

Junction Circuit Using NRD Guide / Vertical Strip Line Transformer at 60GHz

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Since the transverse field distribution of the NRD guide is similar to that of the TE₀₁ rectangular hollow metal waveguide, a mode transition between the NRD guide and vertical strip line can be constructed by making the right angle corner in the same manner as the rectangular hollow metal waveguide / coaxial line transition [1]. With this in mind, we developed the new type of right angle corner using the NRD guide / vertical strip line transition as shown in Fig. 1. The dielectric strip of the NRD guide is made by low loss Teflon with the relative permittivity of 2.04, and the cross sectional dimensions are 2.25mm in height and 2.5mm in width. The vertical strips consist of metal strips etched on a glass Teflon substrate having the cross sectional dimensions of 2.25mm in height and 0.256mm in width. The width of the metal strip is decided to be 1.8mm so as to be characterized by the impedance of 50 Ω. This substrate is transversely inserted in the cross-sectional plane of the NRD guide and are supported by the Teflon piece with the length of L, where the metal strips are inserted in the dielectric by the depth of D. In order to optimize the performance, the length L and depth D were decided by using HFSS. The calculated scattering parameters of the right angle corner are shown in Fig. 2. It is obvious that a good performance can be obtained. By using the right angle corners, a new type of junction circuit was fabricated as shown in Fig. 3. Figure 4 shows the calculated and measured scattering parameters. Low loss and well balanced output level, which were measured to be 4dB ± 1dB in the bandwidth of 4GHz around a frequency of 60GHz, can be obtained, though there is slight discrepancy between theory and measurement because the scattering parameters were calculated in loss less condition. Next step of this research is to apply the junction circuit to semiconductor devices.

Reference [1] F. Kuroki and T. Yoneyama, "Junction Circuits Using NRD Guide at Millimeter-Wavelengths", Proceeding of IEICE, Vol.75-C-I, No.1 (1992)

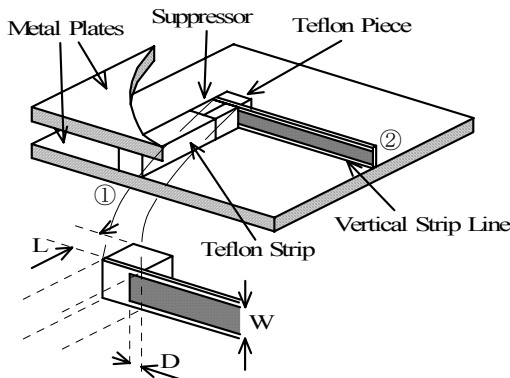


Fig. 1 Structure of right angle corner

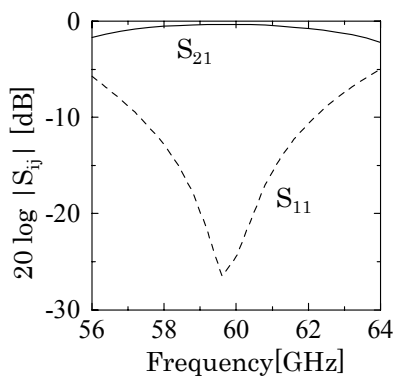


Fig.2 Calculated scattering parameter of right angle corner

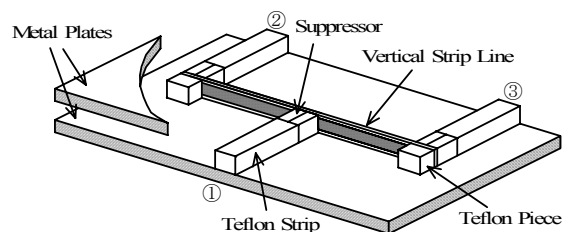


Fig.3 Structure of junction circuit

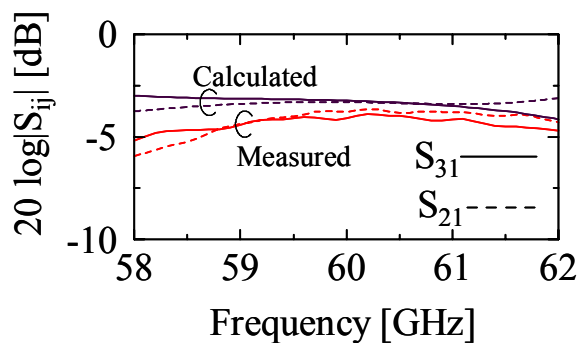


Fig.4 Calculated and measured scattering parameters of junction circuit