

## TEMPLATE PENYEDIAAN MANUSKRIP

#### [CONTOH HALAMAN PRELIM/AWALAN UNTUK MANUSKRIP]

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**DEDIKASI/*DEDICATION***

*(Jika ada)*

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*(Jika ada)*

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**KATA PENGANTAR/*FORWARD***

*(Jika ada)*

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**PRAKATA/*PREFACE***

(*Perlu ada*)

Bahagian ini menjelaskan tentang latar belakang proses penulisan buku objektif permasalahan dan ruang lingkup yang diberi tumpuan oleh buku ini. Penulis boleh membuat ucapan dan memberi *highlight* kandungan utama. Seorang penulis yang baik mampu menghasilkan artikel yang menarik hasil ulasan bab-bab yang diulaskan.

**PENGENALAN/PENDAHULUAN/*INTRODUCTION***

(*Perlu ada*)

Bahagian ini mentakrifkan judul dan bidang buku tersebut, serta mengikat semua bab yang dihimpunkan.

## TEMPLATE PENYEDIAAN MANUSKRIP

#### [CONTOH HALAMAN JUDUL UNTUK MANUSKRIP]

(JUDUL MANUSKRIP - Saiz Rupa Taip 28 point)

**POWER AMPLIFIER FOR 5G TECHNOLOGY**

# Designs and Implementations

Ahmad Fariz Hasan Sohiful Anuar Zainol Murad

Penerbit Universiti Malaysia Perlis KANGAR ● 2023

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  3. Design Challenging
  4. Device Technology

**CHAPTER 2 POWER AMPLIFIER**

* 1. Basic Parameter
     1. Gain
     2. Efficiency
     3. Linearity
  2. Class E Power Amplifier
  3. CMOS Technology
  4. Substrate Bias Effect

#### [CONTOH PRAKATA/PREFACE]

**PREFACE**

*Power Amplifier for 5G Technology: Designs and Implementations* focus on the 5G technology, fundamental knowledge of power amplifier, 5G power amplifier design, design example of low-band 3.5 GHz power amplifier and high-band 28 GHz power amplifier. This book introduces 5G technology with Radio Frequency (RF) system architecture and frequency spectrum. The design challenging and device technology are also discussed. The background of power amplifier focuses on basic parameters, class E power amplifier, CMOS technology and substrate bias effect which put the reader in good pace to be able to understander more advanced in power amplifier design. In addition, this book highlights the specific 5G power amplifier design covers design procedure, specification, transistor size, load impedance, biasing and stability. Read this book to learn more about the design techniques for realizing power amplifiers for 5G application at low-band 3.5 GHz and high-band 28 GHz. The authors discuses design technique, layout and simulation results including comparison with existing state of the art power amplifier designs. This book is a comprehensive reference to student as well as practicing professional in academia and industry working in Radio-Frequency Integrated Circuit (RFIC) design especially RF power amplifier. We sincerely hope you enjoy this book as much as we enjoyed putting it together.

*Ahmad Fariz Hasan*

*Sohiful Anuar Zainol Murad*

#### [CONTOH PENGENALAN/INTRODUCTION]

#### INTRODUCTION

This book has significant value to all level of students both undergraduates as well as, postgraduate students, researchers, and engineers in the field of Radio-Frequency Integrated Circuit (RFIC) design. This book provides comprehensive understanding state-of-the-art for RF design specifically Radio Frequency (RF) power amplifier design. It covers overview of 5G technology, fundamental of power amplifier, design implementation of 5G power amplifier, schematic design, layout and simulation results with an in-depth illustrative discussions and up-to-date references. It is useful as a reference and essential book for high-frequency circuit designers in both academia and industry.

The first chapter of this book covers introduction of 5G technology, RF system architecture for RF front-end design, 5G frequency spectrum in Malaysia and worldwide. It also presents the design challenging such as parasitic effect, transistor size, gate oxide and device technology. In the second chapter, it highlights the overview of power amplifier in general and basic parameters including gain, efficiency and linearity. In addition, basic theory of class E power amplifier followed by CMOS technology and substrate bias effect are discussed. Chapter three focus on addressing design procedure and specification of 5G power amplifier design. It also highlights the sizing of transistor, optimum load impedance, biasing and stability and finally reverse body bias technique.

The last two chapters details design example of power amplifier for 5G technology. In chapter four, a 3.5 GHz class E power amplifier is presented with design schematic and layout. Further, the simulation results are also discussed including comparison with existing state of the art power amplifier designs. Finally, chapter five focus on designing high-band 28 GHz power amplifier design. The cascaded amplification architecture is discussed with theoretical analysis. The authors also cover design implementation and layout with simulation results. Subsequently, the comparison with existing similar power amplifiers design is also included to validate the simulation results.

#### [CONTOH HALAMAN BAHAGIAN TEKS]

[Saiz Rupa Taip teks 12 point dan jenis taip Times News Roman/Arial]

**CHAPTER 1**

[Saiz Rupa Taip 12 point]

### INTRODUCTION TO 5G TECHNOLOGY

[Saiz Rupa Taip 14 point]

* 1. **INTRODUCTION** (saiz 12pt, UPPERCASE, **bold**)

Telecommunication networks are introducing the new technological innovation called the Fifth Generation (5G), allowing cellular data rates of more than 10 Gbps for improved mobile broadband services, supporting 100 times more technological connected devices than the fourth technology (4G) for huge device communication to allow the Internet of Things (IoT) and one millisecond latency for immediate behaviour with ultra-reliable device communications [1]. It would be incredibly difficult to meet the ambitious 5G targets all at once, and so it is anticipated that the 5G transition would come roll out in phases [1], [2].

In the prestandard 5G age in 2014, Ericsson 's live over-the-air demonstration network already reached a record of 5 Gbps capacity by utilizing a revolutionary modern radio interface design in conjunction with advanced multiple-in multiple-output (MIMO) antenna technologies with shorter transmitting time intervals of 15 GHz and broader bandwidths [3]. In addition to the newly developed 5G wireless network framework and the planned for regional 5G architecture with a modern air interface, the Third Generation Partnership Product (3GPP) has announced its first research focused on the New Radio (NR) for 5G, which aims to provide wide range of device models, networks and implementations, and bandwidth at sub-6 GHz and mm-wave frequency [4].

* + 1. **Properties of RCA Concrete** (saiz 12pt, Capitalize Each Word, **bold**)
       1. ***Workability of RCA Concrete*** (saiz 12pt, Capitalize Each Word, **bold**,

*italic*)

* + - * 1. *Compressive Strength of RCA Concrete* (saiz 12pt, Capitalize Each Word,

*italic*)

**[ Bagi penggunaan sistem penomboran hanya digalakkan dalam bidang sains kejuruteraan ]**

###### Contoh Penggunaan Rajah (Figure):

|  |  |  |
| --- | --- | --- |
|  |  |  |

**Figure 1.1.** Three different types of recycle aggregates obtained from sites.

(Saiz Rupa Taip 11 point)

###### Contoh Penggunaan Jadual (Table):

**Table 1.1** Properties of the coarse aggregate (Thomas *et al*. 2013)

(Saiz Rupa Taip 11 point)

|  |  |  |  |
| --- | --- | --- | --- |
| **Property** |  | **Aggregate** |  |
|  | **NA (6/12)** | **NA (12/20)** | **RCA (6/20)** |
| Relative density of particle (g/cm3) | 2.51 | 2.54 | 2.32 |
| Density of particle saturated with dry surface (g/cm3) | 2.55 | 2.59 | 2.31 |
| Water absorption (wt. %) | 1.8 | 1.6 | 5.3 |
| Open porosity (vol. %) | 4.7 | 4.0 | 12.3 |
| Aggregate density (g/cm3) | 1.53 | 1.53 | 1.42 |
| Los Angeles Index (wt. %) | 31 | - | 42 |

***[CONTOH HALAMAN AKHIRAN UNTUK MANUSKRIP]***

**RUJUKAN/*REFERENCES***

*(Perlu ada)*

Bahagian ini mentakrifkan senarai yang disediakan oleh penulis untuk memudahkan pembaca mendapatkan bahan-bahan tambahan. Rujukan ditulis/diberikan dalam gaya APA.

#### Contoh:

**Buku** - Jalil,M. *et al*. (2013). *Semiconductor Optical Amplifiers and Related Applications*. Skudai: Penerbit UniMAP.

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**Tesis** - King, K. 1987. “Development of Pressurised Systems for Oxidation Studies”. Unpublished ph.D. Thesis. Pennsylvania University.

**Laman Sesawang/Website** - Global Security.org. 2016. “Tension Leg Platform technology”. Retrieved from<http://www.globalsecurity.org/military/systems/ship/platform> (accessed on 4 november 2017.

**INDEKS/*INDEX***

*(Perlu ada – disediakan oleh Penulis)*

Indeks ialah senarai perkara dan nama yang dbincangkan dalam buku. Entri daftar kata penting menurut abjad dan diletakkan di bahagian akhir buku.

#### Contoh:

##### A

AC/DC

agriculture air pollution

Air Quality Index (AQI) alarm system

alcohol android

anti-cable theft aquaponics Arduino Arduino IDE Arduino Mega Arduino Uno ARM7

Atmega8U2

##### B

Blackberry block diagram bluetooth Blynk app Blynk server

**BIODATA PENULIS**

*(Jika ada)*

**ABOUT THE AUTHORS**

A picture containing person, person, posing

Description automatically generated

**Ahmad Fariz Hasan** received the B Eng. degree in Electrical Engineering (Telecommunication) from Universiti Teknologi Malaysia, in 2007. From 2007 till 2010 he serves as Process and Equipment engineer at Intel Malaysia. He then obtained his M. Eng in 2012 in Electrical Engineering at Universiti Teknologi Malaysia and PhD in Electronics Engineering from Universiti Malaysia Perlis, in 2022. His research interest includes the areas of design of CMOS Power Amplifier, Radio Ferquency Integrated Circuit, Internet of Things, VLSI Design and Radio Frequency for millimeter wave application. He has published many conference proceedings as well as journal papers in local and international journals.