IMPROVEMENT OF TECHNIQUE TO CONVERT CHEBYSHEV, BUTTERWORTH AND COMPOSITE LOW PASS FILTER INTO MICROSTRIP CIRCUIT

by

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A thesis submitted in fulfillment of the requirements for the degree of Master of Science (Microelectronic Engineering)

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UNIVERSITI MALAYSIA PERLIS

(2014)

UNIVERSITI MALAYSIA PERLIS

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Academic Session : 2013/2014

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ACKNOWLEDGEMENT

First of all, I thank God that He has given me the strength and wisdom to complete this Msc thesis. It is by His blessing and providence that I am able to solve the obstacles along the way and finish the research and thesis.

I would like to express my deepest gratitude to my supervisor Professor Dr. Syed Idris Syed Hassan for his supervision over this work. His encouragement and guidance have always helps me to grow in knowledge and passion for my study. Not forgetting my co-supervisor, Associate Professor Dr. Mohd Fareq Abd. Malek and Associate Professor Dr. Yufridin Wahab for their inputs and assistance in helping me to complete this thesis.

I would like to take this opportunity to express my appreciation to the Dean of School of Microelectronic Engineering, Dr. Rizalafande Bin Che Ismail for his support in this study. I also want to thank Mr. Mazlee Mazalan, Mr. Mohd Ghauth Sazali and Mr. Nasir for their kindness and assistance throughout the laboratory work of this research. I would also like to express my gratitude to the rest of the academic staffs and technical staff in School of Microelectronic Engineering who in one way or another had contributed and assisted in this project.

My sincere thanks go to my friends and colleagues who are Wee Fwen Hoon, Liyana Zahid and Lee Yeng Seng for their accompanies, support and constructive discussions that aided me throughout the research. I would like to highly appreciate the Malaysian Ministry of Higher Education for providing the Fundamental Research Grant Scheme (FRGS) for their financial support. Many thanks must go to Universiti Malaysia Perlis (UniMAP) for the academic support.

Last but not least, I would like to thank my family members for their unfailing love and moral supports. They have never ceased to encourage me and motivate me all the time.

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LIST OF ABBREVIATIONS

ADS	Advanced Design System
BiT	Bismuth Titanate
BST	Barium Strontium Titanate
CBCPW	Conductor Backed Coplanar Waveguide
CPW	Coplanar Waveguide
CST-MW	Computer Simulation Technology Microwave
DC	Direct Current
Dk	Dielectric Constant
DGS	Defected Ground Structure
EM	Electromagnetic
HFSS	High Frequency Structural Simulator
HPF	High-Pass Filter
I/O	Input/Output
LPF	Low Pass Filter
MEMS	Micro-electro Mechanical System
MMIC	Monolithic Microwave Integrated Circuits
MoM	Method of Moment
PCB	Printed Circuit Board
PNA-X	Microwave Network Analyzer
PTH	Plated-Through-Holes
RF	Radio Frequency

RLF	Return Loss Filters
RX	Receiver
SM	Space Mapping
SMA	Sub-Miniature version A
SST	Silk Screen Top
TCDk	Thermal Coefficient of Dielectric Constant
TE	Electric component in transverse mode
TX	Transmitter
UHF	Ultra High Frequency
UV	Ultra Violet
VSWR	Voltage Standing Wave Ratio
WiFi	Wireless Fidelity
WiMAX	Worldwide Interoperability for Microwave Access
WLAN	Wireless Local Area Networking

LIST OF SYMBOLS

c	Speed of light
C	Capacitor
C_i	The final capacitor value
C_{fL}	Fringing capacitance
3D	Three dimension
d	microstrip substrate thickness
d_c	Length of microstrip capacitance
d_L	Length of microstrip inductance
f_c	Center frequency
ε_r	Relative dielectric constants
ε_e	Effective dielectric constant
g_n	Normalized value
h	Height of dielectric substrate
L	Inductor
L_i	The final inductor value
L_{As}	Minimum stopband attenuation
L_{AR}	Equal ripple Chebyshev response
L_{fc}	Fringing inductance
m	Matching
n	Number of order
Q	Quality

Qe	External quality factor
S	Space
δ	Loss tangent
S_{in}	Input port
S_{out}	Output port
S_{11}	Return loss (VSWR)
S_{12}	Insertion loss
S_{21}	Gain
S_{22}	Output VSWR
t	Conductive strip thickness
Ω_s	Matching Ohm
Ω	Ohm
Ω_c	Normalized Frequency
λ	Guided wavelength
λ_d	Wavelength of operating frequency in dielectric
λ_0	Free space wavelength of the resonant frequency
ω_c	Cutoff frequency (2πf)
ω_0	Radian frequency at free space
W	Conductor Width
ω_α	Infinite attenuation frequency
ω_{op}	Sharp cutoff frequency point
Z	Impedance
Z_{iT},	Internal image impendance

Z_o	Characteristic impedance
Z_{oC}	Lowest line impedance
Z_{oL}	Highest line impedance
Z_{max}	Maximum impedance
Z_{min}	Minimum Impedance
θ_c,	Electrical length

MENAMBAHBAIK TEKNIK PENUKARAN PENAPIS LULUS RENDAH CHEBYSHEV, BUTTERWORTH DAN KOMPOSIT KE LITAR MIKROSTRIP

ABSTRAK

Tujuan tesis ini ialah untuk membentangkan teknik penambahbaikkan penukaran litar penapis lulus rendah elemen tergumpal Chebyshev, Butterworth dan Komposit kepada litar mikrostrip yang beroperasi pada jalur Frekuensi Ultra-tinggi UHF (2.5 GHz) untuk sistem komunikasi tanpa wayar. Satu teknik penambahbaikkan mengubah litar elemen tergumpal ke dalam bentuk talian mikrostrip untuk semua tertib tinggi penapis lulus rendah Chebyshev, Butterworth dan Komposit telah diperkenalkan. Penapis laluan rendah Butterworth dan Chebyshev tertib tinggi telah direka pada riak lulus jalur 0.01 dB dan tertib n= 3, 4, 5, 6, 7, 8 dan 9 serta dilaksanakan pada papan cetak FR4. Litar telah disimulasikan dan dibangunkan dengan menggunakan Advanced Design System (ADS) tanpa menggunakan teknik pengoptimuman supaya dapat mengekalkan ciri sambutan sebenar. Penapis kemudiannya ditukarkan ke dalam talian mikrostrip menggunakan teknik pampasan pinggiran. Faktor pampasan pinggiran telah diambilkira disebabkan wujudnya pengaruh mikrojalur dan pemuat mikrojalur di pinggiran. Keputusan analisis daripada litar elemen tergumpal dibandingkan dengan teknik yang dicadangkan untuk mengubah litar elemen tergumpal ke dalam talian mikrostrip. Dari keputusan simulasi ADS menunjukkan bahawa sambutan litar mikrostrip talian bagi semua jenis penapis lulus rendah dengan faktor pampasan pinggiran mempunyai persamaan atau persetujuan yang baik dengan litar tergumpalnya. Secara keseluruhannya, keputusan simulasi telah mencapai persetujuan yang sangat baik dengan keputusan ukuran bagi semua ketiga-tiga jenis penapis lulus rendah mikrostrip. Ini menunjukkan bahawa teknik yang dicadangkan mencapai persetujuan yang agak baik dengan yang direka bentuk. Dengan kata lain, teknik ini mampu untuk menyelesaikan reka bentuk tertib tinggi penapis lulus rendah Butterworth, Chebyshev dan Komposit ke dalam litar talian mikrostrip. Kehilangan balikan (S_{11}) yang mewakili ketidak padanan telah mencapai nilai melebihi 20 dB. Keputusan juga telah menunjukkan bahawa kehilangan sisipan adalah kurang daripada 1 dB, ini bermakna kira-kira 80% daripada isyarat yang dihantar diterima oleh beban. Prestasi sambutan frekuensi di jalur henti (S_{21} pada $2fc$) telah mencapai melebihi daripada 40 dB. Prestasi keluaran semakin bertambah baik apabila bilangan tertib dinaikkan, dan lebih banyak frekuensi yang tidak diingini boleh dihapuskan.