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DRFM TYPE DIGITAL DEVICES FOR STORING AND REPRODUCING RADAR SIGNALS IN RADIO JAMMING

Today, digital frequency storage and reproduction devices, abbreviated as DRFM, are being developed, manufactured, and operated.

In DRFM devices, the signal is divided into quadrature components. This ensures the constancy of the circuit's output effect at those moments when the signal at the output of the cosine channel is zero, at the output of the sine channel is maximum, and vice versa. At any initial phase, the signal can be decomposed into cosine and sine components, and then restored, preserving all the information, but already in low-frequency oscillation.

The phase of the reference frequencies of the quadrature components is recorded with an accuracy of π , that is, single-bit phase quantization is implemented in the analog-digital device. During signal reconstruction, such a rough phase determination leads to the formation of parasitic sidebands around each spectral component of the reconstructed signal. The level of the bands is only 8 dB below the level of the corresponding principal components. As a result, up to 14% of the power of the reconstructed signal is made up of parasitic sidebands of its spectral components.

When using such a signal to create signal-like interference, the presence of parasitic sidebands is dangerous. Due to these components, it is possible to differentiate signals from interference. The differentiation can be made more difficult by simply increasing the number of bits in the quantization of the phase of the quadrature components. Thus, during two-, three-, four-, and five-bit quantization, the phase intensities of parasitic sidebands are reduced by 9, 17, 23, and 29 dB compared to the case of one-bit quantization. At the same time, the power losses due to parasitic components in the restored signal are reduced from 14 to 2; 0.3; 0.1 and 0.02%, respectively. With the reduction of these losses, the accuracy of signal reproduction increases.

Since increasing the quantization levels is not very difficult, it seems reasonable to immediately use multi-bit quantization in order to eliminate the influence of the factor under consideration on the accuracy of signal reproduction. However, the quantization step cannot be chosen arbitrarily. Ultimately, the choice of step is determined by the intensity of noise and the errors of the signal sensor.

Signal recovery in DRFM occurs in the reverse order of storage. The signal reproduced at the operating reference frequency f_c is filtered and sent to the signal-like interference formation device to be endowed with the appropriate types of interference modulation. From the sequence of such copies of the signal of the radio-electronic device, range-leading, speed-leading, re-targeting and other interferences are formed in it. The false Doppler shift is introduced using a digital frequency synthesizer. There are centimeter-range synthesizers with a frequency tuning step of about units of Hertz, which provide suppression of the true frequency by 60... 70 dB and change of the frequency of the radiated interference signal according to any given law within hundreds of kilohertz.

When generating interference by the speed tracking channel in the described DRFM, it is taken into account that the accuracy of its reproduction of the signal

frequency of the radio electronic device being suppressed is about 1 kHz. The inaccuracy of frequency reproduction can be compensated for, for example, by introducing an initial frequency shift of close to 1 kHz of the reconstructed signal in the direction opposite to that chosen for the direction of frequency change.

Note that other DRFMs may have higher accuracy. In one DRFM, for example, operating in the 7...18 GHz frequency band, an accuracy of at least 50 Hz was achieved, however, when receiving a signal with a duration of 1 ms. When memorizing shorter signals, accuracy, of course, decreases. The generated signal-like interference is amplified by the final power amplifier of the corresponding frequency subrange and radiated by the transmitting antenna of the active interference station towards the suppressed radio-electronic device.