filled with air. It was taken into account that the angle of the electromagnetic wave incidence on the layered structure in the waveguide depends on the wavelength and is determined by the Brillouin concept for the fundamental wave H_{10} according to the following formula:

$$\theta_i = \operatorname{asin}\left(\frac{\lambda}{2a}\right) \quad (1)$$

The reflectance of the structure was found using the known expression:

$$R(\mathrm{f}) = \frac{R_{01}+R_{12}\exp(-i\cdot 2\varphi)}{1+R_{01}R_{12}\exp(-i\cdot 2\varphi)}, \quad (2)$$

where R_{01} and R_{12} are Fresnel reflectance complex coefficients.

Thus, the dependence of the reflectance versus frequency was constructed for the given structure. This layered dielectric structure allows achieving the width of the pass band of 2.2 GHz at EBTF and the width of the block band approximately 2 GHz at a frequency of the second harmonic. The highest value of the reflectance was obtained at the second harmonic frequency, which was equal to 0.98.

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MAJOR GLOBAL SATELLITE NAVIGATION SYSTEMS, ROLE AND CHALLENGES

Satellite navigation systems are complex electronic and technical systems consisting of a set of ground and space equipment and designed for positioning in space and time, as well as determining of movement parameters for land, water and air objects [3, p 125].

The role of positioning systems in the modern world is difficult to overestimate. A failure or absence of a navigation signal from the usual GPS can lead to chaos in the operation of air and sea transportation, consumer goods delivery services, and affect the functions of smartphones. Today, it is difficult to imagine the effective use of troops without the data from navigation satellite systems.

Common elements of satellite navigation systems are:

1. An orbital group consisting of approximately 30 artificial Earth satellites that emit special radio signals;

2. Ground-based command and control system, which contains units for measuring the current position of satellites and transmitting the received data to them for correcting information about their orbits;

3. Receiving client equipment used to determine coordinates;

4. Optional: a ground-based beacon system and an informational radio system for transmitting corrections to users [2].

The principle of operation of satellite navigation systems is based on measuring the distance from the antenna on the object, the geographical coordinates of which must be obtained, to the satellites, the location of which is known with high accuracy at any given time. The table of positions of all satellites –an almanac – must be available in each satellite receiver before measurements are started. As a rule, the receiver stores the almanac in memory since the last time it was turned off. Each satellite transmits the entire almanac in its signal. Thus, knowing the distances to several satellites of the system, it is possible to calculate the position of the object in space.

The method of measuring the distance from the satellite to the receiver antenna is based on the certainty of the propagation speed of radio waves. To realize the ability to measure the time of the radio signal being propagated, each satellite of the navigation system emits accurate time signals using system synchronization. During the operation of the satellite receiver, its clock is synchronized with the system time, and during subsequent reception of signals, the delay between the time of radiation contained in the signal itself and the time of reception of the signal is calculated. With this information, the navigation receiver calculates the coordinates of the antenna. All other movement parameters are calculated based on measuring the time the object spent moving between two or more points with coordinates determined by previous calculations [3, p 126].

As of 2023, there are four global systems in operation: the American Global Positioning System (GPS), the Russian Global Navigation Satellite System (GLONASS), the Chinese BeiDou Navigation Satellite System, and the European Galileo.

The American «Navigation Satellite Timing And Ranging Global Positioning System» (NAVSTAR-GPS) is the system we use most often. It includes 32 spacecraft rotating in circular orbits in 6 orbital planes at an altitude of 20,183 km. Typical GPS accuracy is about 6-8 meters. On the territory of the USA, Canada, Japan, China, the European Union and India there are WAAS, EGNOS, MSAS stations that transmit corrections for the differential mode. This allows to reduce the error to 1-2 meters in the territory of these countries. GPS is in the hands of the US Space Force [2; 3, p.124-128].

The Russian «Global Navigation Satellite System» – GLONASS operates similarly to the American GPS, and consists of 24 active satellites located approximately 19,100 kilometres above the earth, and the satellite's orbit around the Earth takes 11 hours and 15 minutes. Errors of GLONASS navigation indicators are 3-6 m when using an average of 7-8 satellites. An important feature of GLONASS is the possibility of using the navigation system at high latitudes in the northern and southern polar regions, where the GPS signal is poorly received.

The Chinese «BeiDou» currently has 35 satellites in orbit, while, according to official data, the accuracy of determining the coordinates of the object for the military sphere by the BeiDou system is up to 2 m, for the civilian one – up to 10 m [2; 3, p.128-129].

The European «Galileo» was built only with the civilian market in mind, however, since 2008 it has been allowed to be used for military operations to ensure European security. So far, the Galileo program has placed 30 satellites in orbit at an altitude of 23,222 kilometres. Currently, the system uses a full constellation of satellites. For most places on earth, 6 to 8 Galileo satellites are available at all times, which means a very high accuracy, which in most situations is measured in centimeters rather than meters. Galileo is compatible with the GPS system, which further improves the accuracy of measurements, and its operation is also supported by the EGNOS system (Geostationary Navigation Overlay Service), consisting of ground components and satellites responsible for improving the operation and accuracy of satellite navigation systems [3, p 129; 4].

Is it easy to block GPS? Disrupting enemy navigation tools is effectively used to combat cruise missile guidance. Satellite signal jamming and blocking is becoming increasingly common, and as a result, weapons based on satellite data alone are no longer as effective as they once were. Interfering with a GPS signal is not particularly difficult. A radio transmitter of the appropriate power and frequency placed near a protected target prevents GPS receivers from receiving the correct data. Satellite manufacturers are trying to combat this by developing increasingly jamming-resistant signals. However, in principle, the advantage is always on the side of those who attack. They can respond to changes faster thanks to less expenditure of time and resources, because satellites cannot be modernized cheaply and quickly. However, we should not expect the military to abandon the GPS system. On the contrary, the fight against jamming systems will increase, and additional components will be added to the equipment and weapons that will prevent GPS signal jamming. Engineers are also looking for fundamentally new technical solutions. For example, after a series of hacks and failures in the GPS system, the US military and several American laboratories announced that they were working on a new quantum navigator that could completely change global search systems, eliminating the need for satellites [1].

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DOCKER AS A MEANS OF LOAD BALANCING

A container is an instance of a Docker image and serves to run applications, processes, or services. It is formed from the content of the Docker image, an execution environment, and a standard set of instructions. If necessary, many instances of containers can be created from the same image to expand the application. The container includes the operating system, user files and metadata. A Docker image contains information on how to initiate a container, including which process to start at its launch, among other settings [3].