SLOW-WAVE MICROSTRIP MATCHING LINE IN A T-JUNCTION

Nesic, D.
IHTM-CMTM

I INTRODUCTION
- Microstrip planar waveguides are popular and widely used passive components. They play an important role in microwave hybrid integration (MIC). Microstrip, as a planar technology, is also compatible with microelectronic technology and has a future in microwave monolithic integration (MMIC). Passive components at microwave frequencies, especially at lower bands, are still large and occupy a lot of space. One of the main goals for all passive components, including that in the microstrip technology, is miniaturization. Solution for the miniaturization of the microstrip structures can be a variation of the characteristic impedance, $Z_C$, along the microstrip signal line. It forms a photonic bandgap (PBG) structure. Also, terminology “photonic bandgap” can be avoided using more appropriate: electromagnetic stop band (ESB) [1,2]. The new proposed terminology will be more common for microwaves but “PBG” will continue in this presentation.
- PBG structures, as known, exhibit slow-wave characteristics in the pass-band near bandgap [3]. At the same time, the average ratio of the inductance and capacitance should remain relatively constant (usually around 50 $\Omega$) for matching input and output lines (usually 50 $\Omega$ lines). Previous solution for the microstrip periodic structures was etching in the ground plane [4]. The etched ground plane must be far enough from any metal plate, which causes packaging problems. The packaging problems are with space, cooling, and mechanical strength. Also, there is a technological problem with etching of the both sides of the substrate.
- Next solution is to modify only the microstrip line without etching in the ground plane [5]. In ref. [6-7] author have introduced a new type of 1D slow-wave PBG microstrip structures. It has no etching in the ground plane and has a simple modification of the microstrip line. They all exhibit significant slow-wave effect.

II REALIZATION AND MEASUREMENT
- Successful application of only one cell is described in this work. It is a matching line in a T-junction between three 50 $\Omega$ lines. Its lay-out is shown in Fig. 1. Dielectric substrate: $\varepsilon_r=2.1$, thickness $h=0.508$ mm and $\tan\delta=4\cdot10^{-4}$. M-lines, Fig. 1, are 1.6 mm wide 50 $\Omega$ lines. Simulated and measured S-parameters are shown in Fig. 2 and Fig. 3 respectively. Reduction of the length of the $\lambda/4$ matching line is 60% comparing to the conventional $\lambda/4$ line.

IV CONCLUSION
- Slow-wave microstrip line is described in this work. It is a matching line in a T-junction between three 50 $\Omega$ lines. Reduction of the length of the $\lambda/4$ matching line is 60% comparing to the conventional $\lambda/4$ line.
REFERENCES


Acknowledgment: The author is grateful to Mrs Ivana Radnovic, Mrs Milka Marjanovic, Mr Momcilo Tasic and Mrs Milica Rakic for their help in realization of the experimental model. The author is especially grateful to Prof Aleksandar Nescic for help in measuring and discussing the paper. This work was supported by Ministry of Science, Technology and Development of the Republic of Serbia (IT.1.04.0062B).

Abstract: Successful application of slow-wave microstrip line is described in this work. It is a matching line in a T-junction between three 50 Ω lines. Reduction of the length of the λ/4 matching line is 60% comparing to the conventional λ/4 line.

SLOW-WAVE MICROSTRIP MATCHING LINE IN A T-JUNCTION, Nescic. D