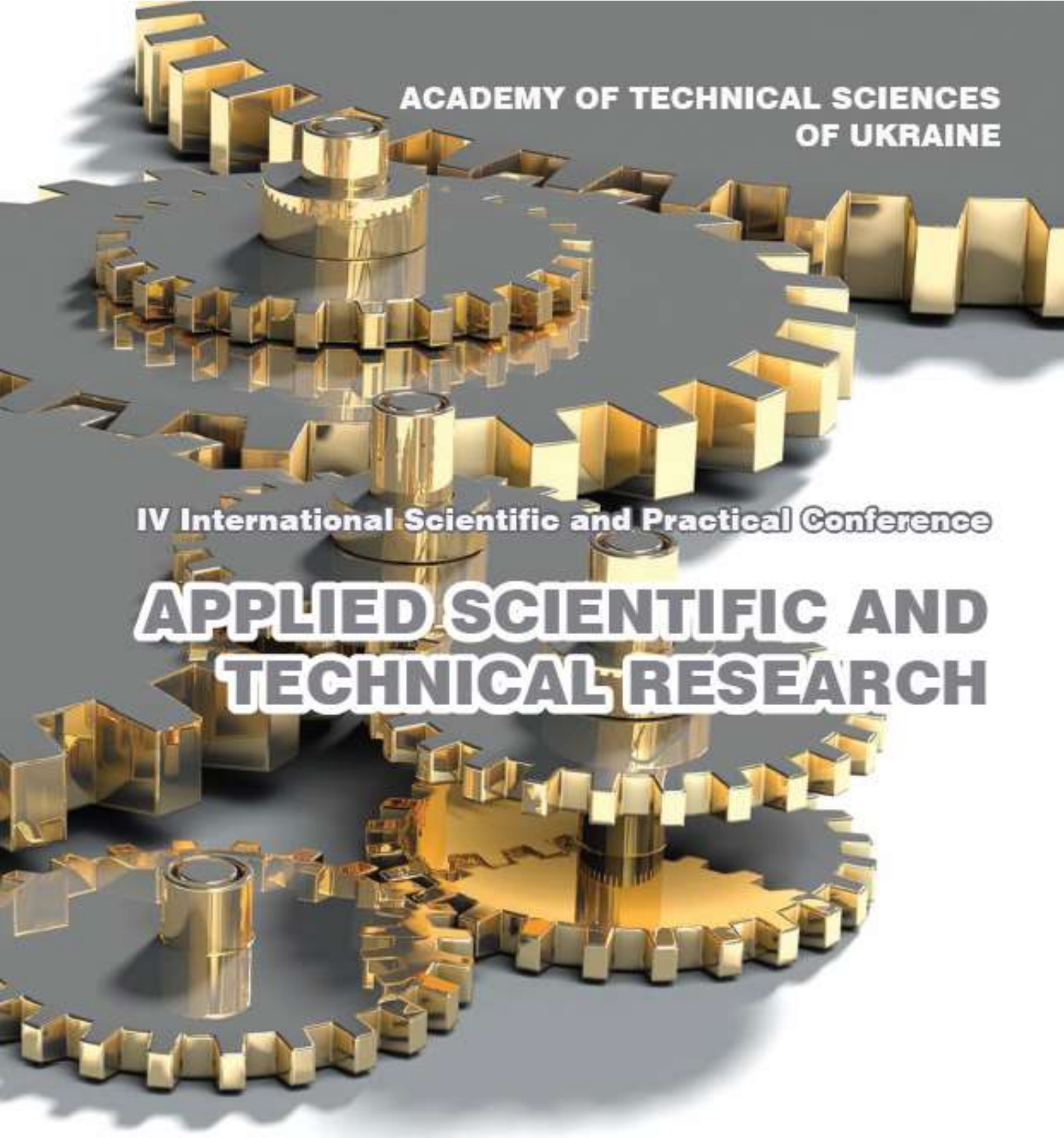

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METHODS FOR WIRELESS TRANSMISSION OF DIGITAL INFORMATION BASED ON ULTRA-WIDEBAND SIGNALS

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Introduction. Mobile wireless networks today are faced with two trends that are in contradiction to each other. The growth of computing power of mobile terminals entails the growth of computing capacity, applications that run on them. This, in turn, leads to higher bandwidth requirements of mobile communication channels. At the same time, the efficiency of the available frequency spectrum is close to saturation. And further improvements are likely to be too expensive for implementation and will provide only limited benefit. In order to cope with such significant traffic growth, the development of modern telecommunication systems should be based on the new conceptual approach – the use of ultra-wideband signals.

Presentation of the material. Analysis of existing technological solutions [1-3] shows that they do not have the possibility of simultaneous realization of a complex of modern requirements for high speed data transmission fulfilling the requirements of electromagnetic compatibility of telecommunications systems and their noise immunity against external noise and interference, as well as combating multipath propagation of radio signals. Therefore, the development of models and methods of ultra-wideband wireless communication that would meet the modern requirements, is an extremely urgent problem.

The transmission of information in telecommunication systems with ultra-wideband spectrum is carried out by simultaneous radiation of coherent reference signal and the modulated information signal. In this frequency range for communication systems selected on the basis of requirements of the frequency resource without licensing the use of ultra-wideband signals with low power radiation, which does not exceed the established boundary [4].

The removal of information signals in communication channel with interference is carried out by inverse Fourier transform from the measured power spectrum for the received signal autocorrelation function which has the information of the correlation peak with a shift of T_1 or T_0 according to a stream of binary bits, and the autocorrelation function for the reference signal and external noise. Further information comparing the correlation peaks with a shift of T_1 or T_0 determines the largest of them, which corresponds to a transmitted bit "1" or "0".

The influence of the external interference in the communication channel accompanied by the growth of extra random emissions for the autocorrelation function in the field of information peaks, which leads to an increase of the recovery error in the receiver of the transmitted binary information, particularly due to the multiplicity of information or delays .The elimination of these additional intra-system interference consists in the installation of multiple T_1 and T_0 delays and in the process of code spectral modulation of ultra-wideband signals in the transmitter [3].

Conclusion. A technique has been developed for wireless transmission of digital information on the basis of ultra-wideband signals, which includes a method for generating information signals with code spectral modulations and the method of extracting information signals in the communication channel with interference. The impact of interference on the quality of the recovered information has been evaluated. It is shown that the use of communication channels with an ultra-wide frequency band makes it possible to simultaneously implement a set of requirements for the electromagnetic compatibility of telecommunication systems, high speed information transfer and noise immunity with respect to the effects of external noise and interference.

Reference.

1. Serkov, A. (2019). Ultra Wideband Signals in Control Systems of Unmanned Aerial Vehicles / A. Serkov, V. Kravets, I. Yakovenko, G. Churyumov, V. Tokariev and W. Nannan // *10th International Conference on Dependable Systems, Services and Technologies (DESSERT)*, Leeds, United Kingdom, 2019, pp. 25-28. Available at: https://doi.org/10.1109/DESSERT.2019.8770039.

2. Serkov, O. A. (2019). On the issue of solving the problem of electromagnetic compatibility of the wireless telecommunication Systems / O. A. Serkov, G. I. Churyumov // Applied Radio Electronics. – Kharkiv: KHNURE, 2017. – Vol. 16 № 3, 4. – P. 117-121.
3. Serkov A. (2018). Method of coding information distributed by wireless communication lines under conditions of interference / A. Serkov, V. Breslavets, M. Tolkachov, V. Kravets // Advanced Information Systems. - 2018. – Vol.2, No.2. pp. 145-148. Available at: https://doi.org/10.20998/2522-9052.2018.2.25.
4. FCC News Release. Feb. 14.2002. New public safety applications and broadband internet access among uses envisioned by fcc authorization of ultra-wideband technology [Electronic resource]. Available at:
https://transition.fcc.gov/Bureaus/Engineering_Technology/News_Releases/2002/nret0203.html.

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OMNIDIRECTIONAL MAGNETIC LOOP ANTENNA

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In most applications the receiving (and transmitting) antenna which do not depend on the arriving wave direction is needed. Common cases include electromagnetic radiation sensors, plasma generating technologies, ignition devices, gas analytical devices, etc. The important case is the microwave antenna for initiation of a gas discharge at the atmospheric pressure. This case is very complicated because the antenna must generate in the gas medium the breakdown electric field of very high value, on the one side, and have simple configuration, on the other side. The suitable type of such antenna is a magnetic loop antenna (otherwise a split-ring resonator). However, it has the maximum sensitivity to waves with magnetic component orthogonal to the loop plane [1, 2]. We proposed to combine three loops with axes oriented orthogonally to each other. All loops have one common gap in which the needed electric field is generated independently on exciting wave propagation directions as well. The proposed omnidirectional antenna configuration is depicted in the Fig. 1. The given work deals with calculation of geometric parameters of this antenna.

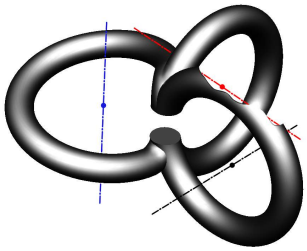

Figure 1 – Omnidirectional magnetic loop antenna

We had to calculate the following parameters for the resonance frequency of 2.45 GHz: diameter of the circular loops, diameter of wire; and to develop loops connection type with the common gap. The program code for such calculation was developed basing on CST Microwave simulation software. The results of calculation are presented in the Table 1.

Table 1 – Parameters of omnidirectional magnetic loop antenna

Parameter name	Value
Antenna material	Aluminum
Wire radius, mm	1
Loop radius, mm	19.95
Gap, mm	2

The experiments with the proposed antenna approved the calculation results.

References

1. Balanis C.A. Antenna theory analysis and design, 4th ed., John Wiley & Sons, Inc., Hoboken, New Jersey, 2016
2. Kraus J.D. Antennas, 2d ed., McGraw-Hill, Inc., New Delhi, 2001

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