

Bozorov J.S.

JSC Uztelecom Kashkadarya branch

MODELING A RADIO LINK IN CELLULAR MOBILE COMMUNICATIONS

Annotation. The article examines the role of radio communications and radio broadcasting, in which the ultrashort wave range has proven attractive due to the possibility of building multi-channel radio links, allowing simultaneous multiple independent transmissions using one network of radio stations.

Key words: radio communications, radio links, command lines, software package, routine maintenance, maintenance, telecommunications equipment.

For radio communications and radio broadcasting, the ultrashort wave range has proven to be attractive due to the possibility of building multi-channel radio links, allowing simultaneous multiple independent transmissions using one network of radio stations. In this range, it is possible to carry out high-quality broadcasting due to the low level of atmospheric and industrial interference and the possibility of using such types of modulation as frequency, which makes it possible to reduce the effect of interference. Finally, small, highly directional antennas can be easily created in this range. All these circumstances will lead in the near future to the fact that all local broadcasting will be transferred to the ultrashort wave range.

Commands are transmitted over several channels on one carrier frequency; The radio communication system in this case is called a command multichannel radio link. Based on the method of channel division on the receiving side,

multichannel radio links are divided into radio links with frequency, time and code division of channels.

The use of pulse types of modulation, in which an informative signal is transmitted by changing one of the parameters of short-term high-frequency pulses lasting fractions (units) of microseconds with repetition periods of about 10^{-4} s, opens up the possibility of transmitting pulses carrying other information in pauses. The operation of multi-channel radio links with time division of channels is based on this principle. Due to the short pulse duration, the line bandwidth is a few megahertz or more, so operating frequencies are usually selected in the centimeter range. The number of channels in such radio links reaches several tens and even hundreds.

Resonant relays of mechanical and electrical types are used to separate (select) signals of different frequencies from a common signal that has a complex spectrum. For example, resonant relays are the main elements of decoders of multi-channel radio links with frequency division of signals into channels on the receiving side. They are also widely used in decoder radio command lines for aircraft and other radio-controlled models.

Multichannel radio links, in addition to radio telemechanical systems, are widely used in radio relay communications. When constructing them, they mainly use the ultrashort wave range, which has great potential for expanding the bandwidth of radio devices and reducing mutual influence between channels. Multichannel radio links can be with continuous and pulsed radiation. The choice of the type of modulation in a multi-channel radio link is determined by the properties of the transmitted signals, the number of channels placed in the radio link and other factors.

From a consideration of the principle of operation of a multi-channel radio link with time division of channels, it follows that the transmitting device emits several (according to the number of channels) pulses in one cycle, which are

modulated in a certain way by the signal voltage of its channel. In the diagram shown in Fig. 19 - 9, switch K performs pulse amplitude modulation. In multi-channel radio links with time division of channels, pulse-width, pulse-phase and pulse-code modulations are also used.

This operation can be repeated at a third frequency. However, the multi-frequency TWT mode, which is also found in multi-channel radio links, should be used with caution due to the reduction in saturation power, mutual modulation and suppression of some signals by others. On multi-channel radio links this may cause crosstalk.

The required number of channels of a radio telemetry system, depending on the task for which it is intended, can reach up to 50 or more. Based on the methods of channel division, multichannel radiotelemetry systems are divided into frequency division systems, time division systems, code division systems and combined channel division systems. The principles of construction, composition, circuits of encoders and decoders, as well as the features of radio transmitting and radio receiving devices of multi-channel radio lines of telemetry systems and radio lines for transmitting commands in command control systems have much in common.

Multi-channel radio links with code division of channels: Recently, the code method (channel division) has been increasingly used. With code selection, each channel is assigned a specific code group (combination) of pulses.

The code consists of pulses located in a group relative to each other at specified time intervals. The combination of time intervals between pulses is a characteristic of the code group and cannot be the same for different channels. With sequential code formation, each code group is assigned its own time interval.

The sequence of pulses at the output of the modulator of a multi-channel code division radio link has the form shown. Here, the code group of each

channel consists of three pulses, the relative position of which is determined by time intervals that are different for different channels. These groups repeat periodically with a period of Hz (transmission cycle). During the modulation process, the parameters of all pulses of the channel code group change simultaneously without changing the intervals.

The most common type of primary modulation in code division radio links is pulse modulation (PM), in which, under the influence of the modulating voltage, a temporary (phase) shift of the code group of pulses relative to its clock position occurs (the position of the code group on the time axis in the absence of modulation).

The time shift of the working code group of the channel on the receiving side is measured relative to another code group - the reference one, the position of which does not change during modulation. All channels may have one or more reference code groups in a transmission cycle.

A radio link with sequential code formation resembles a multi-channel radio link with time-selected channels. If with time division of channels the main feature by which pulses are distributed on the receiving side is the temporal position of the pulses, then with code division the difference in signals is determined by the structure of the code group.

The principle of distributing channel pulses over the corresponding time intervals of channels using electronic switching devices is based on the delay of the pulse of each research channel relative to the pulse of the previous channel for a certain time, including the time interval of the channel and the guard interval between the channels.

On the receiving side of the radio link, after the pulses are distributed over the appropriate channels, they are demodulated (detection). This is how the transmitted messages in each channel are highlighted.

In many radiotelemetry systems used in studying the time dependence of the parameters of certain devices, pulse sequences of channels are not demodulated, but recorded on photographic film.

Subsequently, the photograms are deciphered. Using the method of time division of channels allows you to create relatively simple in design, reliably operating radio links with a large number of channels. In this case, the mutual influence of the channels turns out to be less significant than with frequency separation of the channels.

References:

1. Бозоров Ж. С. ТЕХНИЧЕСКОЕ ОБСЛУЖИВАНИЕ ТЕЛЕКОММУНИКАЦИОННЫХ ОБОРУДОВАНИЙ И СТАНЦИЙ //Экономика и социум. – 2023. – №. 1-2 (104). – С. 599-602.

2. Vozorov J. DIGITAL TECHNOLOGY METHODS IN OPTIMIZING OPTICAL COMMUNICATION NETWORKS //International Scientific and Practical Conference on Algorithms and Current Problems of Programming. – 2023.

3. Бозорова И. Ж. и др. ПРИНЦИП РАБОТЫ ЭЛЕКТРОКАРДИОГРАФА И ЕГО РОЛЬ В СОВРЕМЕННОЙ МЕДИЦИНЕ //НАУЧНЫЕ ДОСТИЖЕНИЯ СТУДЕНТОВ И УЧАЩИХСЯ. – 2020. – С. 25-27.

4. Vozorova I. FEATURES OF INFORMATION SYSTEMS OF ECONOMIC ACCOUNTING OF MATERIAL AND TECHNICAL ASSETS //Science and innovation. – 2023. – Т. 2. – №. А6. – С. 345-348.

5. Бозорова И. Ж. УЧЁТ МЕТОДОВ ОЦЕНКИ ТОВАРНО-МАТЕРИАЛЬНЫХ ЗАПАСОВ //INNOVATION IQTISODIYOTNI SHAKLLANTIRISHDA AXBOROT KOMMUNIKATSIYA TECHNOLOGIYALARINING TUTGAN O ‘RNI. – 2023. – Т. 1. – №. 1.

6. Jumanazarovna B. I. The Use of Digital Technologies in the Process of Improving Economic Systems for Accounting for Inventory Items //Miasto Przyszłości. – 2023. – Т. 36. – С. 62-65.

7. Daminova B. et al. ELECTRONIC TEXTBOOK AS A BASIS FOR INNOVATIVE TEACHING //International Scientific and Practical Conference on Algorithms and Current Problems of Programming. – 2023.

8. Бозорова И. Ж. и др. ТЕХНОЛОГИИ СОЗДАНИЯ ЭЛЕКТРОННЫХ БИБЛИОТЕК И ЭЛЕКТРОННЫХ МУЗЕЕВ //European Scientific Conference. – 2019. – С. 95-97.

9. Бозорова И. Ж. и др. ТЕХНОЛОГИИ СОЗДАНИЯ ЭЛЕКТРОННЫХ БИБЛИОТЕК И ЭЛЕКТРОННЫХ МУЗЕЕВ //European Scientific Conference. – 2019. – С. 95-97.

10. Даминова Б. Э. СРАВНИТЕЛЬНЫЙ АНАЛИЗ СОСТОЯНИЯ ОРГАНИЗАЦИИ МНОГОУРОВНЕВЫХ ОБРАЗОВАТЕЛЬНЫХ ПРОЦЕССОВ //Экономика и социум. – 2023. – №. 1-2 (104). – С. 611-614.

11. Тўраева Д., Даминова Б. ИНФОРМАЦИЯ-КОММУНИКАЦИЯ МЕТОДЫ ПРИМЕНЕНИЯ ТЕХНОЛОГИИ В БИОЛОГИЧЕСКИХ НАУКАХ //Science and innovation. – 2023. – Т. 2. – №. Special Issue 13. – С. 225-228.

12. Daminova B. E., Tolipova M. M., Axadilloeva Z. N. CHIZIQLI ALGEBRAIK TENGLAMALAR SISTEMASINI GAUSS VA ITERATSION YECHISH USULLARI //MAVZUSIDAGI XALQARO ILMIY-AMALIY ANJUMAN. – 2023. – С. 662.

13. Рахимов Н., Эсановна Б., Примкулов О. АХБОРОТ ТИЗИМЛАРИДА МАНТИҚИЙ ХУЛОСАЛАШ САМАРАДОРЛИГИНИ ОШИРИШ ЁНДАШУВИ //International Scientific and Practical Conference on Algorithms and Current Problems of Programming. – 2023.

14. Якубов М., Даминова Б., Юсупова С. ФОРМИРОВАНИЕ И ПОВЫШЕНИЕ КАЧЕСТВА ОБРАЗОВАНИЯ С ПОМОЩЬЮ ОБРАЗОВАТЕЛЬНЫХ ИНФОРМАЦИОННЫХ ТЕХНОЛОГИЙ //International Scientific and Practical Conference on Algorithms and Current Problems of Programming. – 2023.

15. Daminova B. et al. ELECTRONIC TEXTBOOK AS A BASIS FOR INNOVATIVE TEACHING //International Scientific and Practical Conference on Algorithms and Current Problems of Programming. – 2023.

16. Даминова Б. Э., Якубов М. С. Развития познавательной и творческой активности слушателей //Международная конференция “Актуальные проблемы развития инфокоммуникаций и информационного общества. – 2012. – С. 26-27.06.

17. Тошиев А. Э., Даминова Б. Э., Тошиев АЭ Д. Б. Э. Формирование самаркандской региональной транспортно-логистической системы //Перспективные информационные технологии (ПИТ 2017)[Электронный ресурс]: Междунар. науч.-техн. конф. – 2017. – С. 14-16.