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التوثيق الالكتروني والميكروفيلم

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قسم

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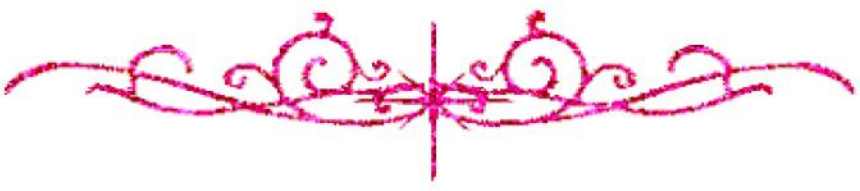
بعض الوثائق الأصلية تالفة



AIN SHAMS UNIVERSITY

FACULTY OF ENGINEERING

Electronics and Communications Engineering Department

Design and Analysis of Microwave Power Dividers/Combiners

A Thesis

Submitted in partial fulfillment of the requirements of the degree of

Master of Science in Electrical Engineering

Submitted by

Abd-El Rahman Mohamed Ali Hassan El-Akhdar

B.Sc. of Electrical Engineering

Military Technical College, 2003

Supervisors

Prof. / Hadia Mohamed El-Hennawy

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STATEMENT

This dissertation is submitted to Ain Shams University for the degree of Master of Science in Electrical Engineering (Electronics and Communications Engineering).

The work included in this thesis was carried out by the author at the Electronics and Communications Engineering Department, Faculty of Engineering, Ain Shams University, Cairo, Egypt.

No part of this thesis was submitted for a degree or a qualification at any other university or institution.

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Curriculum Vitae

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List of submitted publications:

[1] A. M. El-Akhdar, A. M. El-Tager, and H. M. El-Hennawy, "**A Novel Design of Quad-Band Equal Power Divider for 3G and 4G Applications**," Submitted to IEEE-EuMW2012, European Microwave conference, Amsterdam RAI, The Netherlands, October 28 – November 2, 2012.

[2] A. M. El-Akhdar, A. M. El-Tager, and H. M. El-Hennawy, "**Analysis of Coupled Microstrip Lines for Quad-Band Equal Power Dividers/Combiners**," Submitted to Journal of Progress In Electromagnetics Research (PIER), 2012.

ABSTRACT

Abd-El Rahman Mohamed Ali El-Akhdar, "Design and analysis of microwave power dividers/combiners" Master of Science dissertation, Ain Shams University, 2012

Key words: Power dividers/combiners, Coupled lines, Multi-band, Microstrip technology.

Most of recent systems require power dividers/combiners that have compact size, low profile and high efficiency as well as capability to be embedded in integrated circuits. Recently, the rapid progress in modern communication systems requires multi-band transceivers as a demand of integrating more than one standard communication system into a single system. Therefore, multi-band microwave power dividers/combiners play an important role in modern communication systems such as Global System for Mobile Communications (GSM), Universal Mobile Telecommunication Systems (UMTS) Bluetooth, IEEE 802.11 Wireless Local Area Networks (WLAN), and IEEE 802.16 Worldwide Interoperability for Microwave Access (WiMax) systems. As a result, the main purpose of this thesis is to study, develop and implement a quad-band power divider/combiner with small size, simple planar structure, and well organized design methodology. Another objective is to propose novel ideas as well as design guidelines to overcome related constraints and challenges.

Based on the conducted literature survey, conventional quad-band techniques which use four cascaded sections of transmission line

transformers are studied. Hence, this thesis proposes quad-band equal power divider/combiner based on coupled microstrip lines. The novel presented technique depends on the replacement of each single band transmission line transformer used in dual-band Wilkinson power divider based on Monzon's technique by its equivalent dual-band transformer based on coupled microstrip lines. The proposed design doesn't need an optimization method, is applicable to higher frequencies according to the usage of only two isolation resistors with reduced values; instead of four larger resistors, and is recording about 20% size reduction compared to conventional quad-band techniques which use four cascaded sections of transmission line transformers. On the other hand, it presents a detailed study of the dual-band transformer based on coupled microstrip lines to obtain a closed form expression for the design parameters and develop design guidelines as well as clear methodology showing design limitations.

The proposed design method is verified through a fabricated prototype of a quad-band equal power divider operates at frequencies of 2.1 GHz, 2.5 GHz, 3.5 GHz, and 3.8 GHz. The operating frequencies are applicable for 3G and 4G applications such as; WiMax and UMTS receivers. The final design is implemented on low loss Teflon substrate (RT/Duroid 6010) with dielectric constant of 10.5 and height 1.25 mm. The design is simulated using Advanced Design System (ADS) from Agilent. The proposed design provides a compact area of 55 x 30 mm^2. The measured input return loss is better than (11 dB) at the four operating frequencies. The measured insertion loss is better than (0.6 dB). The measured isolation is better than (15 dB) at the four operating frequencies. Very good agreement between measured and simulated results is achieved, which verifies the novel design idea as well as the proposed design methodology.

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