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Bandwidth Enhancement of 5G Parallel Coupled Line Band Pass Filter Using Patterned Ground Structure Technique

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Abstract: This paper presents the design of parallel coupled line band pass filter with 10 GHz operating frequency that will be used in 5G applications. As 5G application requires big data usage and to cater the applications, the bandwidth of 5G devices need to be wider enough to support it. Thus, to improve the bandwidth performance of the designed filter, patterned ground structure (PGS) technique is implemented into it. The result shows that the bandwidth of the designed filter has been improved from 0.25 GHz to 4.98 GHz when PGS is implemented.

Keywords: 5G application, Band Pass Filter, Bandwidth Enhancement, Parallel-Coupled, Patterned Ground Structure

1. Introduction

5th generation technology or known as 5G technology is a more advanced and powerful mobile technology that can support users with higher bandwidth and less significantly transmission delays. 5G network is expected to be launched in three to four years from now where the technology will meet revolution in enabling a host of new applications including humanoid robots, connected cars, and the Internet of Things (IoT) with its billions of devices laden with some embedded sensors [1]. The latest innovation of mobile data technology, the 5G will be as much as 1000 times faster than 4G technology with speeds of up to 100 gigabits per second [2].

The major facilitator for the ubiquity of smartphones is wireless communication system. To enable a future digital world that will transform a variety of economic sector, the overall 5G vision is going far beyond the evolution of mobile broadband. 5G as the modern wireless communication systems that are intended to provide the user with multiple services at ultrahigh data rates in a fully dynamic radio-access scenario [3]. IoT, self-driving cars with vehicle-to-vehicle and vehicle-to-everything connectivity are advancements in these systems which are playing a prominent role in realizing the vision.

The major breakthroughs such as long-term evolution and mm-wave standards are driven by these technologies in realms of electronics and packaging for multiband multi-standard communications. 5G wireless systems will use mm-wave frequency bands, 28 GHz U.S. (24.5-29.5 GHz) and 39 GHz EU (37.0-43.5 GHz), to provide fast data rates of 100 Mb/s to the end users in metropolitan areas [4]. However, as 5G is still under research state, thus there are still no specific operating frequency that is used for this technology. Based on findings, most of the 5G devices currently operated at 10 GHz, 15 GHz and 28 GHz [5-6]. Also, a 5G devices are considered under an operating frequency of 6 GHz and above.

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