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GSM ANTENNA DESIGN

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The article presents the results of designing a GSM antenna. In connection with the development of radio-electronic devices and communication systems, there is a need for GSM antennas. The use of antennas in radio systems allows to increase the capabilities of radio communication systems, radar, as the amount of information transmitted per unit of time is directly proportional to the frequency band of the signal; also allows for high noise immunity of communication channels; improve accuracy when assessing the relative orientation of moving objects.

Introduction. An antenna is a device for radiation and reception of radio waves [1].

The shape, size and design of antennas can vary depending on the length of the emitted or received waves and the destination of the antenna. Antennas are used in the form of a piece of wire, combinations of such segments, reflective metal mirrors of various configurations, cavities with metal walls in which slots are cut (slot antenna), spirals of metal wires and others [2].

GSM antenna is the most common antenna with a fairly narrow radiation pattern in the horizontal and vertical planes. An antenna consists of a set of elements: one vibrator, to which a signal is brought in and taken off (active vibrator) and several passive vibrators, one of which is the reflector and the others work in the mode of directors. The task of the reflector is to weaken the radiation in the rear, not the working direction, the director's task is to amplify the signal in the right direction. All vibrators are parallel and lie in the same plane, this plane determines the polarization of the antenna. Often, such an antenna is called an "wave channel" antenna or "Uda-Yagi" antenna [3].

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The calculation for the antenna allows to obtain only approximate results, since it is necessary to take into account many interrelated factors (the length and thickness of vibrators, the distance between them), and if it is associated with cumbersome calculations. Therefore, most often design the antenna, selecting all their sizes experimentally, adhering to the following rules:

1) for a given operating wave λ, calculate and set the length of the active vibrator 2l taking into account the shortening Δl

2) set the length of the reflector 2 lp by 5 - 10% longer than the length of the active vibrator, and the distance between the vibrators is about 0.2 λ;

3) using the field indicator, measure the field strength E_O (towards the active vibrator) and E_180 (towards the reflector), and adjusting the distance dp between the vibrators and the length of the reflector achieve the minimum ratio E_180/E_O. for a system of two vibrators;

4) add a director, the length of which $2l\_q$ is set shorter by 10 - 15% of the active length, and the distance a_d to the last is about 0.2 λ, and the minimum ratio E_180/E_O is achieved by adjusting the specified dimensions. For a system of three vibrators (this may require a slight adjustment of the reflector);

5) add successively second, third, etc. directors and make similar adjustments.

The shape of the radiation pattern (DN), the standing wave ratio (CWS) and the reflection coefficient (S11) are calculated for the frequency from 1.92 GHz to 2.17 GHz, the material is copper. The antenna has a directional radiation in the direction of 0 °, in the direction of -180 ° there is observed a reverse low radiation of the radiation pattern as shown in Figure 1. The antenna has good matching properties in the frequency range from 1.99 GHz to 2.17 GHz (Figure 2). The reflection coefficient from the input decreases from 0 dB at 1.92 GHz to -10.4 dB at 2.17 GHz, at 2.045 GHz, the reflection coefficient is -6 dB.

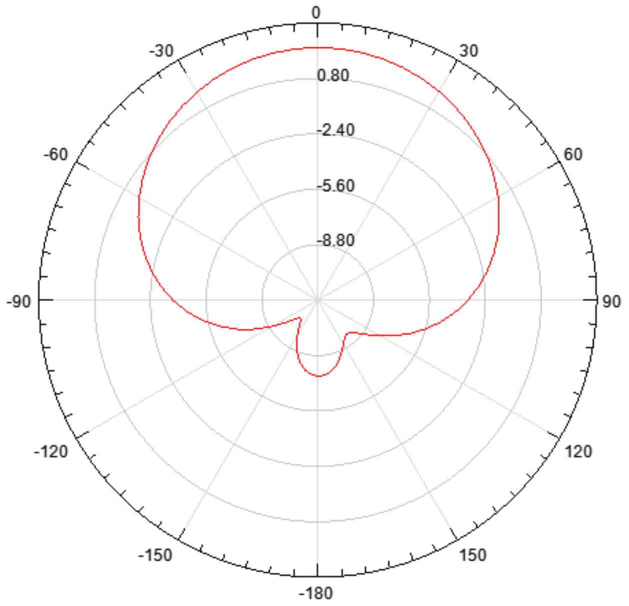

Figure 1. – Antenna pattern

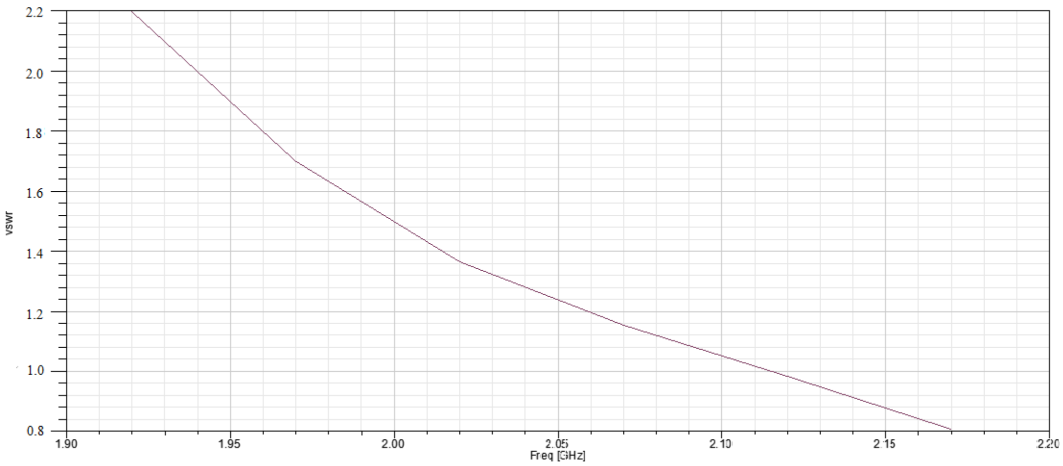

Figure 2. – Antenna standing wave ratio

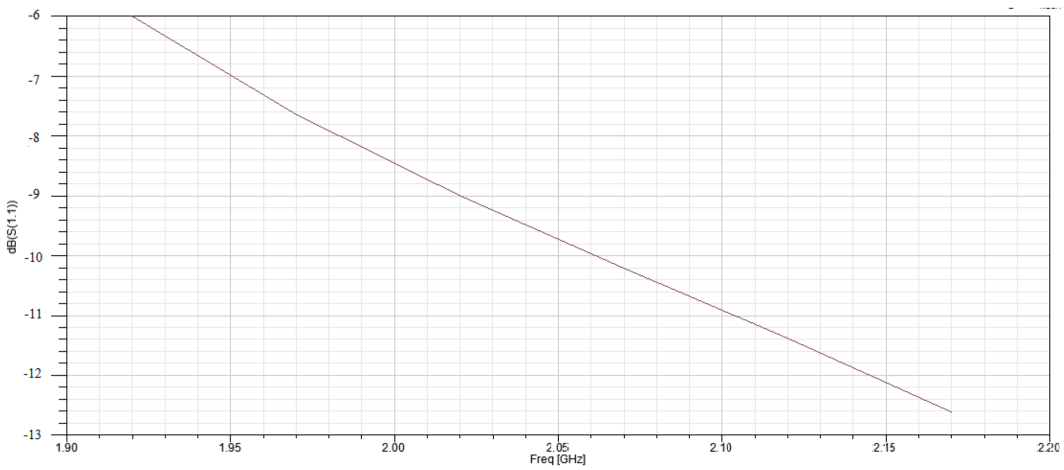

Figure 3. – S_{11} antenna parameter

Conclusion. In connection with the development of radio-electronic devices and communication systems, there is a need for GSM antennas. The use of antennas in radio systems allows you to increase the capabilities of radio communication systems, radar, as the amount of information transmitted per unit of time is directly proportional to the frequency band of the signal; also allows for high noise immunity of communication channels; improve accuracy when assessing the relative orientation of moving objects.

Universal Mobile Telecommunications System (hereinafter UMTS) - Universal Mobile Telecommunications System - cellular technology, developed by the European Telecommunications Standards Institute (ETSI) for the introduction of 3G in Europe. In order to differentiate from competing solutions, UMTS is also often referred to as 3GSM in order to emphasize that the technology belongs to 3G networks and its continuity in development with GSM networks.

REFERENCES

1. GOST 24375-80. Radio communication. Terms and Definitions. 1986
2. Mob [Electronic resource]. – Electronic data. – Access mode: http: //mob.ua. – Access date: 21.02.2019.
3. Yurtsev, O.A. Yu 82 Traveling wave antennas, antenna arrays, short, medium and long wave antennas. At 3 pm / O.A. Yurtsev. – Part 3 : Methodological manual for the course "Antennas and microwave devices" for students of the specialty "Radio Engineering". – Minsk : BSUIR, 2001. – 72 p., Ill. 60.
4. Yanushkevich, V.F. Guidelines for the implementation of course work in the discipline "Microwave devices and antennas" for students of the specialty T.09.01.00. – Novopolotsk, 1997.