



Communication

Low-Noise Amplifier with Bypass for 5G New Radio Frequency n77 Band and n79 Band in Radio Frequency Silicon on Insulator Complementary Metal–Oxide Semiconductor Technology

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Abstract: This paper presents the design of a low-noise amplifier (LNA) with a bypass mode for the n77/79 bands in 5G New Radio (NR). The proposed LNA integrates internal matching networks for both input and output, combining two LNAs for the n77 and n79 bands into a single chip. Additionally, a bypass mode is integrated to accommodate the flexible operation of the receiving system in response to varying input signal levels. For each frequency band, we designed a low-noise amplifier for the n77 band to expand the bandwidths to 900 MHz (3.3 GHz to 4.2 GHz) using resistive–capacitance (RC) feedback and series inductive-peaking techniques. For the n79 band, only the RC feedback technique was employed to optimize the performance of the LNA for its 600 MHz bandwidths (4.4 GHz to 5.0 GHz). Because wideband techniques can lead to a trade-off between gain and noise, causing potential degradation in noise performance, appropriate bandwidth design becomes crucial. The designed n77 band low-noise amplifier achieved a simulated gain of 22.6 dB and a noise figure of 1.7 dB. Similarly, the n79 band exhibited a gain of 21.1 dB and a noise figure of 1.5 dB with a current consumption of 10 mA at a 1.2 supply voltage. The bypass mode was designed with S_{21} of -3.7 dB and -5.0 dB for n77 and n79, respectively.

Keywords: fifth generation (5G); new radio (NR); low-noise amplifier (LNA); RC feedback; series inductive-peaking; bypass mode; wideband



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1. Introduction

Currently, the 3rd Generation Partnership Project (3GPP) is preparing for 5G to address the challenges of saturated communication systems, aiming for high system capacity, wide coverage, and efficient data transmission [1]. For the frequency allocation in New Radio (NR), both licensed and unlicensed spectra from 1 GHz to 52.6 GHz are being considered. Particularly, millimeter-wave frequencies are attracting attention for their advantages in providing increased bandwidth, high data capacity, and rapid transmission [2]. However, the use of millimeter-wave frequencies poses challenges such as signal loss and the necessity for complex infrastructure setups using multi-antenna systems. Furthermore, designing additional stability techniques and implementing multi-stage amplifiers are essential to achieve both high gain and stability. However, this results in an overall increase in the complexity of the system [3]. In contrast, 5G systems in the sub-6 GHz band can utilize system infrastructure using the existing 4G LTE band, and as a technology already implemented in various countries, it proves advantageous in meeting the rapidly growing demands for high data rates. In particular, the United States has adopted 5G, utilizing NR bands such as 2.5–3.98 GHz and 4.49–4.99 GHz [4]. Furthermore, several other countries are also implementing 5G in the n77/79 bands, underscoring the growing emphasis on the need for research to optimize system performance within this frequency range.

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Proceedings of the 4th International Conference on Telecommunications and Communication Engineering Maode Ma, 2021-09-02 The book presents the papers presented at the 4th International Conference on Telecommunications and Communication Engineering ICTCE 2020 held on 4-6 December in Singapore. It covers advanced research topics in the field of computer communication and networking organized into the topics of emerging technologies of wireless communication and networks, 5G wireless communication and networks, information and network security, internet of things and fog computing. These advanced research topics are taking the lead and representing the trend of the recent academic research in the field of computer communication and networking. It is expected that the collection and publication of the research papers with the advanced topics listed in this book will further promote high standard academic research in the field and make a significant contribution to the development of economics and human society. **Proceedings of SIE 2024** Maurizio

Valle, Paolo Gastaldo, Ernesto Limiti, 2025-01-02 This book showcases the state of the art in the field of electronics as presented by researchers and engineers at the 55th Annual Meeting of the Italian Electronics Society SIE held in Genoa, Italy, on June 26-28, 2024. It covers a broad range of aspects including integrated circuits and systems, micro and nano electronic devices, microwave electronics, sensors and microsystems, optoelectronics and photonics, power electronics, electronic systems and applications. *Artificial Intelligence, Data Science and Applications* Yousef Farhaoui, Amir Hussain, Tanzila Saba, Hamed Taherdoost, Anshul Verma, 2024-01-29 This book is to provide a comprehensive reference for professionals in the field of data science and applications, artificial intelligence, big data, IoT and blockchain. In summary, this book is expected to function as a helpful resource and manual enabling readers to navigate the intricate domain of artificial intelligence, the Internet of things, IoT and blockchain in smart environments. This book covers many topics related to integrating AI, IoT, blockchain and smart environments. It begins by laying a solid foundation introducing each technology's fundamental concepts and principles. Subsequent chapters explore applications and real world use cases demonstrating how AI, IoT and blockchain can effectively address critical challenges within data science and applications. **Handbook of Radio and Optical Networks**

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Inventive Systems and Control V. Suma,Joy Iong-Zong Chen,Zubair Baig,Haoxiang Wang,2021-06-07 This book presents selected papers from the 5th International Conference on Inventive Systems and Control ICISC 2021 held on 7 8 January 2021 at JCT College of Engineering and Technology Coimbatore India The book includes an analysis of the class of intelligent systems and control techniques that utilises various artificial intelligence technologies where there are no mathematical models and systems available to make them remain controlled Inspired by various existing intelligent techniques the primary goal is to present the emerging innovative models to tackle the challenges faced by the existing computing and communication technologies The proceedings of ICISC 2021 aim at presenting the state of the art research developments trends and solutions for the challenges faced by the intelligent systems and control community with the real world applications The included research articles feature the novel and unpublished research works on intelligent system representation and control

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Table of Contents Design Semiconductor Low Noise 2013 Paper

1. Understanding the eBook Design Semiconductor Low Noise 2013 Paper
 - The Rise of Digital Reading Design Semiconductor Low Noise 2013 Paper
 - Advantages of eBooks Over Traditional Books
2. Identifying Design Semiconductor Low Noise 2013 Paper
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Design Semiconductor Low Noise 2013 Paper
 - User-Friendly Interface
4. Exploring eBook Recommendations from Design Semiconductor Low Noise 2013 Paper

- Personalized Recommendations
- Design Semiconductor Low Noise 2013 Paper User Reviews and Ratings
- Design Semiconductor Low Noise 2013 Paper and Bestseller Lists
- 5. Accessing Design Semiconductor Low Noise 2013 Paper Free and Paid eBooks
 - Design Semiconductor Low Noise 2013 Paper Public Domain eBooks
 - Design Semiconductor Low Noise 2013 Paper eBook Subscription Services
 - Design Semiconductor Low Noise 2013 Paper Budget-Friendly Options
- 6. Navigating Design Semiconductor Low Noise 2013 Paper eBook Formats
 - ePub, PDF, MOBI, and More
 - Design Semiconductor Low Noise 2013 Paper Compatibility with Devices
 - Design Semiconductor Low Noise 2013 Paper Enhanced eBook Features
- 7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Design Semiconductor Low Noise 2013 Paper
 - Highlighting and Note-Taking Design Semiconductor Low Noise 2013 Paper
 - Interactive Elements Design Semiconductor Low Noise 2013 Paper
- 8. Staying Engaged with Design Semiconductor Low Noise 2013 Paper
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Design Semiconductor Low Noise 2013 Paper
- 9. Balancing eBooks and Physical Books Design Semiconductor Low Noise 2013 Paper
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Design Semiconductor Low Noise 2013 Paper
- 10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
- 11. Cultivating a Reading Routine Design Semiconductor Low Noise 2013 Paper
 - Setting Reading Goals Design Semiconductor Low Noise 2013 Paper
 - Carving Out Dedicated Reading Time
- 12. Sourcing Reliable Information of Design Semiconductor Low Noise 2013 Paper

- Fact-Checking eBook Content of Design Semiconductor Low Noise 2013 Paper
- Distinguishing Credible Sources

13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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