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Police Digital Trunking Communication System - Technical Specifications for Engineering

警用数字集群（PDT）通信系统 工程技术规范

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Police Digital Trunking Communication System - Technical Specifications for Engineering

1 Scope

This Standard specifies the requirements for the design, construction, and engineering acceptance of the Police Digital Trunking (PDT) communication system.

This Standard applies to the construction, reconstruction, and expansion of the Police Digital Trunking (PDT) communication system.

2 Normative References

The following documents are essential to the application of this Document. 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 Document.

GB 50174-2008 Code for Design of Electronic Information System Room

GB 50201-2014 Standard for flood control

GB 50348-2004 Technical code for engineering of security and protection system

GB 50689-2011 Code for design of lightning protection and earthing engineering for telecommunication bureaus (Stations)

GA/T 1056-2013 Police digital trunking communication system—General technical specifications

GA/T 1059-2013 Police digital trunking communication system—Security technical specifications

GA/T 1255-2016 Police digital trunking communication system Technical requirements and measurement methods for radio frequency equipment

GA/T 1367-2017 Police digital trunking communication system-measurement methods for function

GF 005-1994 Technical specification for interface for special mobile communication

--- Security docking platform completes the secure docking of the PDT system and the public security information network, including front-end servers, network gates, back-end servers, firewalls and other equipment to ensure the security of the public security information network and the PDT private network; and ensure to realize real-time interaction, complete functions and no missing of the security of the voice and data services of PDT private network and the public security information network;

--- Other supporting equipment such as database servers, network management servers, etc. provide necessary support for the operation of the soft switch system;

--- The mobile switch office should consider hot backup for disaster recovery in different locations.

5.4 Transmission link design

5.4.1 Overview

The transmission link mainly includes the following links: links between base stations and switching centers, links between switching centers, links between switching centers and management clients, scheduling clients, and monitoring clients.

When using the computer room provided by social resources and the link rented from the public network telecommunications operator, it shall not be directly connected to the public security information network.

5.4.2 Link form

The link shall use an IP dedicated link.

5.4.3 Link bandwidth requirements

IP links are used to connect switching centers.

The link bandwidth requirements between switching centers are 5Mbps~10Mbps.

The link bandwidth between base stations and switches is required to be no less than 64kbps per carrier.

5.4.4 Transmission links between dispatch desks and management terminals

The remote network management/dispatching terminal is connected to the main switching center using a link with a bandwidth of no less than 2Mbps.

5.4.5 Transmission links for monitoring terminals

On the basis of meeting the bandwidth of cluster services, the network bandwidth that supports monitoring video transmission shall be selected to avoid affecting cluster services.

5.4.6 Reliability requirements

Key transmission links should adopt a dual backup design.

Link requirements between base stations and switching centers: network delay is no more than 50 ms, network jitter is no more than 20 ms, and packet loss rate is no more than 1×10^{-3}.

Link requirements between switching centers: network delay is no more than 100ms, network jitter is no more than 50ms, and packet loss rate is no more than 1×10^{-3}.

5.5 Wireless network design

5.5.1 Overview

Wireless network design shall include site coverage planning, capacity design and frequency configuration.

5.5.2 Wireless network coverage design

5.5.2.1 Principles of wireless network coverage design

In wireless network coverage design, the hanging height of antenna, antenna type, antenna azimuth and down-tilt angle of the base station shall be determined based on the principle of meeting the coverage range and reducing frequency interference.

5.5.2.2 Contents of wireless network coverage design

Wireless network coverage design shall include the following contents:

--- Site location;

--- Number of sites;

--- Site type;

--- Hanging height of antenna;

--- Wireless parameters (including transmission power, antenna gain, tilt angle, directional pattern, antenna feed system loss, etc.);

--- Coverage prediction.

In order to solve the problem of mismatch in uplink and downlink communication distance between the handset station and the base station, the following measures can be adopted:

--- Base station adopts diversity reception;

--- Base station receiving antenna uses high-gain directional antenna.

g) Determine the specific site location through on-site survey;

h) Adjust the initial site setting plan according to the actual site.

5.5.3 Wireless network capacity design

5.5.3.1 Contents of wireless network capacity design

The wireless network capacity design shall include the following:

--- Calculate the number of voice channels based on the volume of single call and group call traffic;

--- Calculate the number of data channels based on the amount of satellite positioning data;

--- Consider 20%~30% redundancy.

5.5.3.2 Basic steps for wireless network capacity design

The design of digital trunking wireless capacity should follow the following basic steps:

a) Clarify the user capacity demand target;

b) Predict the traffic and data flow in the coverage area based on the traffic model;

c) Predict the traffic and data flow absorbed by each base station;

d) Determine the number of carriers configured for the base station based on the Irish formula.

5.5.4 Wireless network frequency configuration

The frequency configuration shall comply with the following basic principles:

--- Use a frequency reuse method of no less than 12 groups;

--- No third-order intermodulation and no adjacent channel interference within the station;

--- The minimum channel frequency interval of the same combiner is no less than 250kHz;

--- No adjacent channel interference between adjacent stations, and no co-channel interference between multiplexing stations;

--- When frequency reuse is used, the co-channel suppression, adjacent channel selectivity and intermodulation response suppression indicators shall meet the requirements of GA/T 1056-2013.

5.6 Service platform design

The service platform of the switching control center completes the service generation and provision functions; mainly including service control points and application servers, such as dispatch servers, recording servers, GIS servers, etc.

5.7 Equipment selection

The digital trunking communication system equipment shall meet the relevant requirements of the PDT series standards and pass the inspection of the inspection department. The performance indicators of supporting equipment such as antennas, feeders, combiners, splitters, duplexers, etc. are shown in Appendix A.

5.8 Bureau (station) selection and requirements

5.8.1 Mobile switch office

The selection of the mobile switch office site shall be carried out in accordance with the relevant provisions of GB 50174-2008.

The site of the mobile switch office should take into account factors such as convenient link connection and convenient docking with other application systems; and select a machine room with complete infrastructure and convenient operation and maintenance.

5.8.2 Base station

The base station shall be located near the planned and designed location; and the location deviation shall be based on the principle of not causing frequency interference.

The base station site should be selected in a relatively high terrain, with buildings of appropriate height or where there is a communication tower available. However, it should not blindly pursue the height, which will cause the problem of insufficient effective coverage despite a large coverage area.

The base station shall have a wide field of vision around it, and try to avoid tall obstacles higher than the antenna height within 200m in the direction of the main lobe of the base station antenna.

When the base station site is selected in a civil building, the floor load shall be calculated according to the weight, size and arrangement of all equipment in the station to determine whether necessary reinforcement measures should be taken.

The site should be selected in a place with less man-made noise and other radio interference environments, and should not be set up near high-power radio transmitters, high-power television transmitters, high-power radar stations, etc.

The site shall be selected in a safe environment, and shall not be selected in buildings where flammable and explosive materials are stacked, or near industrial enterprises that are prone to fire and explosion hazards.

5.8.6 Lightning protection

The lightning protection and grounding design of the cluster mobile switch office and base station shall be implemented in accordance with the relevant provisions of GB 50689-2011.

5.8.7 Environmental protection

The various impacts of cluster communication project construction on the surrounding environment shall meet the relevant requirements of YD 5039-2009. The environmental requirements inside the communication bureau (station) shall meet the relevant requirements of YD/T 1821-2008 and YD/T 1712-2007.

6 Construction Requirements

6.1 Computer room and environmental safety

The construction and decoration of the computer room shall be constructed according to the design requirements. The roof shall not leak; the room shall not seep; and the walls and floors shall be flat and dense.

The location and specifications of the trough, reserved holes, embedded steel pipes, bolts, etc. shall comply with the engineering design and installation requirements. The trough cover shall be tight and solid, and there shall be no water seepage in the trough.

The computer room generally adopts upper wiring, and the ceiling shall not be installed. The air inlet shall not be blocked when laying cables.

The interior decoration materials of the computer room shall be flame-retardant materials, the reserved holes shall be equipped with flame-retardant safety covers; and the used wiring holes shall be sealed with fire-proof mud.

The number, location and capacity of the lighting and sockets in the computer room meet the configuration requirements; the installation process is good; and meet the use requirements.

It is strictly forbidden to store flammable and explosive dangerous goods in the computer room.

Anti-seismic measures shall comply with YD 5059-2005 and engineering design requirements.

Fire prevention measures shall comply with the relevant provisions of GB 50174-2008.

Flood control shall comply with the provisions on communication facilities in GB 50201-2014.

6.2 Cable runways and troughs

The installation of cable runways and troughs shall meet the following requirements:

--- The cable runway is straight, without obvious ups and downs, twists and skews;

--- The cable runway is parallel to the wall or cabinet arrangement;

--- The hanging installation meets the requirements of the engineering design, and is vertical, neat and firm;

--- The ground pillars are installed vertically and firmly, and the columns in the same direction are on the same straight line. When the columns hinder the installation of equipment, they are moved appropriately;

--- The side supports and terminal reinforcement angle steels of the cable runway are installed firmly, straight and flat;

--- The horizontal cable runway along the wall is parallel to the ground, and the vertical cable runway along the wall is perpendicular to the ground;

--- All cable runways are reliably grounded;

--- The troughs are installed flat, straight and firm, and the troughs are arranged in a straight line;

--- The expansion bolts used for all support reinforcements have the same length.

6.3 Equipment Installation

Equipment installation shall meet the following requirements:

--- Equipment installation position shall meet the requirements of engineering design plan;

--- Equipment racks shall be installed vertically;

--- Equipment panels of racks in the same row shall be on the same plane;

--- Rack anti-vibration reinforcement shall meet the requirements of YD 5059-2005 and engineering design;

--- Anti-static measures for switching subsystem equipment shall meet the requirements of equipment and engineering design.

6.4 Cable Laying

6.4.1 General requirements

When laying cables on the cable runway, they shall be tied together. The tied cables shall be close to each other, straight and neat in appearance, with uniform spacing between wire buckles, The wire buckles shall be moderately tight, and shall be tied and fixed on the first horizontal iron.

--- A combined grounding system is used in the machine room; and the protective ground and power supply working ground are both led out from the same indoor grounding system;

--- The rack grounding wire generally uses 16mm^2 multi-strand copper wire; and the equipment in the rack is grounded by the rack bus nearby;

--- The grounding wire shall be laid as short and straight as possible; and the excess wire shall be cut off. All connections shall be connected using copper noses or connectors, and the copper noses shall be reliably crimped or welded.

6.4.5 Base station feeder installation method for BBU+RRU architecture

The base station feeder installation method for BBU+RRU architecture is as follows:

--- RRU is installed on the tower; and the BBU and RRU are connected by outdoor optical cables;

--- 1/2″ feeder is used to connect the RRU and the antenna;

--- When laying outdoor optical cables, the cables shall be laid in circles;

--- Fiber optic connectors shall be waterproofed, and waterproof bends shall be made before the optical fiber enters the room;

--- Fiber optic wiring is neat, the turns are smooth, there are no bends, and the optical fiber is installed in the correct position;

--- Redundant optical fiber satisfies the bending radius and is coiled and hung on the outdoor side. The bending radius of the optical fiber must be no less than 20 times its own wire diameter.

6.5 Battery installation

The battery installation shall meet the following requirements:

--- The installation location meets the requirements of the engineering design;

--- The materials, specifications, dimensions and load-bearing capacity of the battery rack meet the design requirements;

--- The battery rack is arranged flat and stable;

--- The expansion bolts at the reinforcement of the iron frame and the ground are treated with anti-corrosion;

--- In earthquake-resistant areas, the installation of battery racks meets the relevant requirements of YD 5059-2005;

--- The model, specification and quantity of the battery meet the requirements of the engineering design; and there is a exit-factory inspection certificate and network access license;

--- Tighten the filter cap or safety valve and air plug during installation to prevent loosening;

--- Battery shell, safety valve and air filter cap are not damaged;

--- Batteries are arranged neatly in each row, with proper front and rear positions and spacing, and the battery cells are kept vertical and horizontal;

--- Battery spacing deviation is no more than 5mm; the connecting strips between batteries are flat; the connecting bolts are tightened; and anti-corrosion coating is applied to the bolts and nuts or plastic box covers are installed;

--- When the battery is installed on the iron frame, cushion rubber pads are used;

--- The positive and negative outlet positions of each group of batteries are determined according to the direction of the feeder bus;

--- On the outside of the battery rack and battery body, there are number marks made of anti-corrosion materials.

6.6 Tower and ground grid

The tower, pole and machine room ground grid of the communication base station shall adopt a joint grounding method; that is, use the same ground grid or use flat steel to weld the tower (pole) ground grid and the machine room ground grid underground.

6.7 Antenna feeder installation of base station

6.7.1 Antenna installation

The antenna installation of the base station shall meet the following requirements:

--- The antenna installation is stable, firm and reliable, and meets the requirements of engineering design;

--- The antenna is well grounded and is within the protection range of the 45° angle under the lightning rod;

--- The azimuth and elevation angles of the antenna meet the requirements of engineering design;

--- The distance between the omnidirectional antenna and the independent lightning rod is not less than 1.5m;

--- The installation height of the antenna is determined by the design of the wireless coverage

--- Base station infrastructure information, including machine room, antenna, cabinet, grounding, power supply, feeder fixing, lightning arrester, etc.;

--- Base station on-site test data, including transmission power per carrier, antenna feeder standing wave ratio, etc., and marked test points;

--- Base station installation and debugging log, including on-site commissioning records, fault alarms, etc.

7.2.3 Documentation for exchange center

The PDT exchange center construction process documentation shall include the following information:

--- Exchange center site information, including the location and conditions of the machine room, etc.;

--- Switch center and link equipment list, including equipment name, model and specification, equipment configuration information, quantity and manufacturer information, exit-factory inspection report or equipment certificate, etc.;

--- Switch center infrastructure information, including machine room, cabinet, grounding, power supply, etc.;

--- Switch center installation and debugging log, including on-site commissioning records, fault alarms, etc.

7.3 Preliminary acceptance of the project

7.3.1 Overview

After the construction phase is over, the preliminary acceptance of the project is carried out. The preliminary acceptance includes preliminary acceptance testing, writing preliminary acceptance reports and conducting preliminary acceptance reviews.

7.3.2 Preliminary acceptance test

According to the system design requirements, the preliminary acceptance test of the project includes the following items:

--- System communication coverage test;

--- Single base station basic function test, to check whether the base station subsystem works normally;

--- Cross-base station basic function test, to check whether the switching subsystem works normally;

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