

Design and Implementation of Sensitivity Test for RF Receiver

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Abstract: This paper relates to a radio frequency receiver sensitivity testing method in the wireless IOT communication field. In this paper the spectrum analyzer is used to capture and collect the valid data of the information transmitted in the radio frequency communication system and signal generator are adopted to demodulate the waveform file corresponding to the specification IEEE802.15.4. The waveform file is loaded into the VSG signal generator to achieve direct, efficient, and accurate testing of the receiver sensitivity of the RF communication system. This way not only can effectively maintain the original technical state and integrity of the device under test, but also can be applied to different radio frequency chips and communication systems, and has good Applicability and compatibility.

Keywords: Sensitivity Test, RF Receiver, IOT.

1. INTRODUCTION

IEEE 802.15.4 provides standard physical layer and MAC layer protocols for low-power wireless sensor networks. Currently, there are many chips and development systems for IEEE 802.15.4 that are widely used in intelligent buildings, smart homes, road traffic safety and agricultural information. However, in the process of developing and using the above-mentioned radio frequency communication module, how to test the performance of the radio frequency module and achieve integration from research and development to production has always been a crucial issue.

In IEEE 802.15.4 conformance test standard, the receiver sensitivity is defined as the minimum input power value when the receiver's packet loss rate is exactly less than 1%. There are many method of sensitivity testing, such as injection method, radiation method, and the test of signal level at present. But these ways are not as accurate as the subjective test results with the factors such as noise, antenna gain, and path loss. Therefore, this paper implements a new method for receiver sensitivity testing accurately.

2. SENSITIVITY DEFINITION

Receiver sensitivity refers to the minimum received power measured at the user terminal antenna interface when the bit error rate does not exceed a certain value. Here, the bit error rate is usually taken as 1%. The bit error rate can be derived from the following formulation.

$$\sigma = \frac{N_0 - N}{N_0} \times 100\%$$

σ Represents the bit error rate, N represents the number of packets received by the receiver, and the N_0 is the number of output packets from the signal generator. So the receiver sensitivity can be obtained through testing the minimum input power value when the bit error rate or the packet loss rate of the receiver is exactly less than 1%.

3. MODE AND FROCESS

3.1 Test model

Fig. 1 shows the test model of receiver sensitivity. The spectrum analyzer captures the RF signals emitted by the transmitter effectively, and it is usually necessary to capture signals of a complete period. And then the standard waveform file is converted and sent to the receiver through the signal generator. Conversion of the waveform file is processed on the computer.

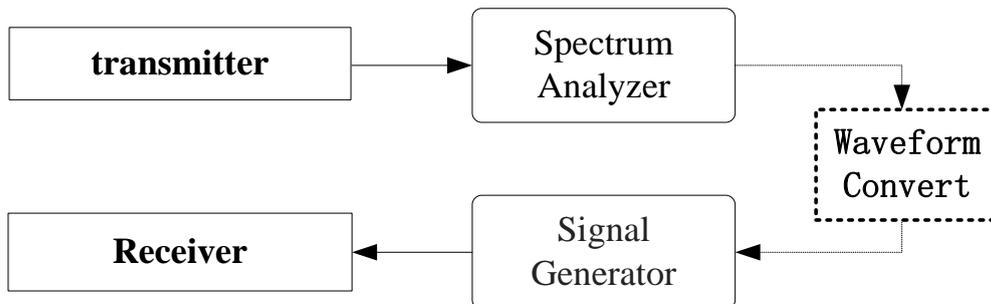


Fig. 1 Test model of receiver sensitivity

3.2 Test processing

At first, Fig. 2 shows the connection when testing the receiver sensitivity, the transmitter is connected to the spectrum analyzer and then obtain the complete valid data of a single data packet, through configuring the parameters of the spectrum analyzer. The captured waveform will be demodulated using the PC.

Then, the signal generator, receiver and the PC are also connected, the demodulated signal is converted and sent to the receiver through the signal generator. We can observed the loss packet though the PC to obtain the minimum input power value when the packet loss rate of the receiver is exactly less than 1%. And then the receiver sensitivity is easy to be obtained on the signal generator.

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