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UDC 621.3

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REGULARITIES OF THE PROCESS OF TARGET DETECTION BY PULSE RADAR STATIONS

The protection and defence of the state’s critical infrastructure against various types of terrorist threats is an integral part of Ukraine's national security. These facilities include nuclear, thermal and hydroelectric power plants, mining and processing plants, petrochemical plants, metallurgical plants and other enterprises that are strategic assets. Today, one of the key tasks of ensuring security is to counteract unmanned aerial vehicles that cause terrorist attacks on strategic facilities and critical infrastructure [1]. It is known that today, the main means for detecting air targets are pulse radar stations, the use of which must be optimised depending on specific factors that ensure the solution of critical infrastructure security tasks [2].

Optimal detection of electromagnetic signals is based on the excess of the level (magnitude or intensity) of the received useful signal $I_{(sig)}$ over the level of interference $I_{(obs)}$ interacting on the input of the receiving device, i.e. the condition must be met:

$$I_{sig} \geq \delta \cdot I_{obs}, \tag{1}$$

where δ is the recognition coefficient, a dimensionless value determined as a result of signal processing in the radar receiver.

Propagating in space, the intensity of an electromagnetic wave decreases not only due to the expansion of the wave front, but also due to volume attenuation. Its value is determined by the volume attenuation coefficient *β*. This value depends on the frequency of electromagnetic oscillations propagating in space and is determined empirically [3,4]. Thus, the current value of the electromagnetic wave intensity will be as follows:

$$\frac{P_i \cdot K_{amp}}{(4\pi Д)^2} \cdot 10^{-0,1 \cdot \beta \cdot Д км}. \tag{2}$$

The reflected electromagnetic wave propagating in the opposite direction will be attenuated due to wave front expansion and volume attenuation. Its intensity will decrease in proportion to the square of the current distance, expressed in metres $(4\pi D)^{(2)}$ and in kilometres $10^{-0.1 \cdot \beta \cdot (D)(km)}$.

$$20 \cdot \lg Д + \beta\ Д_{км} + K \leq \\ \leq \frac{1}{2}\left(10 \cdot \lg\delta + 10 \cdot \lg P_{obs} - 20 \cdot \lg K_{amp} - 10 \cdot \lg P_i - 20 \cdot \lg R_e\right), \tag{3}$$

where $K \approx 10,98$ is dB.

Expression (3) is commonly referred to as a non-strict radar range inequality. The right-hand side of the expression has six terms that express in decibel form the values of the main technical characteristics of the radar, namely: the recognition coefficient *δ*, the sensitivity of the receiving device $P_{(r)}$, the gain of the radar antenna $K_{(p)}$, the radiation power $P_{(i)}$ and the main parameter of the irradiated radar target - the radius of the equivalent reflecting surface $R_{(e)}$.

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UDC 621.3

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CLASSIFICATION OF RADAR EQUIPMENT FOR UNMANNED AERIAL VEHICLES DETECTION

A radar is a system for detecting air, sea and land objects, as well as for determining their range, speed and geometric parameters. The specifics of solving individual tasks and their wide range led to a wide variety of different types of radars:

- by the scope of use: military and civilian;