

RESEARCH AND MODELING OF THE RECEIVER SECTION OF A DIGITAL TELEVISION COMMUNICATION SYSTEM

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In this work, the receiver section of a digital television communication system is studied, modeled, and the quality parameters are calculated using the Matlab/Simulink software environment.

With the Matlab/Simulink software environment, it is possible to determine constellations, error probabilities, synchronized signal reception, as well as calculate frequency offset, phase offset, and symbol frequency offset.

Figure 1 shows the model of the receiver section of a digital television communication system. The model consists of two parts: the transmitting section, which includes the following blocks: a generator forming the binary signal, a 16-QAM modulator, a signal spectrum analyzer, an oscilloscope, and an additive white Gaussian noise (AWGN) communication channel. The receiver section includes the following blocks: the AWGN communication channel, a 16-QAM demodulator, a signal spectrum analyzer, an oscilloscope, and a block for counting bit errors during the reception of binary symbols.

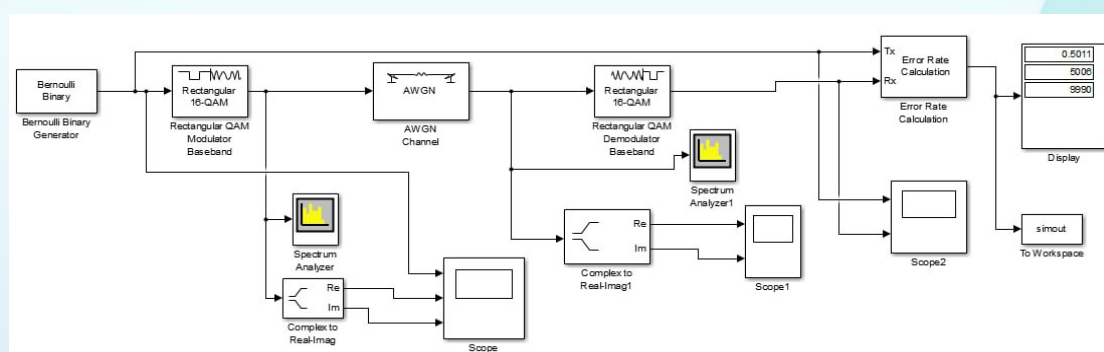


Fig.1. Model of the Receiver Section of a Digital Television Communication System

During the signal reception and processing on the receiver side, data is transmitted through channels with various conditions (e.g., noise, interference, and distortions), which can lead to transmission errors.

In this model, signal demodulation is performed by calculating metrics. When AWGN is added to the communication channel, the receiver section experiences an increased probability of error, as well as frequency and phase misalignments, which result in constellation point spreading and rotation of the signal constellation. By properly selecting the frequency and phase parameters, bit errors at the receiver end can be reduced.

During the modeling of the receiver section of the digital television communication system, the following results were obtained, including the spectral diagram at the output of the 16-QAM modulator (Figure 2).

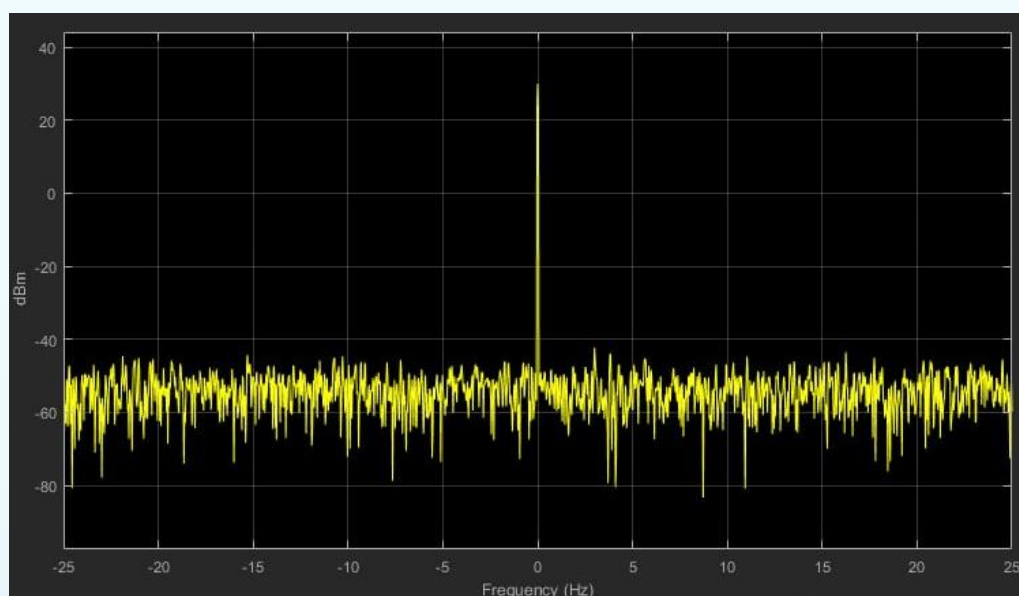


Fig.2. Spectral Diagram at the Output of the 16-QAM Modulator

Table 1 presents the results of the study and calculations, taking into account AWGN, the bit error rate (BER) at the receiver, and the graph showing the dependence of the bit error rate on E_b/N_0 (Figure 3).

No	Number of received bits	Number of bits received with errors	Bit Error Rate (BER)	E_b/N_0 (dB)
1.	9990	3695	0,3699	5
2.	9990	3183	0,3187	10
3.	9990	2550	0,2553	20
4.	9990	2107	0,211	30
5.	9990	1698	0,17	40
6.	9990	1199	0,12	50
7.	9990	799	0,08	60
8.	9990	400	0,04	70
9.	9990	99	0,01	80
10.	9990	0	0	90

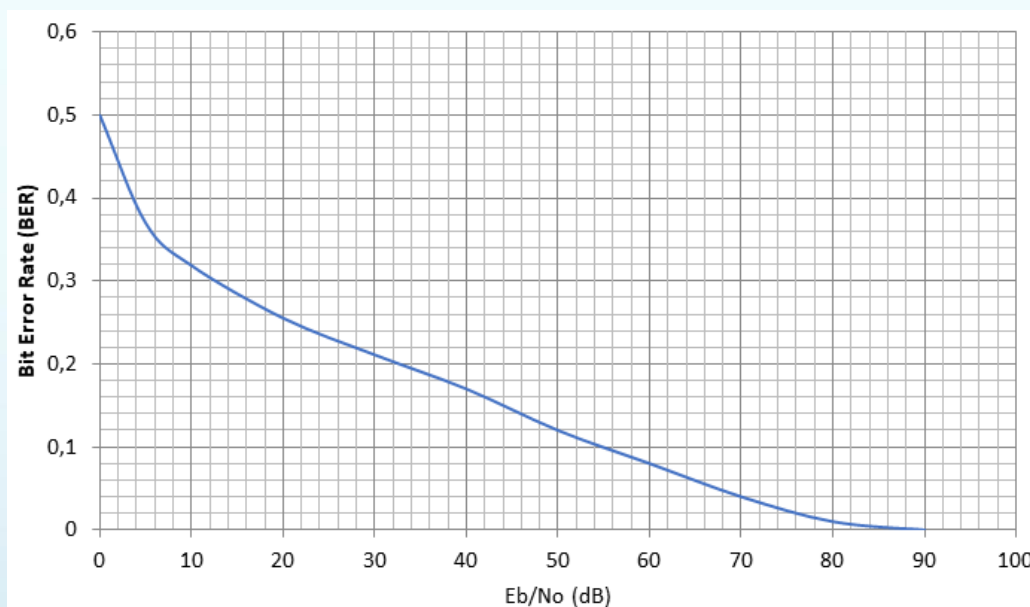


Fig.3. Graph of the Dependence of Bit Error Rate on E_b/N_0

The research and modeling show that the relationship between the number of bits received with errors and the dependence of the bit error rate on E_b/N_0 , when E_b/N_0 is equal to 50 dB, results in increased noise immunity of the digital system. The analysis reveals that by adjusting the phase-specifically, by increasing the phase of the signal-the number of bits received with errors and the bit error rate decrease. Furthermore, the modeling analysis indicates that by modifying the frequency shift-i.e., reducing the frequency shift-the number of bits received with errors and the bit error rate also decrease.

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