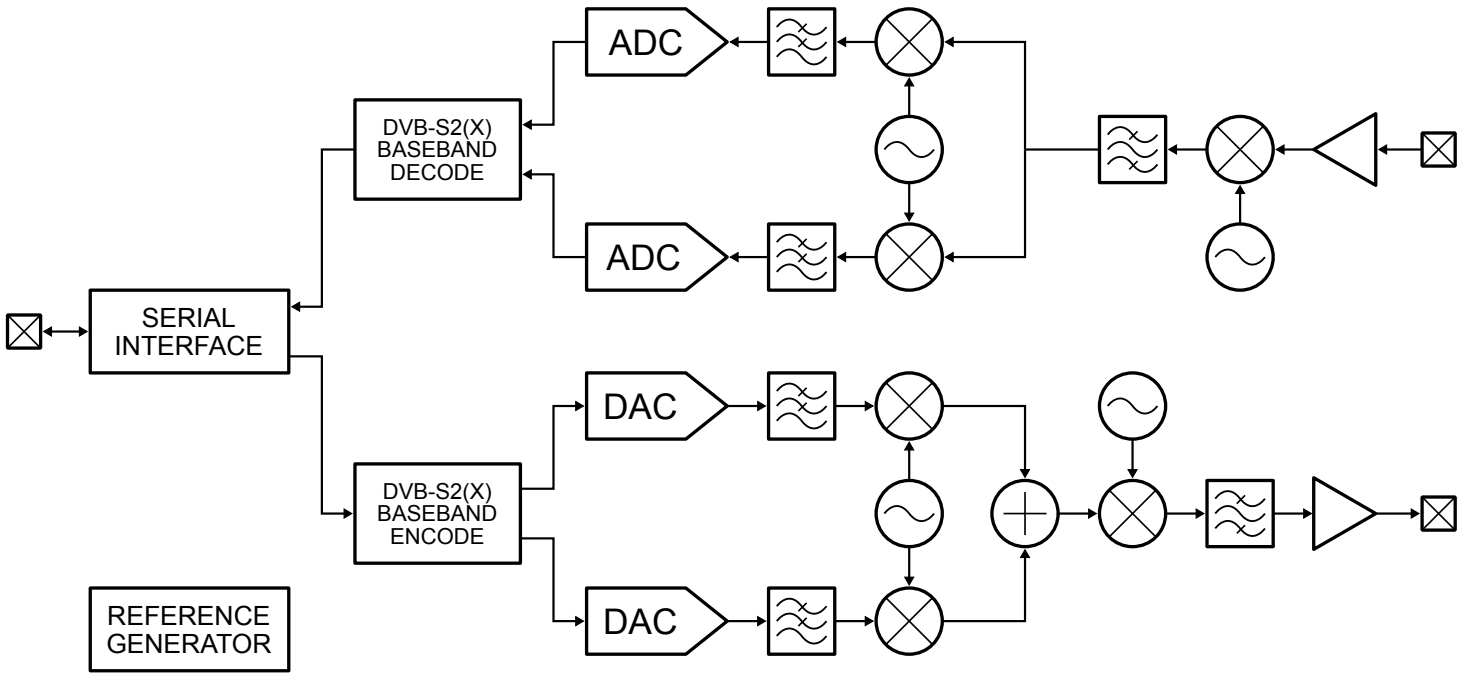
# Amateur Radio Satellite Transceiver (SKY130)

Thomas Parry

April 7, 2021

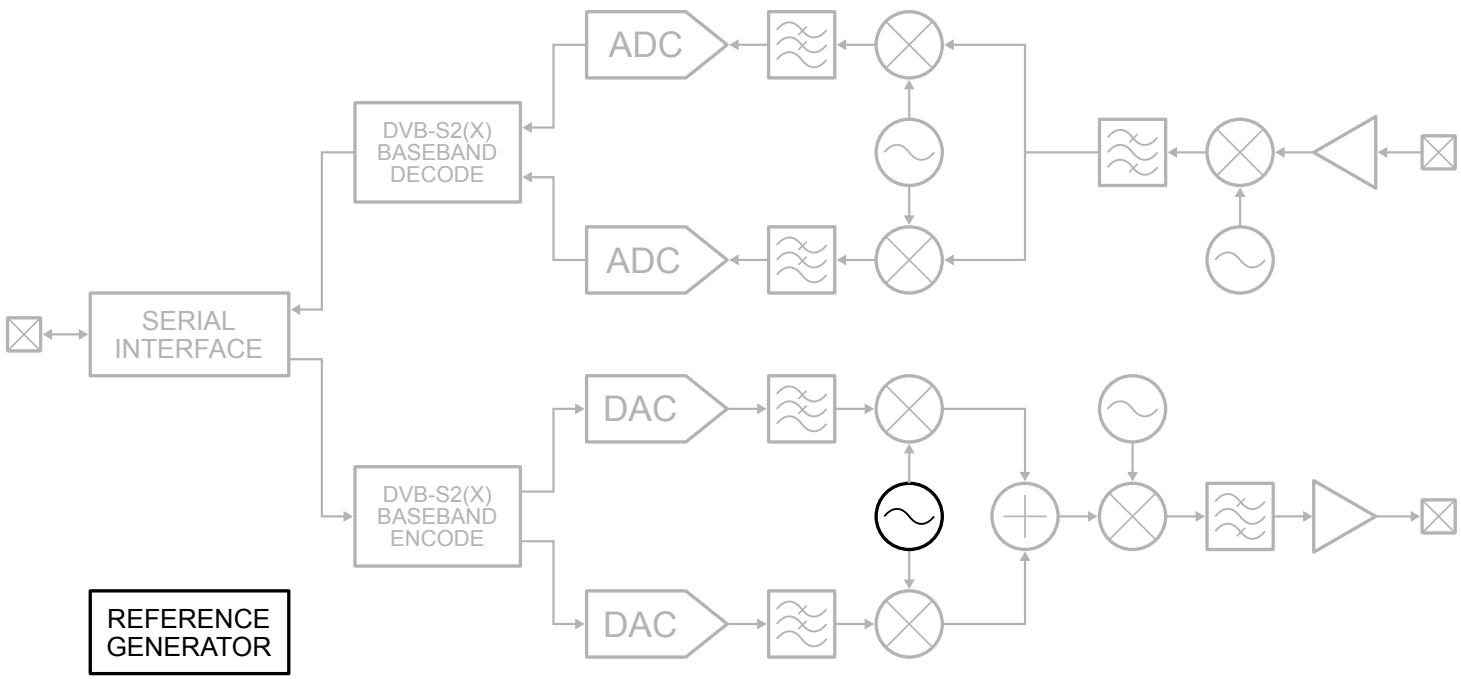
# System Goal



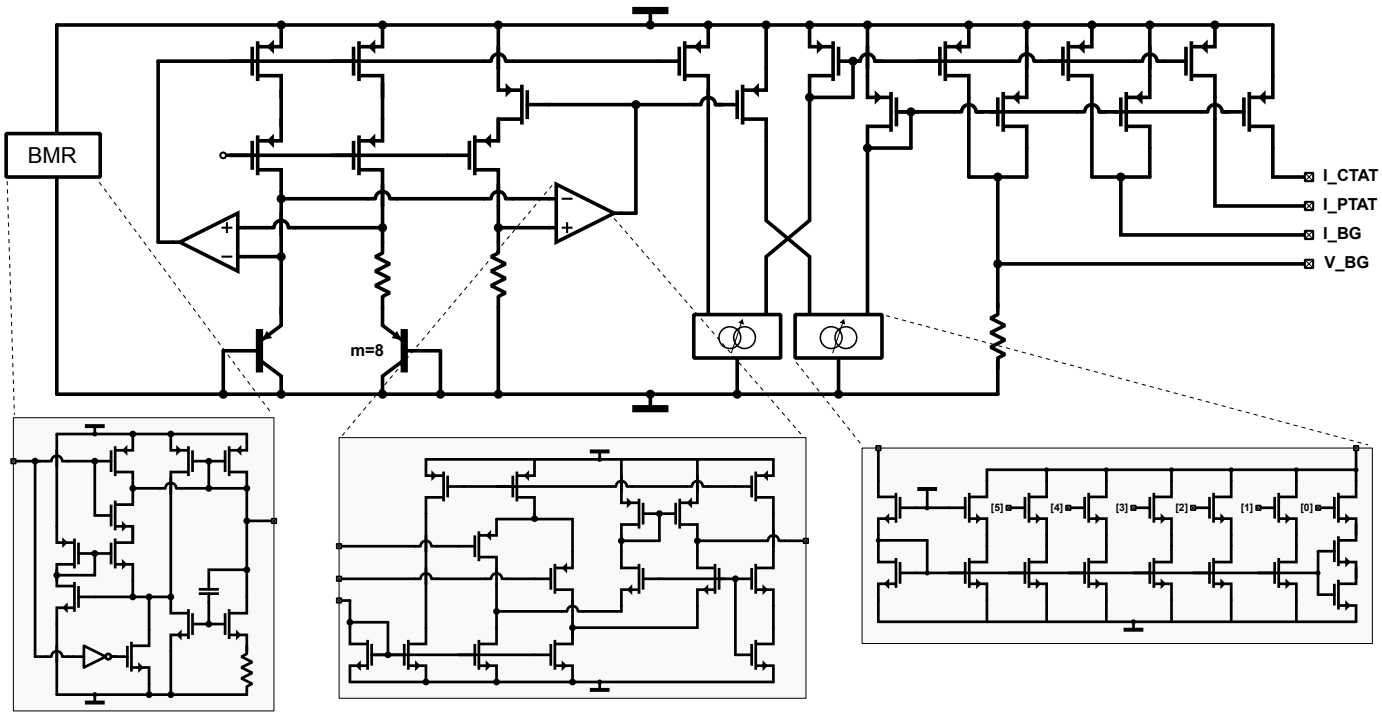

- Amateur radio satellite transceiver
- Microwave bands - 2.4 GHz, 5.8 GHz and 10.2 GHz
- Payload data to antenna and back

# MPW-A

# System View

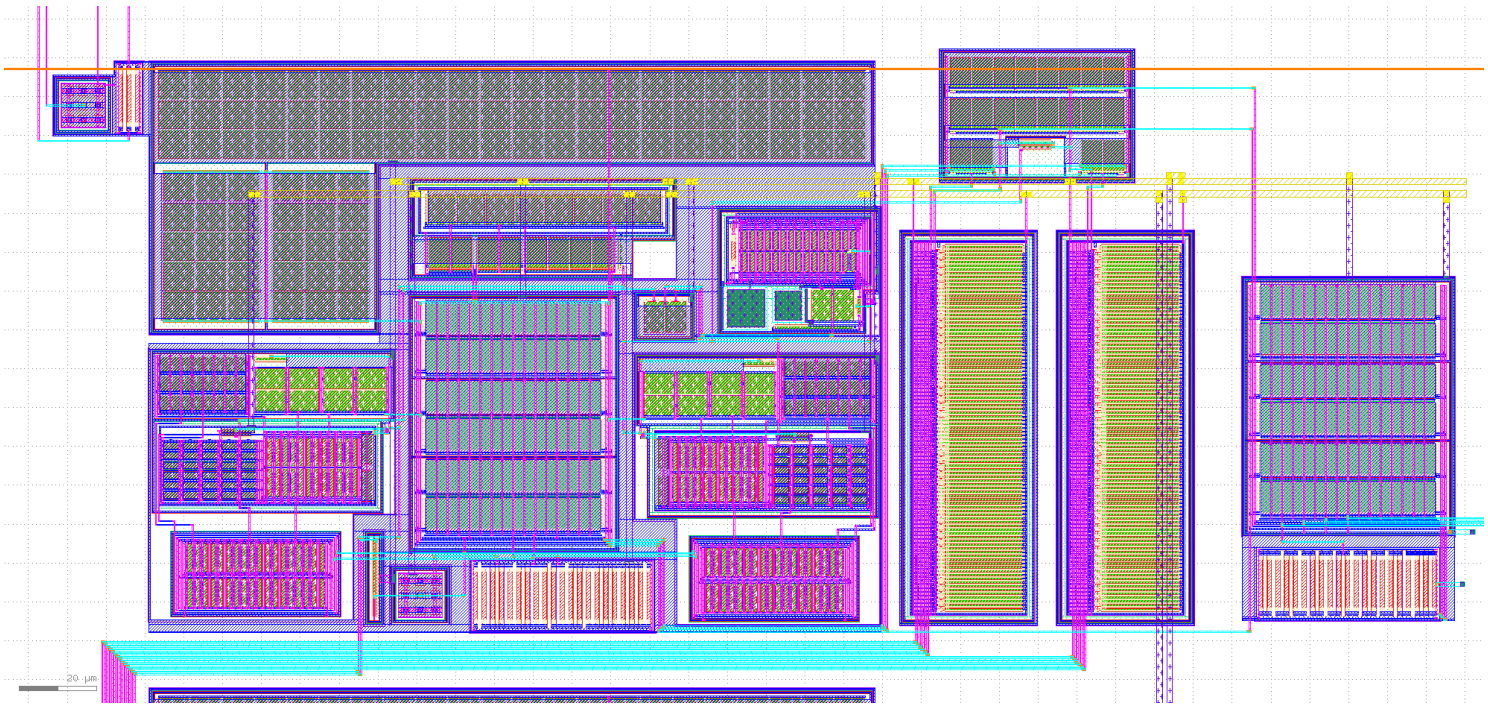

ADC
DVB-S2(X)
BASEBAND
DECODE
ADC
SERIAL
INTERFACE
DAC
DVB-S2(X)
BASEBAND
ENCODE
DAC
REFERENCE
GENERATOR

# Bandgap Topology

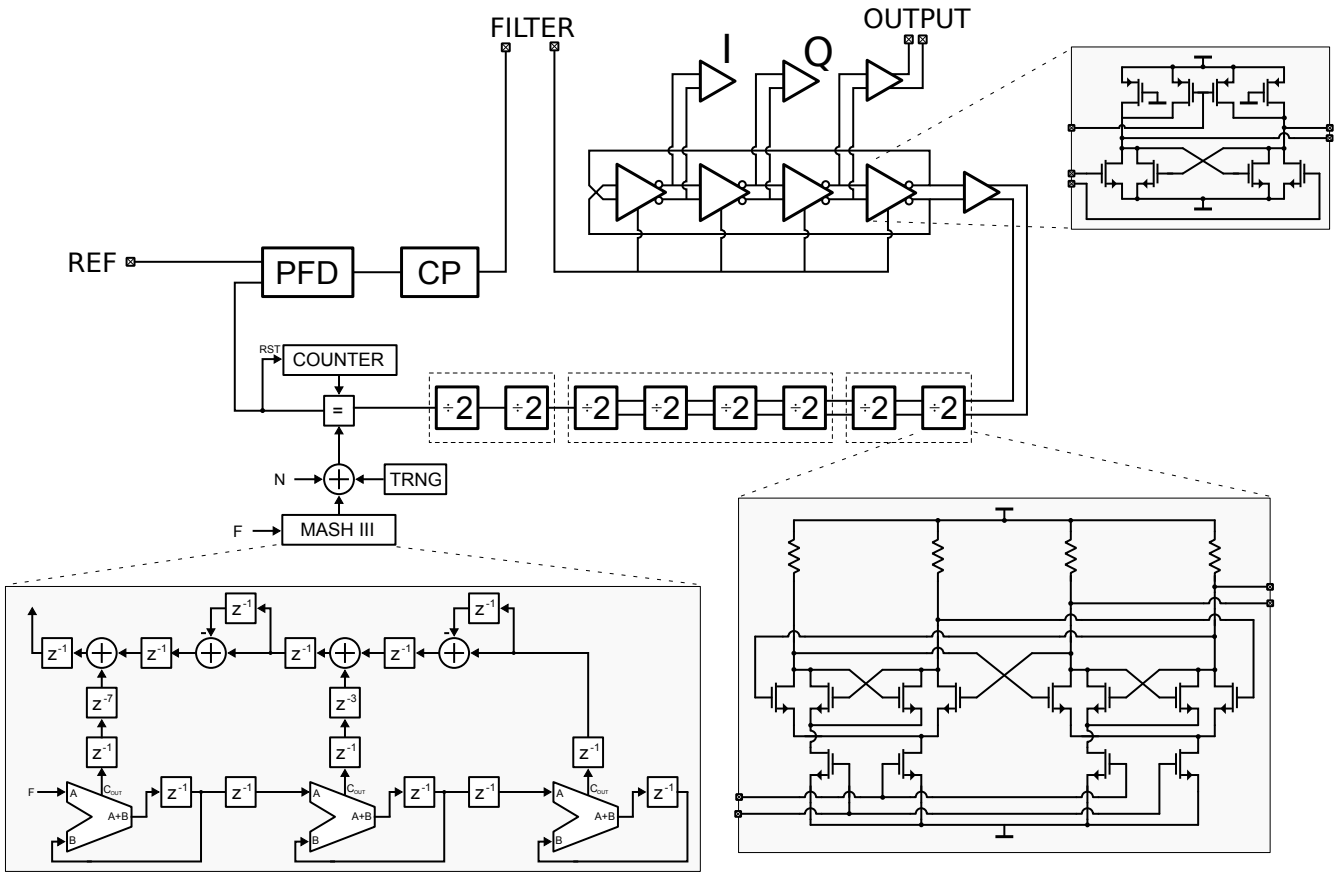



- Separate PTAT and CTAT with 6-bits trimming
- Less than $\pm 0.2\%$ variation from $-40^\circ$ to $125^\circ$

# Bandgap Layout

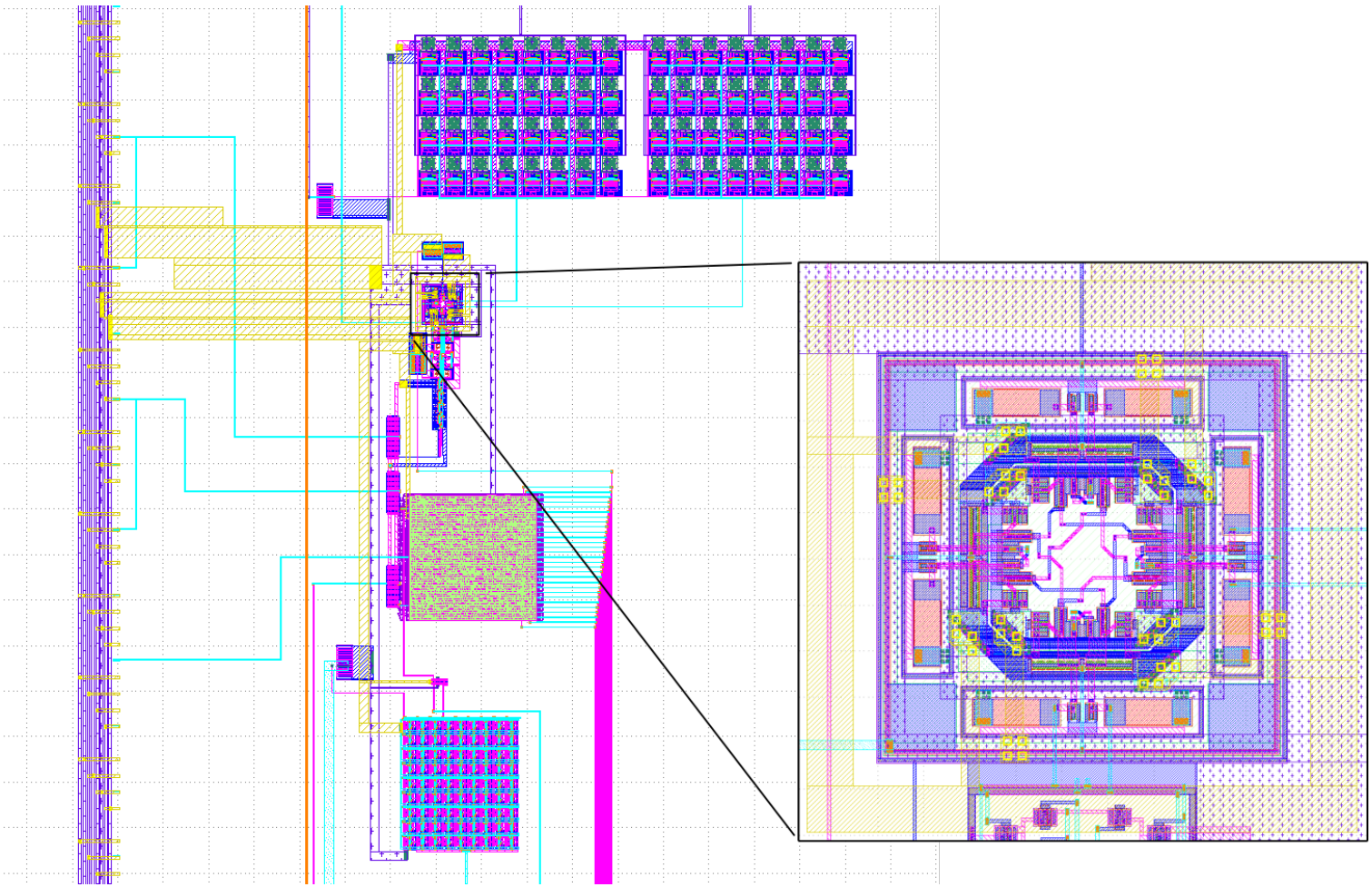


# PLL Topology



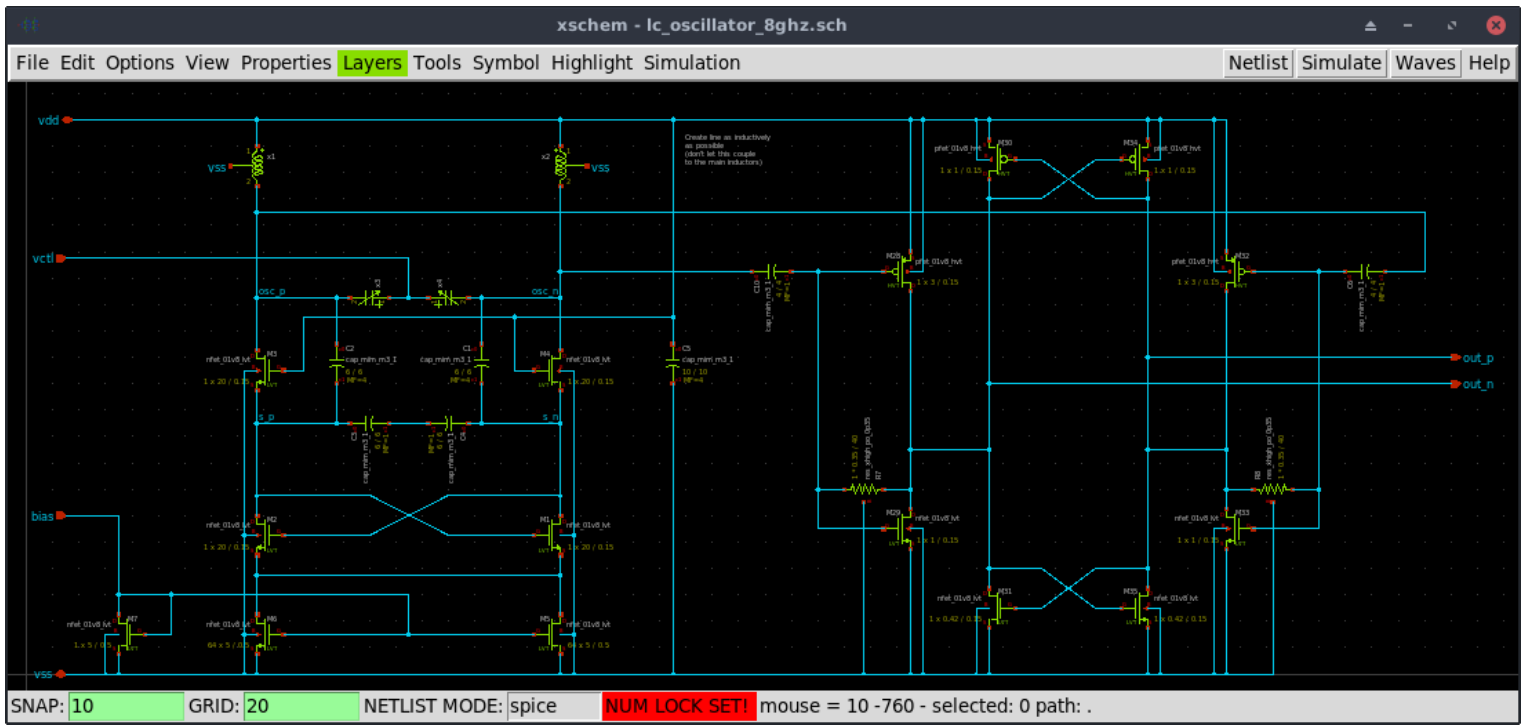

- 1.3 - 3.6 GHz differential quadrature output range
- CML and FF pre-scalars, third-order MASH modulator with TRNG dither
- Off chip compensation filter

# PLL Layout



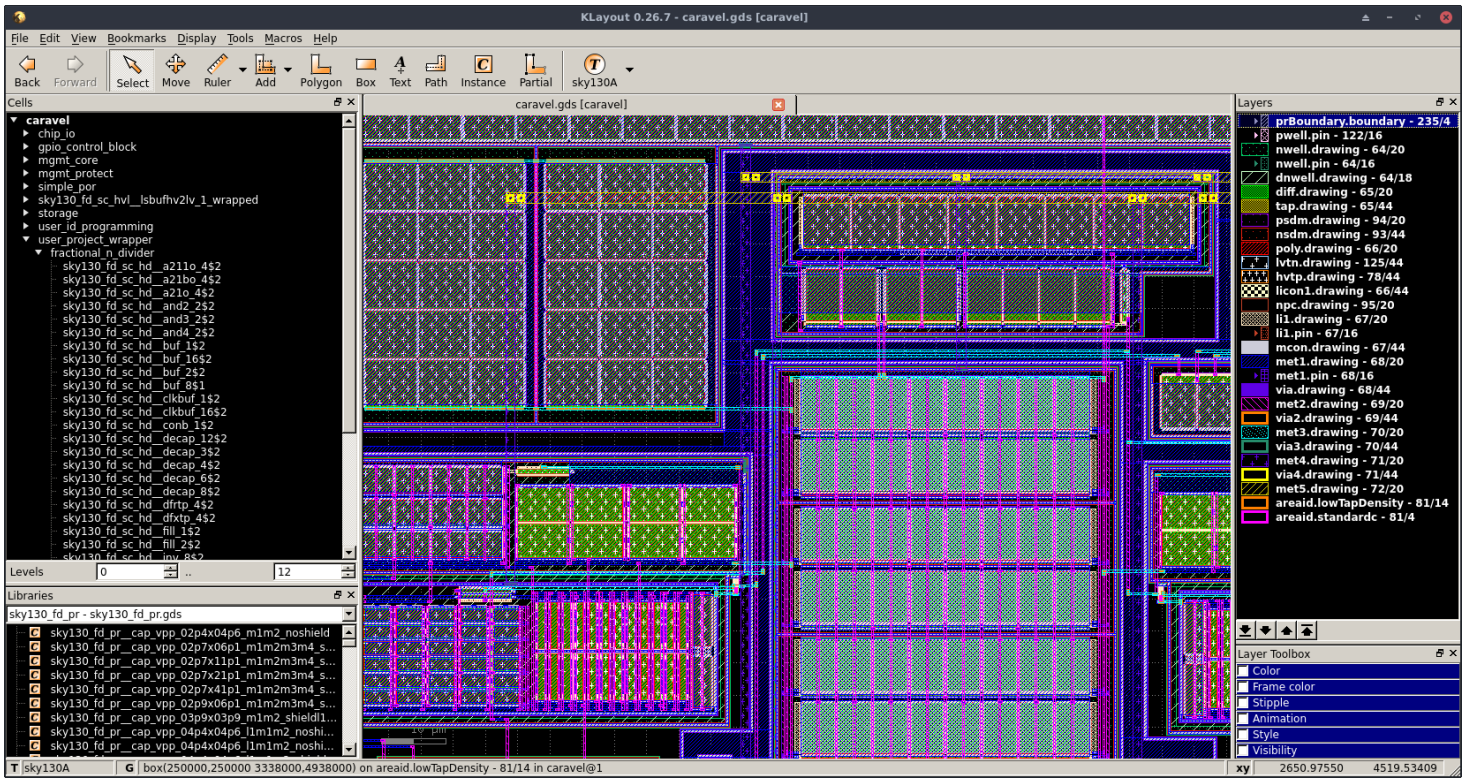
# Tools

# Schematic Capture




xschem - github.com/StefanSchippers/xschem

# Layout




KLayout - klayout.de

Magic - opencircuitdesign.com/magic

# Simulation

Open source Spice simulators:

- NGSpice
- Xyce

Command line interface only

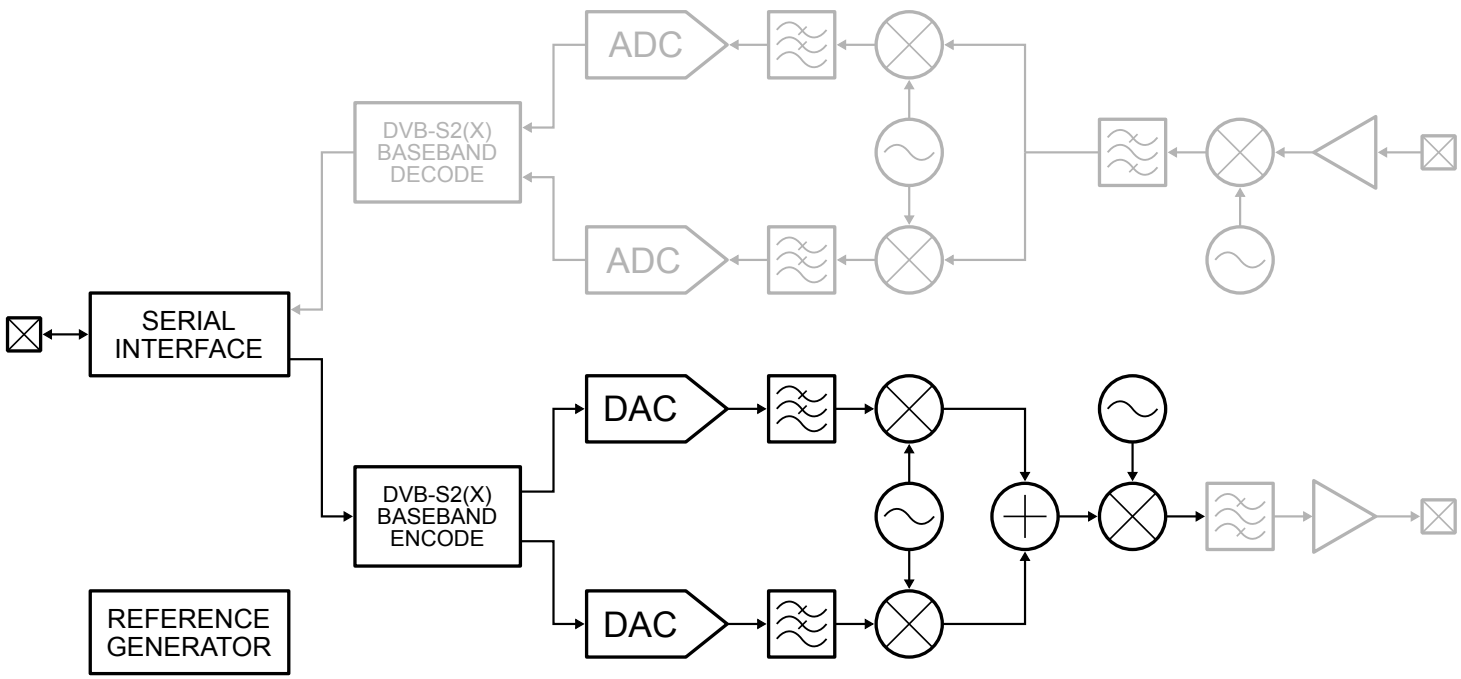
# Python

Components plugged together using Python.

- Device characterisation and querying
- Automated simulation
- Post-processing measurement
- Unit tests (OpenHTF / pytest)

# MPW-B

# Aim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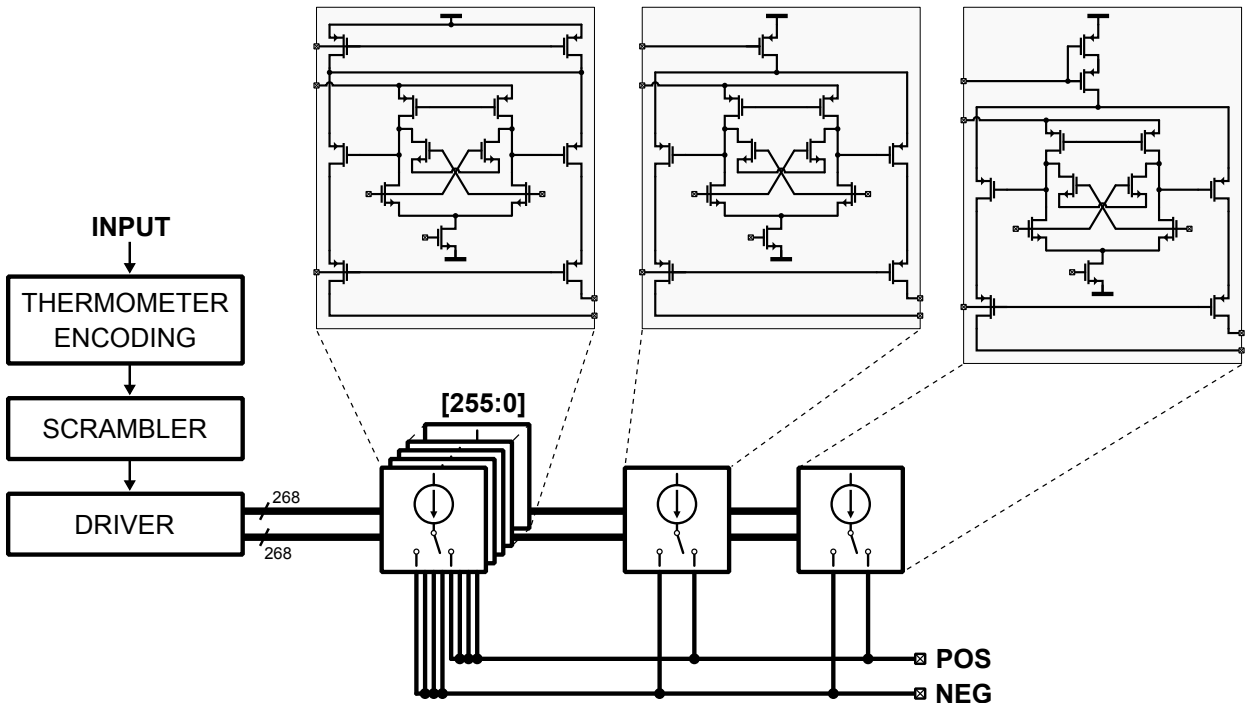
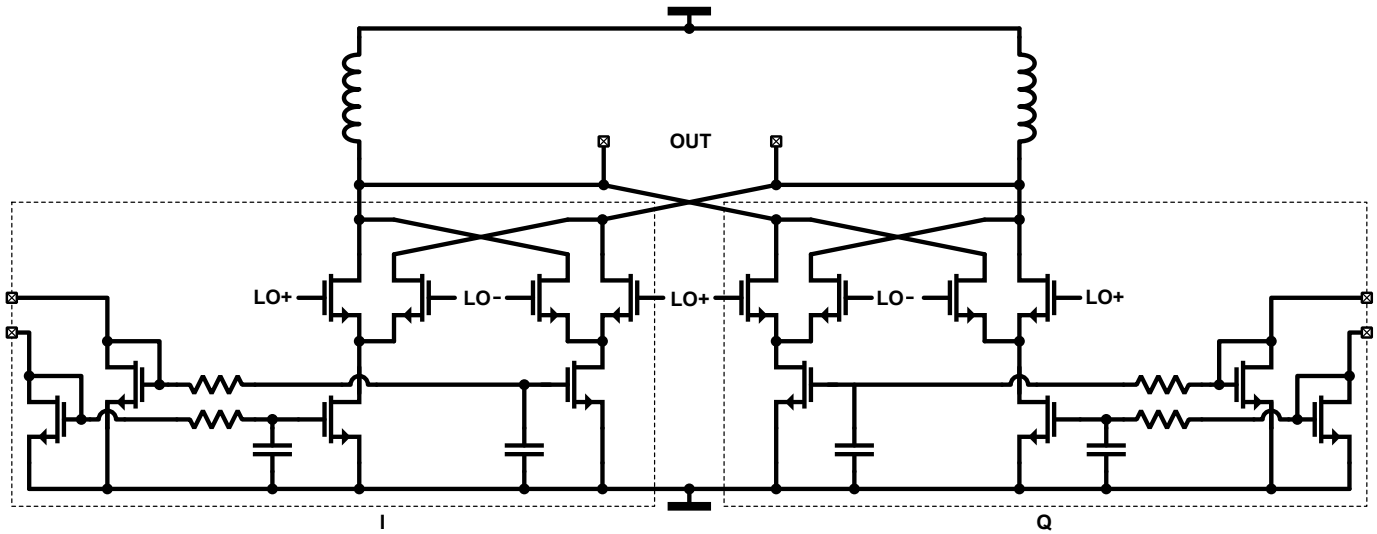
# DAC Topology



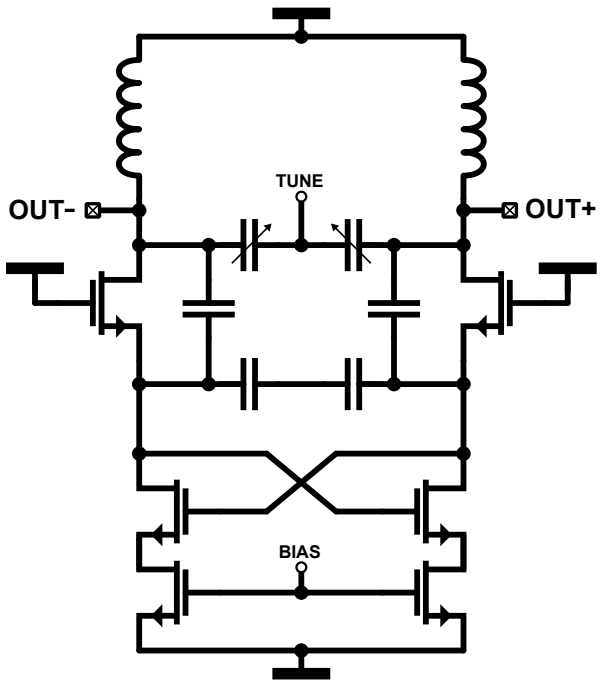

- 10-bit current steered differential DAC
- Mismatch scrambling

# Mixer Topology



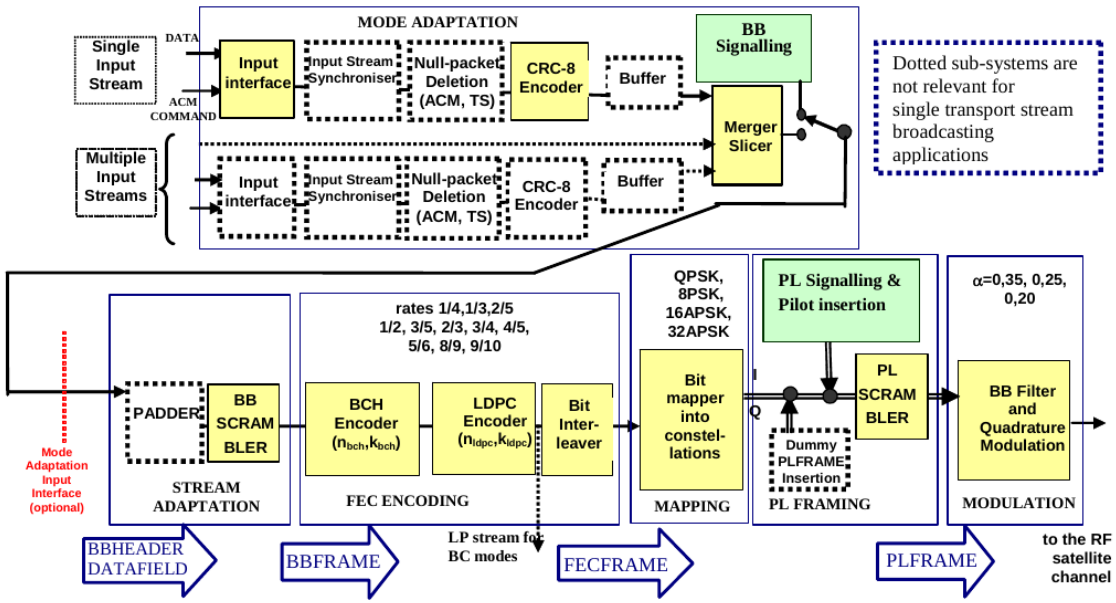

- Current inputs
- Single pole low pass filter
- Baseband to L band

# Oscillator Topology




- Colpitts based topology
- 8 GHz nominal

# DVB-S2(X) Baseband Modulator




- LDPC + BCH forward error correction
- Modulation
- Near Shannon limit operation

Phase4 project: phase4space.github.io

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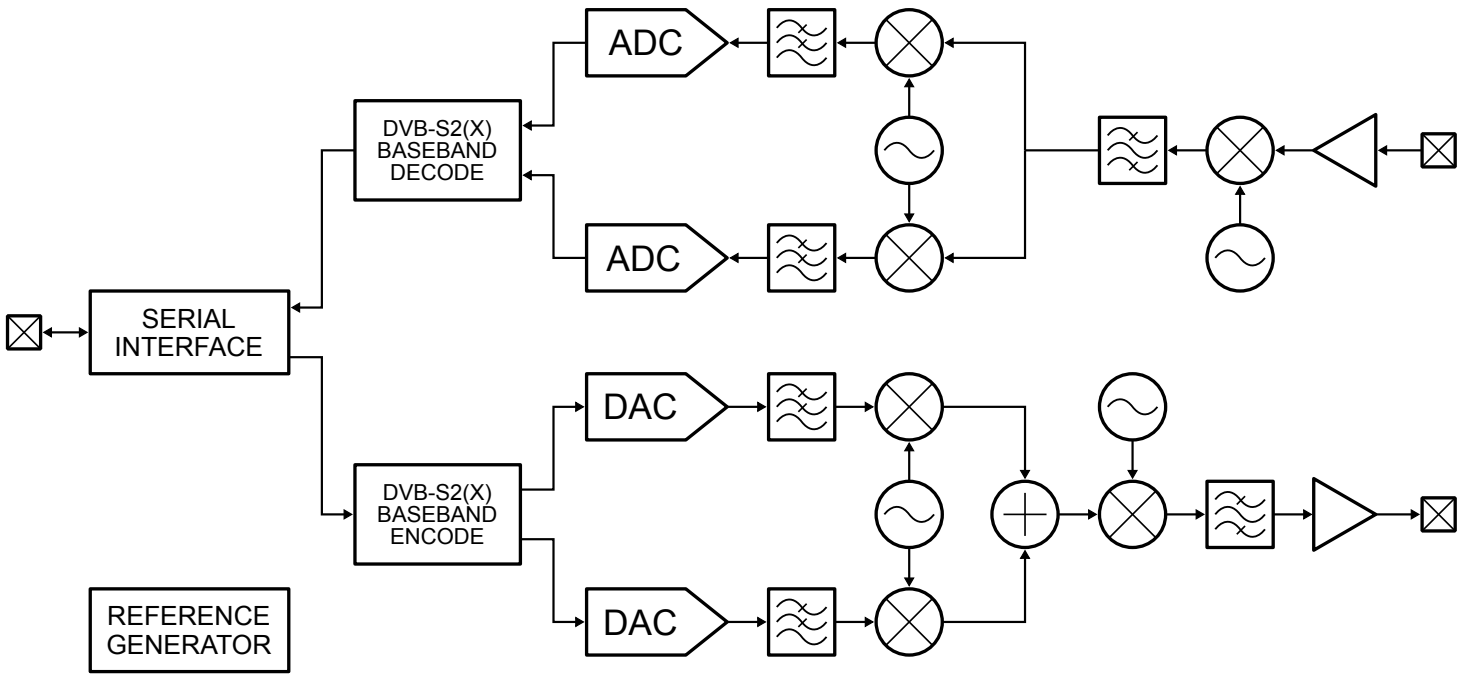
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# Thanks

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@yrrapt on Skywater Slack channel