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PAGING SYSTEMS IN THE WORLD TODAY
СИСТЕМЫ ПЕРСОНАЛЬНОГО РАДИОВЫЗОВА В СОВРЕМЕННОМ МИРЕ

АННОТАЦИЯ. Статья посвящена осмыслению роли систем персонального радиовызова в современном мире. Описаны базовые принципы построения системы персонального радиовызова, а так же схематичный принцип передачи сигналов. В заключении сделан вывод, что в узких, локальных отраслях пейджинг может и пригодиться.

ABSTRACT. The paper considers the role of personal radio systems in the world today. We describe the basic principles of personal radio systems, as well as the schematic principle of signal transmission. It is concluded that paging systems can be useful in the narrow local industries.

КЛЮЧЕВЫЕ СЛОВА: пейджер, системы персонального радиовызова, односторонняя передача сообщений.

KEY WORDS: pager, personal radio paging systems, one-way messaging

Introduction

Life in the 21st century is virtually impossible without timely information support, both at home as well as at work. To ensure human communication possibilities, a lot of different mobile networks such as cellular, paging ones, etc. were created.

Paging system is a system of one-way mobile communication that allows sending short messages from the center of the system – a paging terminal – to the subscriber receivers – pagers. Sometimes they are called "pagerphone systems" or "personal radio paging systems". In its simplest form, paging system comprises a paging terminal, a base station and pagers themselves. The paging terminal (a remote call control and system controller) manages the system. The base station (a transmitter and antenna-distributed unit) provides transmission signals to coverage area (up to 100 km). Messengers also accept messages addressed to them. In more complex cases, the system can include a number of transmitters to provide a more reliable connection, but in general there is one principle of action.

In paging systems, information can be transmitted through four types of messages: tonal, digital, alphanumeric, voice. The first models of the pager messages were the only type tone with a predetermined sense of messages. Then, there was the possibility to send messages that include digital elements, the possibility to send, for example, a phone number. The most common type became alphanumeric messages, which could virtually consist of any text. Such massages (digital or literal) were displayed on a subscriber's receiver (pager) that could display up to eight lines and 20 characters per line. Lengthful messages were displayed piece by piece. But the transfer of voice messages never spread.

Messages addressing is carried out in three ways: in person, a general call (for several persons) or a group call (a pre-formed group). The first way is that the call is addressed to a particular user for his personal number, the second – to several direct subscribers (with serial transfer of their personal numbers), and in the third case the

call is addressed to the group number of recipients. Messages are also sent (input) by three ways: voice input by the operator to call the paging network; via phone using tone dialing (keyboard unit) - those messages are sent directly to the paging terminal (by missing the operator); a personal computer and a telephone network (in this case the same message is sent directly to the terminal).

The biggest peculiarity of paging, which affects the quality of communication, is that the transfer of information takes place asynchronously, i.e. the work is not in real time. The message is sent to the subscriber is not at the same moment when it receives the terminal, but in the order with other messages. However, the delay is almost negligible and does not exceed several minutes. However, the messages are short enough, and that they are transmitted only in one direction, the communication channel is used efficiently enough, at least two times more efficient than the cellular communications channel. To sum up, paging is technically easier to use and much cheaper than cellular communication.

Review and analysis of the construction of paging system

The center of each paging system determining its functionality is its paging terminal.

The paging terminal is a device receiving an individual number (address) of the caller, and transferring the message received from the input device (eg., computer keyboard). A subscriber is sent with a formatted message as a low-frequency signal by a transmitter set up on the terminal. In addition, the terminal may send signals to the system from a transmitter via the communication channels. Standard scheme of paging system is shown in Figure 1.

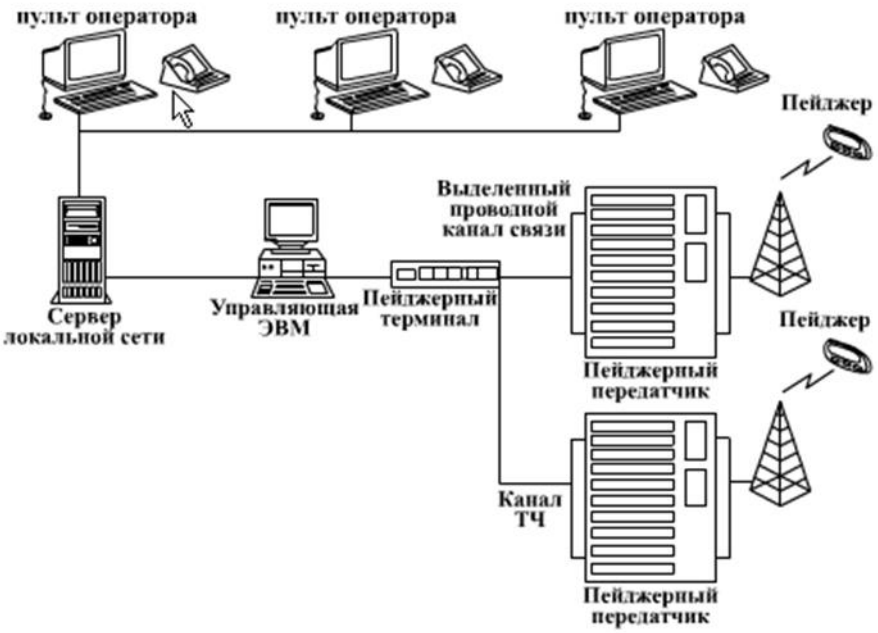

Fig. 1. Scheme of paging system

The characteristics of personal radio paging systems are the following: the maximum number of subscribers, the types of supported protocols, the capability to control different numbers of transmitters, the capability of mobile operator, the capability to send messages to other communication systems (roaming, for example, federal paging system).

Nowadays there is a wide range of different paging terminals from simple to complex. In simple paging terminals, a subscriber base of 100 pagers looks like a computer motherboard or a small stand-alone device adapted to input. Complex systems are designed for a few hundred thousand subscribers, and already represent a massive fail-safe device.

Despite this diversity, the paging terminal functionality remains unchanged to store database with the subscriber numbers in nonvolatile memory and to convert the information received from the input device into a low frequency signal. All this is in accordance with a paging protocol. The paging protocol is referred to a specific format signal sent from a transmitter.

Standard equipment of personal radio paging systems consists of an antenna-distributed system, a paging transmitter, an encoder (for receiving information from input device and create a modulating signal of a transmitter) and a server.

Modern capabilities

Incontestable value of personal radio paging systems is the so-called “group call” when the message (or a packet of information) is sent at the same time to a group of people, and that is very convenient for corporate organizations.

For operational information support of such organizations is quite possible to create a local (within an enterprise) personal radio paging system, which has the capability of forming a small-scale production networks based on personal computers and local area networks, as well as the capability to form personal information channels that are updated several times a day, and for users to ensure the availability and privacy in the area of operations.

The distinctive peculiarities of local paging network are the following: absence of transmission fees, low cost, small size, weight, power consumption of both individual and network equipment. Also, it will be necessary to have a transmitter of low power (less than 100 mW) to enable two-way communication; personal registration; the record labels for quick access to information (or bookmarks). The capability to transfer large amounts of information, centralized access to data resources and decentralized management of micro-cells (cells of the local telecommunications), as well as the capability to extend the functionality to demonstrate mass-volume messages on the screens of any terminals (news feeds) are possible to refer to the advantages.

In our time, the number of existing local paging systems is very small, and almost all of them use the protocol POCSAG 512 or 1200 (with sixteen channels and the operating frequency of 146-174 MHz), well suited for urban networks aimed at sending messages without feedback. However, for the creation of local networks that meet the requirements listed above, it would be better to use the technology RFID (Radio Frequency Identification), which through radio signals manages to read and write information stored in a transponder. The personal radio paging system based on

this technology makes it possible to override these transponders in the paging terminals, thereby providing and transmitting information and reading the personal data (registration RFID-labels, i.e. transponder). For the basis of the construction of the receiver it is most convenient to use a semi-passive tags 863-868 MHz range (this range is freely used in the Russian Federation), as they allow to provide the distance of 10 meters and more when connected to the power. In the absence of the power subscriber registration can be complete using the scanner (stationary or mobile), which is based on the system of inducing (inducing response) of the electromagnetic field in the antenna of a receiver. This provides enough power for activation in the label of a silicon chip CMOS, and sending a response message (through processing and signal reflection - feedback frequency modulation).

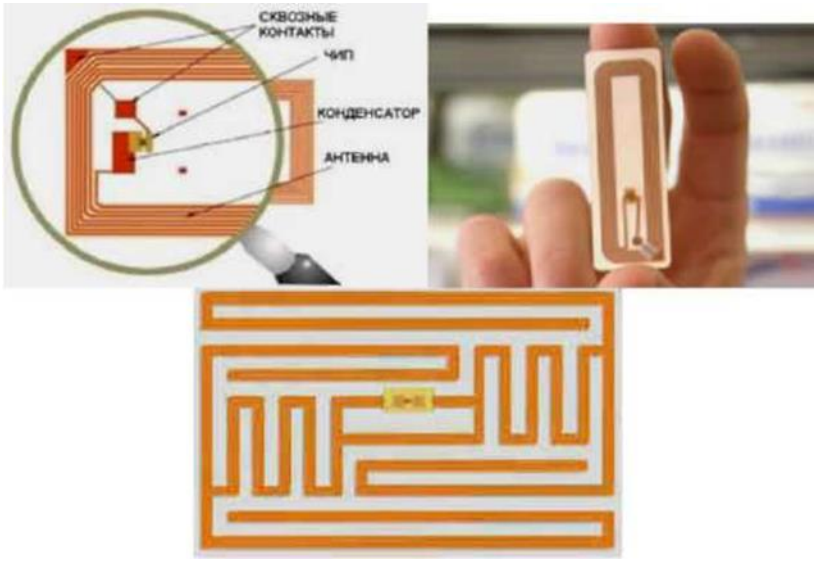

Fig. 2. Passive RFID labels

When power is applied, a half-passive receiver becomes active providing improved reading accuracy and maximum distance, while the battery can operate up to 10 years. The local pager technology allowed to integrate into the receiver different sensors (for example: sensors of radiation, gas content in the air,

temperature) to improve the protection of a subscriber. It is very important in the areas of high risk, as well as in the areas with a large number of people.

Talking about the operation of paging RFID network one can use the English-language expression «Update in situation», which this means that in the immediate local region of the subscriber's location it is possible to complete direct registration and rapid corrections, as well as modification without creating a new version of information data.

One of the RFID technology called “silicon-on-insulator” makes it possible to create a very thin receiver of about 0.15x0.15 mm by size and a thickness of 7.5 microns. Thus, the size of the receiver will depend only on the display, buttons, antenna, and the chip will take up far less space.

To further reducing of size, weight and cost of element base receivers and terminals (stations), the RFID systems also provide the possibility to use dynamically-configurable processors with the capability of analog signal processing (for example, dpASP Anadigm – it may quickly process signals).

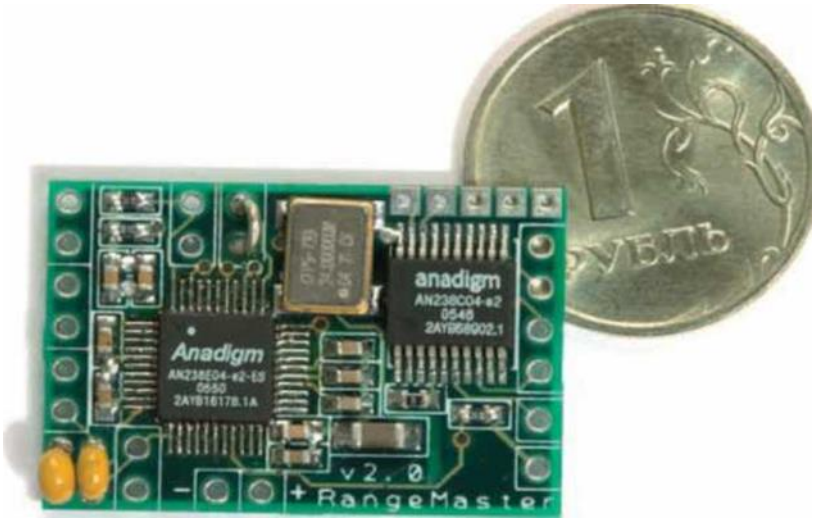

Figure 3. Paging RFID terminal based on Anadigm processors

The decision with the processor allows to achieve the most effective tactical and technical results in comparison with using conventional digital equipment. For

further reducing of cost and size, the display from the budget “electronic paper” can be used.

Figure 4. Example “budget” display

The system in the permissible frequency range on the basis of this principle as the reuse of frequencies at low radiation of repeaters and pagers (typical mobile telecommunications) would deploy such a network locally without significant deterioration of the electromagnetic background. It can be assumed that the development of the prototype and its layout with a sufficient level of modern technology will take no more than two years.

High-speed personal radio paging systems of the near future will certainly support the work in roaming. The tasks of hardware and software (for roaming) are quite difficult, and require the need to develop new approaches to the creation of projects. The main feature will be the development of new decoders and controllers that can handle more data traffic.

One of the major innovations may be the development of instant messaging with built-in frequency synthesizer. Presumably, a pager will have the flexibility to change the working protocols, as well as the independence of frequency within a certain frequency range. The purpose is to provide a pager having the capability to

automatically operate at different frequencies, in various areas of coverage, and provide synthesizing the frequency of heterodyne signals. This system will work only one crystal oscillator for the entire frequency range of the network.

When the above described level is implemented, it will be possible to produce pagers off the assembly line, in contrast to the current system of release of the receivers in limited quantities. More attention will be paid to the software, rather than a physical component of the receivers. When commissioning SoC for signal processing, software importance will increase anyway.

So, paging systems nowadays are non-popular communication networks, but in the narrow circles of any firms, paging is still relevant means of communication. This is especially true of organizations that are in need to transfer information without the subscription fee for a certain distance, as well as in mass distribution of any data. An example of such organization can be a large plant with a sufficiently large area. It is not always necessary to install powerful radio station or to buy expensive portable radio sets. Paging offers the possibility to send information quickly enough, and the feedback is not always necessary.

In general, any paging system comprises a paging terminal (main source of transmitted data), and small-sized personal pagers (data receivers) located at the subscribers . Due to the fact that the receiver has a small size and weight, it does not create any discomfort to subscribers, and the battery power supply has a long service life (as opposed to portable radio sets).

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