A Novel Coaxial Probe Waveguide to Microstrip Transition

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***Abstract*-In this paper, a modified coaxial probe waveguide-to-microstrip transition structure at K-band is proposed. The transition uses two kinds of coaxial probes and has hermetic characteristics. It can also be used in other band, such as Ka-band. The structure is demonstrated for designing the transition. HFSS simulation and measurement results for the transition structure have been compared in terms of $|S_{21}|$. The comparison shows that the measurement agrees well with the simulation result. The measurement has shown 0.5 dB insertion loss.**

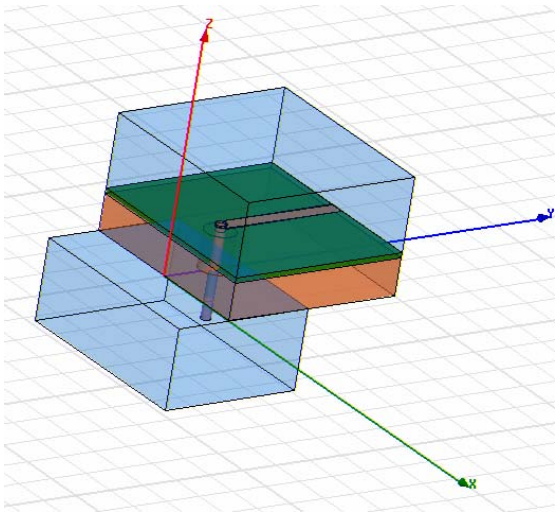
I. INTRODUCTION

It is impossible to construct a microwave circuit or system with a single type of transmission medium. Among various types of transmission media, since rectangular waveguide has low loss characteristic, the waveguide structure has been predominantly used for low loss transmissions as an important transmission medium. And, microstrip line has been also a basic transmission medium for almost all of microwave planar circuits, such as amplifiers, oscillators, power divider/combiners, filters, mixers and so on since it has simple integrating structure. As a result, a direct connection between a rectangular waveguide and a microstrip line, W-M(waveguide-to-microstrip) transition, has been an inevitable structure in microwave circuits.

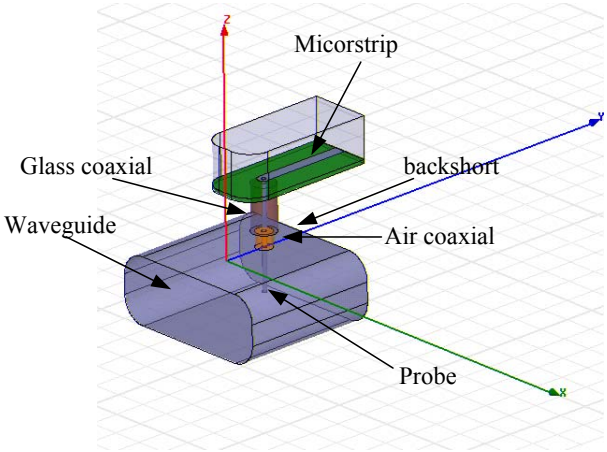
Many W-M transition structures have been carried out for low insertion loss and easy mechanical fabrication. Such as ridge waveguide structure[1][2], antipodal fin line structure[3][4], Microstrip probe type W-M transition[5][6]. Coaxial probe type W-M transitions had been also suggested as an another form of a W-M transition [7]-[9]. A modified coaxial probe type W-M transition is proposed in this paper. It has lower insertion loss than traditional one.

II. TRANSITON STRUCTURE

The traditional coaxial probe W-M transition which has one kind of coaxial is shown in Fig. 1a. The transition proposed in this study has two kinds of coaxial probe, glass and air, as shown in Fig. 1b. The structure is composed of five sections, waveguide, microstrip, coaxial, probe and backshort. The transition has been placed between microstrip and waveguide. The coaxial and probe are perpendicular to microstrip and waveguide. The probe is inserted to the waveguide at the center of waveguide wide side and the length of probe inserted is about 1/2 waveguide height b. The backshort is away from the probe about 1/2 waveguide height b, too. The waveguide has round corners in order to simulate the actual situation.



a. Traditional coaxial W-M transition



b. Modified coaxial W-M transition

Fig. 1 Traditional and modified coaxial probe W-M transition

For this study, WR-42 waveguide and 50Ωmicrostrip line on RT-Duroid 5880($\varepsilon_r = 2.2$, thickness = 0.254 mm)

substrate have been chosen. Characteristic impedance 75Ωhas been used for the air coaxial and 50Ω for the glass coaxial.

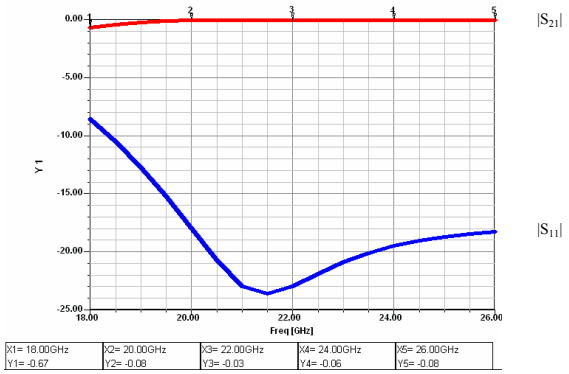
III. Numerical and Experimental Results

The traditional and the novel coaxial W-M transition structures are simulated using HFSS. The numerical simulation results are shown in Fig. 2. The novel structure has lower insertion loss than the traditional one.

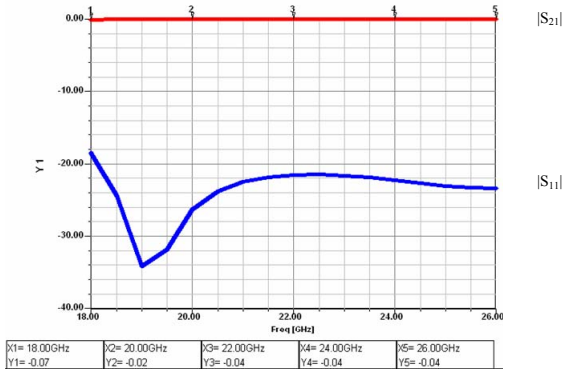
To verify the design, a test structure has been realized and measured. It consists of two proposed coaxial W-M transition to allow the use of waveguide for measurement. The experimental result is shown in Fig.3, Minimum insertion loss of 1 dB was measured (two transitions). A photograph demonstrating the transition fabricated is shown in Fig. 4.

IV. Conclusions

A modified waveguide-to-microstrip transition using two kinds of coaxial probes has been proposed and illustrated in this paper. HFSS simulation and measurement results have been compared. The structure for design has been also demonstrated. The transition is hermetic and easy-manufactured and has broadband performance with low insertion loss.



a.



b.

Fig.2 Simulated results (a. Traditional coaxial W-M transition simulation result, b. Modified coaxial W-M transition simulation result)

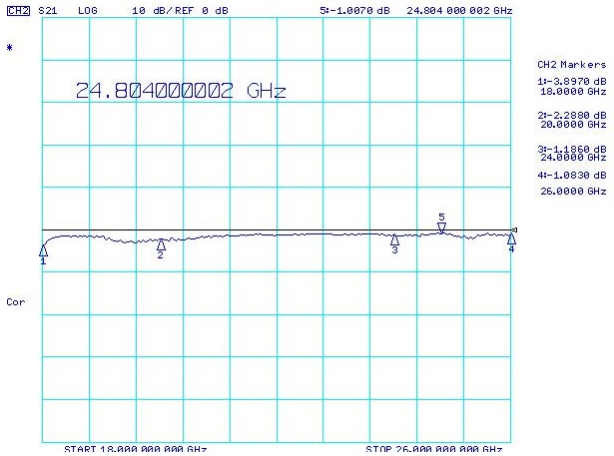


Fig.3 Experimental result of proposed transition

Fig.4 A photograph demonstrating the transition fabricated

ACKNOWLEDGMENT

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