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GB/T 31983.31-2017

Narrowband power line communication over low-voltage mains - Part 31: Narrowband orthogonal frequency division multiplexing power line communication - Physical layer specification

低压窄带电力线通信 第31部分：窄带正交频分复用电力线通信 物理层规范

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Foreword

GB/T 31983 "Low-Voltage Narrowband Power Line Communication" is divided into the following parts.

---Part 11.3kHz~500kHz frequency band division, output level and electromagnetic

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disturbance limit;

---Part 21.3kHz~500kHz frequency band communication equipment and system immunity requirements;

31.Narrowband Orthogonal Frequency Division Multiplexing Power Line Communication Physical Layer Specification;

32.Narrowband Orthogonal Frequency Division Multiplexing Power Line Communication Data Link Layer Specification. This part is part 31 of GB/T 31983. This section was drafted in accordance with the rules given in GB/T 1.1-2009. Please note that certain contents of this document may involve patents. The issuing agency of this document is not responsible for identifying these patents. This part was proposed by China Machinery Industry Federation. This part is under the jurisdiction of the National Electrical Instrumentation Standardization Technical Committee (SAC/TC104). Drafting organizations of this section. State Grid Heilongjiang Electric Power Co., Ltd., Shenzhen Lihe Microelectronics Co., Ltd., Harbin Electrical Instrument Research Institute, China Electric Power Research Institute, Qingdao Dingxin Communication Co., Ltd., Juquan Optoelectronics Technology (Shanghai) Co., Ltd., State Grid Qingshi Electric Power Company Electric Power Research Institute, Heilongjiang Electric Power Co., Ltd. Measurement Center, Shenzhen Aerospace Teruijie Electronics Co., Ltd., China Grid Jiangsu Electric Power Research Institute, Yunnan Power Grid Co., Ltd. Electric Power Research Institute, State Grid Jiangxi Electric Power Research Institute Institute, Yantai Oriental Weston Electric Co., Ltd., Jiangsu Linyang Energy Co., Ltd., Holley Technology Co., Ltd. The main drafters of this section. Liu Kun, Wang Xuan, Chen Bo, Ge Dehui, Liu Xuan, Meng Yu, Zhang Xuming, Li Wanhong, Zhao Feng, Guan Wenju, Yang Xiaoyuan, Sun Hongliang, Cao Min, Wang Tianyu, Zhao Zhenyu, Ji Feng, Liu Jian, Wang Wenguo, Lu Hanxi, Zeng Shitu, Chen Wenxin, Jiang Bin.

With the rapid development of smart grid and power Internet of Things, there is an urgent need to improve network and communication technology according to new demands. The grid itself It is a huge network connecting various electrical equipment and terminals, using power lines for data transmission and realizing various electrical equipment and terminals The network connection has the advantage of not requiring rewiring. Developed countries and the International Organization for Standardization use power lines as the medium for communication technologies and standards With the advancement of industrialization, standards such as ITU.g.9901/2/3/4 and IEEE1901.2 have been introduced successively. In this context, this standard system is formulated in accordance with China's national conditions. This physical layer protocol specification supports 3kHz~500kHz power line communication dedicated frequency band, suitable for data equipment passing indoor or outdoor Low-voltage AC distribution lines or DC transmission lines for data transmission and communication. This physical layer protocol specification is based on Orthogonal Frequency Division Multiplexing (OFDM) Technology, and allows specific application systems to define specific center frequency and bandwidth. On the basis of this physical

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layer protocol specification, the data link layer protocol can be defined. This physical layer protocol specification is not limited to any specific Narrowband power line communication application layer protocol, which is suitable for various low-voltage narrowband power line communication application systems, including (but not limited to) smart Energy meter centralized meter reading (AMR), AMI/AMM, smart home control, street lamp control, building intelligence, electric vehicle charging control, etc. Low-voltage narrowband power line communication

1 Scope

China's national physical layer specification for narrowband OFDM power line communication over low-voltage mains. It is Part 31 of GB/T 31983 and specifies the network model, the physical layer coding and modulation, the physical layer transmission modes, the physical layer services, and the electrical requirements, with five normative annexes covering the CRC structures, the frequency plan, the bit scrambler, the convolutional encoder and the pseudo-random sequence generator. Power line communication uses the electricity distribution network itself as the communication medium, and its dominant application in China is electricity metering: hundreds of millions of meters that have to report readings without any communication network being built to reach them. The attraction is that the wire is already there and already goes to every meter; the difficulty is that the low-voltage distribution network was never designed to carry a signal and is actively hostile to one. Its impedance varies with whatever is plugged in, it is noisy with switching transients from every appliance on it, its attenuation rises sharply with frequency and with distance, and the whole channel changes twice per mains cycle as loads switch. Orthogonal frequency division multiplexing is the answer this part adopts: the data is spread across many narrow subcarriers rather than one wide channel, so a notch in the channel response destroys a few subcarriers rather than the whole signal, and those subcarriers can be dropped while the rest continue. Convolutional coding with interleaving recovers the lost bits, and the standard defines a synchronised transmission mode timed to the mains zero crossing, which exploits the fact that the noise on a power line is periodic with the mains. Issued on 12 May 2017 and in force since 1 December 2017.

This part of GB/T 31983 specifies the physics of low-voltage narrow-band power line communication (PLC) based on orthogonal frequency division multiplexing (OFDM) technology Layer protocol specifications, including physical layer protocol data unit format (PPDU), channel coding, interleaving, OFDM modulation, physical layer signal frame generation And continuous transmission mode and power frequency synchronization zero-crossing time slot transmission mode, etc. This part is applicable to data transmission in the frequency range of 3kHz~500kHz through indoor or outdoor low-voltage AC power distribution lines or DC transmission lines And communication. On the basis of this part of the physical layer protocol specifications, a complete set of multiple communication nodes established on the low-voltage distribution network The entire PLC system also includes a

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data link layer (DLL, which is composed of a medium access control sublayer MAC and a logical link control sublayer LLC) to And the application layer related to the specific application situation. Typical low-voltage narrow-band power line communication application scenarios include centralized meter reading of smart energy meters (AMR), AMI/AMM, home smart control, street light control, smart building, four-meter collection and smart grid (SmartGrid) other Applications, such as. electric vehicle charging control, etc. This section also applies to medium-voltage power line communications, and long-distance power line communications in cities and rural areas.

2 Normative references

The following documents are indispensable for the application of this document. For dated reference documents, only the dated version applies to this article Pieces. For undated references, the latest version (including all amendments) applies to this document.

GB/T 31983.11-2015 Low-voltage narrowband power line communication Part 11.3kHz~500kHz frequency band division, output level And electromagnetic disturbance limit

3 Terms and definitions, symbols, abbreviations

3.1 Terms and definitions The following terms and definitions apply to this document.

3.1.1 Power line communication The information data is modulated to a suitable carrier frequency, and the power line is used as a physical medium for transmission to realize communication between data terminals. Letter or control.

3.1.2 Power line carrier communication That is power line communication.

3.1.3 Narrowband power line communication Power line communication with carrier frequency in 3kHz~500kHz frequency band.

3.1.4 Low voltage power line communication Power line communication using low-voltage distribution lines as the medium.

3.1.5 PLC low-level protocol The PLC low-level protocol includes the physical layer and the data link layer (consisting of the medium access control sublayer and the logical link control sublayer).

3.1.6 PLC application The specific power line communication application system based on the PLC low-level protocol has certain business functions and application-level protocols.

3.2 Symbols The following symbols and codes apply to this document. b

---The width of the bit group loaded on the subcarrier. DL

--- The length factor of the payload carrying data. G

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