MCC125 Wireless link project
Mid-term presentation

Microwave Surfers Group

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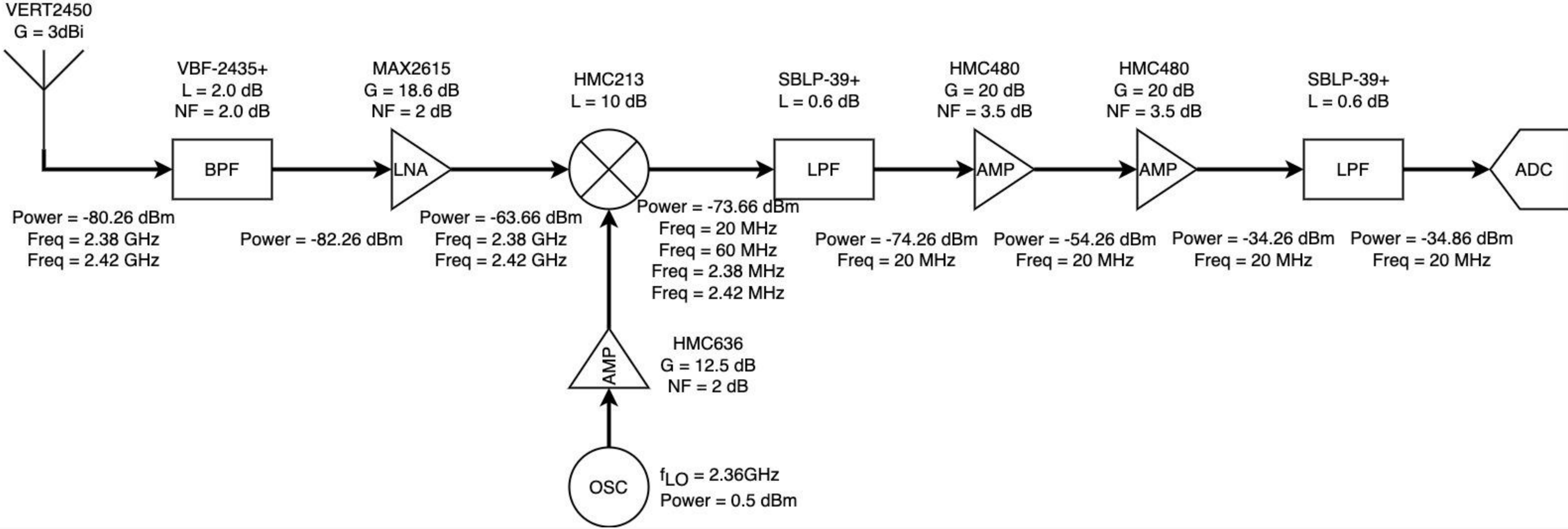
Link budget

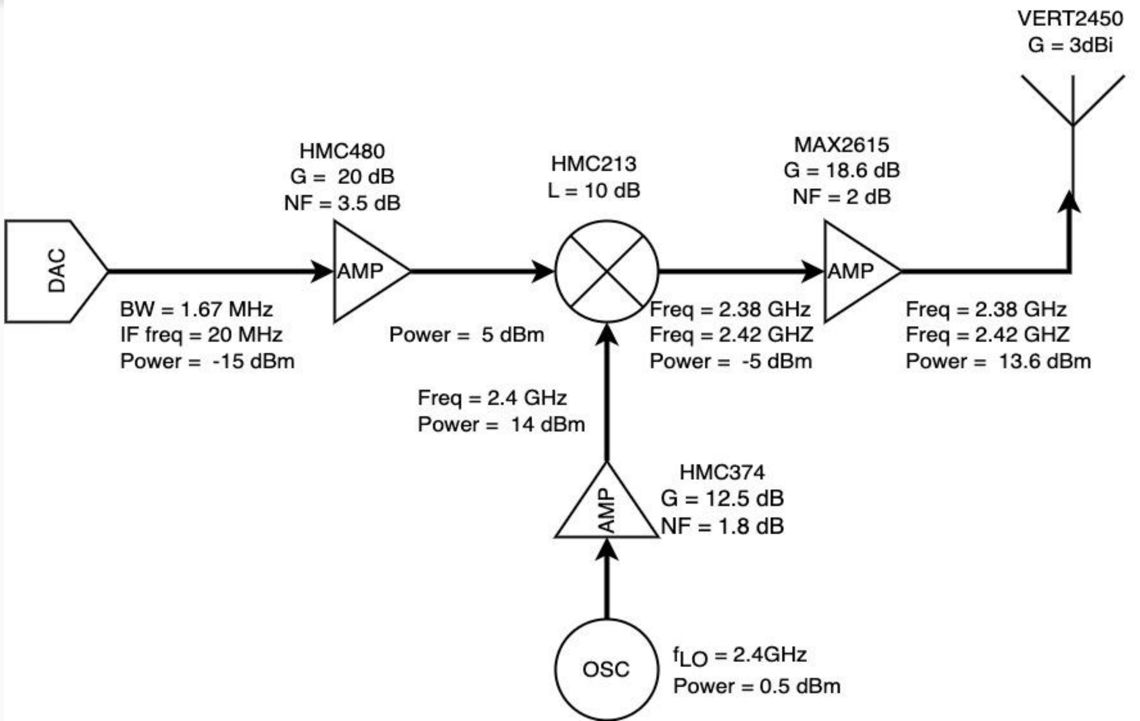
Design specifications

- RF frequency: 2.4 GHz
- 64-QAM as modulation
- 10Mbit/s data rate (Later, we found that the hardware can not support it)
- Distance of 100 m
- With BER = 1e-6 → SNR=26.8dB

Proposed RX block diagram



Proposed TX block diagram



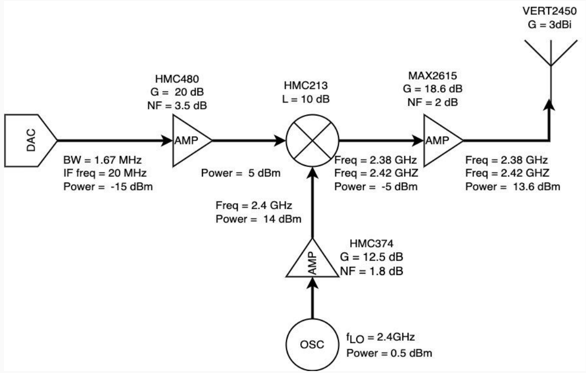
Link budget results

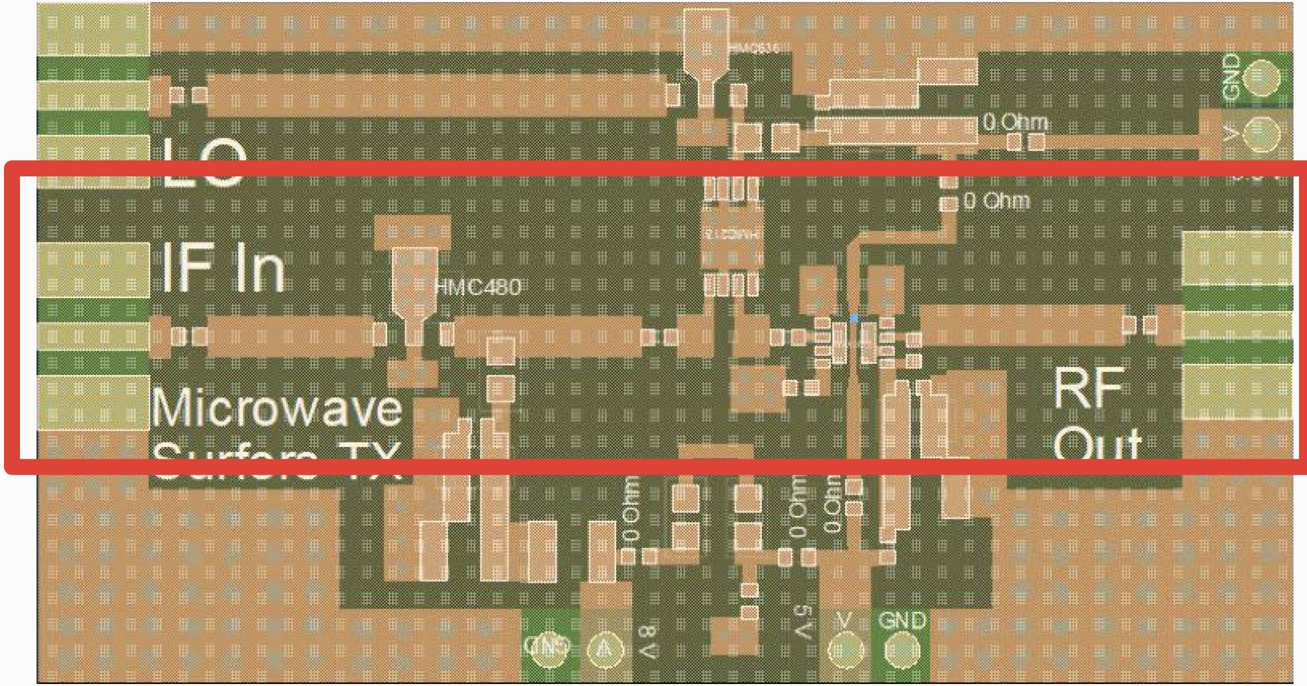
- Receiver noise figure NF=4.74 dB
- Transmitter linearity P1dB=18.3 dBm
- Free-space loss FSPL=-80 dB
- Noise power Pn=-107.4 dB
- → Minimum transmit power Pt=-6.21 dBm

Circuit design

Circuit design TX

Red rectangle represents the main RF line

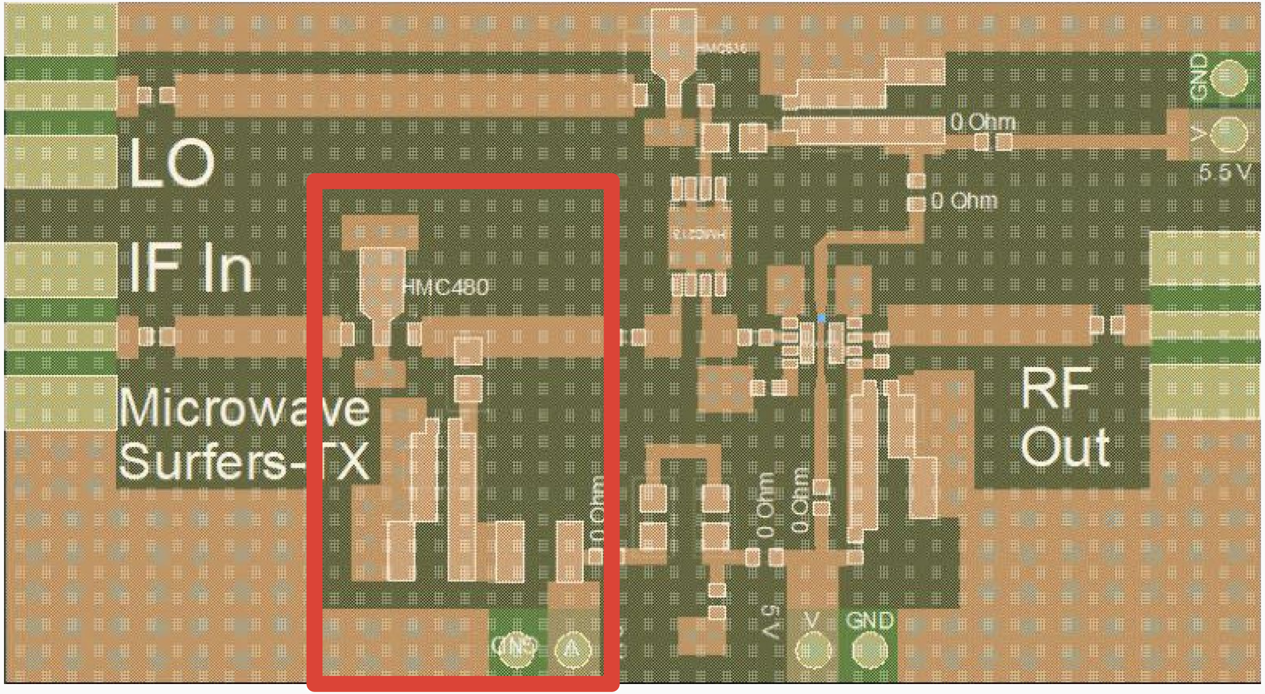




Circuit design TX

First amplifier (HMC480) with its accompanied bias line.

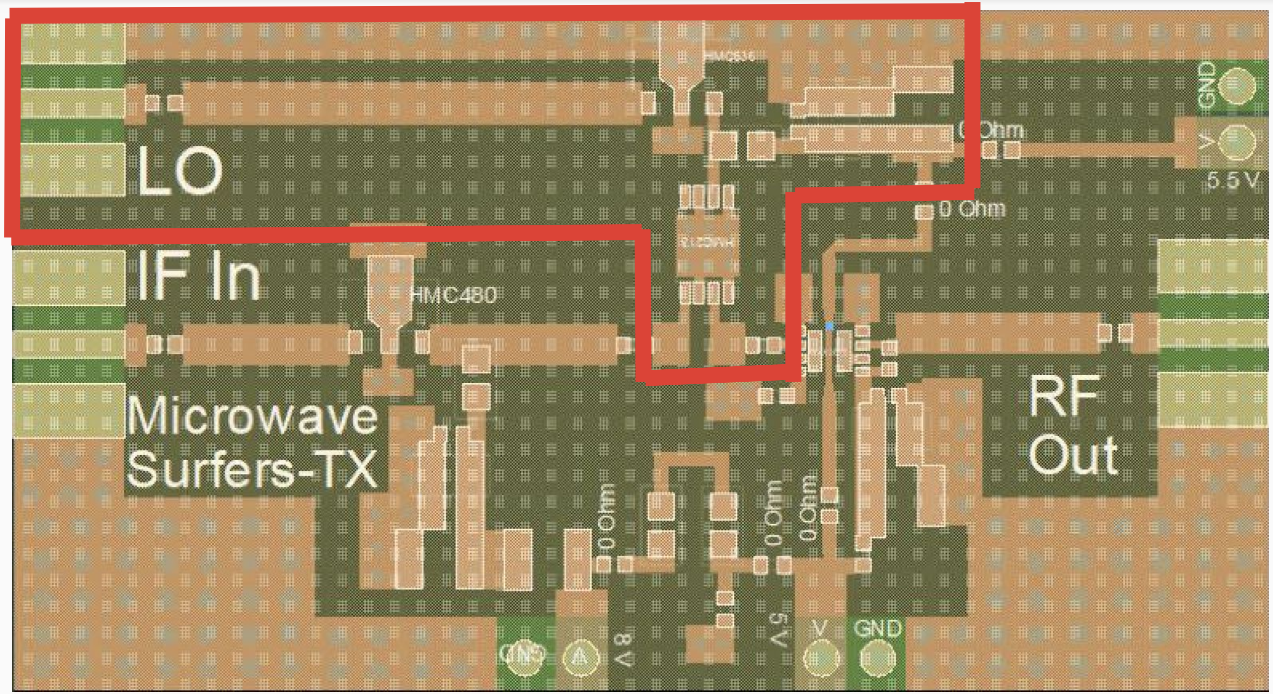
The bias line consists of one series inductor, three shunted capacitors and one bias resistor. The purpose of the bias line is to insert DC into RF line and block RF in bias line.



Circuit design TX

Mixer (HMC213) fed by a amplifier (HMC636) which is fed by the LO.

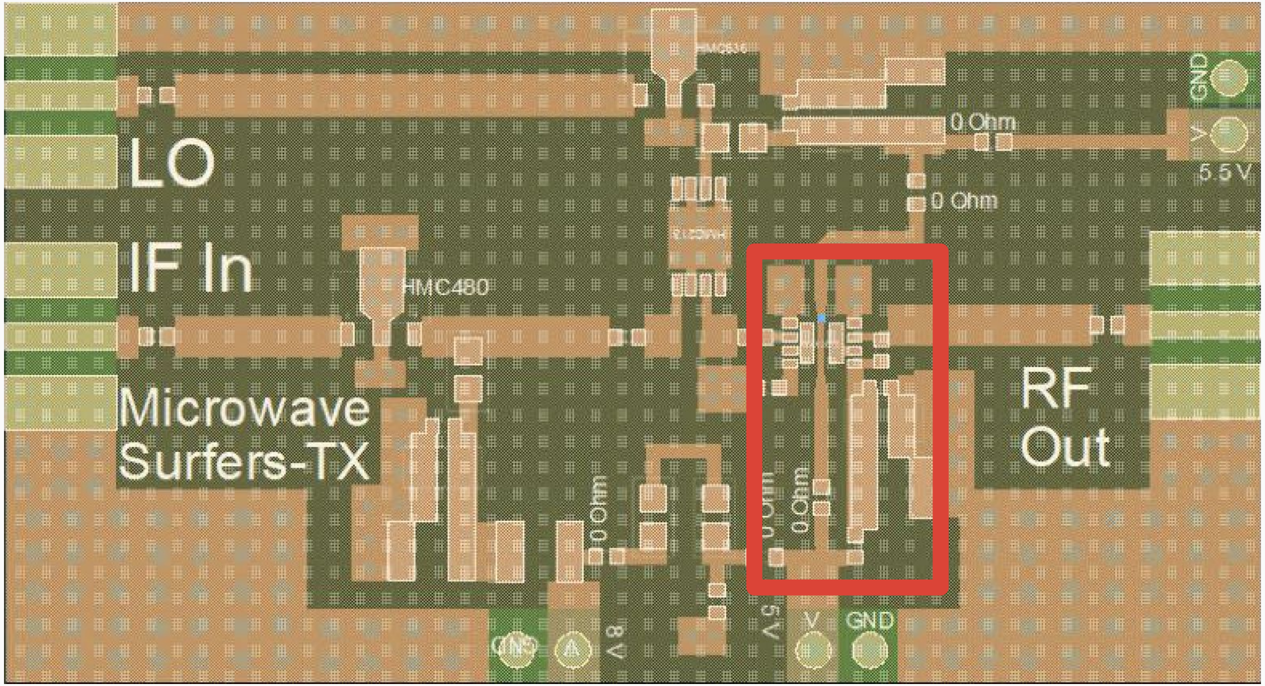
The amplifier has a similar bias line as shown before, only difference is that this bias line does not have a bias resistor.



Circuit design TX

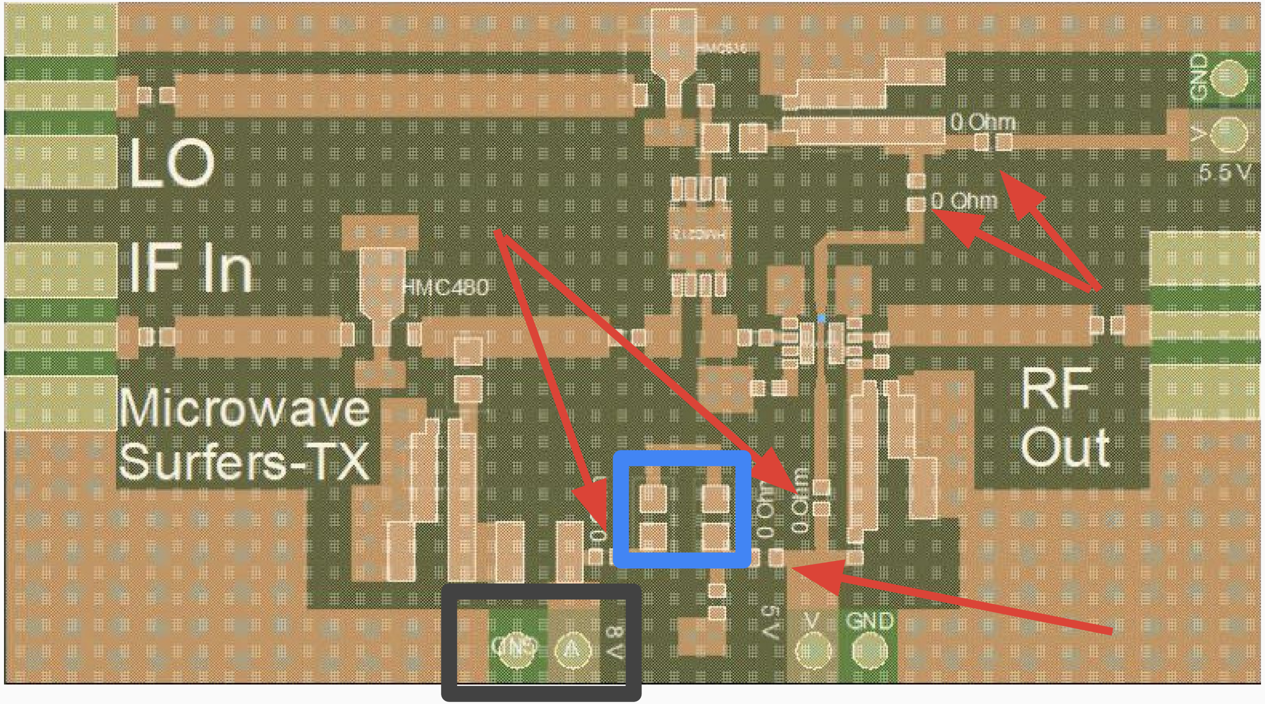
Last amplifier (MAX2615) in RF line.

Has, as all the other amplifiers, a similar bias line.

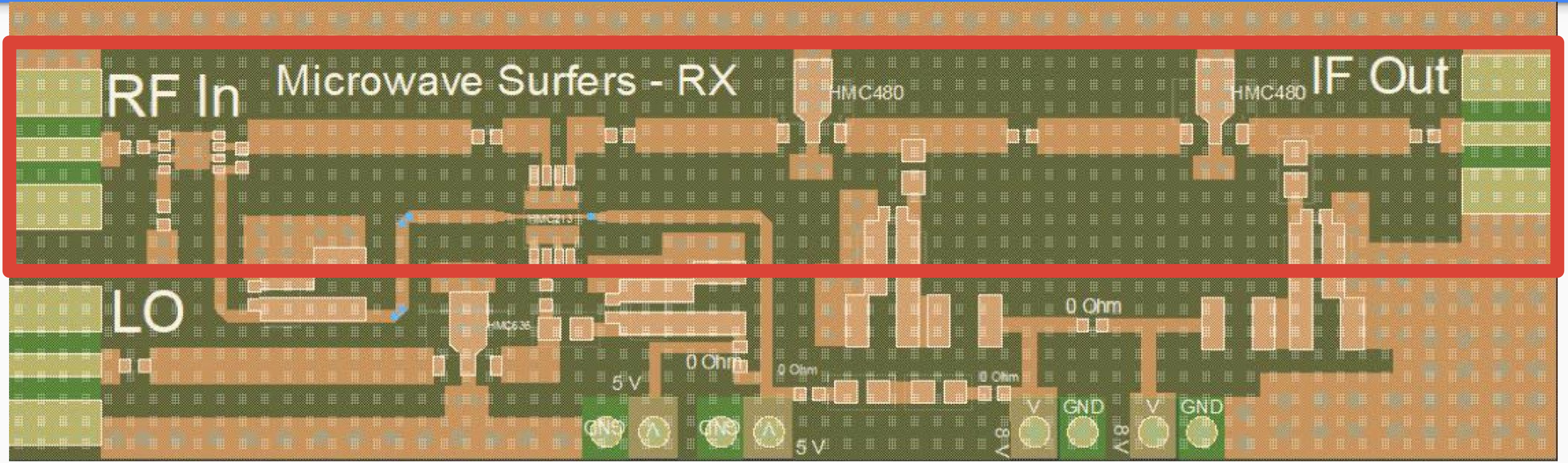


Circuit design TX

Our vision is that we feed all bias lines with one power supply (black rectangle), by soldering the 0 Ohm resistors (red arrows) and by stepping down the voltage with 2 series resistors (blue square). If that does not work, we remove the 0 Ohm resistors and feed each bias line through its own individual power supply.

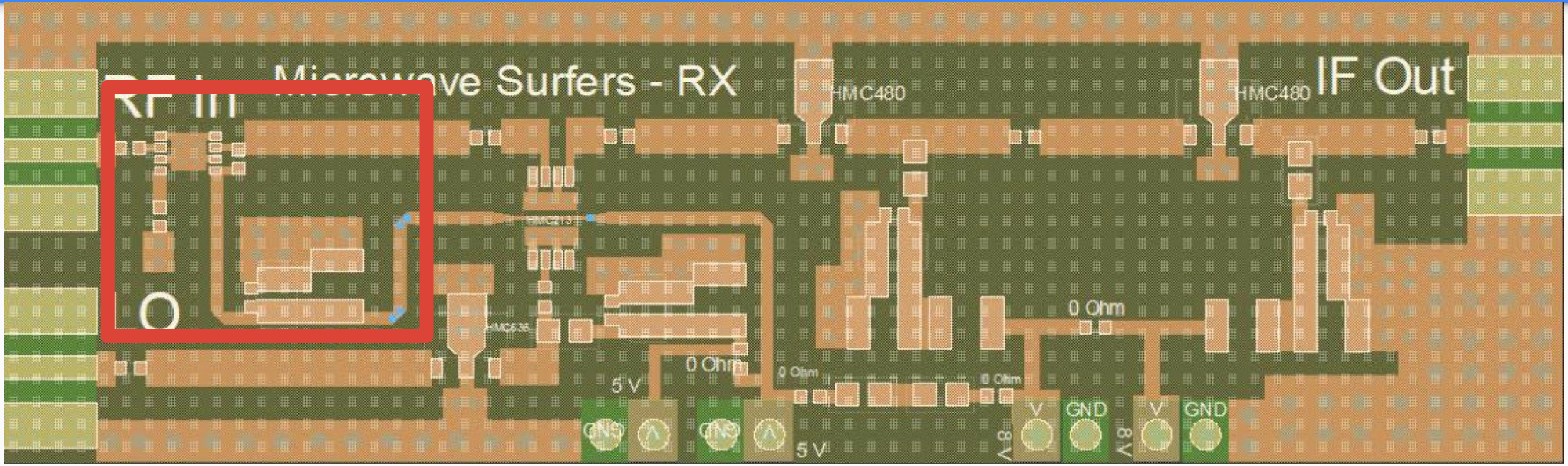


Circuit design RX



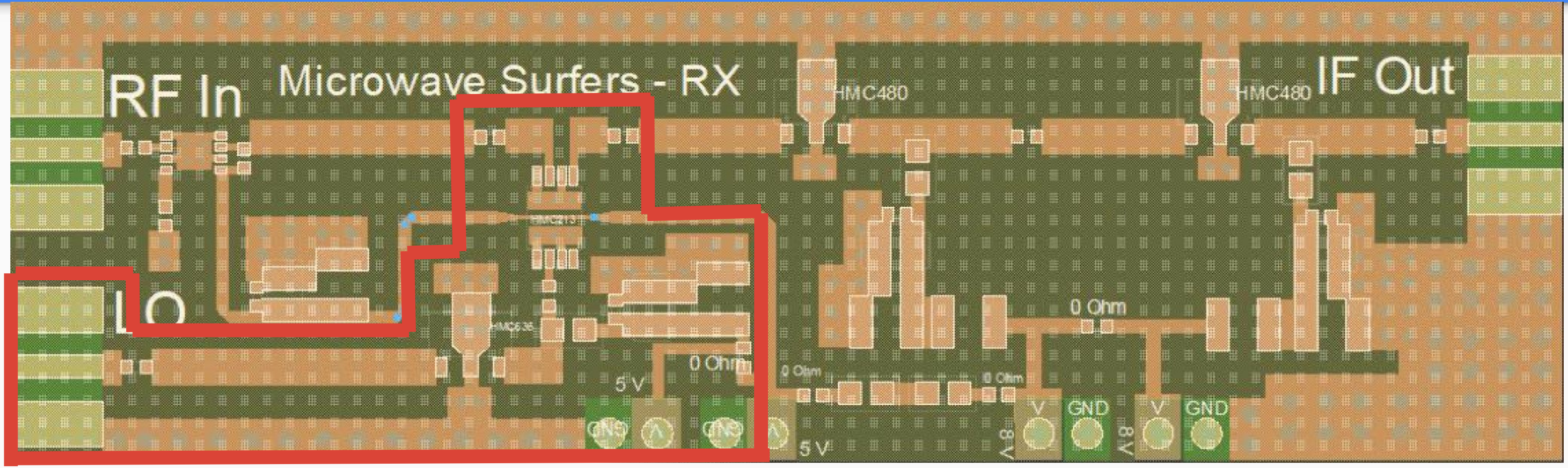
Red rectangle represents the main RF line

Circuit design RX



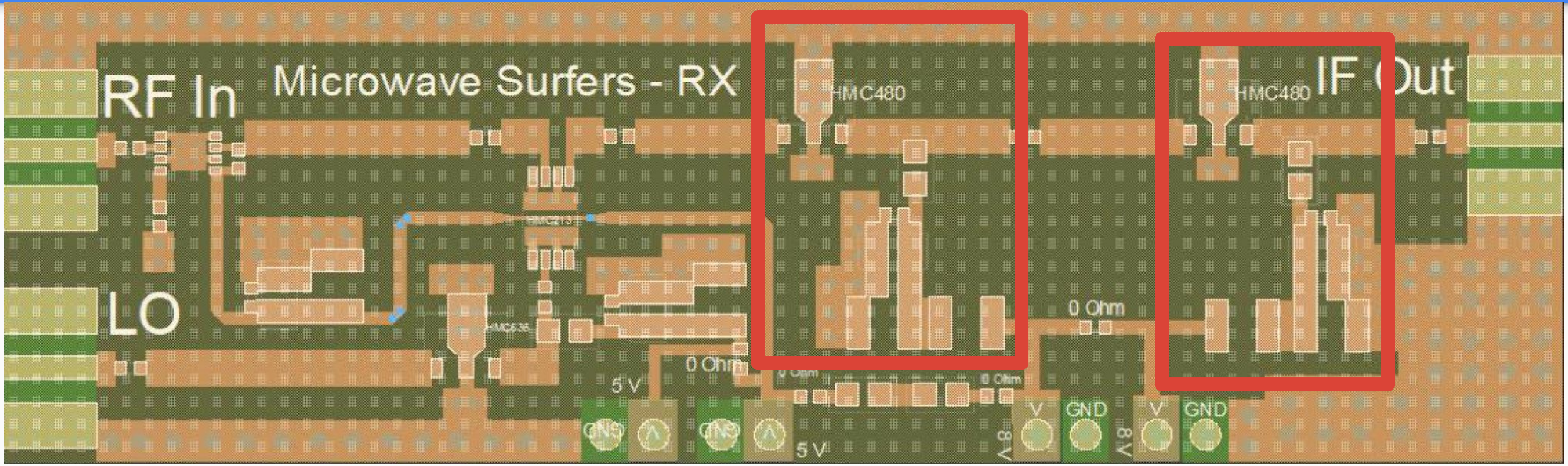
First LNA (MAX2615) with bias line (same as for the MAX2615 in the TX)

Circuit design RX



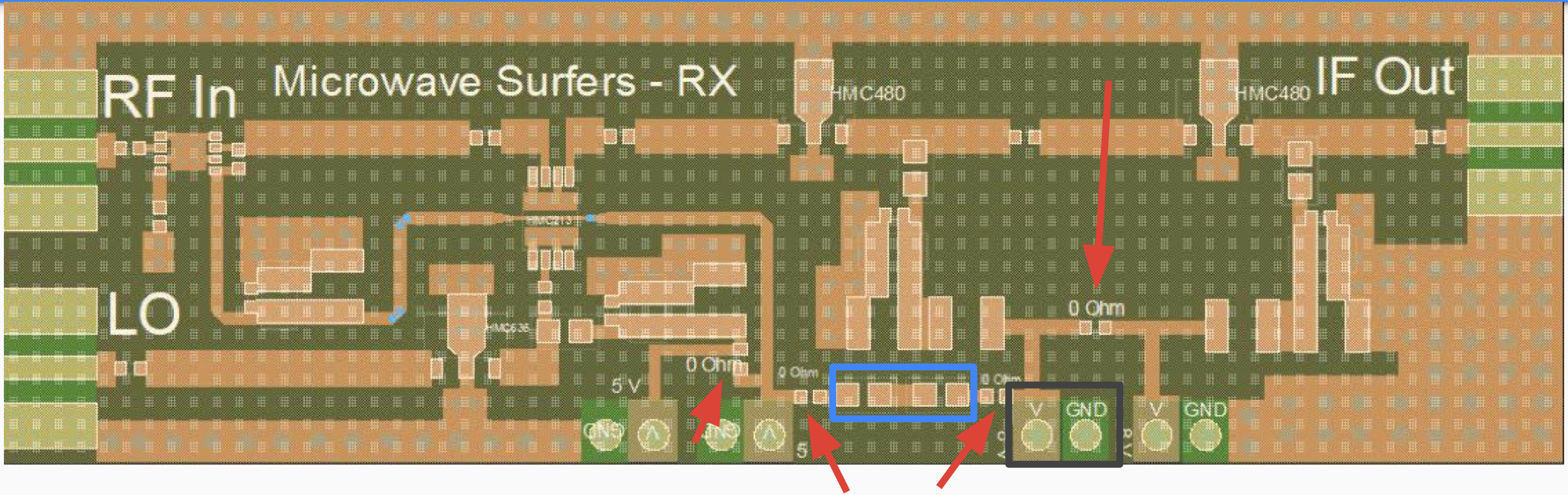
Mixer (HMC213) fed by amplifier HMC636 which is fed by LO. Amplifier has the same bias as the amplifier has in the TX.

Circuit design RX



Last two (identical) amplifiers (HMC480) cascaded. Also has same bias lines as the HMC480 has in the TX.

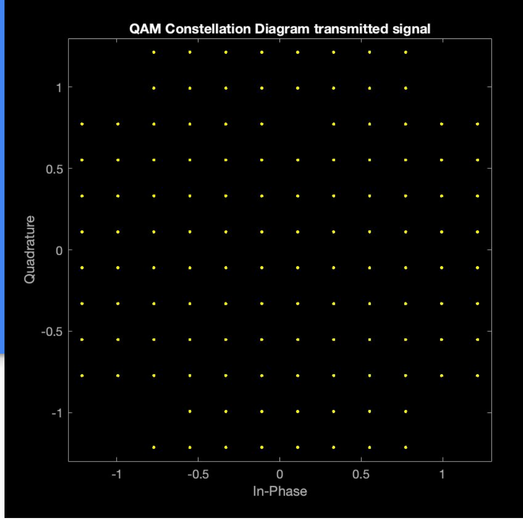
Circuit design RX



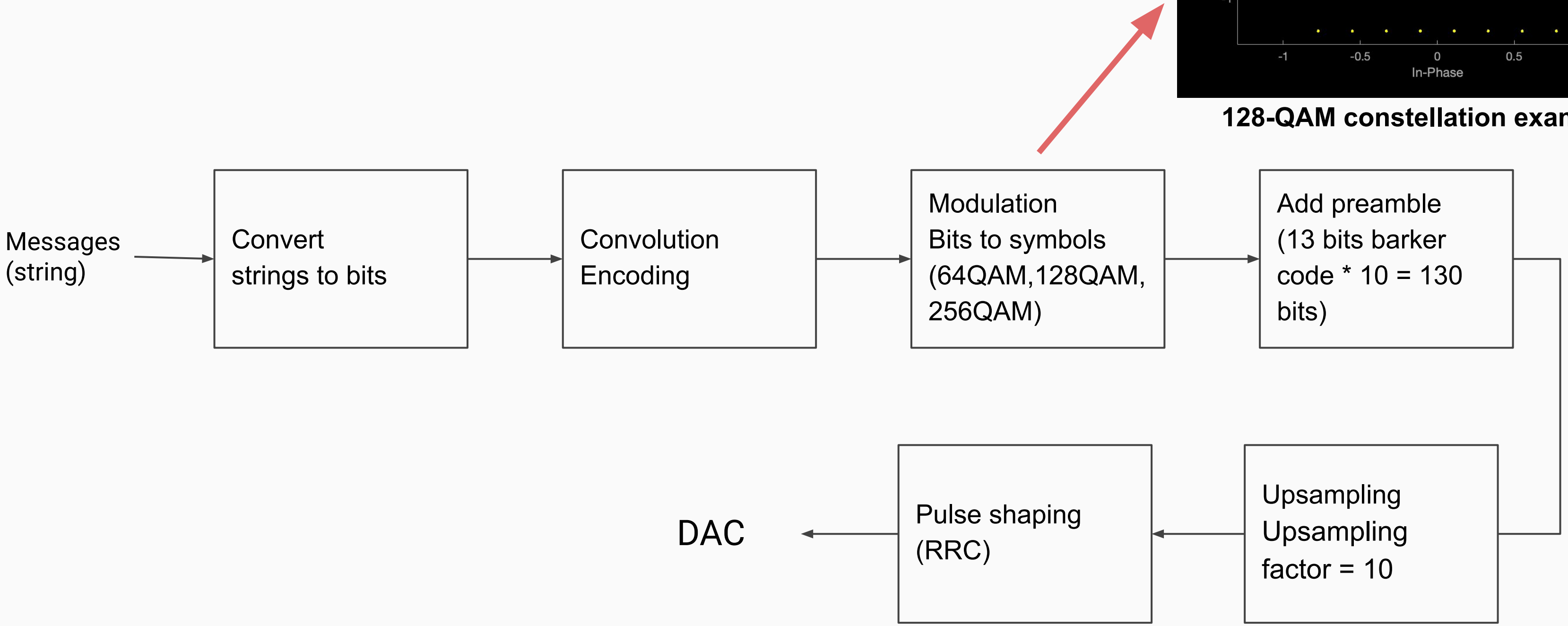
Our vision is that we feed all bias lines with one power supply (black rectangle), by soldering the 0 Ohm resistors (red arrows) and by stepping down the voltage with 2 series resistors (blue square). If that does not work, we remove the 0 Ohm resistors and feed each bias line through its own individual power supply.

Software Design

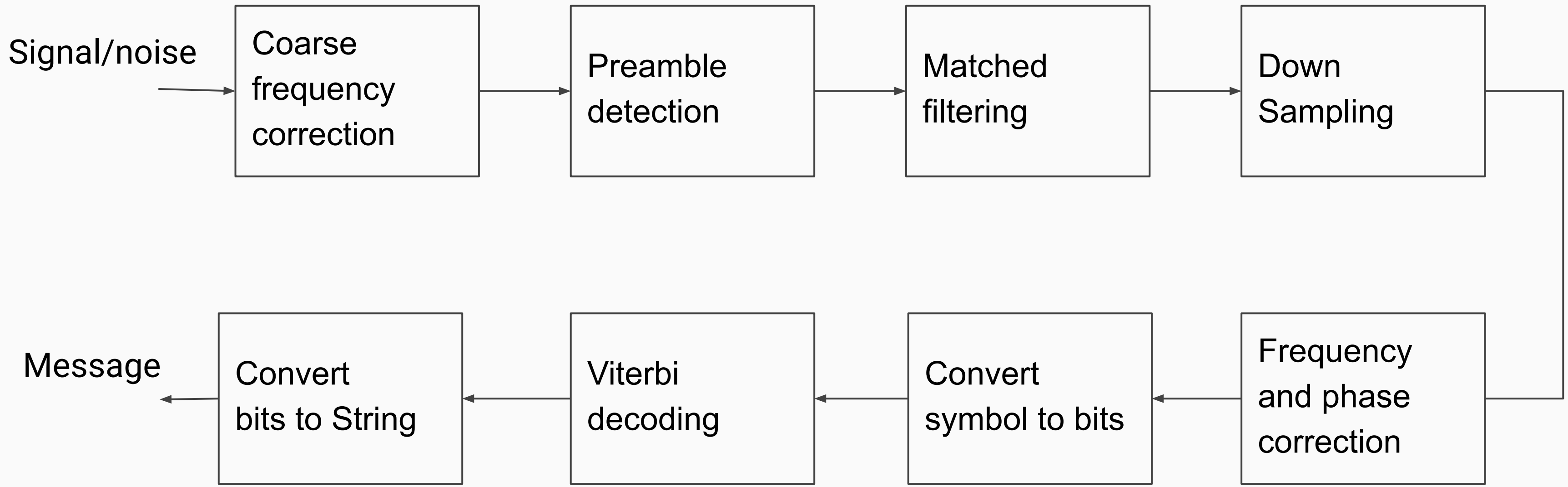
Transmitter Design



128-QAM constellation example



Receiver Design



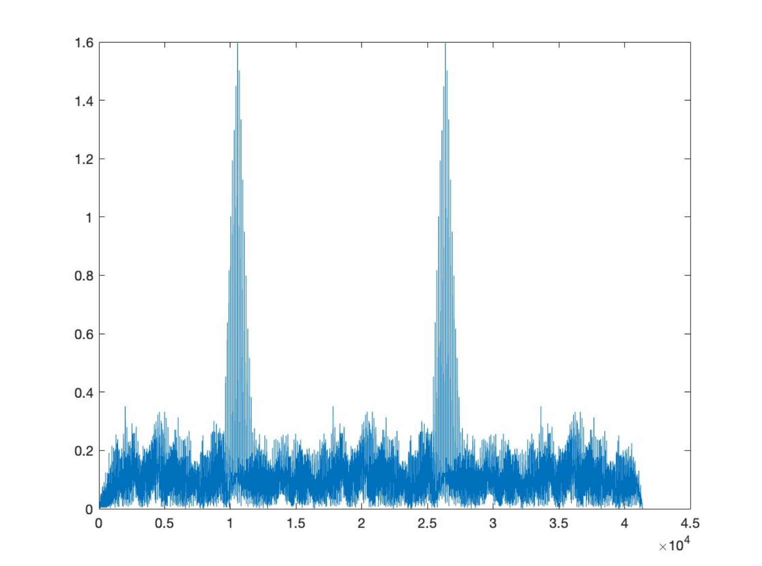
128-QAM (Test on the hardware provided / cable connection)

Parameters we set and got:
Interp_factor = 70, fsfd(sample per symbol) = 10
fs = 100M / Interp_factor = 1.43 MHz
Rb(bit rate) = 1 Mbits/s
BW = 100M / fsfd*Interp_factor = 143 KHz

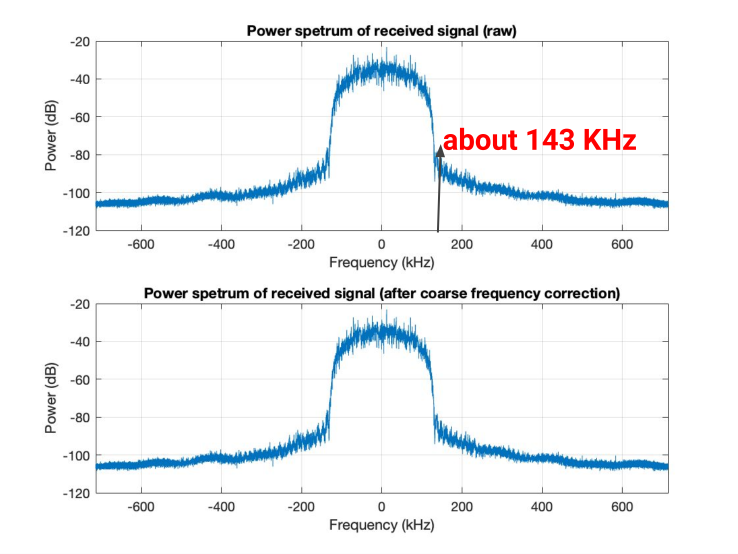
Note: Be careful of limitations of hardware

Ensure stable operation by avoiding clashes when the parameter exceeds or fall below a specified value.

Preamble detection

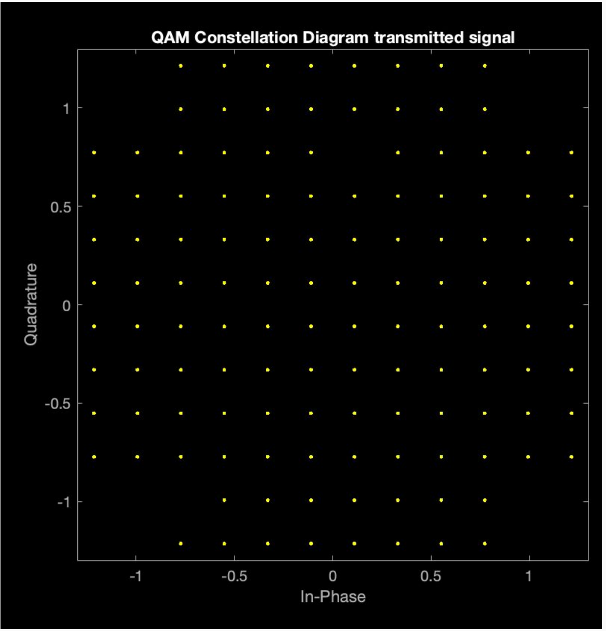


Received signal

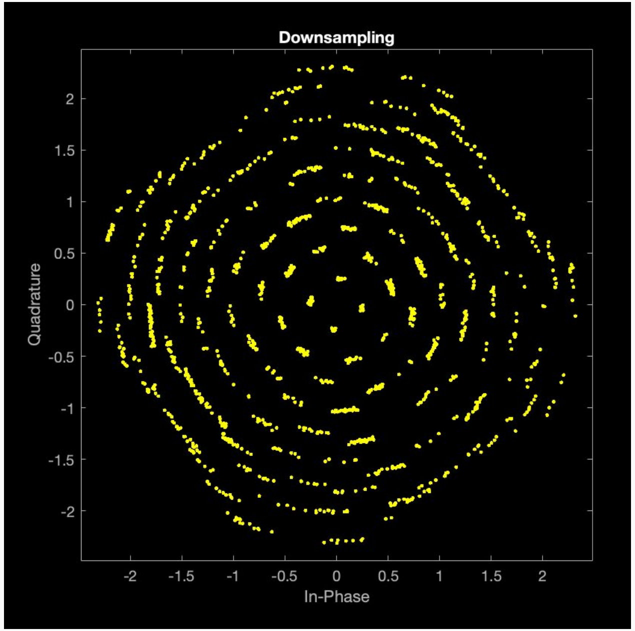


128-QAM (Test on the hardware provided / cable connection)

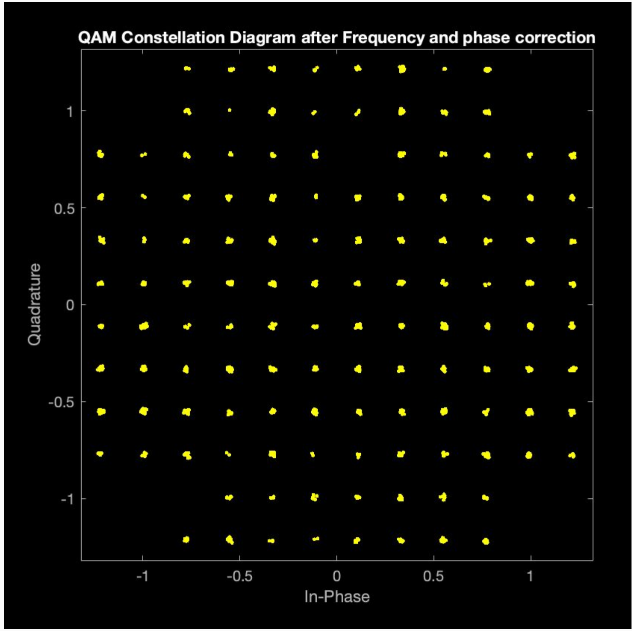
Transmitted signal



Received signal after downsampling



Received signal after frequency and phase correction

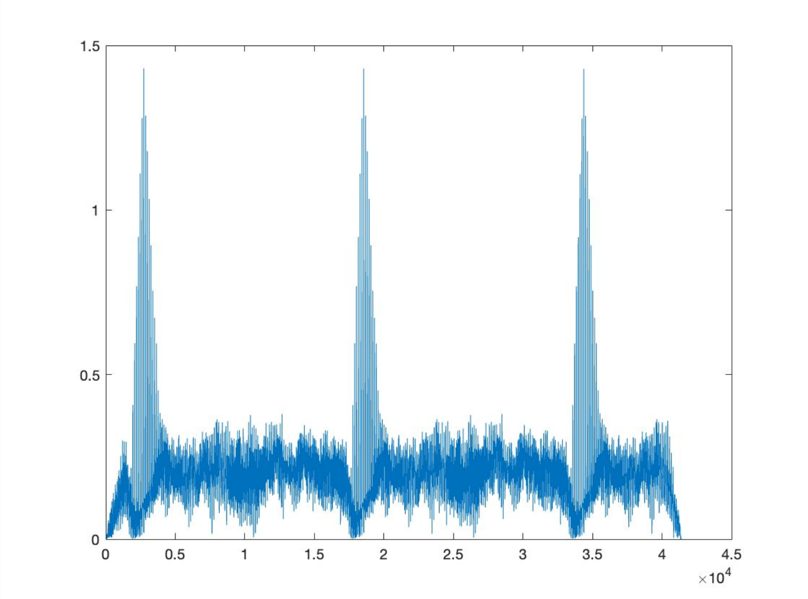


Bit error (0 / 50000 bits)

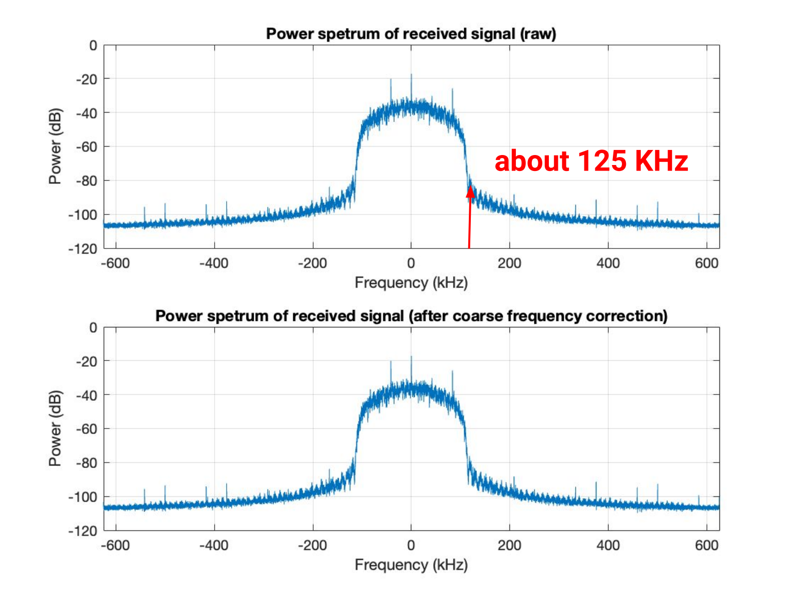
256-QAM (Test on the hardware provided / cable connection)

Parameters we set and got:
Interp_factor = 80, fsfd(sample per symbol) = 10
fs = 100M / Interp_factor = 1.25 MHz
Rb(bit rate) = 1 Mbits/s
BW = 100M / fsfd*Interp_factor = 125 KHz

Preamble detection



Received signal

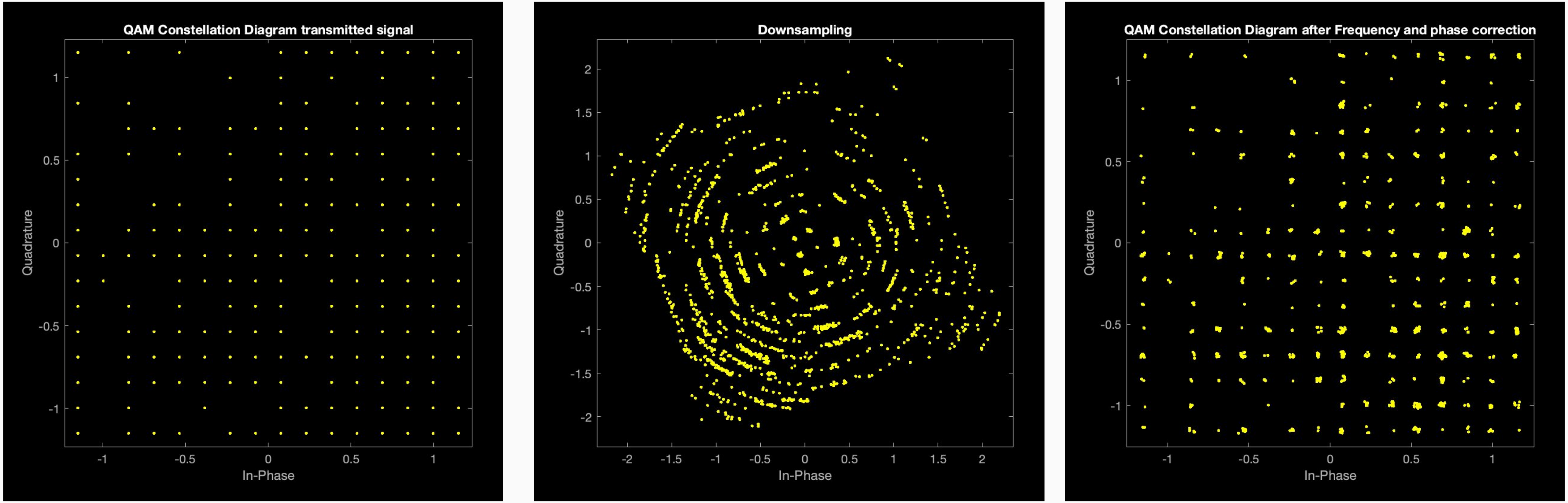


256-QAM (Test on the hardware provided / cable connection)

Transmitted signal

Received signal after downsampling

Received signal after frequency and phase correction



Bit error (0/50000 bits)

Thanks!

Contact us !

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