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Replacing TB/T 2834-2002

Railway radio shunting equipment

铁路无线调车灯显设备

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Foreword

This Standard was drafted in accordance with the rules given in GB/T 1.1-2009.

This Standard replaces TB/T 2834-2002 Technical Specification for Radio Marshalling Equipment of Railway Plane. Compared with TB/T 2834-2002, the main technical modifications are as follows:

- added terms and definitions (see Clause 3 of this Edition);
- modified the composition and functions of railway radio shunting equipment (see Clause 4 of this Edition, Clause 3 of Edition 2002);
- modified the content of modulation mode and channel spacing in technical requirements of equipment (see 5.1.1 of this Edition, 4.1.2 of Edition 2002);
- modified power supply requirements and structural requirements of railway radio shunting equipment (see 5.2, 5.3, 5.4 of this Edition, 4.2, 4.3 of Edition 2002);
- added battery requirements (see 5.5 of this Edition);
- modified operation display requirements (see 5.6 of this Edition, Clause 6, Annex B of Edition 2002);
- modified working environment requirements (see 5.7 of this Edition, 4.4 of Edition 2002);
- modified transmitter and receiver electromechanical performance requirements (see 5.8, 5.9 of this Edition, 4.5, 4.6 of Edition 2002);
- modified safety requirements (see 5.10 of this Edition, 4.8 of Edition 2002);
- added electromagnetic compatibility requirements (see 5.12);
- added inspection method of enclosure protection (see 6.1 of this Edition);
- modified equipment electrical performance test method (see 6.2, Annex C, Annex D of this Edition, 5.2 of Edition 2002);
- modified environmental inspection method (see 6.3 of this Edition, 5.4 of Edition 2002);
- added electromagnetic compatibility test method (see 6.4 of this Edition);
- added battery inspection method (see 6.5 of this Edition);

Railway radio shunting equipment

1 Scope

This Standard specifies the terms and definitions, general technical requirements, equipment technical requirements and inspection methods for railway radio shunting equipment.

This Standard is applicable to the design, manufacturing and inspection of railway radio shunting equipment.

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 3836.1-2010, *Explosive atmospheres - Part 1: Equipment - General requirements*;

GB 3836.4-2010, *Explosive atmospheres - Part 4: Equipment protection by intrinsic safety*;

GB 4208-2008, *Degrees of Protection Provided By Enclosure (IP Code)*;

GB 9254-2008, *Information technology equipment - Radio disturbance characteristics - Limits and methods of measurement*;

GB 15842-1995, *Mobile radio equipment Safety requirements and testing methods*;

GB/T 15844.2-1995, *Environmental requirements and test methods for radio transceiver employing F3E emission used in the mobile services*;

GB/T 17626.2-2006, *Electromagnetic compatibility（EMC） - Testing and measurement techniques - Electrostatic discharge immunity test*;

GB/T 17626.3-2006, *Electromagnetic compatibility - Testing and measurement techniques - Radiated radio-frequency electromagnetic field immunity test*;

GB/T 17626.4-2008, *Electromagnetic compatibility - Testing and*

measurement techniques - Electrical fast transient/burst immunity test;

GB/T 17626.5-2008, *Electromagnetic compatibility - Testing and measurement techniques - Surge immunity test*;

GB/T 17626.6-2008, *Electromagnetic compatibility - Testing and measurement techniques - Immunity to conducted disturbances induced by radio-frequency fields*;

GB 17799.4-2001, *Electromagnetic compatibility - Generic Standards - Emission Standard for industrial environments*;

GB/T 24338.4-2009, *Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus*;

GB/T 24338.5-2009, *Railway applications - Electromagnetic compatibility - Part 4: Emission and immunity of the signalling and telecommunications apparatus*.

3 Terms and definitions

The following terms and definitions apply to this document.

3.1 repeater mode operation

an operating mode of which the railway radio shunting equipment communicates with one or more other railway radio shunting equipment via relay equipment transfer

3.2 direct mode operation

an operating mode of which the railway radio shunting equipment directly communicates with one or more other railway radio shunting equipment without the use of relay equipment

3.3 test signal

the communication contact signal transmitted periodically by the shunting hand to the shunting locomotive controller in the advancing state

4 General technical requirements

4.1 General requirements

4.1.1 The operating frequency range shall comply with the relevant provisions of the radio management.

5.1.1 The shunting equipment shall use 4 level shift keying (4FSK) digital modulation. When the channel spacing is 12.5 kHz, it may use the multiple access mode of time division multiple access (TDMA) or frequency division multiple access (FDMA).

5.1.2 The port impedance of equipment antenna shall be 50 Ω.

5.1.3 The equipment shall have solid structure, good heat dissipation, clear panel logo, easy use and maintenance, external electrical performance measurement interface.

5.2 Locomotive controller

5.2.1 Composition

The locomotive controller can be divided into the fixed one and the portable one. The fixed locomotive controller consists of host, driver box, display lights, speakers, antenna and feeder. The portable locomotive controller consists of host (with battery), driver box, antenna and train operation monitoring device (LKJ) connection cable.

5.2.2 Functions

The equipment shall have the following functions:

a) initiating and receiving shuffler member calls;

b) receiving the shunting signaling issued by shunting personnel, lighting display, voice prompts and issuing a response under idle, call state;

c) recording information parameters such as shunting signaling, voice and time;

d) sending shunting signaling to LKJ.

5.2.3 Power adaptability

The power adaptability shall meet the following requirements:

a) the fixed locomotive controller shall be powered by DC power supply; the nominal voltage is 110 V DC; the minimum operating voltage is 77 V; the maximum operating voltage is 138 V;

b) the portable locomotive controller shall be powered by battery of the controller; the nominal voltage is 7.2 V DC; the minimum operating voltage is 6.3 V; the maximum operating voltage is 8.5 V.

5.2.4 Enclosure rating

The equipment shall have the following functions:

a) initiating and receiving shuffler member calls;

b) initiating calling operator signaling;

c) issuing the shunting signaling to locative controller and receiving response under idle, call state;

d) issuing the test signal to locative controller under idle, call state;

e) alarming at low voltage.

5.4.2.2 Link, brake hand-held station

The equipment shall have the following functions:

a) initiating and receiving shuffler member calls;

b) receiving the response of locative controller;

c) issuing test signal to locative controller when pushing trolley in the case of sending test signal of shunting operator hand-held station;

d) issuing emergency stop shunting signaling under any working state;

e) unlocking the emergency stop signaling sent by itself;

f) alarming at low voltage.

5.4.3 Power requirements

It uses rechargeable lithium battery, NiMH battery under the low temperature environment below 25°C.

5.4.4 Enclosure rating

It shall meet requirements of IP 57 in GB 4208-2008.

5.4.5 Structural requirements

The structure shall meet the following requirements:

a) it shall be easy to operate in hand-held or body hanging conditions;

b) the antenna shall be durable and not easy to break;

c) the panel sets three buttons, V-shaped symmetrically layout; the key position and the color are shown in Figure 1. Keyhole is round. Keyhole size is 8 mm ≤ D ≤ 10 mm (D refers to keyhole diameter). Key height is 1

provisions of equipment safety requirements in GB 15842-1995.

5.11 Reliability requirements

The mean time between failure (MTBF) test lower limit of operator station, hand-held station shall not be less than 600 h. The mean time between failure (MTBF) test lower limit of locomotive controller shall not be less than 500 h.

5.12 Electromagnetic compatibility requirements

5.12.1 Operator station

The electromagnetic compatibility of the operator station shall meet the following requirements:

a) the AC power port conduction harassment, chassis port radiation harassment shall comply with the requirements of Table 1 in GB 17799.4-2001;

b) the chassis port RF electromagnetic field radiation and electrostatic discharge immunity shall comply with the requirements of Table 1 in GB/T 24338.5-2009;

c) the conduction disturbances, electrical fast transient bursts and surge immunity of RF field induction of input/output port, AC power port shall comply with the requirements of Table 2, Table 4 in GB/T 24338.5-2009.

5.12.2 Locomotive controller

The electromagnetic compatibility of the locomotive controller shall meet the following requirements:

a) the power port conduction harassment, chassis port radiation harassment shall comply with the requirements of Table 4, Table 6 in GB/T 24338.4-2009;

b) the chassis port RF electromagnetic field radiation and electrostatic discharge immunity shall comply with the requirements of Table 9 in GB/T 24338.4-2009;

c) the conduction disturbances, electrical fast transient bursts and surge immunity of RF field induction of power port, signal port shall comply with the requirements of Table 7, Table 8 in GB/T 24338.5-2009.

5.12.3 Hand-held station

The electromagnetic compatibility of the hand-held station shall meet the following requirements:

a) the shell radiation harassment shall comply with the requirements of Table 6 in GB/T 24338.4-2009;

b) the shell radio frequency electromagnetic field radiation and electrostatic discharge immunity shall comply with the requirements of Table 1 in GB/T 24338.5-2009.

6 Inspection methods

6.1 Inspection of enclosure rating

Carry out according to the provisions in GB 4208-2008.

6.2 Inspection of electrical performance

6.2.1 Inspection conditions

6.2.1.1 Atmospheric conditions

6.2.1.1.1 Normal conditions

The inspection shall be carried out under the following atmospheric conditions:

a) normal temperature: 15°C ~ 35°C;

b) relative humidity: 20% ~ 75%;

c) normal voltage: nominal voltage;

d) normal air pressure: 86 kPa ~ 106 kPa.

6.2.1.1.2 Limit conditions

It shall inspect the limit working conditions of the equipment under the following atmospheric conditions:

a) limit temperature: -20°C ~ 55°C;

b) limit voltage:

- for the equipment which uses AC power supply, the limit test voltage shall be ± 10% of nominal AC voltage;
- for the equipment which uses other types of batteries:
  - for nickel-metal hydride batteries and lithium batteries, the lower limit of limit test voltage shall be 0.85 times nominal voltage;
  - without the upper limit of limit test voltage.

b) the measured carrier frequency and nominal frequency shall be represented in the relative deviation of several parts per million, i.e., the carrier frequency tolerance; this value shall comply with the indicator requirements of carrier frequency tolerance specified in 5.8;

c) according to the test requirements, CHANGE the working frequency of transmitter under test; REPEAT the testing process from a) to b);

d) repeat the process from a) to c) under limit conditions.

6.2.2.4 Modulation of adjacent channel power

6.2.2.4.1 General

It refers to the power ration BETWEEN the part of the total output power falling within the specified bandwidth of any adjacent channel AND the part falling within the specified bandwidth of the assigned channel, when the transmitter is under the specified modulation conditions, in the wireless mobile service which uses discrete channel spacing.

6.2.2.4.2 Inspection method

Connect the test system according to the connection method shown in Figure 2. It shall use the spectrum analyzer as measurement device which has RMS detection mode and time domain triggering function, of which the amplitude measurement accuracy is within ± 1 dB. The inspection shall be carried out according to the following steps:

a) the transmitter shall work at the maximum power state and transmit the modulation signal according to standard requirements;

b) on the measurement device, SET the measurement bandwidth as 8.5 kHz, channel spacing as 12.5 kHz; ADJUST the resolution bandwidth to 100 Hz, video resolution bandwidth as 1 kHz;

c) for TDMA device, SET time domain trigger mode on the measurement device, SELECT the effective time domain envelope part of the transmitter signal, as shown in zone B in Figure 3, PERFORM the strobe trigger to obtain the complete frequency domain envelope of the transmitter signal;

c) for TDMA device, SET time domain trigger mode on the measurement device, SELECT the rising edge (zone A in Figure 3) of the time domain envelope or falling edge (zone C in Figure 3) trigger, CATCH the on-off switching of transmitter's power under time domain so as to OBTAIN the complete frequency domain envelope of the transmitter signal;

d) the ratio BETWEEN the obtained carrier frequency nominal channel power AND the adjacent first and second channel powers shall be transient switching adjacent channel power; this value shall comply with the indicator requirements of transient switching adjacent channel power specified in 5.8;

e) according to the test requirements, CHANGE the test frequency of the transmitter under test; REPEAT the testing process from a) to d).

6.2.2.6 Transmitter spurious emission

6.2.2.6.1 General

Spurious emission is an unwanted electromagnetic emission signal present at a discrete frequency or in a narrow frequency band, in addition to carrier and the modulation component near its emission bandwidth, of which the reduction of its emission level shall not affect the transmission of the useful information. These spurious emission components include harmonic, non-harmonic components and parasitic components. The measurement of spurious emission includes:

- antenna port spurious emission, which refers to the spurious emission measurement tested in conductive mode through the device antenna port;

- chassis port spurious emissions, which refers to the spurious emission measurement tested in radiation mode through device chassis port.

6.2.2.6.2 Inspection method for transmitter antenna port spurious emission

Connect the test system according to the connection method shown in Figure 2. Select spectrum analyzer as measurement device. The measurement frequency band is 9 kHz ~ 12.75 GHz. The frequency band range of the channel spacing (2.5×12.5 kHz = 31.25 kHz) 2.5 times transmitter operating frequency point is the free frequency band of spurious emission. Spectrum analyzer resolution bandwidth / video bandwidth settings shall be carried out according to the ones listed in Table 11.

Table 11 Transmitter antenna port spurious emission measurement resolution bandwidth / video bandwidth settings

Frequency range	Resolution bandwidth	Video bandwidth

It refers to the size of the input signal power of the receiver antenna port, under the specified test frequency and modulation mode, when the receiver bit error rate is less than or equal to 5×10^{-2}.

6.2.3.2.2 Inspection method

Connect the test system according to the connection method shown in Figure 4. The useful signal generator shall select the device that can produce D-M1 signal and output the data sequence error evaluation equipment comparison. The device under test shall provide a demodulated output data interface. The inspection shall be carried out according to the following steps:

a) SET the receiving frequency of receiver as test frequency; TURN ON the useful signal generator 1; according to the selected test frequency and different technical system, SET the signal generator output standard test signal D-M1; TURN OFF interference signal generators 2 and 3;

b) ADJUST the useful signal generator output power to make the bit error rate of the receiver less than or equal to 5×10^{-2}; RECORD the power size of the receiver antenna port at this time;

c) the power recorded in step b) shall be the sensitivity, in dBm; this value shall comply with the indicator requirements of receiver sensitivity specified in 5.9;

d) according to the test requirements, CHANGE the receiving frequency of receiver; REPEAT the process from a) to c);

e) REPEAT the process from a) to d) under limit conditions.

6.2.3.3 Bit error rate of receiver under high power signal input state

6.2.3.3.1 General

The bit error rate of receiver under high power signal input state refers to the receiver error performance when the receiver input signal power is much greater than the receiver sensitivity.

6.2.3.3.2 Inspection method

Connect the test system according to the connection method shown in Figure 4. Select the device that can produce D-M1 signal, can output data sequence for error evaluation equipment comparison as useful signal generator. The device under test shall provide a demodulated output data interface. The inspection shall be carried out according to the following steps:

a) SET the receiving frequency of receiver as test frequency; TURN ON the useful signal generator 1; according to the selected test frequency and

d) the receiver antenna port input interference signal power minus the useful signal power shall be the co-channel suppression, in dB; this value shall comply with the indicator requirements for the receiver co-channel suppression specified in 5.9 of this Standard;

e) according to the test requirements, CHANGE the receiving frequency of receiver; REPEAT the process from a) to d).

6.2.3.5 Adjacent channel selectivity

6.2.3.5.1 General

The adjacent channel selectivity refers to the receiver performance degradation when the useful modulation signal output is at the receiver nominal reception frequency, the interference signal output signal is at the receiver adjacent channel center frequency.

6.2.3.5.2 Inspection method

Connect the test system according to the connection method shown in Figure 4. Select the device that can produce D-M1 signal, can output data sequence for error evaluation equipment comparison as useful signal generator. The interference signal generator 2 is capable of generating the A- M1 signal. The device under test shall provide a demodulated output data interface. The inspection shall be carried out according to the following steps:

a) TURN ON the useful signal generator 1; according to the selected test frequency and different technical system, SET signal generator output standard test signal D-M1; the interfering signal generator shall emit the A-M1 signal; its frequency shall be the adjacent channel center frequency of the receiver under test's receiving frequency; INPUT those two into the receiver under test antenna port;

b) TURN OFF the interference signal generator; ADJUST the useful signal generator output power so as to make the receiver antenna port input power as -114 dBm;

c) TURN On the interference signal generator; ADJUST its output power to make the error rate on the error evaluation device less than or equal to 5 x 10^{-2}; RECORD the input power when the interference signal reaches to the receiver antenna port at this time;

d) the receiver antenna port input interference signal power minus the useful signal power shall be the adjacent channel selectivity, in dB; this value shall comply with the indicator requirements for the receiver adjacent channel selectivity specified in 5.9 of this Standard;

first stage mixer (nf_{LO}) add and minus the first pole frequency (f_{11}). Use equation (4) to determine its discrete frequency point:

$$f_{ff} = nf_{LO} \pm f_{11} \quad \cdots\cdots(4)$$

where,

f_{ff} - the discrete frequency point outside specified frequency band;

nf_{LO} - the harmonic frequency of the local oscillator signal of receiver's first stage mixer;

f_{11} - the first pole frequency of receiver.

The device under test shall provide the operating frequency of the tested intercom receiver, local oscillator signal frequency (f_{LO}), intermediate frequency (f_{11} to f_{In}) of the first stage mixer, so as to facilitate the spurious response immunity measurement.

6.2.3.6.4 Inspection method

Connect the test system according to the connection method shown in Figure 4. Select the device that can produce D-M1 signal, can output data sequence for error evaluation equipment comparison as useful signal generator. The interference signal generator 2 is capable of generating the A- M1 signal. The device under test shall provide a demodulated output data interface. The inspection shall be carried out according to the following steps:

a) TURN ON the useful signal generator 1; according to the selected test frequency and different technical system, SET signal generator output standard test signal D-M1; the interfering signal generator shall emit the continuous wave signal; refer to 6.2.3.6.2 and 6.2.3.6.3 for its frequency setting; INPUT those two into the receiver under test antenna port;

b) TURN OFF the interference signal generator; ADJUST the useful signal generator output power so as to make the receiver antenna port input power as -114 dBm;

c) TURN On the interference signal generator; ADJUST its output power to make the error rate on the error evaluation device less than or equal to 5 x 10^{-2}; RECORD the input power when the interference signal reaches to the receiver antenna port at this time;

d) the receiver antenna port input interference signal power minus the useful signal power shall be the spurious corresponding immunity, in dB; this value shall comply with the indicator requirements for the receiver spurious corresponding immunity specified in 5.9;

6.2.3.8.1 General

It refers to the ability of receiving usual modulation signal of receiver in the case of removing the spurious response or the interfere input signal at the frequency of the adjacent channel.

6.2.3.8.2 Inspection method

Connect the test system according to the connection method shown in Figure 4. Select the device that can produce D-M1 signal, can output data sequence for error evaluation equipment comparison as useful signal generator. The device under test shall provide a demodulated output data interface. The interference signal generator 2 shall OUTPUT the continuous wave signal. The inspection shall be carried out according to the following steps:

a) according to the selected test frequency and different technical system, SET signal generator output standard test signal D-M1, its frequency shall be the receiving frequency of the receiver under test; the interference signal generator shall emit the continuous wave signal; its frequency shall be 1 MHz higher than the receiver's receiving frequency; INPUT those two into the receiver under test antenna port;

b) TURN OFF the interference signal generator; ADJUST the useful signal generator output power so as to make the receiver antenna port input power as -114 dBm;

c) TURN On the interference signal generator; ADJUST its output power to make the error rate on the error evaluation device less than or equal to 5 x 10^{-2}; RECORD the input power when the interference signal reaches to the receiver antenna port at this time;

d) the receiver antenna port input interference signal power minus the useful signal power shall be the block, in dB; this value shall comply with the indicator requirements for the receiver intermodulation response immunity specified in 5.9;

e) respectively SET the interference signal frequency on the basis of the original and CARRY OUT those measurements when they are ±1 MHz, ±2 MHz, ±5 MHz and ±10 MHz from the receiver's rated signal; REPEAT the process from c) to d);

f) according to the test requirements, CHANGE the receiving frequency of receiver; REPEAT the process from a) to e).

6.2.3.9 Receiver spurious emission inspection

6.2.3.9.1 General

The electromagnetic compatibility test method for the operator station and the locomotive controller shall be carried out according to the following requirements:

a) power port conduction harassment, chassis port radiation harassment test methods shall be according to the provisions of GB 9254-2008;

b) test method for radiation immunity of radio frequency electromagnetic field in chassis port shall be according to the provisions of GB/T 17626.3-2006;

c) test method for electrostatic discharge immunity of chassis port shall be according to the provisions of GB/T 17626.2-2006;

d) test method for conducted disturbance immunity of RF field induction of input/output port / signal port, AC power port shall be according to the provisions of GB/T 17626.6-2008;

e) test method for fast transient burst immunity of input/output port / signal port, AC power port shall be according to the provisions of GB/T 17626.4-2008;

f) test method for surge immunity of input/output port / signal port, AC power port shall be according to the provisions of GB/T 17626.5-2008.

6.4.2 Hand-held station

The electromagnetic compatibility test method of the hand-held station shall be carried out according to the following requirements:

a) the test method for radiation harassment of enclosure shall be in accordance with the provisions of GB 9254-2008;

b) the test method for enclosure radio frequency electromagnetic radiation immunity shall be in accordance with the provisions of GB/T 17626.3-2006;

c) the test method for enclosure electrostatic discharge immunity shall be in accordance with the provisions of GB/T 17626.2-2006.

6.5 Battery inspection

6.5.1 Capacity inspection

In the standard atmospheric test conditions, after fully charging according to the charging conditions specified in Table 1 of 5.5.3, the battery shall be open for 1 h ~ 4 h and discharge at a constant current of 0.2 C_5 A at 20°C ± 5°C, of which the Ni-MH battery shall discharge to n × 1.0 x (1 ± 2%) V, the lithium ion battery shall discharge to n × 2.75 x (1 ± 2%) V, and,

b) after discharging according to the provisions of 5.5.6, charge the battery according to the provisions of 5.5.3, then, at 20°C ± 5°C, discharge according to the provisions of 5.5.6.

6.5.6 Safety performance inspection

The safety performance inspection shall be carried out very carefully. The test shall be conducted in protective device.

When the battery is at 20°C ± 5°C, use a wire to connect the positive and negative terminals directly to make short circuit. Then disconnect the wire to check if the charging and discharging are normal.

6.5.7 Internal resistance measurement

The internal resistance of the battery is measured by using a battery internal resistance tester. The single cells that make up the battery shall be tested separately for internal resistance. Calculate the difference between the maximum internal resistance and the minimum internal resistance.

6.5.8 Vibration inspection

After charging according to the provisions of Table 1 in 5.5.3, carry out the vibration test according to 6.3.1. After the vibration, check the battery appearance. Measure the battery voltage.

6.5.9 Impact inspection

After the vibration test, carry out the impact test according to 6.3.1. After the impact, check the battery appearance. Measure the battery voltage.

6.5.10 Falling inspection

After the vibration and impact tests, load the battery into the hand-held station. Carry out the falling test. The falling height is 1500 mm. From the back, the bottom, two corners of the bottom, it shall fall on the steel floor, 3 times separately. Check the battery appearance. Charge and discharge according to the provisions of 6.5.1.

6.5.11 Enclosure rating inspection

Carry out according to the provisions of GB 4208-2008.

Annex B

(Normative)

Charging equipment

B.1 Basic working conditions for charging equipment

B.1.1 Working voltage: AC 220 V / 50 Hz; the lowest working voltage is 150 V; the highest working voltage is 260 V.

B.1.2 Ambient temperature: 5°C ~ 35°C

B.1.3 Relative temperature: ≤ 90% (at 40°C)

B.2 Basic functions

B.2.1 The charging device shall have power indicator.

B.2.2 Ni-MH battery charging equipment surface shall have the instructions for battery charging, full, discharging; shall have the function that it shall automatically switch to charging after discharging. During Ni-MH battery normal charging and discharging, the discharging current shall not exceed 0.3 C_5 A, the charging current shall not exceed 0.5 C_5 A; the whole charging and discharging process shall not be greater than 12 h.

B.2.3 Lithium ion battery charging equipment surface shall have the instructions for battery charging, full. It shall use a charging method: constant current prior to constant voltage. The charging current shall be 0.2 C_5 A ~ 0.5 C_5 A. The charging voltage shall be n × 4.2 V. The constant voltage accuracy shall not be greater than 1%. The whole charging process shall not exceed 8 h.

B.2.4 The discharge termination voltage of Ni-MH battery charging equipment is n × 1.0 × (1±2%) V.

B.2.5 The enclosure temperature when charging equipment is working shall be lower than 60°C (the ambient temperature is 5°C).

B.2.6 Lithium battery charging device can charge the battery in the over-discharge protection state.

B.2.7 The charger life is 5 years.

B.3 Test methods

B.3.1 Appearance process quality: use visual inspection

Annex C

(Normative)

Guidance on site layout for testing sites and radiation testing

C.1 Testing site

C.1.1 Wide testing site or semi-anechoic chamber

The wide testing site or semi-anechoic chamber shall comply with the corresponding requirements for testing site in GB 9254.

At the frequency band less than 1 GHz, the test distance of measurement dual-mode antenna shall not be less than 3 m. At the frequency band greater than 1 GHz, select a suitable test distance. The size of the equipment under test shall be less than 20% of the test distance. The height of the equipment under test or the height of the substitute antenna is 1. 5 m. The measuring antenna height is required to adjust within 1 m ~ 4 m.

In order to ensure that the reflected wave signal generated by the obstacle near the testing site has no effect on the test results, the testing site shall comply with the following conditions:

a) there is no conductive object of which the diameter is greater than λ /4 of the maximum testing frequency (λ is the wave length);

b) the connection cables are laid as far as possible along the floor surface, under the floor for the best; low-impedance cables shall use shielded cables,

The typical testing arrangement is shown in Figure C.1.