

Modular RF Communication System for Analog and Digital Signal Transmission

Prof. Dr. Matthias Kronauge (matthias.kronauge@haw-hamburg.de)

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I. INTRODUCTION

This project aims to develop a modular RF communication platform that enables the transmission and reception of both analog and digitally processed signals using commercially available evaluation boards. The system is designed to be used in teaching environments, allowing students to explore signal processing concepts such as source coding, channel coding, and pulse shaping in a hands-on manner.

The platform will be built using Analog Devices components: the LTC5589 (quadrature modulator) [1], LTC5594 (quadrature demodulator) [2], and ADF4350 (wideband synthesizer) [3]. A sound card will serve as the interface between the PC and the RF hardware, enabling real-time signal input and output.

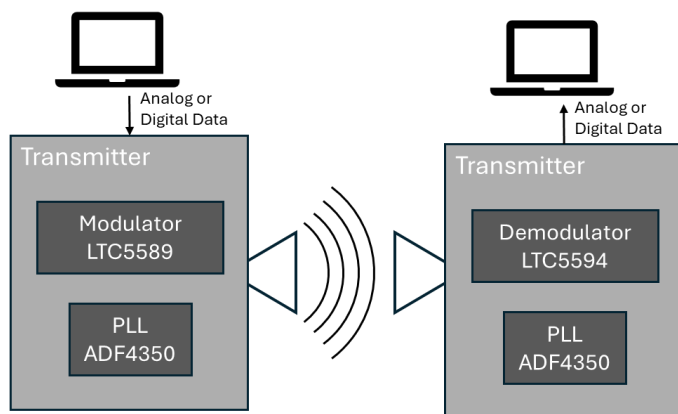


Fig. 1. Communications System based on LTC5589 [1], LTC5594 [2] and ADF4355 [3]

II. PROJECT DESCRIPTION

A. Task

In this project, your team will design and implement a modular RF communication system consisting of a transmitter and receiver. The transmitter will accept analog or digitally processed signals from a PC sound card, modulate them using the LTC5589, and transmit them via RF. The receiver will use the LTC5594 to demodulate the signal and output it to another sound card for further processing or playback.

You will configure the ADF4350 synthesizer to provide the necessary LO signals for modulation and demodulation. The system should be modular and reusable for future student projects and lab exercises.

B. Work packages

Your project could be structured as follows:

- Literature study on RF communication systems and the use of evaluation boards in education (starting points could be [4], [5] or [6])

- Familiarization with the LTC5589, LTC5594, and ADF4350 evaluation boards and their datasheets
- Design and implementation of the transmitter and receiver circuits
- Integration of sound cards as input/output interfaces
- Testing and evaluation of analog and digital signal transmission
- Documentation of the system for future use in teaching

C. Deliverables

The following deliverables are expected:

- A working prototype of the RF communication system with transmitter and receiver
- Demonstration of analog and digital signal transmission using sound cards
- Midterm oral presentation (using e.g. power point slides).
- A poster for the final conference describing your system architecture, implementation, and evaluation results

D. Project team organization

One team of three students will work on the complete system. You will have biweekly meetings with your advisor to discuss progress and challenges.

III. LEARNING OUTCOME

As a team, you will gain practical experience in RF system design, signal processing, and hardware integration. You will learn how to work with evaluation boards, configure RF synthesizers, and interface analog hardware with digital systems. The project will also enhance your skills in documentation and teamwork.

IV. PREREQUISITES

At least one project participant should have basic experience in electronics and signal processing. Familiarity with RF concepts and sound card interfacing is helpful but not required. Suitable for both Master's programs MES and ICE.

REFERENCES

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