Incorporation of CSRRs for Bandwidth Enhancement of SIW Bandpass Filter

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Abstract—The development of 5G telecommunication technology requires large bandwidth to be able to transfer or receive data. The larger the filter bandwidth, the more data transmission will be processed. To obtain a wide bandwidth filter, some methods can be involved in the design, for example using defected ground structure (DGS), slot, and others. The methods also available for the filter design developed based on substrate integrated waveguide (SIW) structure. In this paper, the incorporation of complimentary split ring resonator (CSRR) is proposed for enhancing bandwidth of SIW bandpass filter. The proposed filter which is designed and deployed on a 1.524 mm thick 4003C Duroid dielectric substrate is intended to operate at the center frequency of 3.5 GHz. In order to attain the filter with a wide bandwidth response, an array of 14 CSRRs is incorporated on the SIW surface and arranged in a certain configuration to improve the mutual coupling. The incorporation of CSRR also utilizes to improve the filter performance in gaining the return loss value. Based on the optimum design result, the proposed configuration of SIW bandpass filter with CSRR incorporation is then fabricated and experimentally characterized. The measurement result shows that the realized SIW bandpass filter works at the center frequency of 3.38 GHz with the bandwidth of 1.24 GHz, or the fractional bandwidth of 36.7%. This bandwidth achievement is wider than the one without CSRR incorporation which has the bandwidth of 0.48 GHz at the center frequency of 4.29 GHz, or the fractional bandwidth of 11.2%. In addition, the incorporation of CSRR can improve the value of return loss more than 6 dB at its passband frequency range.