Design of Novel Wideband Reflective Phase Shifters with Wide Range of Phase Applications

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Abstract: This paper presents wideband compact differential reflective phase shifter based on the double layer slot-coupled coupler configuration. This novel phase shifter arrangement consists of a 3-dB hybrid coupler with the coupled and transmission ports terminated with rectangular and elliptically shaped microstrip loads. By altering the ports termination of the coupler, phase shifters propose differential phase ranging from -90° to +90° over 1.3-5.9 GHz frequency band. To achieve different range of phase performance, the proper reactance is calculated at the outputs of coupler. These reactances are transformed to the elliptical or rectangular-shaped microstrip load with various dimensions for every phase shifter. The calculation and simulations results show that the developed circuits could provide ±30°, ±60°, ±45° and ±90° differential phase shifts. For verification of this wideband phase shifter design method, two phase shifter example with rectangular and elliptical load termination is fabricated and measured. The measured return loss of the phase shifter with elliptically load is better than 10 dB over 1.3-5.9 GHz frequency band as well as insertion loss is less than 1dB. The phase shift deviation is less than 2.1°. The results demonstrate that the proposed phase shifters are well suited for use in GPS/LTE/WiMax/WLAN frequency bands.

Keywords: Coupler, differential reflective phase shifter, multi-layer configuration, slot coupled, wideband

1. INTRODUCTION

Differential phase shifters are widely used components in many microwave instrumentation and systems such as phased array antennas, measurement systems, balanced amplifiers, mixers and monopulse networks. These four-port passive microwave devices provide a constant phase difference between the signals at their output ports over the band of interest. The most famous differential phase shifter is
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