GA

PUBLIC SECURITY INDUSTRY STANDARD

OF THE PEOPLE'S REPUBLIC OF CHINA

ICS 33.060.01

A 90

GA/T 1255-2016

Police Digital Trunking Communication System - Technical Requirements and Measurement Methods for Radio Frequency Equipment

警用数字集群（PDT）通信系统　射频设备技术要求和测试方法

Issued on: September 8, 2016 **Implemented on: September 8, 2016**

Issued by: The Ministry of Public Security of the People's Republic of China

Table of Contents

Police Digital Trunking Communication System - Technical Requirements and Measurement Methods for Radio Frequency Equipment

1 Scope

This Standard stipulates the terms, definitions, symbols and abbreviations, classification, requirements and measurement methods for radio frequency equipment of the police digital trunking communication system.

This Standard is applicable to the transceiver stations, mobile stations and portable stations of the police digital trunking communication system, as well as their related systems and other equipment.

2 Normative References

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

GB/T 2423.1-2008 Environmental Testing for Electric and Electronic Products - Part 2: Test Methods - Tests A: Cold

GB/T 2423.2-2008 Environmental Testing for Electric and Electronic Products - Part 2: Test Methods - Tests B: Dry Heat

GB/T 2423.3-2006 Environmental Testing for Electric and Electronic Products - Part 2: Testing Method - Test Cab: Damp Heat, Steady State

GB/T 2423.5-1995 Environmental Testing for Electric and Electronic Products - Part 2: Test Methods - Test Ea and Guidance: Shock

GB/T 2423.8-1995 Environmental Testing for Electric and Electronic Products - Part 2: Test Methods - Test Ed: Free Fall

GB/T 2423.10-2008 Environmental Testing for Electric and Electronic Products - Part 2: Tests Methods - Test Fc: Vibration (Sinusoidal)

GB/T 2423.17-2008 Environmental Testing for Electric and Electronic Products - Part 2: Test Methods - Test Ka: Salt Mist

The electrical fast transient pulse group (power port) immunity of the transceiver station shall comply with the requirements of test level 3 in GB/T 17626.4-2008. During the test, the transceiver station allows temporary loss or reduction of functions or performance. After the test is stopped, the transceiver station shall be able to resume normal operating state by itself without human intervention.

5.2.6 Surge (power port) (impact) immunity

The surge (impact) immunity of the transceiver station using AC power supply shall comply with the requirements of test level 3 in GB/T 17626.5-2008. The surge (impact) immunity of the transceiver station using DC power supply shall comply with the requirements of test level 2 in GB/T 17626.5-2008. During the test, the transceiver station allows temporary loss or reduction of functions or performance. After the test is stopped, the transceiver station shall be able to resume normal operating state by itself without human intervention.

The surge (impact) immunity of the mobile station shall comply with the requirements of test level 2 in GB/T 17626.5-2008. During the test, the mobile station allows temporary loss or reduction of functions or performance. After the test is stopped, the mobile station shall be able to resume normal operating state by itself without human intervention.

5.2.7 Immunity to conducted disturbances induced by RF field (power port)

The immunity to conducted disturbances induced by RF field of the transceiver station and mobile station shall comply with the requirements of test level 3 in GB/T 17626.6-2008. During the test, the transceiver station and mobile station allow temporary loss or reduction of functions or performance. After the test is stopped, the transceiver station and mobile station shall be able to resume normal operating state by themselves without human intervention.

5.2.8 Immunity to voltage sags, short interruptions and voltage variations

The transceiver station powered by AC power grid is subjected to 40% voltage sag for 10 cycles, 70% voltage sag for 25 cycles and short interruption for 250 cycles. During the test, the transceiver station allows temporary loss or reduction of functions or performance. After the test is stopped, the transceiver station shall be able to resume normal operating state by itself without human intervention.

5.3 Electrical Safety Requirements

It shall comply with the requirements of Chapter 12 of GA/T 1056-2013.

5.4 Environmental Adaptability Requirements

5.4.1 Test criteria and configuration requirements

In the environmental adaptability test, basic electrical performance (carrier output power, carrier frequency error and static sensitivity) is used as the performance criterion after the test. In the environmental adaptability test of the portable station, the basic electrical performance

test uses the portable station's standard battery.

5.4.2 Mechanical environmental adaptability

5.4.2.1 Impact

After the mobile station, portable station and transceiver station are tested according to the method specified in 9.1.1, the appearance of the mobile station, portable station and transceiver station and their internal structural units shall not produce permanent structural deformation, mechanical damage, electrical failure and loose fastening parts. The internal circuits, circuit boards, interfaces and other plug-ins of the mobile station, portable station and transceiver station shall not fall off, become loose or have poor contact. After the test, the mobile station and portable station shall be able to communicate normally, the transceiver station shall be able to transmit and receive normally, and the basic electrical performance shall not change.

5.4.2.2 Free fall

After the portable station is tested according to the method specified in 9.1.2, the appearance of the portable station and its internal structural units shall not produce permanent structural deformation or mechanical damage. During the test, the portable station battery is allowed to fall off or become loose. After the test, the portable station can operate normally, and the basic electrical performance will not change.

5.4.2.3 Vibration

After the transceiver station, mobile station and portable station are tested according to the method specified in 9.1.3, the appearance of the transceiver station and mobile station and the portable station and its internal structural units shall not produce permanent structural deformation, mechanical damage, electrical failure and loose fastening parts. The internal circuits, circuit boards, interfaces and other plug-ins of the transceiver station, mobile station and portable station shall not fall off, become loose or have poor contact. After the test, the mobile station and portable station shall be able to communicate normally, and the basic electrical performance shall not change. The transceiver station shall be able to transmit and receive normally, and the basic electrical performance shall not change.

5.4.3 Climate and environmental adaptability

The transceiver station, mobile station and portable station shall be tested for climate and environmental adaptability as specified in Table 3. During the test, there shall be no state change, the transceiver station shall be able to transmit and receive normally, and the mobile station and portable station shall be able to communicate normally in digital direct mode. After the test, the transceiver station, mobile station and portable station shall be able to start up normally, the transceiver station shall be able to transmit and receive normally, and the mobile station and portable station shall be able to communicate normally in digital trunking mode and digital direct mode. After the salt spray test, there shall be no rust on the surface of the transceiver station, mobile station and portable station, the transceiver station shall be able

6 RF Performance Parameter Test Conditions and Test Methods

6.1 RF Performance Parameter Test Conditions

6.1.1 Test conditions

6.1.1.1 General test conditions

The general test conditions of the equipment are as follows:

---Normal temperature: +15°C ~ +35°C;

---Relative humidity: 20% ~ 75%;

---Normal voltage: For equipment powered by lead-acid batteries, the normal voltage is 1.1 times the nominal operating voltage; for equipment of other power supply types, the normal voltage is the nominal voltage;

---Normal atmospheric pressure: 86kPa ~ 106kPa.

6.1.1.2 Extreme conditions

The transceiver station, mobile station and portable station shall, based on the types of equipment they are suitable for in different climatic environments, take the high temperature (operating state) and low temperature (operating state) in their respective operating states as the extreme conditions of the test according to the provisions in Table 1.

6.1.2 Test operating conditions

6.1.2.1 Test sample conditions

6.1.2.1.1 The samples to be tested can be products submitted by the manufacturer for inspection or products sampled by the testing department according to regulations. For all samples submitted for inspection or random inspection, the manufacturer shall provide the technical documents and auxiliary testing devices required for testing before testing can be carried out.

6.1.2.1.2 Auxiliary testing devices include: RF adapters or RF cables that can be connected to standard testing instruments; power supply cables that need to be connected to external power supplies, etc.

6.1.2.1.3 In principle, it is not allowed to open the casing for testing during the entire test process. If it is necessary to open the casing for testing, it shall be stated in the test report.

6.1.2.1.4 When testing the spurious emission of the transmitter chassis port and the receiver

P (P') -- Output power of the transmitter under test read on the test equipment, in decibel-milliwatts (dBm);

L_1 -- Insertion loss of the "connection/conversion device" in the specified frequency band (frequency), in decibels (dB);

L_2 -- Attenuation of the fixed attenuator, in decibels (dB).

Determine whether the result complies with the requirements of the transmitter power (conducted) and power tolerance change specified in Table 1;

d) According to the provisions of 6.1.2.2, change the operating frequency of the transmitter under test and repeat the test process from b) to c);

e) Repeat the process from a) to d) under extreme conditions.

6.2.3 Test method for 4FSK modulation frequency deviation error

Connect the test system as shown in Figure 1. The test equipment may be a comprehensive tester or a spectrum analyzer with vector analysis function. The test procedure is as follows:

a) The transmitter operates at the maximum transmitter power (conducted) state at a specified test frequency; select a certain number of slots (greater than or equal to 100), use the test equipment to measure the 4FSK modulation within the valid time domain envelope time, and read or calculate the 4FSK modulation frequency deviation error of the transmitter under test from the test equipment;

b) Determine whether the test result of the 4FSK modulation frequency deviation error of the transmitter under test complies with the indicator requirements of the 4FSK modulation frequency deviation error specified in Table 1;

c) According to the provisions of 6.1.2.2, change the operating frequency of the transmitter under test and repeat the test process from a) to b).

6.2.4 Test method for 4FSK transmitter bit error ratio

Connect the test system as shown in Figure 1. The test equipment may be a comprehensive tester or a spectrum analyzer with vector analysis function. The test procedure is as follows:

a) The transmitter operates at the maximum transmitter power (conducted) state at a specified test frequency; select a certain number of slots (greater than or equal to 100), use the test equipment to measure the 4FSK modulation within the valid time domain envelope time, and read or calculate the 4FSK transmitter bit error ratio of the transmitter under test from the test equipment;

b) Determine whether the test result of the 4FSK transmitter bit error ratio of the transmitter under test complies with the indicator requirements of the 4FSK transmitter bit error ratio specified in Table 1;

c) According to the provisions of 6.1.2.2, change the operating frequency of the transmitter under test and repeat the test process from a) to b).

6.2.5 Test method for occupied bandwidth

Connect the test system as shown in Figure 1. The test equipment may be a spectrum analyzer with automatic bandwidth detection function. The test procedure is as follows:

a) The transmitter operates at the maximum transmitter power (conducted) state at a specified test frequency; select a certain number of slots (greater than or equal to 100), use the test equipment to measure its spectrum within the valid time domain envelope time, set the resolution bandwidth to 100Hz on the test equipment and the detection mode to RMS detection, and read the occupied bandwidth of the transmitter under test from the test equipment;

b) Determine whether the test result of the occupied bandwidth of the transmitter under test complies with the indicator requirements of the occupied bandwidth specified in Table 1;

c) According to the provisions of 6.1.2.2, change the operating frequency of the transmitter under test and repeat the test process from a) to b).

6.2.6 Test method for frequency error

Connect the test system as shown in Figure 1. The test equipment may be a frequency counter, a comprehensive tester or other test equipment that can measure frequency parameters. The test procedure is as follows:

a) The transmitter under test operates at the maximum power state without modulation, and the test equipment measures the carrier frequency of the transmitter under test; if the transmitter under test cannot operate in a non-modulated state, it is necessary to demodulate the modulated signal and measure the carrier frequency of the transmitter under test;

b) The difference between the carrier frequency obtained by the test and the nominal frequency is the carrier frequency error; determine whether the ratio of this difference to the nominal frequency complies with the indicator requirements of the transmitter carrier frequency error specified in Table 1;

c) According to the provisions of 6.1.2.2, change the operating frequency of the transmitter under test and repeat the test process from a) to b);

d) Repeat the process from a) to c) under extreme conditions.

6.2.7 Test method for transmitter attack time and transmitter release time

Connect the test system as shown in Figure 1. The test equipment may be a comprehensive tester or other spectrum analyzers with power-time relationship function. The test procedure is

a) Set the receiving frequency of the receiver to the test frequency, turn on the wanted signal generator 1, set the signal generator to output the standard test signal D-M2 according to the selected test frequency, and turn off the interference signal generators 2 and 3;

b) Adjust the output power of the wanted signal generator until the input power of the receiver antenna port is higher than the static sensitivity limit of 33 dB;

c) Record the bit error ratio displayed by the bit error evaluation equipment at this time, and determine whether this value complies with the requirements of the receiver bit error ratio at high input level specified in Table 2;

d) Adjust the output power of the wanted signal generator until the input power of the receiver antenna port is -10 dBm, and repeat the test step c);

e) According to the provisions of 6.1.2.2, change the receiving frequency of the receiver and repeat the process from a) to c).

6.3.4 Test method for intermodulation response rejection

Connect the test system as shown in Figure 4. The wanted signal generator shall be a signal generator that can generate D-M2 signals and output data sequences for comparison by the bit error evaluation equipment.

The interference signal generator 2 generates a continuous wave signal, and the interference signal generator 3 generates an A-M1 signal. The equipment under test shall provide a demodulation output data interface. The test procedure is as follows:

a) Set the wanted signal generator to transmit a D-M2 signal, whose frequency is the receiving frequency of the receiver under test, adjust the interference test signal frequency, so that the interference signal generator 2 is 50 kHz higher than the wanted signal frequency and the interference signal generator 3 is 100 kHz higher than the wanted signal frequency, and combine the two to input to the antenna port of the receiver under test;

b) Turn off the interference signal generator, adjust the output power of the wanted signal generator so that the receiver bit error ratio is less than or equal to 5×10^{-2}, and record the wanted signal power input to the receiver antenna port at this time;

c) Increase the wanted input signal level by 3 dB;

d) Turn on the interference signal generator and adjust its output power synchronously so that the bit error ratio on the bit error evaluation equipment is less than or equal to 5×10^{-2}, and record the input power of the interference signal reaching the receiver antenna port at this time;

e) The intermodulation response immunity is the power of the interference signal input

to the receiver antenna port minus the power of the wanted signal, expressed in decibels (dB); determine whether this value complies with the indicator requirements of the receiver intermodulation response immunity specified in Table 2;

f) According to the provisions of 6.1.2.2, change the receiving frequency of the receiver and repeat the process from a) to e).

6.3.5 Test method for blocking

Connect the test system as shown in Figure 4. The wanted signal generator shall be a signal generator that can generate D-M2 signals and output data sequences for comparison by the bit error evaluation equipment. The interference signal generator 2 outputs a single carrier signal. The equipment under test shall provide a demodulation output data interface. The test procedure is as follows:

a) Set the wanted signal generator to transmit a D-M2 signal, whose frequency is the receiving frequency of the receiver under test, and the interference signal generator to transmit a continuous wave signal, whose frequency is 1 MHz higher than the receiving frequency of the receiver, and combine the two to input to the antenna port of the receiver under test;

b) Turn off the interference signal generator, adjust the output power of the wanted signal generator so that the receiver bit error ratio is less than or equal to 5×10^{-2}, and record the wanted signal power input to the receiver antenna port at this time;

c) Increase the wanted input signal level by 3 dB;

d) Turn on the interference signal generator and adjust its output power so that the bit error ratio on the bit error evaluation equipment is less than or equal to 5×10^{-2}, and record the input power of the interference signal reaching the receiver antenna port at this time;

e) The blocking is the power of the interference signal input to the receiver antenna port minus the power of the wanted signal, expressed in decibels (dB); determine whether this value complies with the indicator requirements of the receiver blocking specified in Table 2;

f) Set the interference signal frequency to ±1 MHz, ±2 MHz, ±5 MHz and ±10 MHz from the rated signal of the receiver, perform these tests, and repeat the process from c) to e);

g) According to the provisions of 6.1.2.2, change the receiving frequency of the receiver and repeat the process from a) to f).

6.3.6 Spurious response rejection

signal generator so that the receiver bit error ratio is less than or equal to 5×10^{-2}, and record the wanted signal power input to the receiver antenna port at this time;

c) Increase the wanted input signal level by 3 dB;

d) Turn on the interference signal generator and adjust its output power so that the bit error ratio on the bit error evaluation equipment is less than or equal to 5×10^{-2}, and record the input power of the interference signal reaching the receiver antenna port at this time;

e) The spurious response immunity is the power of the interference signal input to the receiver antenna port minus the power of the wanted signal, expressed in decibels (dB); determine whether this value complies with the indicator requirements of the receiver spurious response immunity specified in Table 2;

f) According to the provisions of 6.1.2.2, change the receiving frequency of the receiver and repeat the process from a) to e).

6.3.7 Test method for co-channel rejection

Connect the test system as shown in Figure 4. The wanted signal generator shall be a signal generator that can generate D-M2 signals and output data sequences for comparison by the bit error evaluation equipment. The interference signal generator 2 can generate A-M1 signals. The equipment under test shall provide a demodulation output data interface. The test procedure is as follows:

a) Set the wanted signal generator to transmit a D-M2 signal, whose frequency is the receiving frequency of the receiver under test, and the interference signal generator to transmit an A-M1 signal, whose frequency is the receiving frequency of the receiver under test, and combine the two to input to the antenna port of the receiver under test;

b) Turn off the interference signal generator, adjust the output power of the wanted signal generator so that the receiver bit error ratio is less than or equal to 5×10^{-2}, and record the wanted signal power input to the receiver antenna port at this time;

c) Increase the wanted input signal level by 3 dB;

d) Turn on the interference signal generator and adjust its output power so that the bit error ratio on the bit error evaluation equipment is less than or equal to 5×10^{-2}, and record the input power of the interference signal reaching the receiver antenna port at this time;

e) The co-channel rejection is the power of the interference signal input to the receiver antenna port minus the power of the wanted signal, expressed in decibels (dB); determine whether this value complies with the indicator requirements of the receiver co-channel rejection specified in Table 2;

f) According to the provisions of 6.1.2.2, change the receiving frequency of the receiver and repeat the process from a) to d).

6.3.8 Test method for adjacent channel selectivity

Connect the test system as shown in Figure 4. The wanted signal generator shall be a signal generator that can generate D-M2 signals and output data sequences for comparison by the bit error evaluation equipment. The interference signal generator 2 can generate A-M1 signals. The equipment under test shall provide a demodulation output data interface. The test procedure is as follows:

a) Set the wanted signal generator to transmit a D-M2 signal, whose frequency is the receiving frequency of the receiver under test, and the interference signal generator to transmit an A-M1 signal, whose frequency is the adjacent channel center frequency of the receiving frequency of the receiver under test, and combine the two to input to the antenna port of the receiver under test;

b) Turn off the interference signal generator, adjust the output power of the wanted signal generator so that the receiver bit error ratio is less than or equal to 5×10^{-2}, and record the wanted signal power input to the receiver antenna port at this time;

c) Increase the wanted input signal level by 3 dB;

d) Turn on the interference signal generator and adjust its output power so that the bit error ratio on the bit error evaluation equipment is less than or equal to 5×10^{-2}, and record the input power of the interference signal reaching the receiver antenna port at this time;

e) The adjacent channel selectivity is the power of the interference signal input to the receiver antenna port minus the power of the wanted signal, expressed in decibels (dB); determine whether this value complies with the indicator requirements of the receiver adjacent channel selectivity specified in Table 2;

f) According to the provisions of 6.1.2.2, change the receiving frequency of the receiver and repeat the process from a) to d).

6.3.9 Test method for receiver spurious emission

6.3.9.1 Test method for antenna port spurious emission

Connect the test system as shown in Figure 1. The test equipment is a spectrum analyzer, and the measurement frequency band of the conducted spurious emission is 9 kHz ~ 12.75 GHz. The resolution bandwidth/video bandwidth settings of the spectrum analyzer shall be as shown in Table 7.

This is an excerpt of the PDF (Some pages are marked off intentionally)

------ The End ------