

ICS 43.020
CCS T 09



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

GB/T 40428-2021

**Electromagnetic compatibility requirements and test methods
for conducted charging of electric vehicles**

电动汽车传导充电电磁兼容性要求和试验方法

Issued on: August 20, 2021

Implemented on: March 1, 2022

**Issued by: State Administration for Market Regulation;
Standardization Administration of the PRC**

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1 Scope

China's national electromagnetic compatibility requirements and test methods for the conducted charging of electric vehicles. It specifies the terms and definitions and the requirements. Charging is the electromagnetically noisiest thing a vehicle does. A DC fast charger switches hundreds of amperes at kilohertz frequencies, connected to the vehicle by

a cable several metres long that acts as an antenna, while the vehicle's own on-board systems continue to operate. The emissions have to be limited in both directions: the charging system must not disturb radio services or the equipment around it, and it must not inject harmonics into the supply network, which matters increasingly as charging capacity grows relative to the local distribution. It must also be immune - a charge session interrupted by interference is a fault the customer experiences. Testing is awkward because the equipment under test spans the vehicle, the cable and the charger, which are made by different people.

This document specifies the electromagnetic compatibility requirements and test methods, for conductive charging of electric vehicles. This document applies to electric vehicles (or vehicles for short), that can be externally charged, as well as to systems, which are composed of vehicles and power supply equipment. This document applies to the electric vehicles, whose vehicle sockets (connection method B and connection method C) comply with GB/T 20234.2 and/or GB/T 20234.3, AND power supply plugs (connection method A) comply with GB/T 1002 and/or GB/T 20234.2. This document does not apply to electric buses, which have top-contact charging systems.

2 Normative references

The contents of the following documents constitute the indispensable clauses of this document through normative references in the text. For the dated documents, only the versions with the dates indicated are applicable to this document; for the undated documents, only the latest version (including all the amendments) is applicable to this standard.

GB/T 1002 Single phase plugs and socket-outlets for household and similar purposes - Types, basic parameters and dimensions

GB/T 6113.102 Specification for radio disturbance and immunity measuring apparatus and methods - Part 1-

2.Radio disturbance and immunity measuring apparatus - Coupling devices for conducted disturbance measurements

GB/T 6113.201 Specification for radio disturbance and immunity measuring apparatus and methods - Part 2-

1.Methods of measurement of disturbances and immunity - Conducted disturbance measurements

GB 17625.1 Electromagnetic compatibility - Limits - Limits for harmonic current emissions (equipment input current ≤ 16 A per phase)

GB/T 17625.2 Electromagnetic compatibility (EMC) - Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems, for equipment with

rated current ≤ 16 A per phase and subject to unconditional connection

GB/T 17625.7 Electromagnetic compatibility - Limits - Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems for equipment with rated current ≤ 75 A and subject to conditional connection

3 Terms and definitions

The terms and definitions, as defined in GB/T 18487.1-2015, GB/T 18655, GB/T 19596, GB/T 20234.1, GB/T 29259, as well as the following terms and definitions, apply to this document.

3.1 Conductive charging A way to charge a rechargeable energy storage system, by the use of electrical conduction.

3.2 Electric vehicle supply equipment; EVSE A device, that is composed of AC charging piles, off-board chargers and/or charging connection devices, to provide electrical energy for electric vehicles.

3.3 Charging mode A method of connecting an external power source to an electric vehicle, to power the vehicle.

3.4 Type of connection A method of connecting an electric vehicle to the power grid (power source), by the use of a charging connection device.

4.1 General requirements

4.1.1 When the electric vehicle adopts the vehicle interface of GB/T 20234.2, the vehicle shall be tested, according to the method of 5.2 ~ 5.8; the test results shall meet the requirements of 4.2 ~ 4.8, respectively.

4.1.2 When the electric vehicle adopts the vehicle interface of GB/T 20234.3, the vehicle shall be tested, according to the methods of

5.2 and 5.6; the test results shall meet the requirements of

4.2 and 4.6, respectively.

4.1.3 When the electric vehicle adopts the connection mode A, the vehicle shall be tested, according to the method of 5.2 ~ 5.8; the test results shall meet the requirements of 4.2 ~ 4.8, respectively.

4.1.4 Electric vehicles can form a system with power supply equipment, which are jointly serve as test objects. When the system is the test object, the system shall be tested, according to the method of 5.2 ~ 5.5; the test results shall meet the requirements of 4.2 ~ 4.5, respectively.

4.2 Broadband electromagnetic radiation emission characteristics

4.2.1 When using the 10 m method to test, the bandwidth of the quasi-peak detector is 120 kHz; the broadband electromagnetic radiation emission characteristics shall not exceed the limit requirements in Table 1 and Figure 1.

4.2.2 When using the 3 m method to test, the bandwidth of the quasi-peak detector is 120 kHz; the broadband electromagnetic radiation emission characteristics shall not exceed the limit requirements in Table 2 and Figure 2.

4.3 Harmonic emission characteristics along the AC power line

4.3.1 When the input current per phase of AC power supply (single-phase or three-phase) is ≤ 16 A, the harmonic emission, along the AC power line, shall not exceed the limit requirements in Table 3.

4.3.2 When the input current of each phase of AC power supply is > 16 A and ≤ 75 A, the harmonic emission, along the AC power line, shall meet the following requirements.

4.4 Voltage variation, voltage fluctuation, flicker emission characteristics along the AC power line The voltage change, voltage fluctuation, flicker emission along the AC power line shall meet the following requirements.

4.5 Radio frequency conducted emission characteristics along the AC power line

4.5.1 The radio frequency conducted emission, along the AC power line, shall not exceed the quasi-peak and average limit requirements of Table 7.

4.5.2 When it can only be connected to the power grid in an industrial environment, the radio frequency conducted emission, along the AC power line, shall not exceed the quasi-peak and average limit requirements in Table 8.

4.6 Immunity to electromagnetic radiation

4.6.1 In the frequency band above 90% of 20 MHz ~ 2000 MHz, the field strength shall be 30 V/m (root mean square value). The field strength in other remaining frequency bands shall not be less than 25 V/m (root mean square value).

4.6.2 During the immunity test, the vehicle in non-parking state, shall not be able to move, through its own drive system; the parking function of the vehicle, in the parking state, shall be normal; the vehicle charging process shall not be interrupted. After the immunity test, the driving and parking functions of the vehicle shall be normal.

4.8 Surge immunity along AC power lines

4.8.1 The open circuit test voltage between line and ground is ± 2 kV; the open circuit test