Design of Ku-band Circular Waveguide-to-coaxial Adapter

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Abstract— Circular waveguides are widely used in feeding the reflector antenna for satellite communications, because they allow cylindrical symmetry and lower loss than coaxial cables or rectangular waveguides. They have a dominant mode of TE_{11} which supports a dual polarization (two orthogonal modes) allowing transmit and receive signals through a single waveguide. In order to connect the circular waveguides to other circuit components in a coaxial cable, the electromagnetic modes should be converted to that of the coaxial cable.

In this paper, we design a circular waveguide-to-coaxial adapter at Ku-band which transforms the electromagnetic mode between TEM mode of coaxial cable and TE_{11} mode of circular waveguide. The center conductor of the coaxial cable is extended to the hollow circular waveguide from the side as shown in Fig. 1. It functions as a field probe which captures the electromagnetic energy from the circular waveguide and transmit to the coaxial cable. The probe dimensions (probe diameter (d_p), length (l_p), and the distance (l_b) from the backshort) greatly influences the performance of the adapter such as insertion loss, return loss and bandwidth. The backshort distance affects the center frequency of the adapter and is determined very close to a quarter of the guided wavelength in the circular waveguide. The dimensions were carefully determined by using a commercial full 3-D electromagnetic structure simulator. Fig. 2 shows the simulated performance of the designed adapter. The insertion loss was as low as 0.45 dB from 10.7 to 12.75 GHz with return loss better than 12.61 dB.

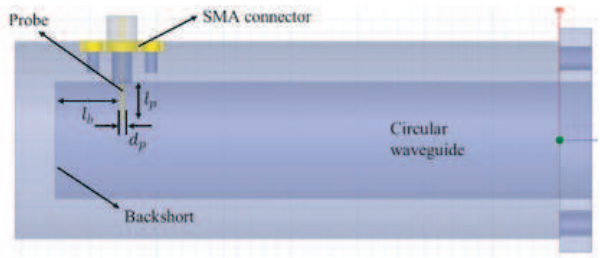

Figure 1: Circular waveguide-to-coaxial adapter.

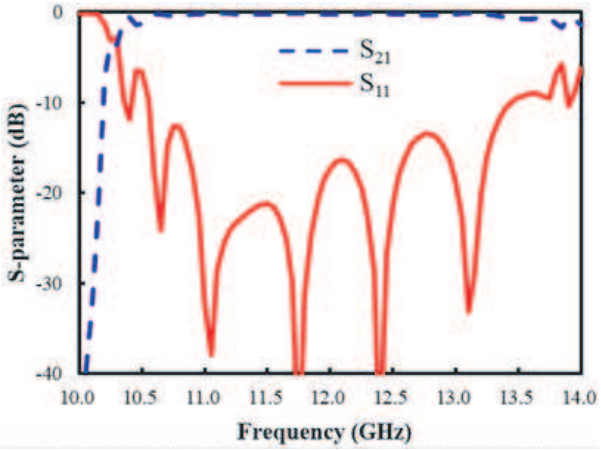

Figure 2: Simulated performance.