USRP Research Presentation

Github

- https://github.com/adam-kamrath/USRP_Research_Summer2023
- No baseband signal files in GitHub

Folders

- Weekly Reports (3 - 8)
- VCDSignals
- VCDandVICCSignals
- Sinewave
- FrequencyCalibrationSimulink (20KHz)
- Documents
- Applications

VCDSignals

- Files used to capture the signal sent from the card reader
- Used for experimentation
- Files:
  - Writer: creates a baseband file of the received signal
  - Reader: plots an already created baseband file
  - Receiver: plots the real-time reception of the signal
- Folders:
  - Signals: used to store the baseband files
  - Photos: pictures used in the Weekly Reports

VCDandVICCSignals

- Files used to plot, analyze, and decode signals from the card reader and card itself
- Used for experimentation
- Files:
  - Bandpass.m: creates a band-pass filter
  - Highpass.m: creates a high-pass filter
  - Writer.m: creates a baseband file from the received signal
  - editData.m: changes a baseband file's data to be 1's or 0's (values need changed depending on what is being decoded)
  - decodeReaderData.m: decodes the signal sent out from the card reader
  - decodeCardData.m: decodes the signal sent out from the card (about 2 min)
  - decodeCardDataFast: decodes the signal sent out from the card (about 30 sec)
  - sortBinarySequence.m: separates the different fields of the card's response signal for a system information command

Sinewave

- Used to send out and receive a sine wave with the two USRP devices
- Used for experimentation
- Files:
  - Transmitter: Sends out a sine wave
  - Writer: creates a baseband file of the signal received
  - Reader: plots the data in a baseband file
  - Receiver: plots the data being received in real-time
  - Capture.bb: baseband file created for the test

FrequencyCalibrationSimulink (20KHz)

- Used to calibrate the frequency difference between the two USRP devices (20KHz was found, but hurt reception from the card reader)
- Uses simulink
- Files:
  - Transmission.slx: Used to transmit a signal over 13.56 MHz
  - Receiver.slx: Plots the received signal in a spectrum analyzer centered at 13.56 MHz
- The frequency difference is determined by how far the peak is from center of the spectrum analyzer plot

Documents

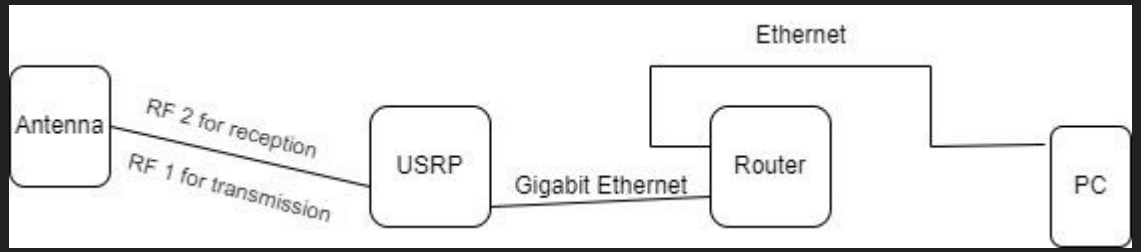
- Contains ISO-15693 documents
- Contains data sheet for card reader (ISO-MR102 USB)

Applications

- Contains the applications for sending and receiving signals
- Transmitter only sends out a sine wave currently
- Receiver:
  - Create baseband file
  - Plot baseband file
  - Decode baseband file
  - Plot in real-time
  - Decode in “real-time”

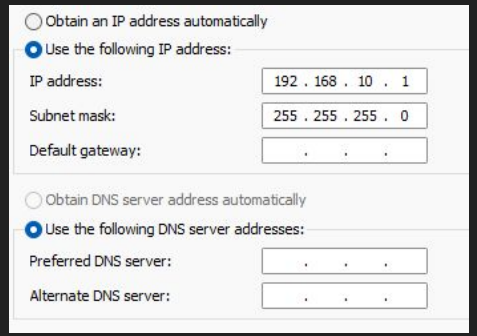
USRP Setup

- Antenna -> USRP (RF 2 slot for reception, RF 1 for transmission)
- USRP -> Router via gigabit ethernet cord
- Router -> PC via ethernet
- Keep antenna away from metal



USRP Windows Setup

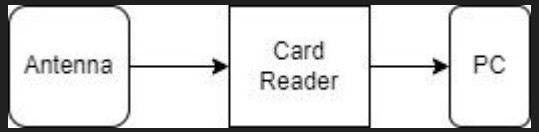
- Must change ethernet adapter settings
- Must have wifi disabled to connect to USRP
- Control Panel -> Network and Internet -> Network and Sharing Center -> Change adapter settings
- Right click on ethernet adapter -> Properties -> Internet Protocol Version 4 -> Properties
- Change to:



- Use “findsdru” in Matlab to test connection

Card Reader Setup

- Antenna -> Card Reader -> PC



- Download ISOStart+ v11.06.00
- Open ISOStart+ -> File -> Detect Reader ->USB -> Detect -> Run without change
- Use the “Get System Information” command in NON-ADDRESSED mode to get the correct data

Antenna and Card Setup

- Antennas placed flat on ground, away from metal
- Right antenna is the receiver antenna
- Left antenna is the card reader antenna
- Antennas are parallel to each other
- Antennas are 37.5 cm apart
- The card is placed flat in the upper left part of the square on the right antenna