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**Communication Industry Standard
of the People's Republic of China**

YD/T 2165-2010

**Technical specification of modular uninterruptible
power systems for telecommunications**

通信用模块化不间断电源

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Issued on: December 29, 2010

Implemented on: January 1, 2011

**Issued by: Ministry of Industry and Information Technology of the
People's Republic of China**

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Foreword

This Standard pays attention to the harmonization with the following standard during the development:

- YD/T 1095-2008 *Uninterruptible power systems for communications*

This Standard was proposed by and shall be under the jurisdiction of the China Communications Standards Association.

Drafting organizations of this Standard: China Academy of Telecommunication Research (former Telecommunications Research Institute of the Ministry of Industry and Information Technology), ZTE Corporation, Meilanrilan Electronics (China) Co., Ltd, SANTAK Electronics (Shenzhen) Co., Ltd, Xiamen Kehua Hengsheng Co., Ltd, Shenzhen KSTAR Science and Technology Co., Ltd, Delta Greentech (China) Co., Ltd, Hebei SICON Chat Union Power Equipment Co., Ltd, China Mobile Communications Corporation, China Information Technology Designing & Consulting Institute, China Telecommunications Corporation, Emerson Network Power Co., Ltd, and China Potevio Information Industry Co., Ltd.

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Technical specification of modular uninterruptible power systems for telecommunications

1 Scope

This Standard specifies the terms and definitions, requirements, test methods, inspection rules, marks, packaging, transportation, and storage of modular uninterruptible power systems for telecommunications.

This Standard applies to the modular uninterruptible power systems for telecommunications (hereinafter referred to as “UPS systems for telecommunications”).

2 Normative references

The provisions in the following documents become the provisions of this Standard through reference in this Standard. For dated references, the subsequent amendments (excluding corrections) or revisions do not apply to this Standard. However, parties who reach an agreement based on this Standard are encouraged to study if the latest versions of these documents are applicable. For undated references, the latest versions apply to this Standard.

GB/T 191 *Packaging – Pictorial marking for handling of goods*

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 2423.10-2008 *Environmental testing for electric and electronic products – Part 2: Tests methods – Test Fc: Vibration (sinusoidal)*

GB/T 2828.1-2003 *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*

GB/T 3873-1983 *General specifications for products packaging of*

communication equipment

GB/T 4980-2003 Determination of sound level for noise emitted by displacement compressors

YD/T 282-2000 General reliability test methods for communication equipment

YD/T 944-2007 Technical specification and testing methods for surge protection of power supply for communications

YD/T 983-1998 Limits and methods of measurement of electromagnetic compatibility for telecommunication power supply equipment

YD/T 1363.1 Specification of supervision system for power, air conditioner and environment – Part 1: Generic specification

YD/T 1363.3 Specification of supervision system for power, air conditioner and environment – Part 3: Intelligent equipment communication protocol

3 Terms and definitions

The following terms and definitions apply to this Standard.

3.1 Modular uninterruptible power system

It is composed of input distribution, output distribution, power module, and control module. The modules are possessed of the following properties:

- Have independent mechanical framework;
- Have complete and independent function;
- The modules shall work cooperatively.

3.2 Power module

It includes rectification, inversion, charging (optional), power factor correction, and relevant control circuits. As the main module of the UPS system, the power module has hot swapped function and parallel redundancy operation function under the normal operating mode of the UPS system.

3.3 Control module

It shall be responsible for the real-time monitoring of the operating mode of the UPS system as well as the collection and storage of the operating parameters,

5.5.3 Output overload protection of power modules

When the power module's output exceeds the rated load, the UPS system shall give an audible and visual alarm; when the power module's output exceeds its overload capacity, EXIT the UPS system; when all the power modules in the UPS system exceed the overload capacity, SWITCH to bypass for power supply.

5.5.4 Over-temperature protection

When the internal temperature of the power module comes up to the protection settings, the power module shall be able to automatically give an alarm, exit the system for protection, and return back to the operating mode after troubleshooting.

5.5.5 Low battery voltage protection

When the UPS system is in battery inverter mode, and the battery voltage reduces to the protection point, the UPS system shall give an audible and visual alarm, and the battery shall stop providing power supply.

Note: When the mains power supply recovers after the shutdown caused by battery discharge termination, users can set whether the system can automatically restart.

5.5.6 Output over-voltage and under-voltage protection

When the inverter output voltage of the UPS system exceeds the over-voltage and under-voltage set values, the UPS system shall give an audible and visual alarm, and shall switch to bypass for power supply.

5.5.7 Module fuse (or breaker) protection

The main circuit of the power module shall set fuse (or breaker) protection, so as to restrict further expansion of certain faults.

5.5.8 System fuse (or breaker) protection

The AC main input, bypass input, and AC output of the UPS system shall be respectively equipped with fuse (or breaker), and other protective equipment.

5.6 Fan fault alarm

The UPS system shall give an audible and visual alarm when the fan breaks down.

5.7 Lightning protection performance

The lightning withstand current ratings and technical requirements of the UPS

5.15.3.1 The touch current of the UPS system's protective earth (PE) to the input neutral (N) shall not be greater than 3.5mA.

5.15.3.2 When the touch current is greater than 3.5mA, the effective value of the protective conductor current shall not exceed 5% of the input current per phase. If the loads are unbalanced, USE the maximum among 3 phase current values for calculation. On the large current path of the protective conductor, the cross-sectional area of the protective conductor shall not be less than 1.0mm². SET warning or similar signs at the primary power connection terminal close to the equipment.

5.16 Reliability

5.16.1 Module MTBF

Under normal environmental conditions for operation, the module mean time between failures (MTBF) of the UPS system shall not be less than 5×10^4 h (without storage batteries).

5.16.2 System MTBF

Under normal environmental conditions for operation, the mean time between failures (MTBF) of the UPS system shall not be less than 1×10^5 h (without storage batteries).

5.16.3 System MTTR

Under normal environmental conditions for operation, the mean time to repair (MTTR) of the UPS system shall not be greater than 0.5h (without storage batteries).

6 Test methods

6.1 Appearance and structure

The equipment appearance and structure visual inspections shall conform to the requirements specified in the Section 5.2 of this Standard.

6.2 Input voltage range

The test circuit is shown in Figure 1. CONNECT the input with the rated linear load. Respectively ADJUST the AC input voltage to the upper and lower limits specified in Table 1. The UPS system can operate normally, and the output voltage shall not exceed the value specified in Table 1 in the process of input voltage adjustment.

and frequency of the UPS system to the rated values. Respectively CONNECT the output with 50% and 100% rated non-linear loads. In normal operating mode of the UPS system, USE a power harmonic analyzer to measure the ratio OF the sum of the input harmonic current TO the fundamental current twice to 39 times, which shall conform to the provisions specified in Table 1.

6.7 Output voltage regulation accuracy

The test procedures are as follows:

- The test circuit is shown in Figure 1. ADJUST the input voltage of the UPS system to the lower limit given in Table 1. CONNECT the output with rated linear load. USE a power harmonic analyzer or voltmeter to measure the output voltage of the UPS system U_a ;
- ADJUST the input voltage of the UPS system to the upper limit given in Table 1 for no-load output. USE a power harmonic analyzer or voltmeter to measure the output voltage of the UPS system U_b . CALCULATE the output voltage regulation accuracy according to the Formula (1). The calculation result shall conform to the provisions specified in Table 1:

$$S = \frac{U_{a(b)} - U_0}{U_0} \times 100\% \dots\dots\dots(1)$$

Where:

U_0 – Rated output voltage of the UPS system (V).

6.8 Output frequency

In battery inverter operating mode of the UPS system, CONNECT the output with rated linear load. USE a power harmonic analyzer to measure the output frequency. The value shall conform to the provisions specified in Table 1.

6.9 Frequency tracking rate

When the input frequency sharply varies from the lower limit to the upper limit within the frequency tracking range, the ratio (Hz/s) OF the sharp variation range of the input frequency TO the time spent in tracking output frequency to the upper limit of the input frequency shall conform to the provisions specified in Table 1.

6.10 Voltage waveform distortion

The test circuit is shown in Figure 1. The input voltage waveform distortion shall

sound level meter to measure the audio noise at 1m in front of the equipment and at the height of 1/2. The measured value shall conform to the provisions specified in Table 1.

6.23.2 The difference BETWEEN the noise of the tested samples on the test site AND the background noise shall not be less than 7dB. Otherwise, the measured data shall be modified according to the requirements specified in the GB/T 4980-2003.

6.24 Electromagnetic compatibility

6.24.1 Conduction disturbance limits

The conduction disturbance limits shall be measured according to the methods for the conducted emission test specified in the Section 5.5.1 of the YD/T 983-1998. The result shall conform to the provisions specified in the Section 5.4.1 of this Standard.

6.24.2 Radiation disturbance limits

The radiation disturbance limits shall be measured according to the methods for the radiated emission test specified in the Section 5.5.2 of the YD/T 983-1998. The result shall conform to the provisions specified in the Section 5.4.2 of this Standard.

6.24.3 Immunity

The immunity shall be measured according to the methods for the immunity test specified in the Section 7.4 of the YD/T 983-1998. The result shall conform to the provisions specified in the Section 5.4.3 of this Standard.

6.25 Protection functions

6.25.1 AC input over-voltage and under-voltage protection

When the UPS system is in normal operating mode or bypass operating mode, respectively CONNECT with rated load. Respectively ADJUST the AC input voltage to the over-voltage and under-voltage protection values. RECOVER to normal range afterwards. OBSERVE whether the UPS system operates according to the provisions specified in the Section 5.5.1 of this Standard.

6.25.2 Output short-circuit protection

6.25.2.1 During the input of nominal voltage, CUT off the bypass. SELECT an appropriate contactor to short-circuit the output (between phases or between phase and neutral) of the UPS system. CHECK whether the UPS system gives

CHECK whether the main circuit of the power module is equipped with the fuse (or breaker) with appropriate capacity. CONDUCT fault simulation. OBSERVE whether the actions are taken according to the requirements specified in the Section 5.5.7 of this Standard.

6.25.8 System breaker protection

CHECK whether the AC main input, bypass input, and AC output of the system are equipped with fuse (or breaker) protective devices. The results shall conform to the provisions specified in the Section 5.5.8 of this Standard.

6.26 Fan fault alarm

When the UPS system is in normal operating mode and battery inverter mode, TURN off the fan of the power module. CHECK whether the UPS system gives an audible and visual alarm.

6.27 Lightning protection performance

CONDUCT the test according to the methods specified in the YD/T 944-2007. After the lightning protection test, the output voltage regulation accuracy, output frequency, and output waveform distortion of the UPS system shall conform to the provisions specified in Table 1. The insulation resistance shall conform to the requirements specified in the Section 5.17.1 of this Standard.

6.28 Hot swapped function

When the UPS system is in normal operating mode, CONNECT the system with 50% rated linear load. TURN off a power module or control module. PLUG it out afterwards. CHECK whether the UPS system continues to provide uninterruptible power supply for the loads without changing the operating mode. PLUG in an electrified power module. CHECK whether the system rejects its access. The result shall conform to the requirements specified in the Section 5.8 of this Standard.

6.29 Automatic exit function of fault power modules

When the UPS system is in normal operating mode, CONDUCT fault simulation of power modules. The result shall conform to the requirements specified in the Section 5.9 of this Standard.

6.30 Intelligent management of battery packs

SIMULATE and CHECK the regular float charging and equalized charging conversion. CHECK whether the battery packs have charging temperature compensation, and discharge recording functions. CONDUCT fault simulation

continuous testing time is 16h. After recovering under standard atmospheric conditions for 2h after the test, the electrified UPS system shall be able to function properly. After the test, the output voltage regulation accuracy, output frequency, and output waveform distortion of the UPS system shall conform to the provisions specified in Table 1.

6.37.4 High temperature operation test

CONDUCT the test according to the methods of “test Bd” specified in the GB/T 2423.2-2008. The test temperature is within the range of $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The products have no packaging, and are electrified and applied with rated linear load. The continuous testing time is 2h. The UPS system shall be able to function properly. After the test, the output voltage regulation accuracy, output frequency, and output waveform distortion of the UPS system shall conform to the provisions specified in Table 1.

6.37.5 Steady-state damp heat test

CONDUCT the test according to the methods of “test Cab” specified in the GB/T 2423.3-2006. The products have no packaging, and are not electrified. The test temperature is within the range of $40^{\circ}\text{C} \pm 2^{\circ}\text{C}$. The relative humidity is within the range of $93\% \pm 3\%$. The continuous testing time is 48h. After recovering under standard atmospheric conditions for 2h after the test, the UPS system’s output voltage regulation accuracy, output frequency, and output waveform distortion shall conform to the provisions specified in Table 1. Furthermore, the insulation resistance shall conform to the requirements specified in the Section 5.17.1 of this Standard.

6.37.6 Vibration test

6.37.6.1 Vibration test (sinusoidal)

CONDUCT the test according to the methods of “test Fc” specified in the GB/T 2423.10-2008 *Environmental testing for electric and electronic products – Part 2: Tests methods – Test Fc: Vibration (sinusoidal)*. The products have no packaging and batteries, and are not electrified. The vibration frequency is within the range of 10Hz to 55Hz. The amplitude is 0.35mm. There are respectively 5 continuous cycles in the X, Y and Z directions. After the test, CHECK whether the UPS system has mechanical damages and loose fasteners. The electrified UPS system shall be able to function properly.

6.37.6.2 Transportation test (applicable to the UPS systems with the capacity of greater than 20kVA)

CONDUCT the test according to the provisions on the “road transportation test”

implemented according to the Article 7 in the GB/T 2828.1-2003 *Sampling procedures for inspection by attributes – Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*.

SEE Table 2 for the inspection items, requirements and test methods of sampling inspection.

7.2.3 Type inspection

The type inspection shall be conducted periodically, generally once a year. CONDUCT type inspection under one of the following circumstances:

- a) REPRODUCE after stopping manufacturing products for more than one period;
- b) TRANSFER the plant(s) for production along with the trial manufacture to finalize the design;
- c) There are major changes in structure, materials, process, etc. after official production;
- d) Before the products are brought into production, or the quality supervision agency puts forward the requirement for type inspection.

SEE Table 2 for the inspection items, requirements and test methods of type inspection.

8 Marks, packaging, transportation and storage

8.1 Marks

8.1.1 Product surface

There shall be Chinese identifications on the product surfaces, including product name, product model, product serial number, manufacturer's name, data of production, major parameters of the product, etc.

8.1.2 Packaging marks

There shall be marks on the product packaging. The packaging marks shall conform to the provisions specified in the GB/T 191 *Packaging – Pictorial marking for handling of goods*.

8.2 Packaging

The product packaging shall take moisture-proof and anti-vibration measures,

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