Current Density Distribution on the Perimeter of Waveguide Exciter Cylindrical Vibrator Conductor

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Abstract - **On ground of electrodynamic analysis the surface current distribution nonuniformity on the perimeter of waveguide-exciter cylindrical conductor is found. Considerable influence of current distribution nonuniformity on exciter input reactance is established. It is also showed, that the current distribution on the vibrator perimeter, for conductor radius no greater then 0,07 of waveguide cross section breadth, approximately uniform is.**

Keywords – **Vibrator waveguide exciter; waveguide/line junction**

INTRODUCTION

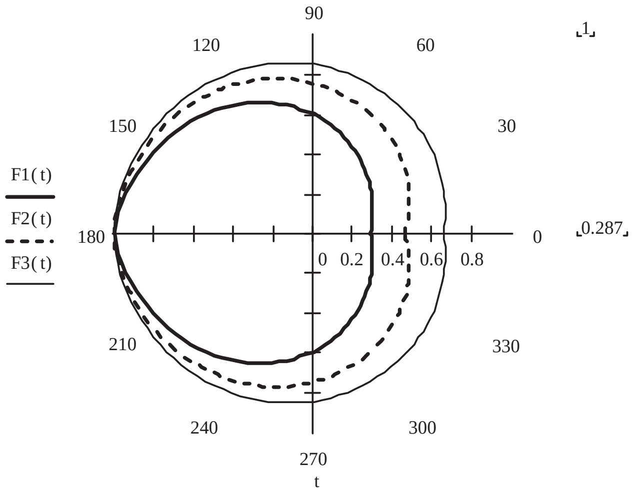
At present day designing of ultra high frequency (UHF)-devices demands the sufficient high calculation accuracy. Therefore in analysis of UHF electrodynamic structures it is necessary to take into account all influence factors. In present work the influence of current density distribution nonuniformity around the vibrator wire in rectangular waveguide is considered. In waveguide exciter analysis it is useful to know the exciter input impedance variations caused by that nonuniformity.

The current density distribution on thin cylindrical vibrator perimeter ($\frac{a}{A} \le 0{,}03$; $a-$ vibrator wire radius; $A-$ width of rectangular waveguide cross section) is practical uniform. The current density nonuniformity manifests itself on vibrators of increased ($0{,}03 \le \frac{a}{A} \le 0{,}07$), and great ($\frac{a}{A} \ge 0{,}07$) conductor diameter.

ANALYSIS RESULT

On the reciprocity theorem basis was the input impedance of cylidrical vibrator in rectangular waveguide calculated. Structure parameter are given in srtandartizired form: $\zeta = B/A = 0.44$, where $B < A$-the waveguide cross section height; $\nu = h/B = 0.7$, where h-vibrator height. The variable parameter are: $q = \lambda_o / 2A$, field wavelength; $e = d/A$-distance of vibrator axis from the narrow waveguide wall; $s = a/A$-vibrator conductor radius. The vibrator structure we think as cylindrical pipe with thin wall.

On the given figure the dependence of relation module, calculated for current density on cylyndrical vibrator perimeter at angle t, and maximum current density value, on the angle t. Showed dependences are for $s = 0.17$ calculated. (Curve $F_1(t)$ is for $e = 0{,}3, q = 0{,}6$, and $F_2(t), F_3(t)$- for $e = 0{,}4; q = 0{,}6;$ $q = 0{,}8$ presented .) Density maximum is to the nearer waveguide narrow wall directed. Such



distribution is in coformity with electricity laws. The nonuniformity is as module of relation for current density maximum to minimum determined. The current distribution nonuniformity is greater at shorter wavelength, at greater vibrator conductor diameter, in the case of little distance from narrow waveguide wall. Nonuniformity of current density distribution remains also at $s < 0.1$.

CONCLUSION

Vibrator waveguide exciter input impedance we consider as relation of feed voltage to average current value around the vibrator. At corresponding calculation are phase variations of current density taken into account. The vibrator input resistance decreases a little at higher current distribution nonuniformity (less then 10%). The essential influence has the current density nonuniformity on the input reactance. For greater current density nonuniformity input reactance is more inductive. Reactance value decreases almost linearly with entlargering of vibrator wire radius.

As fundamental conclusion is necessity the nonuniform current density distribution around vibrator in waveguide in analysis to consider if $s > 0{,}07$. Suppose the uniform current density distribution only, we obtain inaccurate value of vibrator input reactance

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