

OVERVIEW OF WIRELESS TECHNOLOGIES FOR MODERN MOBILE COMMUNICATION  
DEVICES

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**Annotation:** *The article publishes a lot of reviews in which various mobile devices are compared in terms of providing the user with all kinds of services. The purpose of this article is to look at this unique subject from the point of view of modern wireless technologies.*

**Key words:** *PDA, GSM/CDMA, Wi-Fi, Wi-MAX, GPS, satellite navigation, BPSK.*

Mobile devices are successfully used not only in everyday life, but also in the production sector. They become an indispensable attribute of our life. Mobile devices are a wide range of equipment for various purposes, from a robot vacuum cleaner with autonomous power supply to modern PDAs.

Their main feature is, first of all, the availability of autonomous power sources.

In order not to try to embrace the immensity, consider the technologies of those mobile devices that have the ability to communicate wirelessly with the outside world (Internet) and with different devices, in particular with a computer. Formally, this definition includes a large family of cell phones and mobile terminals, PDAs, smartphones (phones with PDA functions) and communicators (PDAs with phone function) with built-in nodes of various wireless technologies, ranging from Bluetooth, GSM/CDMA, (Wi-MAX) and ending with GPS (see fig. 1). Among cell phones and mobile terminals, the brands Siemens, Nokia, Motorola and Sony-Ericsson are well known. The most popular PDAs are manufactured by HP, ASUS, Fujitsu-Siemens, Mitac, Palm, Sony, Toshiba, and among communicators and smartphones, Q-teck, I-mate and Motorola products are in particular demand. Despite the widest choice of mobile devices, they are united by versatility, which gives the user the maximum possible modern services.

From the point of view of wireless technologies, the listed mobile devices should be considered as devices that provide the user with:

- wireless connection to a stationary or portable computer;
- wireless broadband internet access;
- positioning of the object by means of GPS or GLONASS satellite navigation;
- cellular communication.

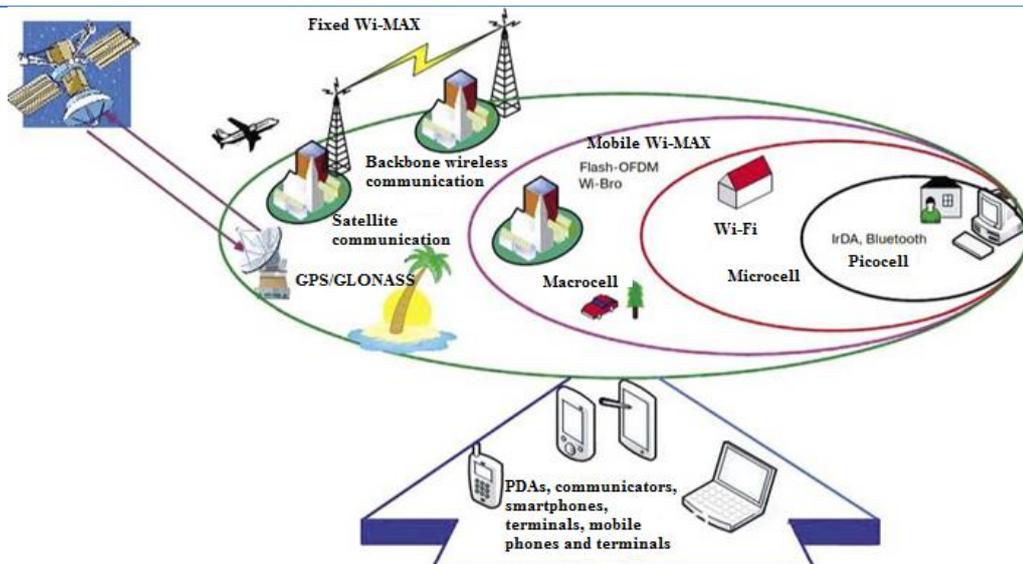


Fig.1. - (PDAs with phone function) with built-in nodes of various wireless technologies, ranging from Bluetooth, GSM/CDMA, (Wi-MAX) and ending with GPS

### ***Positioning Mobile device***

The use of satellite positioning systems (GPS and GLONASS) to determine the location of an object has become possible in Russia quite recently.

In early December 2006, the State Telecommunication Commission of the Russian Federation authorized the use of satellite navigation devices, including those that may be part of mobile communications.

It is known that there are now two navigation systems in the world: the American GPS (Global Positioning System), or NAVSTAR, and the Russian GLONASS (Global Navigation Satellite System). They are conceptually similar, the differences relate only to some aspects of technical implementation, namely:

- technology — FDMA (GLONASS), CDMA (GPS);
- data transfer rate of 50 bits/s;
- modulation — BPSK (GLONASS), BPSK NRZ (GPS);
- carrier frequency — 1598/  
1604 MHz (GLONASS), 1575 MHz (GPS);
- orbits of satellites - 20 thousand km.

Today, the GPS system has received the greatest distribution, because its openness has led to a rapid saturation of the market with inexpensive receivers with a positioning accuracy of 15...30 m. As for the use of the GLONASS system, it is already possible to find universal mobile devices on the market of modern wireless technologies that have the ability to work in any of these satellite systems. Unfortunately, their use is not widespread due to the high cost, and they were created rather for professional use (with positioning accuracy up to 20 cm), such as, for example, the Trimble R8 GNSS R8201-51-XX mobile receiver worth 15 thousand rubles. USD: Kit — the mobile station includes a dual-frequency GPS/GLONASS receiver, a built-in GSM or VHF modem, a battery and a charger.

As for GPS, mass-use receivers can be divided into two large groups: some of them are built into the mobile device itself, others can be connected to it via universal RS-232, USB or a special interface (for example, Compact Flash type 1 or PCMCIA). As a rule, the very management of a mobile GPS receiver at the system level is determined by the NMEA Global Sat protocol [1].

### **Wireless communication with a computer**

Two standards should be noted here - Bluetooth and IrDA.

The IrDA interface has long been an integral part of the motherboards of stationary and portable computers.

The Bluetooth standard is also in the spotlight of well-known motherboard manufacturers such as MSI, Gigabyte Technology, Abit Computer and Albatron Technology.

These two technologies provide a modern mobile device with the ability to exchange almost any information with a computer, from SMS messages to files with new music or ringtones.

### **IrDa**

Universal standard for data transmission via the infrared port. Connecting two devices ("point-to-point") through this "cordless" interface is the most accessible and easiest way to organize wireless communication if there is no need to transmit information over long distances and if the wires are really tired. Interface 1g1)And it is described by the standards:

- IrDA 1.1 FIR (Fast Infrared) and MIR (Middle Infrared), data transfer rate up to 4 Mbit/s;
- IrDA 1.0 SIR (Serial Infrared), up to 115 Kbit/s;
- ASK IR (Amplitude Shift Keyed IR), up to 56 Kbit/s.

Communication is possible at a distance of up to 1 m.

### **Bluetooth**

This technology (radio interface) of low power (1 MW) was also developed to replace the existing cable connections of office and household appliances with a wide range of portable devices.

Unlike IrDA, topology options are possible, both "point-to—point" and "point- to-many points", which allows you to organize wireless networks.

Bluetooth differs from IrDA in the simplicity of connection settings. It becomes an indispensable attribute of a modern mobile device.

The main technical characteristics of Bluetooth:

- frequency range 2,400. .2.4835 GHz (unlicensed range, can be freely used by anyone);
- FHSS signal generation technology (Frequency Hopping Spread Spectrum, spectrum expansion with frequency jumps);
- data transfer rate from 721 Kbit/s (V1.1) to 10 Mbit/s (V1.2);
- reach area up to 10 m.

This technology finds a wide variety of applications in mobile communication devices, such as portable computers, mobile telephones, telephone headsets and PDAs, as well as digital cameras and video cameras, and in various combinations.

Bluetooth technology has become a competitor not only to IrDA, but also to technologies such as IEEE 802.11. It is the most common technology for wireless connection of computers and peripheral devices. Bluetooth devices are able to connect to each other, forming Pico cell, each of which can include up to 256 devices. Overlapping pic cell can form a distributed network over which data migrates.

Today, Bluetooth technology is widely considered by many developers as a wireless technology of universal radio communication.

Another widespread radio interface is Wi-Fi (802.11b, g). It should be noted that the 802.11b, g standard gets along well with Bluetooth, despite the fact that they work in the same 2.4 GHz frequency range. Although the developers still had to solve some problems related to signal interference when integrating these two radio interfaces into one chip.

The use of Wi-Fi technology (802.11b, g) is becoming more and more familiar and indispensable every day in places of mass use, where "hot spot" type base stations are already installed [2].

The main features of the technology are:

- simplicity of the principles of construction and functioning of both the network itself and the settings of the mobile subscriber for it;
- providing communication in a small open area (in a zone with a radius of up to 150 m) and indoors;
- high-speed data transmission;
- incompatibility with the Bluetooth standard.

These properties of Wi-Fi technology, combined with publicly available equipment and the possibility of unlicensed use of the 2.4 GHz frequency range adopted in many countries, allowed it to become widely used in a fairly short time.

The main technical characteristics of the standard 802.11b, g:

- operating frequency range 2.4 ^2.4835 GHz;
- the width of the signal spectrum 22 MHz;
- modulation methods — CSC and OFDM (Orthogonal Frequency Division Multiplexing 1), PBCC (Optional Packet Binary Convolution Coding);
- Data transfer rate up to 54 Mbit/s.

### **Conclusions**

The modern mobile device has small dimensions, excellent ergonomics. In addition, it is a universal communication device represented by various wireless technologies, the radio interfaces of which are constantly being improved.

Compact subscriber devices (smartphones, PDAs, laptops) with antennas providing mobile access according to the 802.16e standard are expected to appear in early 2007.

And Wi-Fi will soon be replaced by fixed high-speed Wi-MAX, which will allow a mobile object to connect to the base stations of this network within its radius of availability.

Modern 3G and 4G cellular communication technologies will not remain aloof from WiMAX, since the success of the introduction of broadband wireless network standards is most likely determined by the degree of participation of mobile operators in the development of these networks.

At this stage of the development of mobile communication networks, this is confirmed by the addition of Wi-Fi to UMTS technology, where the elements of the network subsystem necessary for their unification in order to provide a single set of services and "silent" service during the transition between networks have already been identified.

It is also encouraging that at the end of 2006, a Proton rocket with three satellites was launched to maintain the GLONASS system in working condition. It was decided to develop and commercialize this system, so in the future we should expect the mass appearance of inexpensive mobile devices with GPS/GLONASS positioning function.

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