Radioelectronics and Communications Systems
Vol. 47, No. 12, pp. 28–31, 2004

Izvestiya VUZ. Radioelektronika
Vol. 47, No. 12, pp. 40–44, 2004
UDC 621.396.037

EFFECTIVENESS OF MESSAGE TRANSMISSION WITH THE AID OF ANALOG CODING

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The paper considers a method of message transmission based on taking the sum of real number modules instead of 0 and 1 when defining the checking and coding symbols in the algorithms of coding and decoding. The checking relationships are used as separate duplicating channels of sample transmission with subsequent pooling of the sample estimates obtained into the sum, which is weighted by the least squares method. It is shown that the use of the method suggested makes it possible to raise noise immunity substantially in comparison to the known methods.

It is well known that noise immunity can be improved by increasing the signal spectral width Δf by $\alpha = \Delta f/\Delta F$ times in comparison with the width of the message spectrum ΔF [1, 2]. In this case we use various systems of modulation or coding, and digital methods for transmission of continuous messages. An important criterion permitting us to compare the methods of improvement of noise immunity is the so-called information effectiveness [1], characterizing the rate of utilization of traffic capacity of communication channels. In [3] we considered a method of transmission of messages with a limited spectrum with the aid of analog coding, and investigated the noise immunity of some its variants based on the use of a stationary Gaussian communication channel. However, we did not investigate their information effectiveness and, hence, could not compare properly the method of message transmission based on analog coding with other methods. The purpose of this work is to fill this gap.

The essence of analog coding and decoding (at the reception side) [3] is as follows. From each next segment of duration kT in the transmitted message $x(t)$ we extract and store k sampled values (samples for brevity) x_i, $b \geq x_i \geq -b$, $i = 1, 2, \ldots, k$, $T \leq 1/2\, f_{\text{up}}$, where f_{up} is the upper boundary frequency of the message.

The samples are transmitted with the aid of the analog pulse type of modulation, simultaneously with the checking values x_{k+h}, $h = \overline{1, r}$, generated in conformity with the checking relationships

$$x_{k+h} = \left[\left(\sum_{i+1}^{k} x_i g_{ik+h} + 2bg\right) \bmod 2b\right] - b, \quad h = \overline{1, r}, \tag{1}$$

where the constant value $b > |x_i|$, $i = \overline{1, k}$, $g_{ik+h} = \overline{0, 1}$ are the elements of a checking matrix of the block systematic code (n, k, d), d is the code distance, $\left(\sum_{i=1}^{k} x_i g_{ik+h} + 2bq\right) \bmod 2b$ is the residue from division of the expression in brackets by $2b$, the constant value $2bq \geq \max\left|\sum_{i=1}^{k} x_i g_{ik+h}\right|$, and $q = 1, 2, 3, \ldots$ is an integer.

In the receiver the following operations are to be performed:

1) To set the transfer factor of the channel, including the receiver detector, equal to unity;

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18 July 2003