K6MG Gary Lauterbach

MGDCDL

A DC to Daylight Transceiver

The Motivation

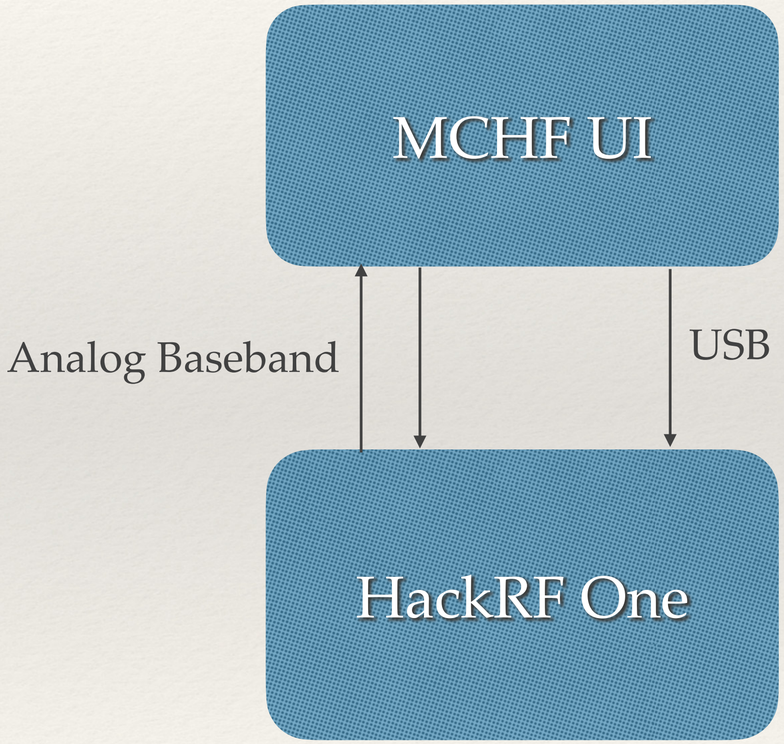
- A single compact radio that could be used for:
  - Backpacking/Camping/Vacation
  - SBMS multi-band microwave contest
  - mm-wave IF radio
  - SOTA

The idea

- MCHF user interface
  - Us old guys like to have an interface with switches and knobs
  - Don’t need to lug a Laptop along
  - Excellent development and user community supporting it
  - Was available for $150 without the RF board
- HackRF One
  - 1 MHz to 6 GHz SDR
  - Reasonable price: $300
  - Transceiver, many SDRs are receive only

The architecture

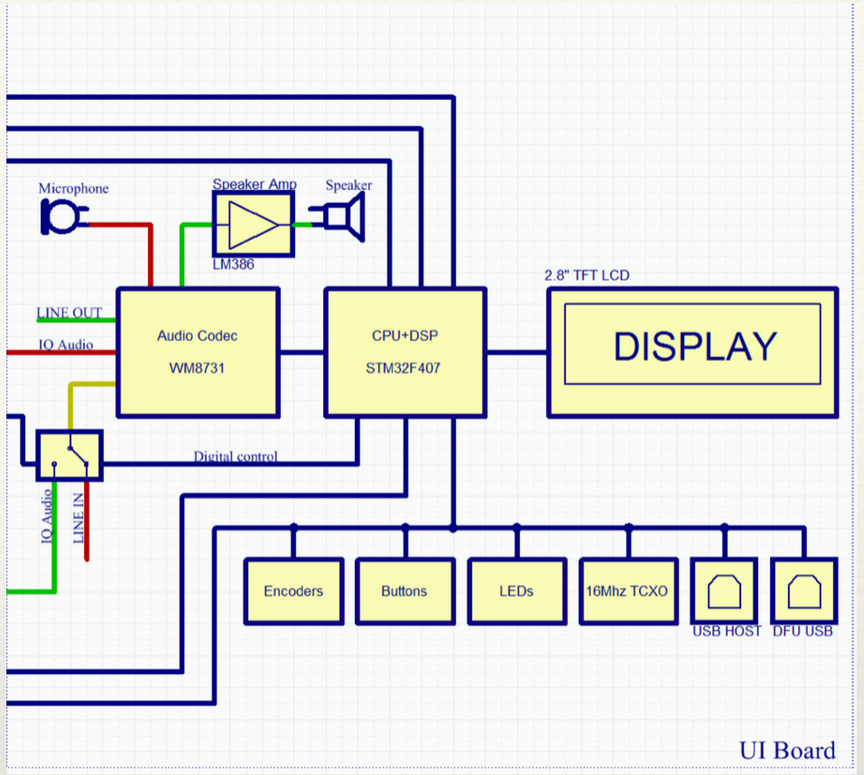
- The HackRF uses an 8 bit high speed A/D and D/A
  - low dynamic range
  - wide bandwidth
  - Not really ideal for narrow band ham radio activities
- Tap off the analog baseband signals and send to/from the MCHF
  - Utilizes the MCHF codec which is well supported with many modulation schemes
- Tuning and T/R over USB

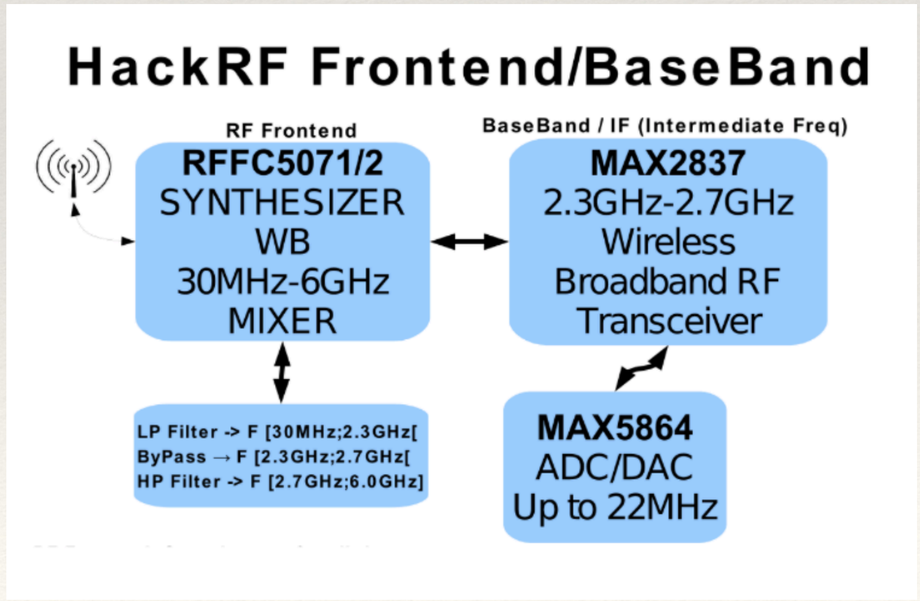


Block diagrams

MCHF UI: audio codec, LCD, microprocessor, front panel, speaker amplifier

HackRF: wide band converter, synthesizer, 2.4 GHz IF converter

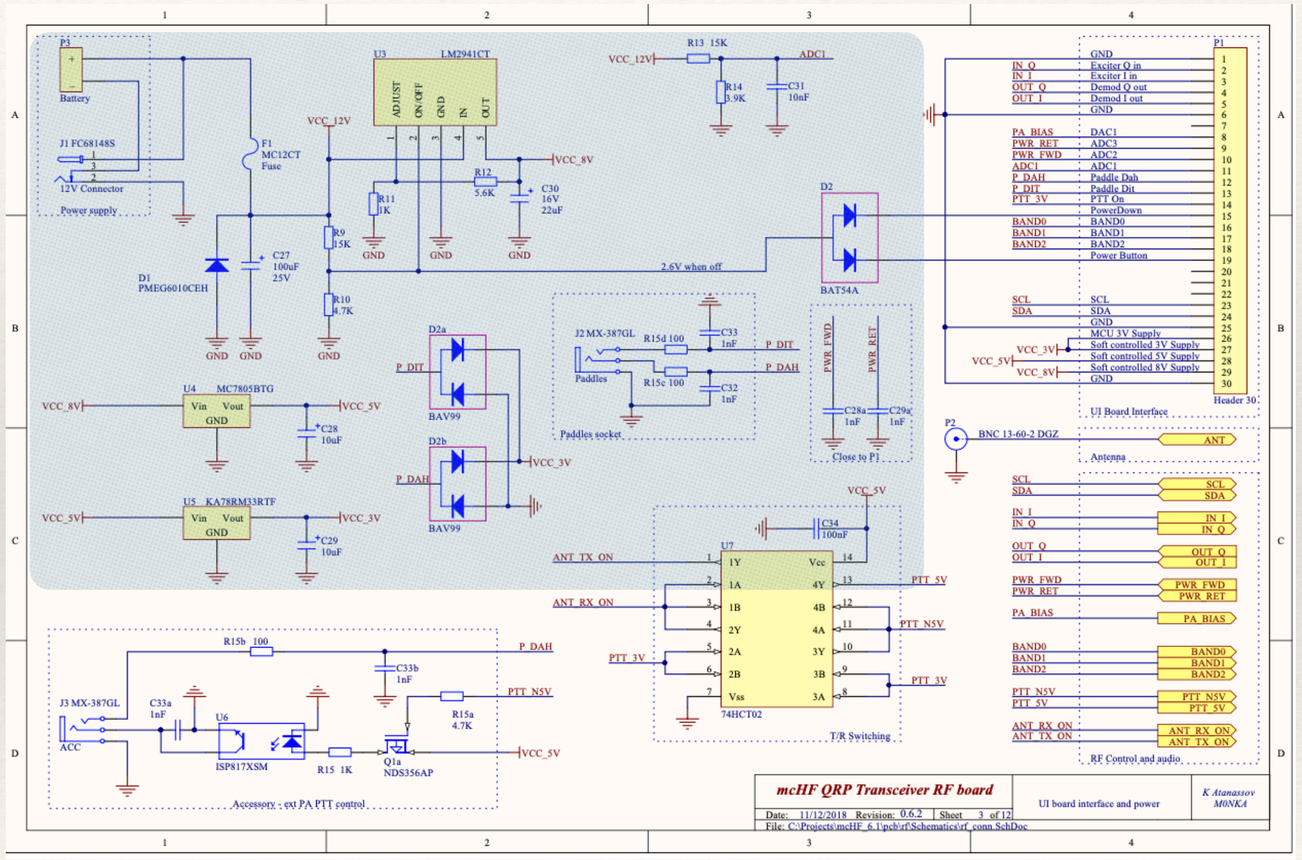




MCHF UI additions

Some voltage regulators required to power the MCHF UI board are on the missing RF board

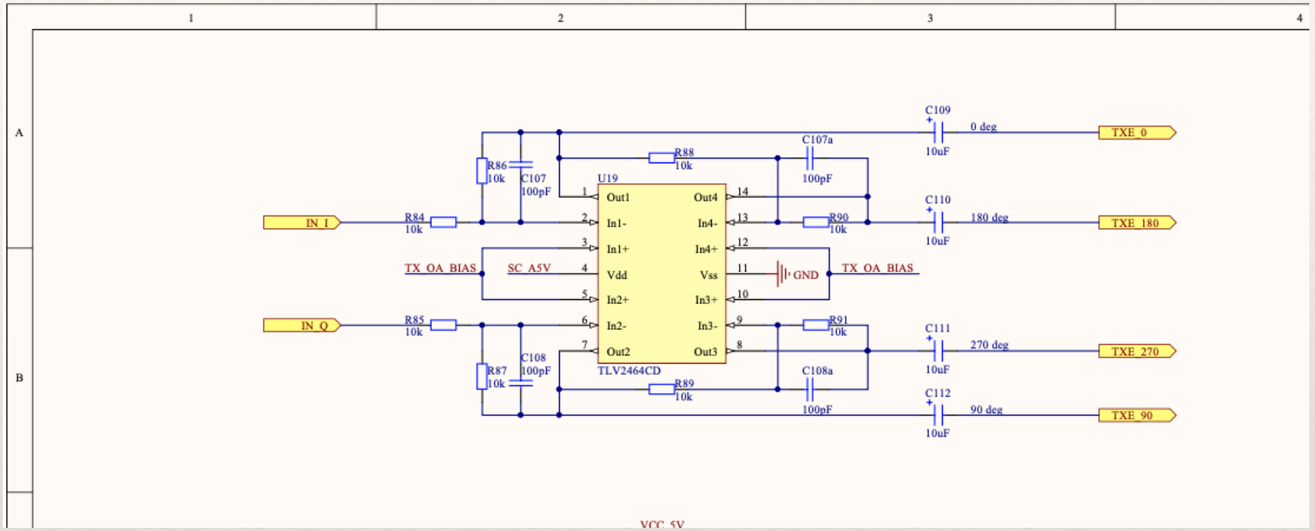
I built these on a small perf board

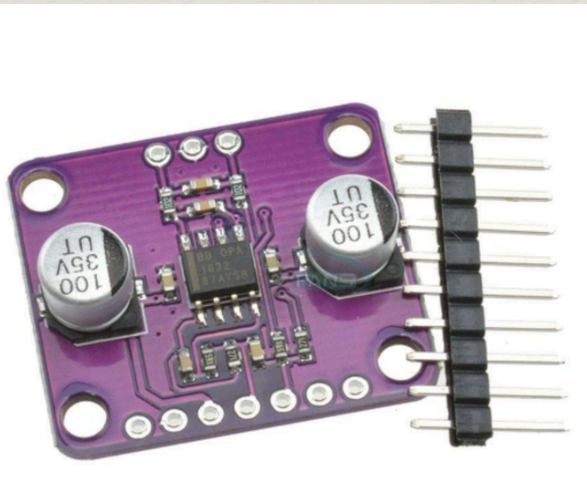


TX analog interface to HackRF

MCHF RF board uses a quad opamp to interface the codec to the transmit mixer

I replaced this with two OPA1632 differential audio line drivers



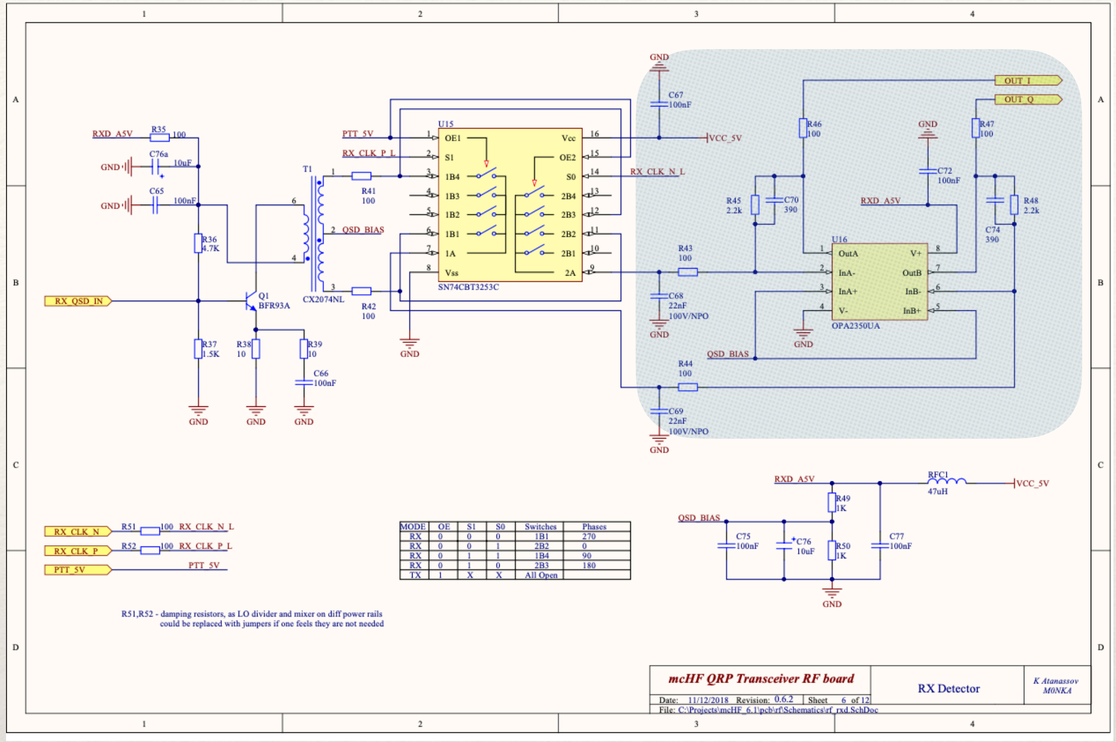


RX analog interface to HackRF

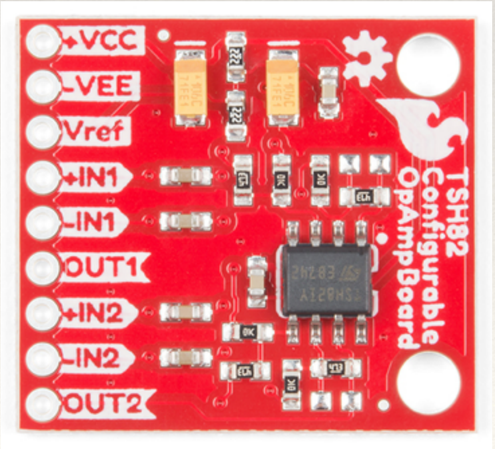
Replace the MCHF RF mixer post amplifier with dual differential input to single ended output TSH82 op-amp

HackRF is differential output, MCHF codec is single ended

Differential signals run between the HackRF and MCHF UI



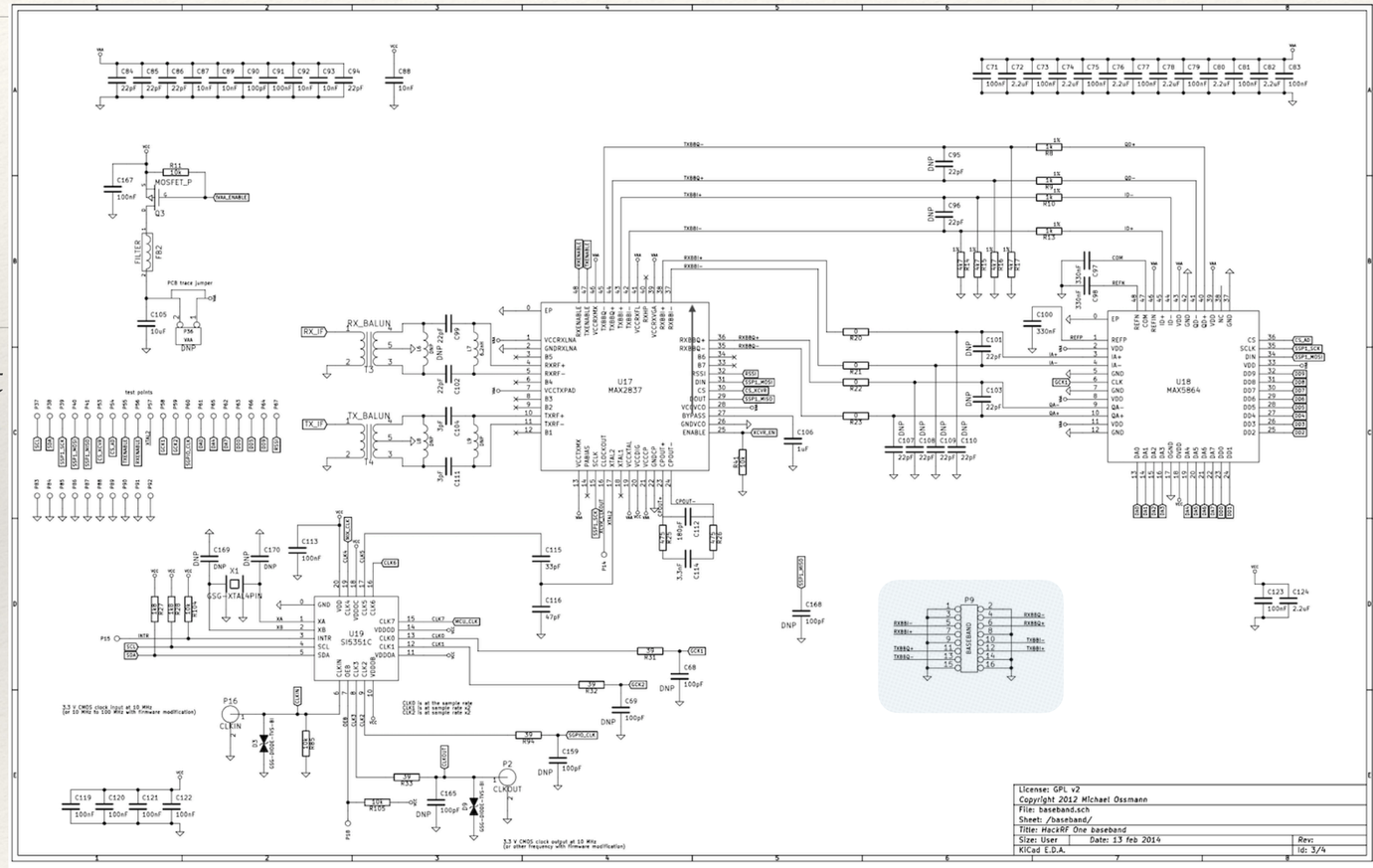
MODE	OE	S1	S0	Switches	Phases
RX	0	0	0	1B1	270
RX	0	0	1	2B2	0
RX	0	1	1	1B4	90
RX	0	1	0	2B3	180
TX	1	X	X	All Open	



HackRF audio connections

Differential baseband audio in/out available on P9 socket

Shielded differential cables connect the HackRF to the MCHF UI



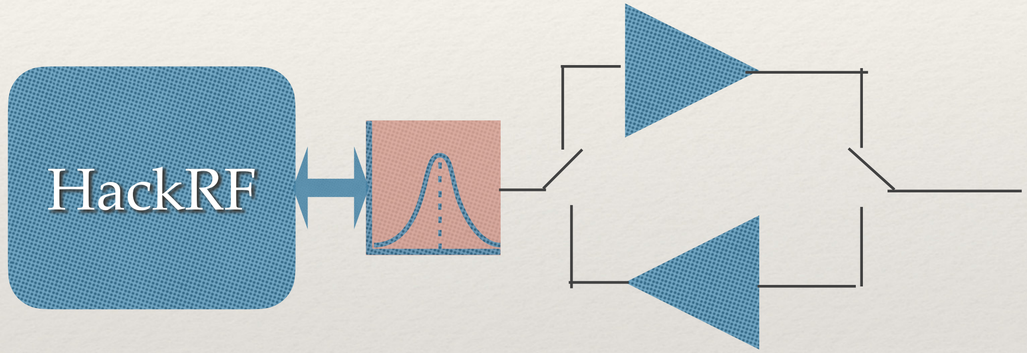
Software Modifications and additions

- Downloaded the MCHF SW environment from GitHub
- Built the standard release using “command line” tools not Eclipse
- Added the additional bands to the code:
  6m,2m,220,432,900,1296,2304,3456,5760
- Still have to add the USB interface code to connect the MCHF tuning knob to the HackRF synthesizer

POWER
- BAND +
mcHF-QRP
RX TX
HF SDR TRANSCEIVER
3488.105.200
DISABLED
DISABLED
MODE
DSP
PA
BW
F1
F2
F3
F4
F5
STEP

POWER
- BAND +
mcHF-QRP
RX TX
HF SDR TRANSCEIVER
3456.105.200
DISABLED
DISABLED
8.48 V
MENU
SWAP
SPLIT
VFO A
TUNE
MODE
DSP
PA
BW
F1
F2
F3
F4
F5
STEP

POWER
- BAND +
mcHF-QRP
RX TX
HF SDR TRANSCEIVER
1296.305.200
MENU
SWAP
SPLIT
VFO A
TUNE
MODE
DSP
PA
BW
F1
F2
F3
F4
F5
STEP

High performance

- Frontends and PA's for each band are needed for high performance
  - Base HackRF is 1-10 mw
  - ~10db NF
  - No band filtering