Single Layer Microstrip Gysel Combiner for High-Power CW Applications

B.Sugumaran(1), O.Silva(1), F.Vega(1),C.Kasmi(1)

(1) Directed Energy Research Center, Technology Innovation Institute, Abu Dhabi, United Arab Emirates
Bharathidasan.Sugumaran@tii.ae , Oliver.Silva@tii.ae , felix.vega@tii.ae , chaouki.kasmi@tii.ae

Abstract—This paper presents the design and simulation of a single layer broadband microstrip Gysel combiner for high-power, continuous-wave applications. The combiner is designed to operate in the 1.4 to 1.8 GHz frequency range, handling a combined output power of 500 Watts CW. The design is limited to a single layer microstrip to avoid complex mechanical fixtures keeping a compact size. Besides, it offers return loss lower than 20 dB and isolation between ports is 20 dB, according to simulation results. This is the first report on a high-power Gysel combiner that uses a planar and single layer microstrip approach.

I. INTRODUCTION

The Gysel power combiner [1] is often used for power applications due to its superior power handling capabilities and good thermal performance, when compared to Wilkinson power combiners [2]. Unlike the later, where the resistor is embedded into the network resulting in poor thermal dissipation, the Gysel uses two isolation resistors connected to the ground improving the thermal dissipation. The isolation resistors can be high power terminations, improving the suitability for high-power applications.

The general configuration of the 2:1 Gysel power combiner proposed in this paper is shown in Figure 1. The impedances and the length of the lines are calculated according to [2]. The combiner will be built on the RT6035HTC substrate, to take advantage of the high thermal conductivity and dissipation efficiency. The corresponding impedances for each line and its associated electrical length are described in the Figure 1.

II. SIMULATION RESULTS

The circuit was simulated in Keysight Advanced Design System (ADS). The results are shown in Figure 2. It can be seen that the isolation is better than 20 dB and the insertion losses are better than 0.3 dB in the band of operation, 1.4 - 1.8 GHz. It can also be seen that the S11 is less than -20 dB.

The expected resulted combined power, when applying 250 Watts to each input is 468 Watts. The efficiency of the combiner reaches 93.6%, with only 32W losses due to insertion and heating.

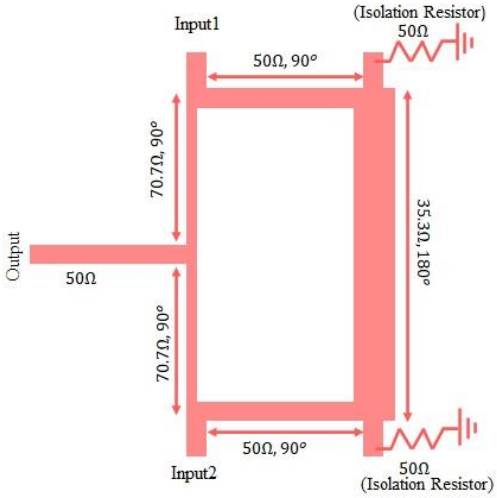

Figure 1: Architecture of 2 to 1 Gysel Power Combiner for port impedance of 50 ohms.

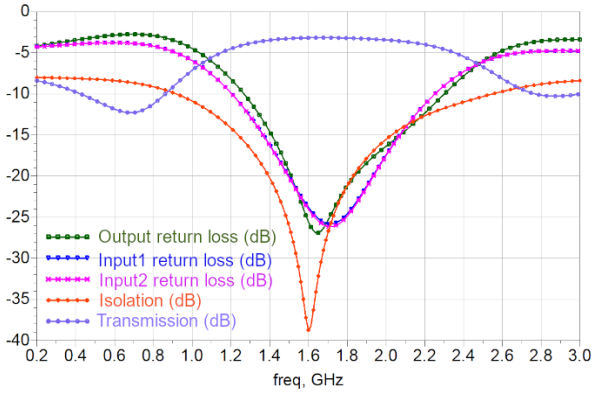

Figure 2 : Simulated result of Gysel Power Combiner.

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