UDC 621.396.1

INFLUENCE OF FADINGS ON THE COMMUNICATION CHANNEL AND METHODS OF RESISTING THEM IN THE MULTIPLAYER SYSTEM OF DVB-T2 STANDARD

Solianikova V.Y.

National Technical University of Ukraine "Igor Sikorsky Kyiv Polytechnic Institute"

E-mail: leka-br@mail.ru

ВПЛИВ ЗАВМИРАНЬ НА КАНАЛ ЗВ'ЯЗКУ ТА МЕТОДИ БОРОТЬБИ З НИМИ В МУЛЬТИСЕРВІСНІЙ СИСТЕМІ СТАНДАРТУ DVB-T2

В даній статті описується вплив багатопроминевості на наземній канал телевізійного мовлення. Розглянуто основні методи забезпечення працездатності каналу, а також описано методи боротьби з завмираннями в мультисервісній системі стандарту DVB-T2.

This article describes the multidimensional effects of the terrestrial television broadcast channel. The basic methods of ensuring the efficiency of the channel are considered, as well as methods of fading resisting in the DVB-T2 multiservice system.

The propagation of radio waves is characterized by three partially independent effects, known as loss in proliferation, screening and fading due to multiply propagation. Fading through multidivision is described by the fading of the envelope (independent of the frequency of the amplitude change), the Doppler scattering (time-selective, or temporal, random phase noise), and time scattering. The time scattering leads to the appearance of frequency selective fading [1].

Frequency-selective fading is characteristic for terrestrial television.

The main cause of frequency selective fading is time scattering due to multipath propagation. Phase differences between components of the same frequency propagating in different ways can be practically independent for different frequencies of the spectrum, so that some harmonics as a result of multipath interference can be amplified, while others, on the contrary, can be suppressed.

Frequency-selective fading occurs when the width of the spectrum of the signal exceeds the coherence band of the communication channel - the frequency interval at whose boundaries the fading of the spectral components is characterized by a certain limit value of the correlation coefficient. The level of permissible distortion depends on the processing methods of the signals in the codec and the modem.

In the DVB-T2 multiservice system, there are many tools to improve the system's resistance to interference, such as: cascade coding (BCH and LDPS), modulation (QPSK, QAM-16 ... QAM-256), constellation rotation, four interleaving (bit, cells, time and frequency) and OFDM (Orthogonal Frequency Division Multiplex).

To resist frequency selective fading, the DVB-T2 television standard uses bit interleaving as well as frequency interleaving using OFDM technology.

The bit interleaver alternates the code bits in the low-density parity-check code (LDPC) code word to avoid unwanted interaction between bits that are transmitted in the same cell and structure, is present in the LDPC code [2].

OFDM is a modulation technology using orthogonal carriers, i.e. modulated nominal subcarriers (1K-32K), located in a given band with a fixed frequency step (Fig. 1). The modulation rate of an individual carrier is thus small enough that it allows the use of effective noise-immune encoding and takes measures to prevent intersymbol interference (introduce special guard intervals for each OFDM symbol) [3].

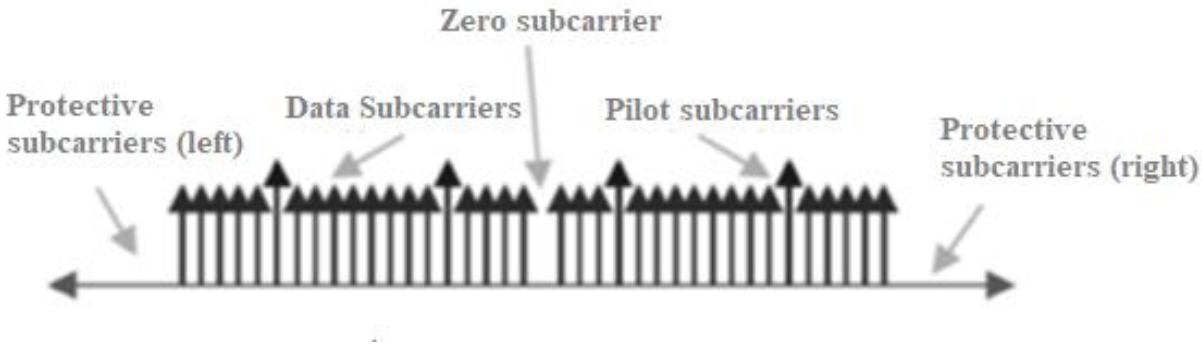

Fig. 1. The sub-carriers of the CRM signal

Generally, OFDM technology today is considered one of the most promising for the construction of broadband digital radio communication systems with multipath channels, providing a fairly high spectral efficiency of these systems.

The frequency interleaver is a pseudo-random block interleaver that operates on OFDM symbols and has several features. First, it mixes cells from different PLPs (Physical Layer Pipe), transmitted in one OFDM symbol. Secondly, this interleaver uses a pseudo-random sequence to output a time interleaver, thereby breaking the structured temporal interleaving. Third, the interleaver alternates between two different permutations, which helps increase the number of OFDM carriers to which each PLP is mapped [2].

Temporal and frequency interleaving is relevant for broadcasting in conditions of complex terrain and urban development, when multipaths and multipath signal propagation, fading zones arise, and so on.

Therefore, the tools used in the multiservice DVB-T2 standard are quite effective in fading resistance, which occurs when reflecting in the conditions of urban development. In the future, these techniques should be used to build duplex communication lines to adapt to the complex and changing operating conditions of telecommunication systems using tools offered by the DVB-T2 standard.

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