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Tunable Characteristics of Ferrite Composite Right/left Handed Coplanar Waveguide Coupled Line Coupler – Measurement and Experimental Verification

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This paper presents the experimental verification of the tunable characteristics of a ferrite composite right/left handed coupled line coupler. The coupler is designed using two coupled CRLH-CRLH transmission lines. The coupler is designed to demonstrate equal through and backward coupling. The novel coupler has been designed and realized in coplanar waveguide configuration on a ferrite substrate. The tunable characteristics are achieved by changing the applied DC magnetic bias to the ferrite substrate. The measurement results reveal that the coupler's fractional bandwidth can be tuned from 29% to 69% by varying the applied DC magnetic bias from 1000 Oe to 1750 Oe. Within the tunable bandwidth, the maximum backward coupling is -5 dB. The coupler has high forward coupling isolation, close to -30 dB at its centre operating frequency. In addition to its tuning capability, the coupler has the advantages of its compact size; it has the length of 11.5 mm and not-so-tight line separations of 2.5 mm. Furthermore the coupler only requires low DC magnetic bias.

Keywords: Ferrite circuits, left handed media, metamaterials. coupled line couplers

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I. Introduction:

In the past decade, artificial composite right/left handed transmission lines (CRLH) or negative refractive index (NRI) transmission lines have been proven to have unique novel properties. These lines have negative effective index of refraction that supports backward wave with slow wave propagation [1]-[3]. These lines are considered the planar version of artificial engineered media that commonly referred as metamaterial. Hence, these lines have been employed to design radio frequency microwave components and antennas. This includes compact / multiband / wideband impedance transformers [4], balun [5], power splitters [6],