include:

---Test vehicle's uniqueness information, such as trademark, model number and VIN, etc.;

---Test vehicle's working condition;

---Test environment;

---Test equipment's information, such as manufacturer, model number, serial number, calibration information and service life, etc.;

---General requirements of test, such as test arrangement and frequency range, etc.;

---Measurement result of magnetic field in various areas during the test process;

---Any other questions that need to be declared in the test report.

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