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A DISTRIBUTED TYPE ADAPTIVE MATCHING DEVICE FOR DECAMETER RANGE ANTENNAS

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The paper considers an antenna-matching device in the form of a transmission line segment (for the decameter range — a delay line composed of several segments of a low-pass filter). Depending on the phase of the reflection coefficient in a given section, additional capacitors may be connected to or disconnected from the segment.

The antenna-matching device (AMD) reduces the complex input impedance of an antenna system to the active resistance of the feeder (usually — 50 Ω). The main requirements imposed on the matching devices for decameter range antennas are as follows: high accuracy of matching the antenna parameters (a travelling wave ratio (TWR) in the feeder after adjustment no less that 0.75) over the whole operation band of frequencies from 2 to 30 MHz; fast (less than 0.2 s) readjustment from one frequency to another; small weight and overall dimensions.

Among the available types of matching devices, the above specifications can be met by AMD using discrete adjustment components. However, the matching devices of this type are distinguished by a rather complex algorithm of adjustment to signal frequency and require a special control unit. The matching device considered below is free of this disadvantage.

The antenna-matching device of distributed type (AMDDT) consists of a segment of a delay line composed of LPF sections [1, 2], where we can connect additional parallel reactances to this segment or disconnect them from it. Connection of additional reactances is performed by the following algorithm:

— if the voltages in neighboring sections $U(i)$ and $U(i-1)$ differ from each other by less than by some quantity g determined by the inert zone of the comparator, then the capacitance $C(i)$ does not change its value;

— if $U(i) > U(i-1) + g$ then the capacitance $C(i)$ increases by ΔC;

— if $U(i) < U(i-1) - g$ then the capacitance $C(i)$ decreases by ΔC.

This algorithm permits us to obtain the time of matching equal to the time of transmission of the signal over the long line, if the electron switches, modifying the values of capacitors $C(i)$, change their states instantaneously. In our case the time of signal advancement is less than the operating time of the electron switches (relays), so that the time of matching (adjustment) will equal the operating time of all the switches (relays).

Let us turn to a specific example. We have to match a slot antenna to a 50-Ω feeder in the range of frequencies from 2 to 30 MHz with TWR no less than 0.75. The antenna parameters measured are such that at frequencies 2 to 23 MHz its impedance is mainly of inductive nature, but at frequencies 23–30 MHz — mainly of capacitance nature. Note that in the 2–8 MHz band the active part of the antenna impedance is less than 10 Ω.

The preliminary analysis has shown that to overlap the whole operation band of frequencies from 2 to 30 MHz with the aid of a single matching device is hardly expedient, since it will lead to a very large (more than a hundred) number of sections to get an acceptable TWR value. To reduce the number of AMD sections, we have to break the whole frequency

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