Design and characterization of PCB transmission lines for 2.45 GHz.

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Abstract - This work presents the design and measurement of auxiliary elements applied in the characterization of integrated circuits (ICs) at 2.45GHz. Two transmission lines structures are designed and characterized (Coplanar Waveguide and Grounded Coplanar Waveguide) over an FR4 substrate.

I. Introduction

The impact of PCB transmission lines when working at radio-frequencies, particularly in the band of 2.45GHz should be specially considered in the design of systems and ICs test setups. In order to reliably test ICs in this spectrum region it is necessary to correctly design PCB lines This work aims to verify the design of PCB lines for the particular PCB manufacturing process we apply. Coplanar Waveguide(CPW) are chosen due to their advantages respect to microstrips when substrate thickness is not very well controlled as in a cheap PCB fabrication service. Both "ideal" transmission lines and transmission lines with modifications that represent the necessary changes to the line width when connecting to the IC package are tested.

II. Transmission lines design

Two types of waveguides were designed and tested, a coplanar (CPW) and a grounded (CPWG) waveguide, as shown in Fig. 1.a and 1.b, respectively. Moreover, a CPW was narrowed in the center in order to simulate the narrow connections at the chip input and output. In Table I the characteristic of the fabricated "ideal" CPW (CPW1), narrowed CPW (CPW2) and CPWG are given. Fig. 2. shows the layout of the three of them.

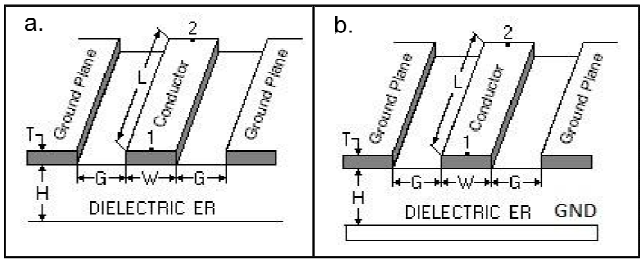

Fig. 1. Coplanar (a) and (b) Grounded Coplanar Waveguides

Table I. Design parameters of the tested lines (CPW: Coplanar, CPWG: Grounded Coplanar)

	H(mm)	G(mm)	W(mm)	L(mm)	T(mm)	Zo(Ohm)
CPW1	1.6	0.22	1.47	38.4	0.036	50
CPW2	1.6	0.22	1.47	38.4	0.036	50
CPWG	1.6	0.20	1.00	38.4	0.036	50

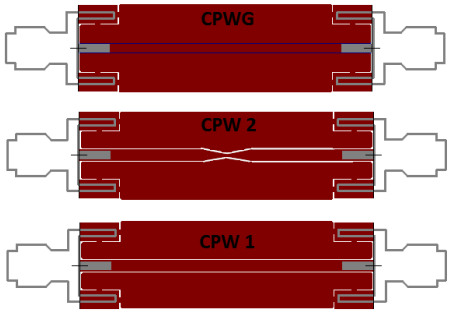

Fig. 2. Layout of the PCB design.

III. Transmission lines measurement results

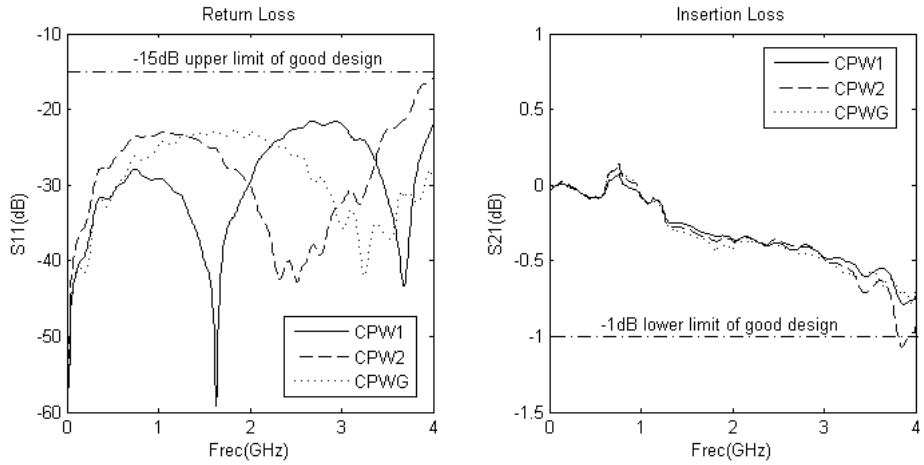

Fig. 3: Return loss and insertion loss measurements of CPW1,CPW2 and CPWG.

Table II. Return loss and insertion loss at 2.45GHz

	RL	IL
CPW 1	-22.7 dB	-0.4 dB
CPW 2	-40.3 dB	-0.4 dB
CPWG	-26.1 dB	-0.4 dB

In Fig. 3 the return loss (RL) and insertion loss (IL) of the three transmission lines are presented. As shown in Table II, at 2.45GHz the RL is lower than -15dB and IL above -1dB (both limits are considered conservative).

IV. Conclusions

It was presented the design and characterization of PCB transmission lines for the 2.45GHz band, showing that the single layer Coplanar Wave structure present good performance, which is tolerant to changes in the substrate thickness and route width at IC connections points.

[1] **Acknowledgements**
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