Synchronization of antennas-oscillators

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Abstract – **results of research of antennas-oscillators in the mode of synchronization is presented. Three methods of supply of signal of synchronization of antennas-oscillators are considered in the work.**

Keywords – **is synchronization, antenna-oscillator, pattern of direction.**

I. INTRODUCTION

To change property of antennas-oscillators (AO) working frequency under action of external conditions of propagation of radio waves conditioned that antenna, except for the traditional function, simultaneously executes the function of element of the oscillating system of oscillator. Instability of parameters of antenna also is the reason of instability of the AO frequency. It limits the AO application in a precision receiving-transmission apparatus. One of ways of providing of high stability of frequency of the radiated vibrations at the variable terms of radiation is synchronization by the AO external, high-stable on frequency signal, by analogy with synchronization of the microwave oscillators.

II. RESEARCH OF METHODS OF SERVE OF SIGNAL OF SYNCHRONIZATION

As compared to synchronization of ordinary oscillators [1], the AO synchronization is in more wide positions that to introduction of external signal of synchronization to the chart (fig. 1).

At first, signal of synchronization it is possible to give in unradiative part of the oscillating system as in the case of synchronization of ordinary oscillators , secondly - directly in antenna which is the element of this oscillating system, thirdly - due to the interconnection between the AO antenna and auxiliary antenna, that radiates vibrations stable after frequency. During the external synchronization AO it is necessary to provide the upshot between her and synchronizing generator for providing of one-sided synchronization and exception of the phenomenon of the mutual tightening of frequency.

Researches were conducted in a range decimetre of waves. In the mode of free vibrations at tension of feed 12 V AO had the following parameters: frequency of the generation f0 = 2652 MHz, radiated power - 120 mW, output-input ratio 16%, filtration of higher accordions not worst 20 dB, instability of frequency - 10-4 at the change of temperature within the limits of 50° C.

Power of external clock pulse made 10 mW. Measurings of the AO parameters in the synchronous mode were conducted by the analyzer of the spectrum С4-60 and cymometer Ч3-34А with carrying of the frequency Я3Ч-51. The width of band of synchronization was determined after saving of monochromatic spectrum of the radiated signal.

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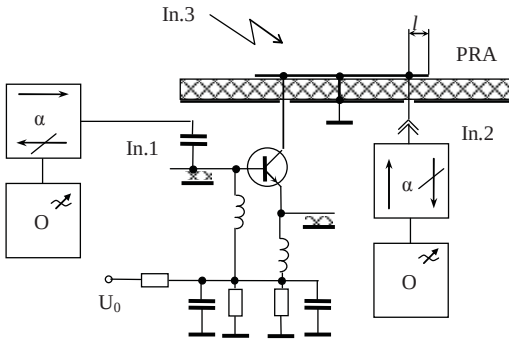

Fig. 1. Methods of serve of signal of synchronization in the AO circles

As a result of researches there are the got following results: the band of synchronization made 0,55% at the unevenness of initial power not more than 15%. Dependence of the radiated power in the band of synchronization from frequency at the serve of signal of synchronization directly in the base of transistor is represented on fig. by a 2 continuous line. The concordance in the circle of the AO synchronization allowed to multiply the band of synchronization to 1%, to multiply the level of the radiated power and decrease its unevenness to 10% (dotted line).

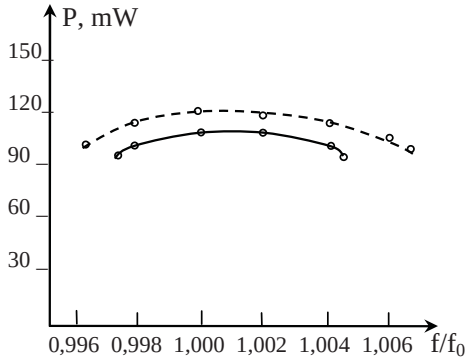

Fig. 2. Dependence of the radiated power in the band of synchronization from frequency at the serve of signal on In.1.

It is set that with the increase of power of signal of synchronization is increased the radiated power of synchronized AO that band of synchronization. Thus there is no insignificant symmetry of band of synchronization in relation to the working frequency AO f_0.

The use of printing resonance antennas (PRA) in AO allows to give the signal of synchronization directly in an emitter (In.2.) At the serve of signal of synchronization directly in the PRA emitter in the distance l=0,126λ from his edge the band

of synchronization made 0,36%, and unevenness of the radiated power in this band - 20% (fig. 3, continuous curve).

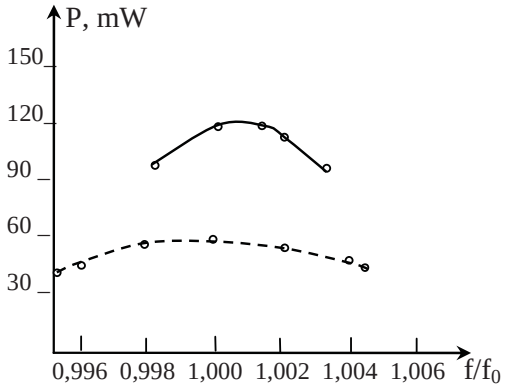

Fig. 3. Dependence of the radiated power in the band of synchronization from frequency at the supply of signal on In.2

The serve of signal of synchronization pithily, that l=0,095λ was in the distance from the edge of rectangular emitter, allows to multiply the band of synchronization to 0,87% (fig. 3, dotted curve). The however here radiated power diminishes almost in two times, that is caused by shunting by the AO circle of source of synchronization.

At the serve of signal of synchronization by auxiliary antenna (In.3) next terms were executed. Identical antennas were used, namely printing resonance antennas. Antennas were located in one plane and had the same level of the radiated power.

At distance between the axes of antenna even the λ/2 band of synchronization made 0,27% and was symmetric in relation to the own frequency AO. Diagram of orientation as dependence of the total radiated power on the corner of supervision it is represented on fig. 4. At frequency of synchronization to even frequency of the free vibrations AO the decline of the radiated power in direction of perpendicular is characteristic, and DP becomes twobeams. It is explained it by synchronization by the AO antiphase signal. On overhead and lower frequency of synchronization the diagram of orientation is one beam, its declination answers a phase change even ±π/2.

At distance between antennas to the even wave-length the width of band of synchronization diminishes to 0,1% due to diminishment of level of signal of synchronization. The proper changes of form of diagram of orientation are represented on fig. 5. Change of diagram of orientation of the explored system of emitters it is caused by the changes of phase correlations of the radiated waves.

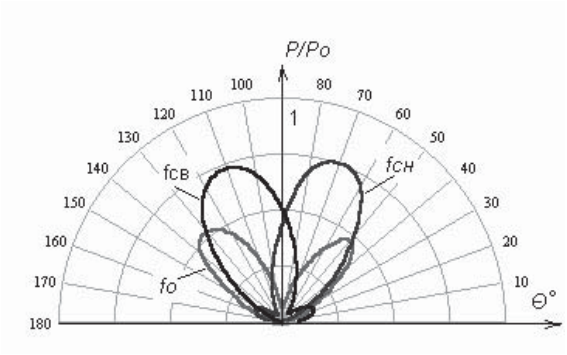

Fig. 4. Dependence of the total radiated power on the corner of supervision is represented at distance between the antennas λ/2

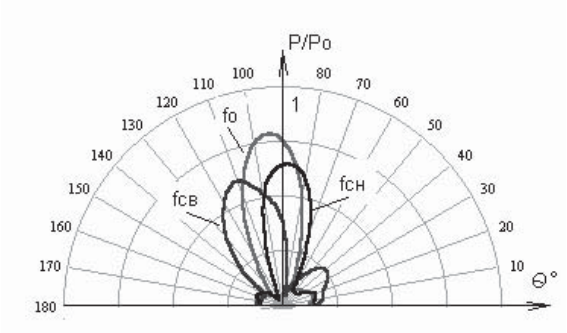

Fig. 5. Dependence of the total radiated power on the corner of supervision is represented at distance between antennas of λ

During mutual synchronization of antennas-oscillators the mode of synphase radiation, as a rule, was absent, that was explained by a different level of the radiated power and different radio frequency sensitiveness of the explored antennas-oscillators.

III. CONCLUSIONS

Research was shown, that at the AO entrance in the synchronous mode and exit from him the spectrum of the radiated signal is similar to the spectrum of the ordinary microwave oscillator. The AO Synchronization on the second accordion is characterized by diminishment of band of synchronization in 1,5 - 2 at the identical levels of powers.

The AO synchronization by auxiliary antenna allows to manage the form of diagram of orientation, that together with mutual synchronization of antennas, can be used for construction of active phased antenna arrays.

REFERENCES

[1] Raditecnical device bazed on synchronous oscillators/ under red. of Fomin N.N. – M.: Radio i svjaz. 1991. – 191c. (rus).