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5G Coupler Design for Intelligent Transportation System (ITS) Application

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ABSTRACT

Aiming to achieve 3-dB coupling, operating in fifth generation (5G) technologies, this paper introduces a new design of tight coupling coupler that will be operated in 5G technologies. Two stubs and two slots have been implemented into the 3-dB coupler design in order to achieve impedance matching between the ports and to give better coupling performances, respectively. Moreover, a study on the stubs' and slots' effects towards the S_{31} of the 3-dB coupler has also been presented in this paper. The proposed coupler is designed on Rogers RO4003C substrate. The simulation results and the analytical study on the stubs and slots implementation show that both stubs and slots affect the performance of the coupling coefficient.

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1. INTRODUCTION

Recently, fifth generation (5G) mobile technology has been introduced, which expected to be deployed in year 2020 [1]. As it is still considered as a new technology, few encounters need to be attended in order to change from fourth generation (4G) technology to 5G [2-3]. These include the security for the system, limitation in the frequency spectrum resources, the choice among various wireless system, network infrastructure and QoS support, jamming and spoofing and last but not least, the multi-mode user terminals [4-5]. Few advantages of having 5G technologies in our lives such as this technology will provide better coverage, higher speed and enhanced spectral efficiency. In addition to the challenges mentioned above, limited resources and also lack of new designs have been noted in 5G technologies. This includes antenna and passive devices.

One of the most suitable applications for 5G technology is Intelligent Transportation System (ITS). However, due to 5G short-range, limited space can be covered during the transmission of the data. One way to overcome the problem is by using beam-forming system where by implementing beamforming system into 5G technology the range can be widen. One of the mostly used beamforming system is Butler Matrix [6]. Basically, Butler Matrix is an N×N network, where the N indicates the inputs and outputs of the network. By using Butler Matrix, it will be easy to produce various beams in different directions. Henceforth, those beams