

RFANALOG FRONT-END

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Introduction

The project RF Analog Front-End aims to build transmitter and receiver front ends that operate in the 3.5 GHz band. A baseband analog signal is input to the RF chain, and the developed receiver – transmitter pair allows us to transfer this analog input. This chain is composed of RF amplifiers, mixers, filters, and phase shifters, much like any other RF Design.

An RF Front-End is applicable to many communication systems. This Project provides hardware design of such a system in 3.5 GHz band for 5G and beyond studies.

Solution Methodology

The transmitter and recevier board descriptions are as such:





Specifications and Design Requirements

Operation Frequency: 3.5 GHz Bandwidth: 200 MHz Low Noise Figure **No Out-of-Band Emissions Protects Signal Integrity**

Results and Discussion

Two PCB boards were designed and simulated in ANSYS SIWave environment. Also, system level simulations were performed in MATLAB Simulink. The simulations produced healthy results in terms of power distrubiton and field analysis.





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ADL5541ACPZ-R7

F amplifier

Figure 2: An overall description of the receiver components. With these main components, two PCB boards were developed. Each component intended to meet design requirements such as operation frequency, r out-of-band emissions and adjustable output power. Signal integrity wa protected by impedance-controlled RF paths. The following equation was used to calculate the noise figure.

| $O(E) = O(E_1) + \frac{1}{2}$ | NF2 - 1) | (NF3 - 1) | |
|-------------------------------|----------|----------------------|---|
| (NF) = (NF1) + - | 2 | + 2 2 | + |
| | G_1^- | $G_{1}^{-}G_{2}^{-}$ | |

Equation 1: Noise Figure Calculation