

## **Design and Implementation of Medium and Low Voltage Power Line Carrier Communication Receiving System based on OFDM Technology**

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**Abstract:** The advancement of science and technology has promoted the development of information communication systems, and the arrival of the information age has made people's communication activities easier. There are many contents involved in information transmission, among which power line carrier communication makes the main method of home broadband access means. Low-voltage power line carrier communication technology is widely favored by the development of home automation due to its good application prospects. OFDM technology is considered to be the mainstream technology for signal transmission in currently used communication environments. The power line carrier communication system that continues OFDM technology can achieve ultra-high utilization of the frequency band and can effectively overcome interference. In this paper, the medium and low voltage power line carrier communication receiving system of OFDM technology is taken as the research object. The design and implementation of the medium and low voltage power line carrier communication receiving system based on OFDM technology are analyzed.

### **1. Introduction**

The rapid development of the communication industry is an important symbol of China's scientific and technological progress. In the process of rapid advancement of the communications industry, the advancement of technology has dominated. OFDM technology has certain advantages, but also has certain drawbacks. OFDM technology relies on the development of chip structure and is more affected by many environments. The design of medium and low voltage power line carrier communication receiving system based on OFDM technology should focus on the coordination of the overall design. The circuits of each module of the system need to be integrated to build a hardware platform of the power carrier communication system, and the software is modularized according to each part, and is completed in the ADS environment, and the MCU is compiled and tasked. The core of this research is based on the fact that the power line carrier communication system based on OFDM technology has better data transmission function, and the correlation of the peak-to-average ratio reduction effect is studied.

### **2. Analysis of key technologies of OFDM technology in power line carrier communication**

#### **2.1 System composition of OFDM technology applied in power line carrier communication**

In a multi-carrier communication system, the entire system is divided into a plurality of mutually separated sub-channels, and a certain interval needs to be maintained between the carriers, so as to avoid mutual interference between the leaders. The multi-carrier communication scheme actually selects the carrier frequencies that are orthogonal to each other. This technique is actually OFDM technology. OFDM technology is a special multi-carrier communication scheme. The user's single information stream is transformed into multiple low-rate code streams. The symbol period in each channel is relatively increased. The purpose is to reduce the interference of the transmission channel and reduce the interference. The impact of the system. In the structure of OFDM system, the modulation and demodulation of the system are realized by IDFT and DFT respectively. The data

sequence is used to form a complex sequence to transform between signals, and the receiving end collects the signal, and the user is quickly calculated. The serial mode of the signal is sent to the converter to adjust any data transmission rate on the line to R/M code words per second. In this way, signal transmission is performed in a serial manner by cyclic information encoding. The operation between the receiver and the engine requires information to be redundantly designed, and signals are exchanged between the signals through the conversion module.

## 2.2 Unique structural advantages of OFDM technology

The spectrum utilization of OFDM technology is high, and the spectrum resources are limited. Especially in power line carrier communication, the spectrum rate is a criterion for determining the adjustment mode. The emergence of OFDM systems is to improve the spectrum utilization of the carrier and improve the modulation of multiple carriers. OFDM technology has strong anti-interference ability. It divides the signal into multiple sub-carriers according to modulation and demodulation, which will broaden the bandwidth. When reducing the noise density, the 10-day line can have obvious resistance in complex communication environments. Interference function. OFDM technology has strong anti-drop capability. It has OFDM technology, which divides the single product signal into multiple subcarrier signals. When some of the frequency bands are weak, most of the platforms can still maintain normal communication, which will fundamentally solve the system. The problem of anti-aging ability. In the OFDM system, the main technical advantage is to expand the channel in multiple ways, and the principle of OFDM technology is used in the medium and low voltage power line carrier communication.

## 2.3 Related technologies of OFDM technology in medium and low voltage power line carrier communication receiving system

The main technology of OFDM technology in the medium and low voltage power line carrier communication receiving system is the peak-to-average ratio reduction technology of OFDM modulation. This technology is mainly for generating large peak power of the composite signal. For an OFDM system including N subchannels, if N sub-signals are summed with the same phase, it is necessary to pay attention to the change between the values. The problem with the peak-to-average ratio is that it affects the power amplifiers at the transmitter and receiver because the amplifier is not linear and the dynamic range is limited. OFDM peak-to-average ratio pre-compensation technology, this technology is mainly to improve the linear output capability of the system power amplifier of OFDM system. The concept of this technology is relatively simple, but it is necessary to grasp whether the pre-compensation signal exits distortion during the actual operation. The polar coordinate method table pre-compensation technology is insensitive to the phase of the loop signal, and has a fast convergence speed and is widely used. During the entire pre-compensation adjustment process, attention needs to be paid to the conversion between the output signal coordinates.

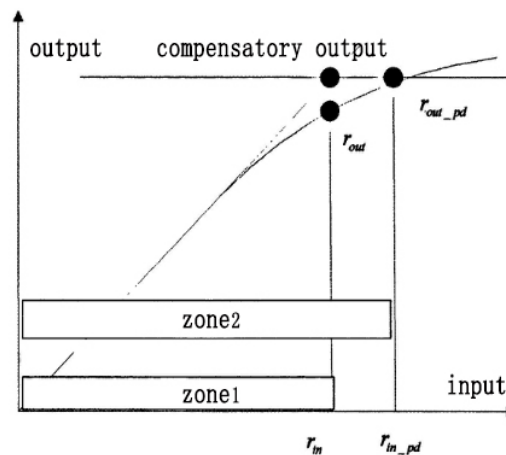


Figure 1. Variation of linear range of power amplifier before and after precompensation

### 3. Design and implementation of medium and low voltage power line carrier communication receiving system based on OFDM technology

#### 3.1 Hardware system design

The hardware design in the power carrier communication system mainly includes the interface design between the MCU and the display, and the interface design between the MCU and the DSP. Power circuit design and communication front-end circuit design. The circuit of the communication front end has two different parts according to the transmitting and receiving boards. The main design is that the DAC of the transmitting part is converted into a circuit, a low-pass filter circuit, a power amplifying circuit, and an on-line coupling circuit. The technical part mainly includes a downlink coupling circuit, a low noise amplification circuit, a band pass filter circuit, an automatic gain circuit, and an analog to digital conversion circuit. The hardware design is complemented by various peripheral circuits to achieve power line carrier communication. The MCU is the core of the entire control center, which plays a role in scheduling and controlling the transmission of data, and is also responsible for the display function of the display. DSP is the processing core of data, and it modulates and demodulates the transmitted and received data.

#### 3.2 Software system design

The software design of OFDM power line carrier communication system mainly includes the software design of MCU and the software design of DSP. In the system, it mainly covers the programming of the MCU. After the system is powered on, the MCU first needs to initialize the port design, and connect these designs to the device according to the design. Serial port initialization uses serial port transmission. The timer is initialized in the system for timing transmission and timeout waiting. The initialization design of the timer requires mastering the inventory information between the various values, and querying the way the data is sent according to the characters displayed on the display. After the main program enters the main loop program again, the window task button detects the task, the display shows the task, the serial code generation task, the data transmission task, and the data receiving task. The function module of OFDM modulation and demodulation software is written, which is an important part of software technology. The software module needs to set the encoder, parse the principle of interleaving and deinterleaver, and adjust the channel coding. In particular, digital modulation modules mostly use two modulation methods, QPSK and 16QAM.

#### 3.3 Experimental testing of the design system

For the medium and low voltage power lines of OFDM technology, the design of the carrier communication receiving system needs to be tested, although the process mainly includes hardware and software design experiments. The commonly used method is actually monitoring under the DSP development environment CCS, and the displayed transmission results are counted to realize the observation of the transmission and reception, analyzing and researching the stability and reliability of the system, and evaluating the software and hardware of the system. Experimental testing of the design system is particularly important to ensure that the receiving system is highly stable in terms of system and technology in future use. The experimental test should accurately judge each index to achieve stable operation between data.

Table 1. Test results at short distances with different parameters

Number of frames transmitted	Number of bytes per frame	Number of frames received correctly	accuracy
100	64	100	100%
200	64	199	99.5%
200	32	200	100%
300	16	299	99.6%
400	16	399	99.7%

#### **4. Conclusion**

In the process of development of the communication industry, relying on the continuous advancement of various technologies, in the development and advancement of the communication industry for many years, fresh science and technology will have a rapid application method to achieve industrial upgrading. The medium and low voltage power line carrier communication receiving system of OFDM technology is the most widely used communication technology in the current application. It can be found in the research that the development of technology requires the design of multiple processes, which requires a high degree of integration between internal design and external design, which needs to be in each The details reflect the precise application of the technology. The design of the medium and low voltage power line carrier communication receiving system based on OFDM technology is actually to closely test the internal conditions and external conditions. The design and implementation of the system software requires precise completion between data, and various technologies are constructed. Strictly implement multiple comparisons to achieve the overall effect of the communication receiving system as a standard.

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