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Integrated Open Loop Resonator Filter Designed with Notch Patch Antenna for Microwave Applications

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Abstract

This paper presented the design of integrated open loop resonator bandpass filter with notch type antenna for the use in microwave applications. Chebyshev type filter is selected as the filter characteristics and cascaded design with the antenna to produce a single module, Integrated Filter Antenna (IFA). Special feature of the antenna is the implementation of notch on the patch antenna to improve the efficiency. IFA is then simulated in electromagnetic simulation tool, Agilent Advance Design System (ADS) version 2016 and measured using R&S Vector Network Analyzer. It shows that the proposed IFA produced good measured return loss >-30dB with both vertical and horizontal gain of 9.11dBi and 8.01dBi respectively.

Keywords*: integrated antenna, notch patch, return loss, gain*

1. Introduction

Antenna and filter are the two irreplaceable passive components in RF/microwave front end [1]. They are always treated as an individual research and mostly connected via transmission lines which might increase loss and circuit area. Integrating both antenna and filter into a single subsystem would solve the current problem involving, impedance mismatch, reducing both loss and the size thus enhancing overall performance of the system. Dealing with the impedance mismatches is one of the crucial concerns that all the designers should take seriously in designing integrated filter-antenna due to separate interconnection between them that will contribute to extra impedance transformation needed [2].

Recent research shows that different researchers introduced different design and method on integrating filter and antenna. For example, the co-design approach is being presented in to achieve miniaturization, low cost and also providing high selectivity of signal in their proposed design [2]. Not only that, the cascaded approach or known as traditional method also still being used in integrating filter-antenna [3]. Thus, this paper briefly discuss the proposed design of integrated filter antenna (IFA) with the combination of open loop resonator bandpass filter and notch patch antenna, fabricated on 1.6μm FR4 substrate for microwave applications.

2. The Design of Integrated Filter Antenna

2.1 The Filter

Open loop resonator bandpass filter (OLRF) is used as the filter for the proposed design with the method of filter synthesis [4]. In this project, the OLRF with Chebyshev's characteristic is proposed because this type of filter form a smaller transition region than the same order of the Butterworth filter which is at the expenses of the ripples in its pass band and very efficient to minimize the height of the maximum ripple thus allows some ripple in the pass band and stop band, thus, stepper cut-off frequency will be realized. OLR is one examples of the compact and miniature filter. It is composed of a microstrip line that having both end loaded with folded open stubs. Folded arms of open stub is generally not only for increasing the loading capacitance to

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