

The research of interference resistance of chips of contactless identification

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Abstract— The effect of noise and noise interference resistance of wideband signals is described. probabilistic description Interference resistance contactless identification chip is submitted.

Keywords— the chips of contactless identification, the probability, the signal

I. Introduction

It is obviously, because of the increased noise Interference resistance, today in everyday life the chips of contactless identification (CCI) have globally usefull applications. System access control, electronic documents, contactless smart tags that come to replace the traditional bar code are not an exhaustive list of areas in which technology allows CCI to obtain qualitatively new results in the organization and management processes and logistics tasks. In this regard, there is often a need for systems CCI with demanding structural secrecy, confidentiality and authenticity of information, able to protect against unauthorized reading or modifying data.

The application of the method of code division multiple access technology based direct spread spectrum (CDMA) gives the possibility for system CCI to use full advantage of broadband technology, allowing reuse of the spectrum that is highly secretive information work and allows to increase noise Interference resistance and reliability of the information, and solve the issue of electromagnetic compatibility radio equipment for various purposes.

As noted above, broadband signals (BS), in particular CCI, due to increased interference resistance, have an extremely high range of applications. However, it should be noted that because of the growing use of both BS and CCI is observed the failures interference resistance, which explains randomly overlapping in the same frequency band.

In operation, broadband systems may also carry so-called structural interference represent the same type of BS. Structural interference occurs when the transmitter is connected to the interfering transmitter is much closer and useful subscriber has a large capacity and the degree of correlation with the received signal. In this case, we can also speak of intentional interference, the purpose of which disrupt the system. Structural obstacle for its statistical properties is far from a Gaussian random process. Analysis of its impact on the interference resistance system should be carried out using the structural properties of the useful signal and noise and taking into account the distribution of their energy.

In this connection it is interesting to study interference resistance of BS.

II. Effects of noise BS

As it is well known (see, for example, [4-7]), broadband (complex noise-like) signals (BS) are called such signals whose product of spectral width of the active work F and the duration T is much greater than unity. This product is called the base signal B . That is, for BS we have the following

$$B = FT \gg 1 \quad (1)$$

As long as the broadband signals be used only in exceptional cases, they do allow to get a big win relatively concentrated interference (see [8]). If BS starts in universal application, the situation changes substantially because interference will not be narrowband.

Assume that in the analyzed system the signals are transmitted simultaneously from n labels randomly overlapping a frequency band F . As noted in [7], in this case, the course of the correlator operates programming signals

$$v(t) = \sum_{i=1}^n u_i(t), \quad (2)$$

where one of which is an address, the remaining $(n-1)$ are a nuisance, they are also called interference [8,9].

III. Interference resistance of BS

Interference resistance of BS is defined broadly known relation (see [10]), connecting the signal to noise ratio at the receiver output q^2 with signal-to-noise ratio at the receiver input p^2 :

$$q^2 = 2B p^2, \quad (3)$$

where $p^2 = P_c/P_n$ (P_c, P_n are the power and the interference of BS); $q^2 = 2E/N_n$, E is the energy of BS, N_n is noise power spectral density in the band of BS. Accordingly, $E = P_c T$, $N_n = P_n/F$; B is the base of BS.

The ratio of signal-to-noise at the output q^2 determines performance characteristics of reception BS, and the ratio of signal-to-noise at the input p^2 is the power and signal interference. The value q^2 can be obtained according to the requirements of the system (10 ... 30 decibels), even if $p^2 \ll 1$. It suffices to choose the BS with the necessary base B satisfying (3). As you can see from (3), receiving BS of matched filter or correlator is accompanied with the amplification of the signal (or the suppression of interference) in $2B$ times. That is why the value

$$K_{BS} = q^2/p^2 \quad (4)$$



is called amplification factor of PS when processing. From (3) and (4) it is follow that increased processing $K_{BS} = 2B$. In BS receiving information characterized by the ratio of the interference signal $h^2 = q^2/2$, i.e.

$$h^2 = Bp^2. \quad (5)$$

Relations (4) and (5) are fundamental in the theory of communication systems with BS. They were produced for interference in the form of white noise with uniform power spectral density within the frequency band whose width is equal to the width of the spectrum of BS. However, these relations are valid for a wide range of interference (narrowband pulse, structural), that determines their fundamental significance.

Thus, one of the main purposes of system, due to the BS is ensure reliable reception of information under the influence of strong interference when signal-to-noise ratio at the receiver input p^2 can be much less than unity. We must once again be noted that the these relations are strictly true for interference in the form of a Gaussian random process with a uniform power spectral density ("white" noise).

iv. Probabilistic representation of Interference resistance CCI

Probabilistic analysis of erroneous reception of signal element in coherent reception was previously considered in [11]. Similarly, we consider the dependence of the probability of sum of interference (2).

Under certain assumptions, the time between the appearance of two signals from the i -th addressee ($i=1, \dots, n$) is a random variable $U_i(t)$ with an exponential distribution with an average waiting time of a new signal $1/\lambda_i$ ($i=1, \dots, n$). The parameter λ_i ($i=1, \dots, n$) can be interpreted as the average number of new signals from addressee i -th ($i=1, \dots, n$) per unit time. Therefore, the density of the exponential random variable $U_i(t)$ is given (see [12])

$$f(u_i(t), \lambda_i) = \begin{cases} \lambda_i e^{-\lambda_i u_i(t)}, & u_i(t) \geq 0, \\ 0, & u_i(t) < 0 \end{cases}$$

and the distribution's function has the form

$$F(u_i(t), \lambda_i) = \begin{cases} 1 - e^{-\lambda_i u_i(t)}, & u_i(t) \geq 0, \\ 0, & u_i(t) < 0. \end{cases}$$

Obviously, the joint distribution of overlapping signals from n recipients is a marginal distribution (see [12]), i.e. the joint density of overlapping signals from the n recipients is represented in the form

$$f(\{u_i(t), \lambda_i\}_{i=1, \dots, n}) = \prod_{i=1}^n f(u_i(t), \lambda_i).$$

In other words, the probability that a randomly overlapping in the same frequency band marks $F n$ (2) where in one of which is an address represented in the form

$$p = \sum_{v(t)=\sum_{i=1}^n u_i(t)} \int f(\{x_i(t), \lambda_i\}_{i=1, \dots, n}) \times p_d(\{x_i(t), \lambda_i\}_{i=1, \dots, n}) dx_1 \dots dx_n \quad (6)$$

where $f(\{u_i(t), \lambda_i\}_{i=1, \dots, n})$ is the joint probability density of the signal parameters and structural interference, and $p_d(\{u_i(t), \lambda_i\}_{i=1, \dots, n})$ is full conditional probability of erroneous reception of the signal, calculated assuming a constant signal parameters and structural interference based on methods developed for channels with a normal fluctuation noise, λ_i ($i=1, \dots, n$) is the average number of new signals from the i -th destination.

The full conditional probability $p_d(\{u_i(t), \lambda_i\}_{i=1, \dots, n})$ of erroneous reception of the signal is determined as the sum of conditional probabilities provided overlapping interference.

The equation (6) can, in some cases, enough to hold a full analysis of the impact of structural interference of resistance system.

Conclusion

The article studies conducted immunity signal chips contactless identification and obtain expressions for the evaluation of noise immunity signal with respect to signal power. The results can be used to calculate the noise immunity of communication systems with broadband noise-like signals in difficult noise conditions.

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