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Research and analysis of efficiency of modernization of transmitters for organization of digital sound radio broadcasting in DAB+ standard

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Abstract:

In the article the questions of modernization of analog transmitters for use in systems of digital sound radio broadcasting of DAB+ standard are considered. The comparative analysis of calculated and experimental data of zones of confident reception is carried out, and also the quality of a signal in various conditions is estimated. The peculiarities of the modernized transmitters related to their technical characteristics, compliance with standards and impact on the quality of broadcasting are revealed.

Keywords: On the basis of 6-12 TV channels allocated for digital broadcasting by the Agreement "Geneva-06" for the Republic of Uzbekistan frequency-territorial planning of digital sound radio broadcasting using single-frequency method, taking into account the existing fleet of modernized radio transmitters.

Introduction

Today, a digital television broadcasting network is in operation in the Republic of Uzbekistan, providing full coverage of the population. This network is created and managed in strict compliance with existing standards, guiding documents and regulations governing telecommunications and digital broadcasting.

However, the implementation of digital radio broadcasting in Uzbekistan requires revision of some existing regulatory documents and the development of new ones that comply with international standards for digital radio broadcasting. These standards will serve as a basis for the creation and improvement of the digital radio broadcasting network in the country.

On the basis of 6-12 TV channels allocated for digital broadcasting by the Agreement "Geneva-06" for the Republic of Uzbekistan frequency-territorial planning of digital sound radio broadcasting using single-frequency method, taking into account the existing fleet of modernized radio transmitters. In this case, the points of placement of transmitters and frequency channels were determined in order to optimize the frequency resource and reduce the possible mutual influence of transmitters.

Numerical calculations and studies were carried out in relation to the conditions of the Republic of Uzbekistan, using the developed software, mutual interference was taken into account and the key issues of interference situation were considered (Fig. 1) [1].

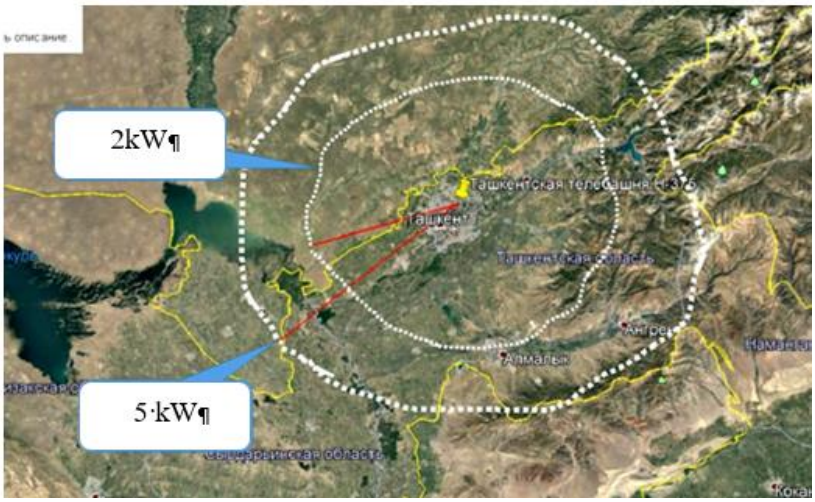

Fig.1. Digital radio broadcasting zone with 2kW and 5 kW power at the Tashkent TV Tower

In accordance with the requirements of the Agreement "Geneva-06" (signal-to-noise ratio is 15 dB, minimum median value of field strength - 58 dBmkV/m) and the following parameters of the digital transmitter to be installed on the Tashk

ent TV tower: height of the transmitting antenna - 276 m, height of the receiving antenna - 1.5 m, gain of the receiving antenna - 0 dB, radio transmitter power - 4 kW, operating frequency - 208.592 MHz. At the same time, the coverage radius at 2 kW power was about 63.7 km, at 5 kW power - about 80.15 km.

Fig. 2 shows the coverage area of the digital transmitter on the Tashkent TV tower [2,3].

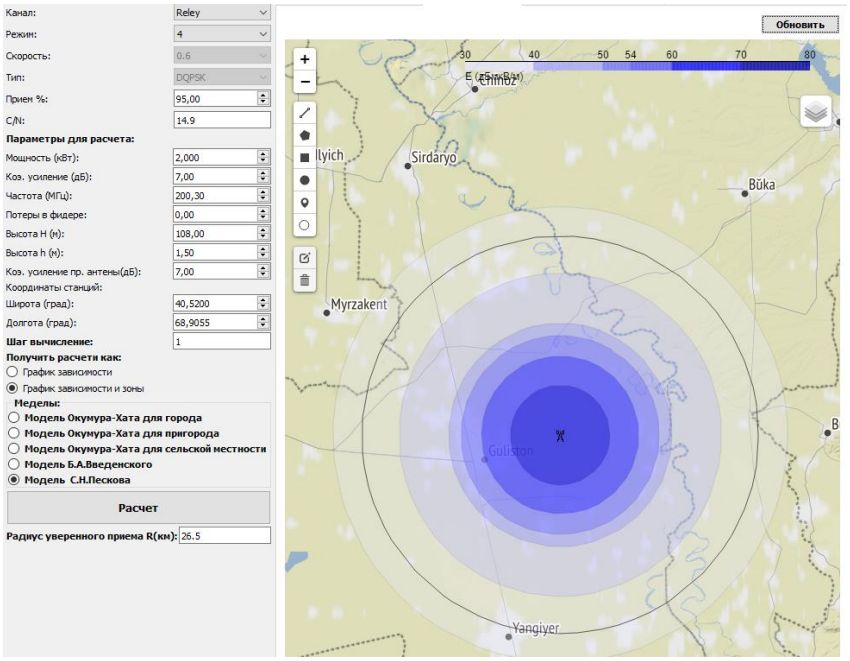

Fig.2. Coverage area of the digital transmitter on the Tashkent TV tower [4]

Experimental broadcasting areas were organized to evaluate the zones of confident reception and technical characteristics of upgraded analog broadcasting transmitters operating in the DAB+ standard. Experimental studies were conducted using upgraded powerful analog transmitters and existing antenna-feeder systems.

Transmitting antennas were operated with horizontal and vertical polarization of the radio signal. For the modernized analog TV transmitter, converted into a digital transmitter of DAB+ standard with an output power of 3 kW and the height of the transmit antenna 320 m in Tashkent city and Tashkent region, the experimental zone of confident reception was 30 km. Beyond 30 km the signal is received with unacceptable fades or is absent completely.

The calculated zone of confident reception for this transmitter is 56 km, which is almost twice the experimental data, and the radius of the coverage area is 83 km, where the real signal is completely absent. The map with calculated and experimental data is presented in Fig.3.

For the digital transmitter of DAB+ standard with output power of 1 kW and the height of suspension of the transmitting antenna 38 m in Samarkand city and Samarkand region the experimental zone of confident reception was 30 km. Beyond 30 km signal is received with fading. The calculated zone of confident reception for this transmitter is 24 km, and the radius of coverage area is 44 km, where the signal is present, but is received with fades and disappearances.

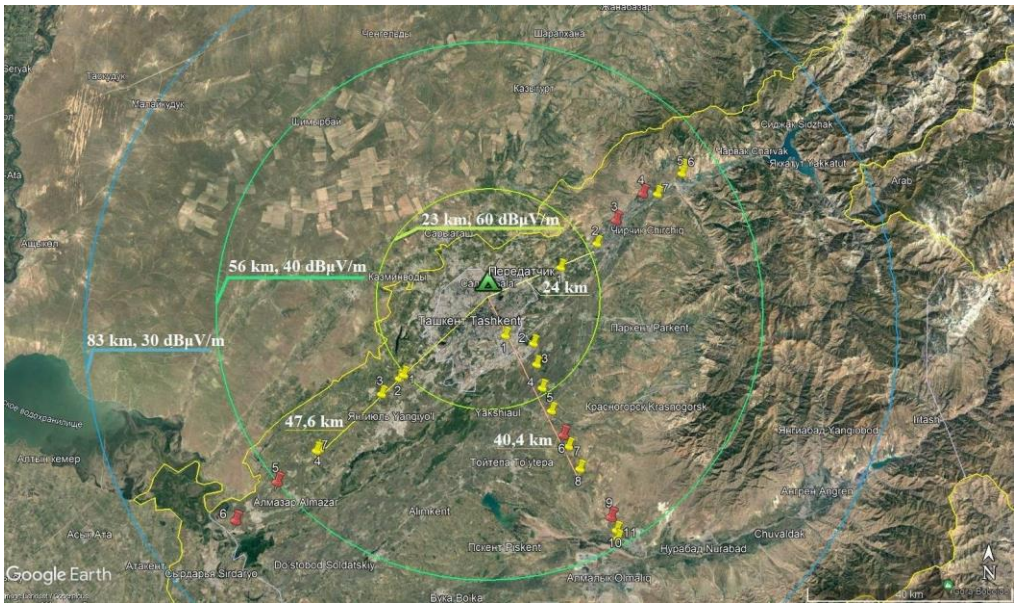

Fig.2. Map with calculated and obtained experimental data (Tashkent TV tower)

The difference between the calculated and experimental zones of confident reception for this transmitter is due to the fact that the transmitter in Samarkand region (Chopon-ata) is installed on a mountainous terrain. This provides additional height for the transmitting antenna, which uses vertical polarization. The map with calculated and experimental data is presented in Fig. 4.

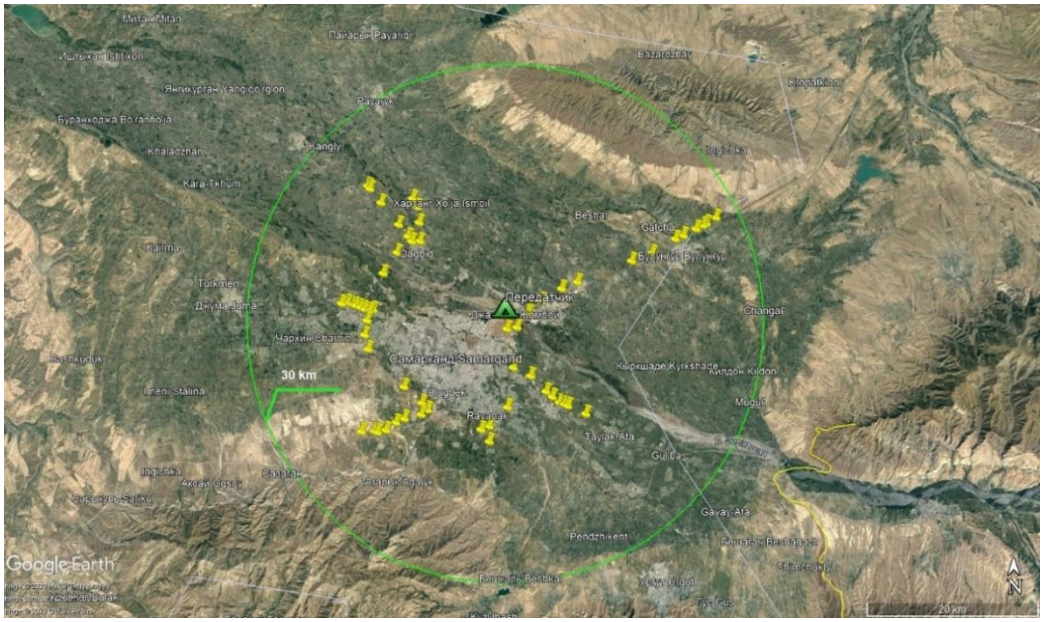

Figure 4. Map with calculated and obtained experimental data (Chopan-ata)

Comparative analysis of calculated and experimental data revealed the following[5]:

- digital transmitter of DAB+ standard with vertical polarization (Samarkand) provides higher signal quality, with calculated data fully coincide with measured data.

However, despite the possibility of upgrading analog TV transmitters (replacing the analog exciter with a digital one), there are some limitations:

- transmitters operate only on fixed channels (6-12), their reconfiguration to other frequencies is impossible;

- measured parameters of modernized transmitters do not meet the requirements of DAB+ standards (EN 300 401 [6], TR 101 496 [7], TS 102 563 [8]);
- exceeding the recommended number of radio programs (not more than 10 stereo or 20 mono) negatively affects the quality of broadcasting;
- the use of modernized transmitters is possible only as a temporary replacement of digital transmitters. However, this leads to a decrease in the areas of reliable reception and deterioration of the signal quality.

These limitations require a careful and balanced approach when using mothballed analog transmitters in digital broadcasting systems.

Conclusions

Modernized analog transmitters, adapted for operation in the DAB+ standard, in some cases show limited coverage areas and reduced signal quality.

Transmitters with horizontal polarization (Tashkent) are inferior to their vertically polarized counterparts, which underlines the need for further optimization of their use.

The introduction of digital radio broadcasting requires revision of existing regulatory documents and development of new standards that will take into account modern technologies and international requirements for effective construction of the broadcasting network.

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