CHAPTER 1

INTRODUCTION

1.1 Introduction to Wideband Low-Noise Amplifier in Wireless Communication.

Low noise amplifier is a typical component used regularly in wireless circuit. Based on **Figure 1.1**, placed between Band Selection Filter (BPF1) and Image Rejection Filter (BPF2), low noise amplifier is the simple block in receiver most front ends. This part provide amplifying the signal while introducing a minimum amount of noise to the signal [5]. The signal that came from BPF1 that are too week for direct processing will be amplify. Usually, Low Noise Amplifier (LNA) are implemented via tune amplifier, exploiting amplifier and capacitor in resonating LC-circuit. For this project , a wideband Low Noise Amplifier (LNA), is designed by concentrating on the amplifier core. The layout of the design will be the product at the end of the process.

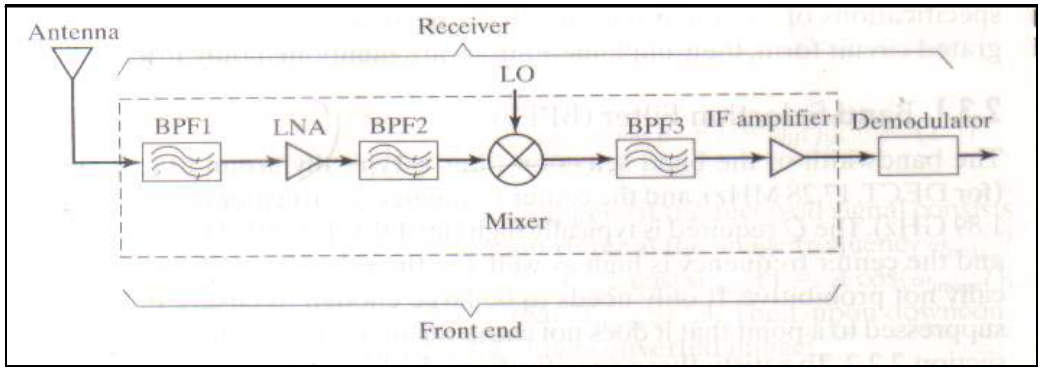

Figure 1.1: Low Noise Amplifier (LNA) and others receiver component

Before going through, the title of this project is define word by word. Low noise amplifier as is a part that amplifying the signal plus bring a minimal amount of noise to the signal. It is a special type of electronic amplifier or amplifier used in communication systems to amplify very weak signals captured by an antenna [3]. While wireless is term that used refer to any type of electrical or electronic which accomplished without the used of a "hardwired' connection.

1.1.1 Project Specification.

The main aim for this project is to design a wideband low noise amplifier. It is done using mentor graphic software using 0.35-tsmc CMOS process technology for design and simulation.

In order to achieve the target of design wideband low noise amplifier, the specification from Digital Enhanced Cordless Telecommunication (DECT) had been used. The specification that need to be consider in design this project are shown below:-

Table 1.1: Specification of DECT

Specification	Value
f_o	1.9GHZ
Input matching	$S_{11} \prec -10dB$
Noise factor	$NF \prec 3dB$
Voltage gain	15 dB
Power at 3.3V	40mW

At the end of the process, layout for low noise amplifier will be produced. To achieve this, layout must be clean from error either LVS error that detect rules for design layout or DRC error that that detect missing port or overlap in design. Layout is been simulated until zero error achieved.

1.2 Digital Enhanced Cordless Telecommunication

Digital Enhanced Cordless Telecommunication (DECT) or previously known as Digital European Cordless Telecommunication is a system is widely used for residential, and business cordless phone communications. Designed for short-range use as an access mechanism to the main networks, DECT offers cordless voice, fax, data and multimedia communications and wireless local area networks. By using this standard , it can provide wireless access for both indoor and outdoor environments, with cell radius ranging from 50 to several hundred meters [5]. Moreover, it is not limited to telephony but also handles text and data as well.

1.3 Problem Statement.

Design of Low- Noise amplifier consists of 3 part:-

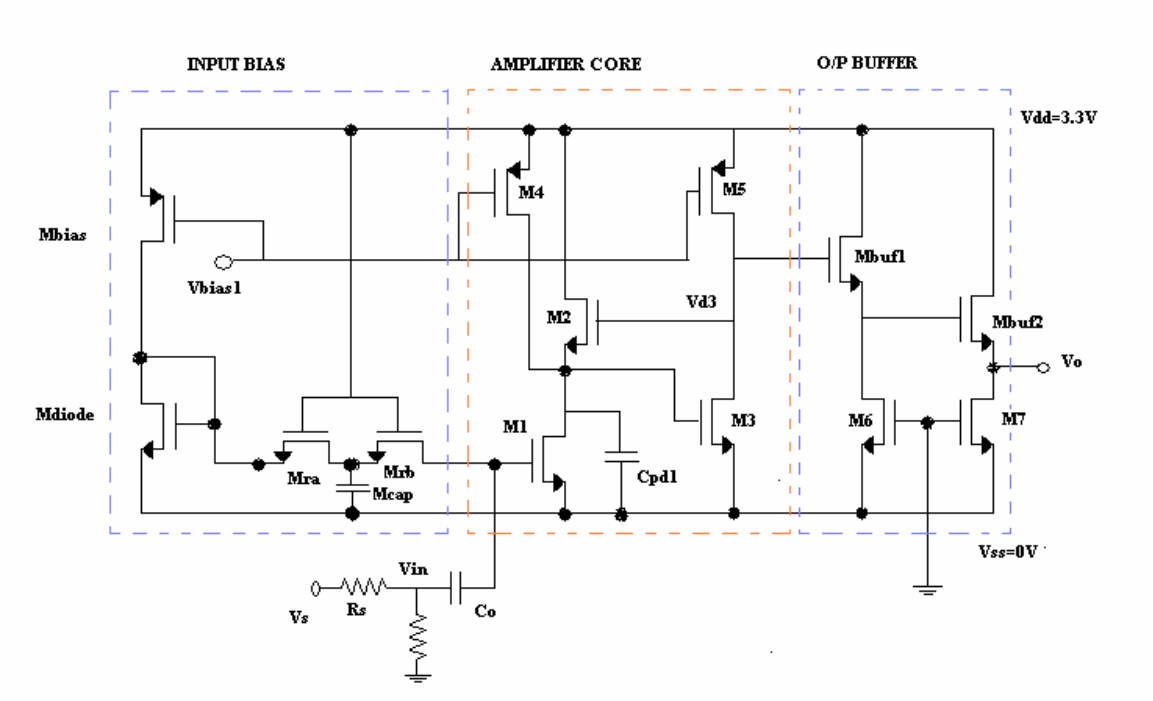

Figure 1.2 :Wideband Low- Noise Amplifier Circuit

(a) Amplifier Core

Core of amplifier consist of two stages. The first stages is a simple common source (CS) transconductance structure, which is good for low noise amplifier. This is driving a tightly coupled transresistance amplifier with an active feedback path. The second stage looked also as a simple common source amplifier. The feedback is introduced to modify the second-stage input and output impedance. This helps to broadband the core amplifier by reducing the Miller capacitance of transistor M1.

(b) Bias Circuit

The DC bias of the entire topology is examined. Bias problem involves involves establishing the V_{gs} of M_1 and associated drain current. Given that the RF signal from output of BPF1, Vs, is capacitively coupled into the amplifier at this point, it is important to prevent Vs from being injected into the current bias chains. This can be accomplished by using and R-C-R filter.

(c) Output Buffer

Output buffer been used to achieve an impedance match with BPF2. Even though the output resistance of the tranresistance stages reduce due to to feedback, it is still difficult to make output resistance sufficiently low .

1.4 Chapter Organization

The first chapter, Chapter 1 of this final year project consist of project introduction. This chapter describe briefly the role that played by low noise amplifier in the real world,

specification that use to accomplish the project, the objective of this project and the problem need to challenge while designing it. In this chapter, illustration of the circuit design is mentioned here as well.

The next chapter, Chapter 2 consist of literature review that be done in term to study parts that build the low-noise amplifier. The component parts that has studied including filter designing, filter, core amplifier designing and software that are used in this project, by Mentor Graphic. All theoretical part about how to design amplifier core of this project is mentioned here in Chapter 2.

Methodology of this project are in Chapter 3. It involve on general utilizing of Mentor Graphic software starting from schematic design until the last phase of this project that is to produce layout of the low- noise amplifier. Circuit design starting from calculation, theory that is used while designing, assumption and function of designing part are describe here.

The result of the low- noise amplifier design are describe in Chapter 4. This chapter describe the all result that achieve along the project progress starting from schematic level until layout process and in addition, discussion of the result with theoretical part that been set at the beginning of the project. Last chapter of this report is conclusion part in Chapter 5. This chapter involve of the whole summary of this project design and discussion either this project achieve the objective of the project.