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SYNTHESIS OF TRANSFORMER OF RESISTANCE FOR MATCHING A DECIMETRIC-WAVE ANTENNA TO TRANSMITTER OUTPUT STAGE

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A method is suggested for synthesis of element values of a transformer of resistance made as a band-pass filter. The method permits to minimize deviation of the transformation ratio from the prescribed value in the prescribed band of transformer's operation frequencies. An example of the transformer calculation and of its usage in the power amplifier for the decimetric wave range is included.

In conformity with [1, 2], the optimal load resistance $R_{\text{ld.opt}}$ of a power transistor, consuming the maximal power, is several ohms and can be determined from the relation

$$R_{\text{ld.opt}} = (E_{\text{ss}} - U_{\text{res}})^2 / 2P_{\text{out max}}, \quad (1)$$

where E_{ss} is the recommended voltage of the supply source (reference value taken from handbook) [3]; $P_{\text{out max}}$ is the maximal value of output power given up by the transistor (taken from handbook); $U_{\text{res}} = I_{\text{cr}}U_{\text{sat}}/I_{\text{c.sat}}$ is the residual voltage; I_{cr} is the critical current (taken from handbook); U_{sat} is the collector-emitter saturation voltage (reference value); and $I_{\text{c.sat}}$ is the collector current corresponding to the measured U_{sat} value (reference value).

For a number of transistors, the values I_{cr}, U_{sat}, and $I_{\text{c.sat}}$ are absent in handbooks. In this case we have to take U_{res} = 1–2 V, which is appropriate for the majority of power transistors [3].

The output stages of power amplifiers in transmitters used in radio broadcasting and radio communication systems are loaded by antenna-feeder channels having, as a rule, the standard input resistance 50 or 75 Ω [1].

Traditionally, the transformation of the resistance of antenna-feeder channel into optimal load resistance of a power transistor is performed with the aid of transformers of resistance made as low-pass filters (LPF) (Fig. 1) [1, 4–6]. Such decision is often dictated by the availability of well-elaborated techniques of calculation of these transformers — with the use of tables of components' normalized values [7–9].

Usually such transformers are realized as the fourth-order LPF [1, 4–6]. A disadvantage of these transformers consists in considerable frequency-dependent deviation of their transformation ratio K_{tr} from the prescribed value when we try to raise simultaneously both the ratio and the relative band of operation frequencies $W = f_{\text{up}}/f_{\text{low}}$, where f_{up} and f_{low} are the upper and lower working frequencies of the transformer.

The above drawback can be eliminated if using transformers made as band-pass filters [10, 11], which is achieved by raising their reflection factor outside the band of operation frequencies [12]. In the range of decimetric waves, most appropriate is a transformer built in conformity to the network depicted in Fig. 2 [11]. However, application of such transformers meets some difficulties because of absence of methods of their calculation.

The purpose of the present work is development of the method of synthesis of the transformer of resistance under consideration (Fig. 2). With the use of normalized values of transformer's elements, the method permits to realize it with a

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