A High Performance RF Transceiver Implementation

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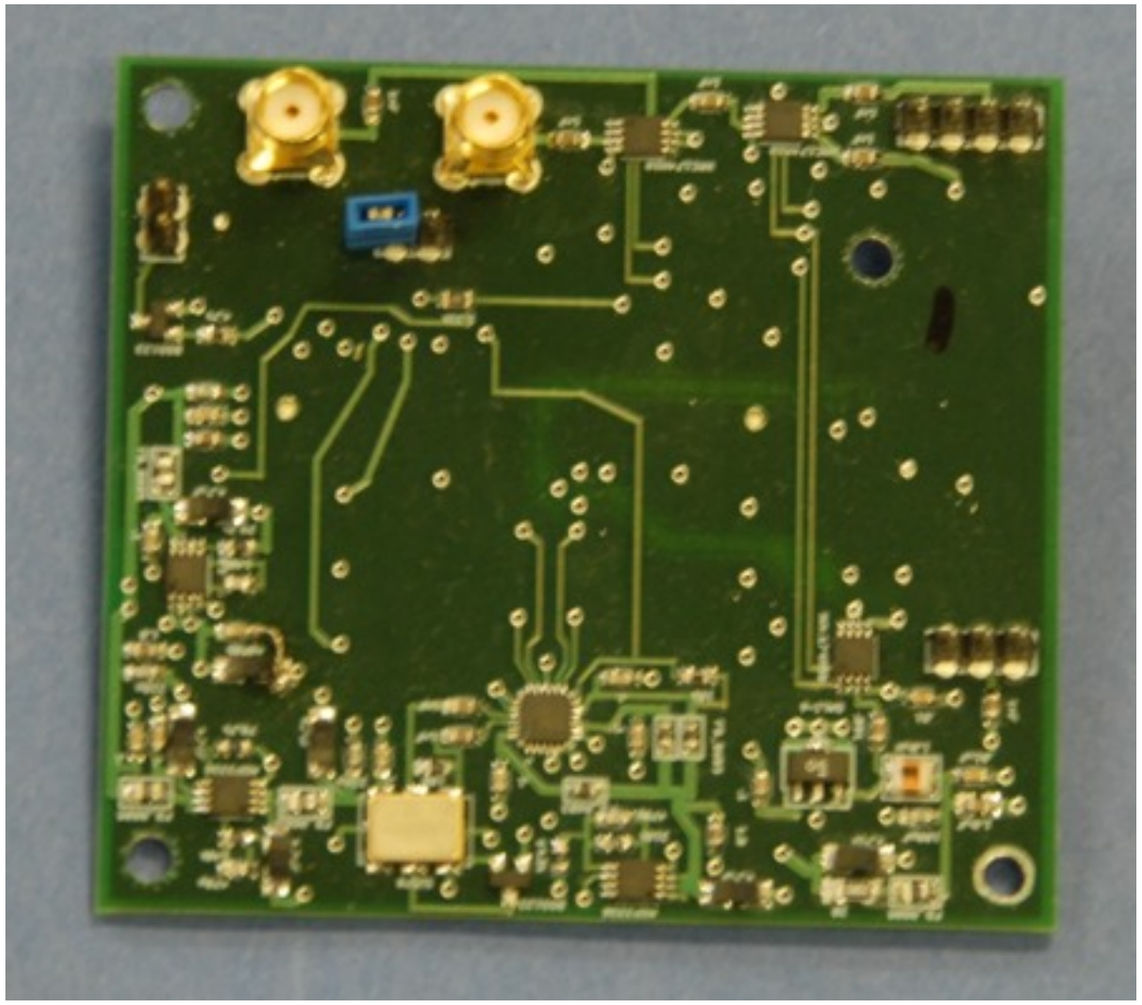
Motivation

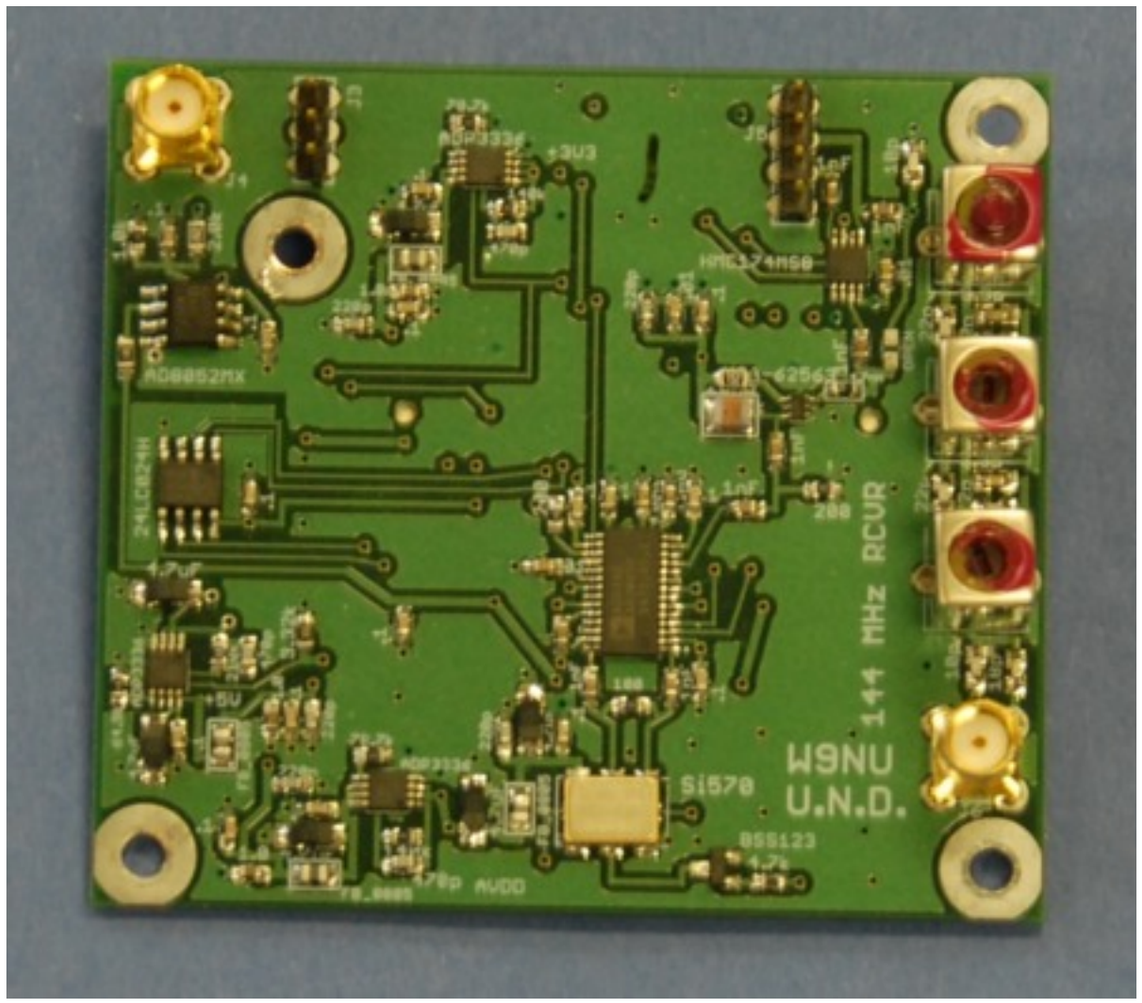
- Dynamic spectrum access systems:
  - High sensitivity (e.g. -114 dBm for TV band)
  - Flexibility (software radio)
- Group research projects:
  - Public safety communications
  - Spectrum sensing algorithms

➡ Decision to develop custom RF solution

UND 144 Transceiver



UND 144 Transmitter



UND 144 Receiver

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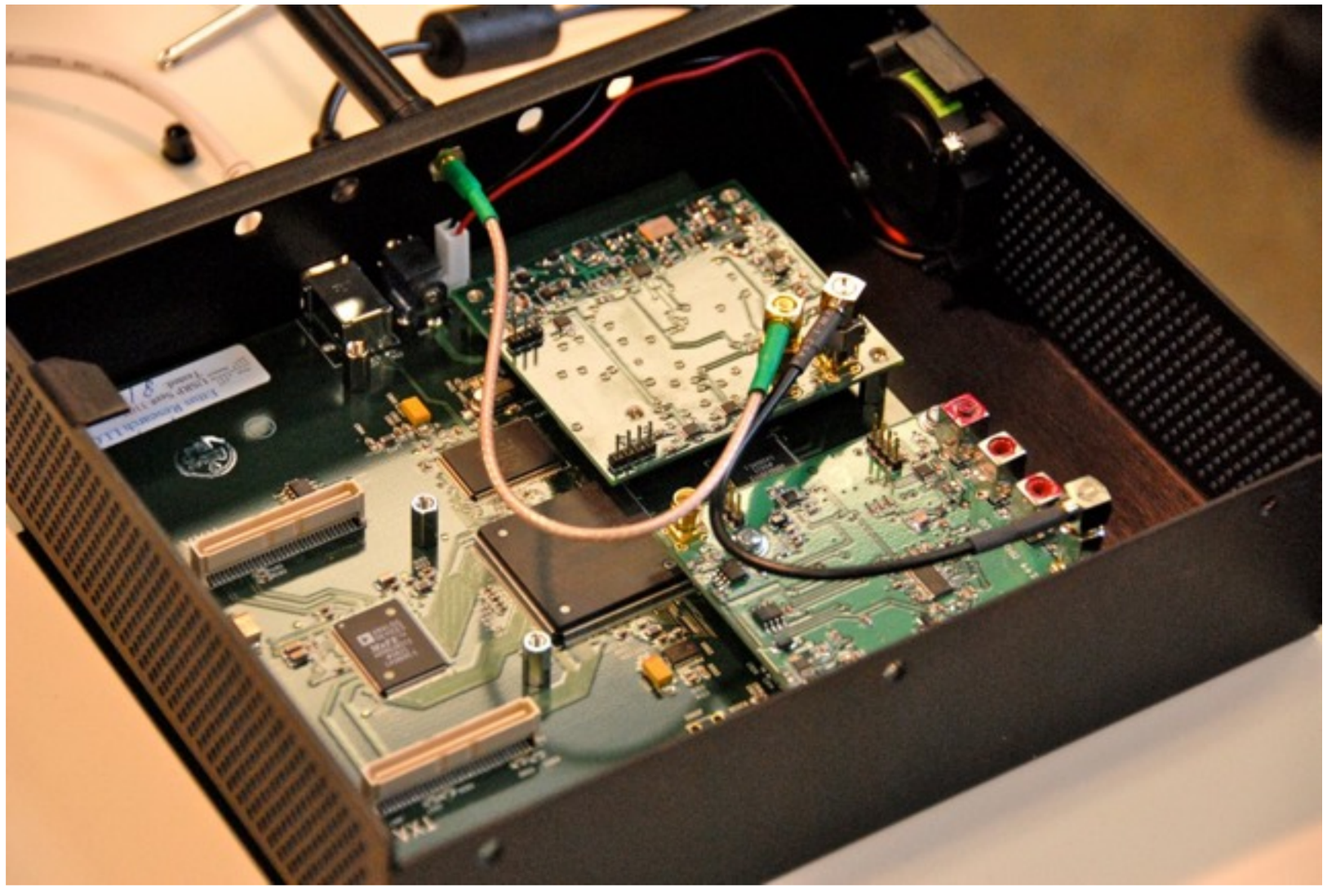
UND 144 Transceiver

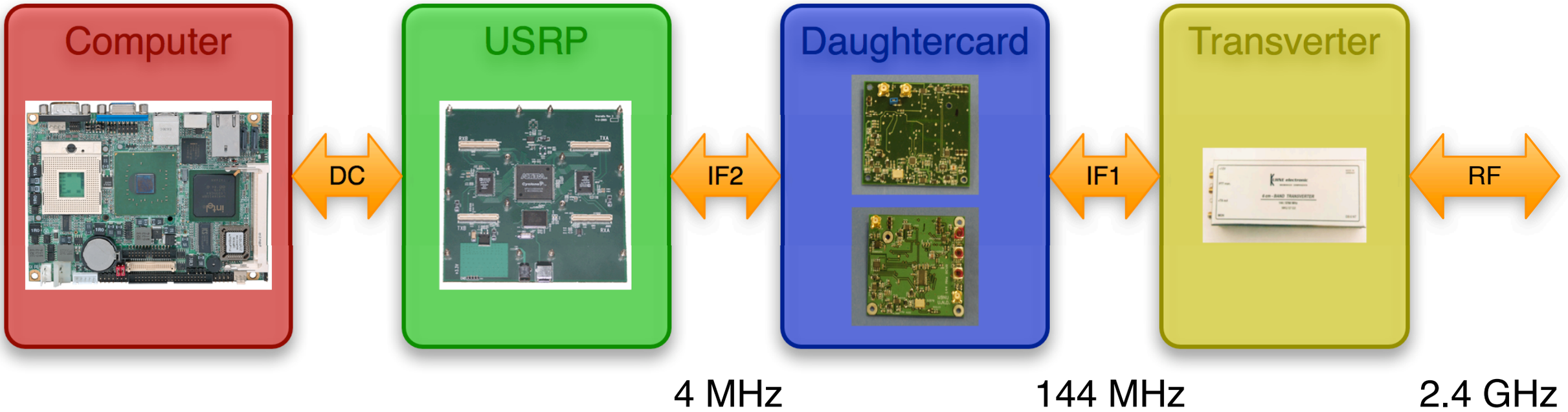


Transceiver Description

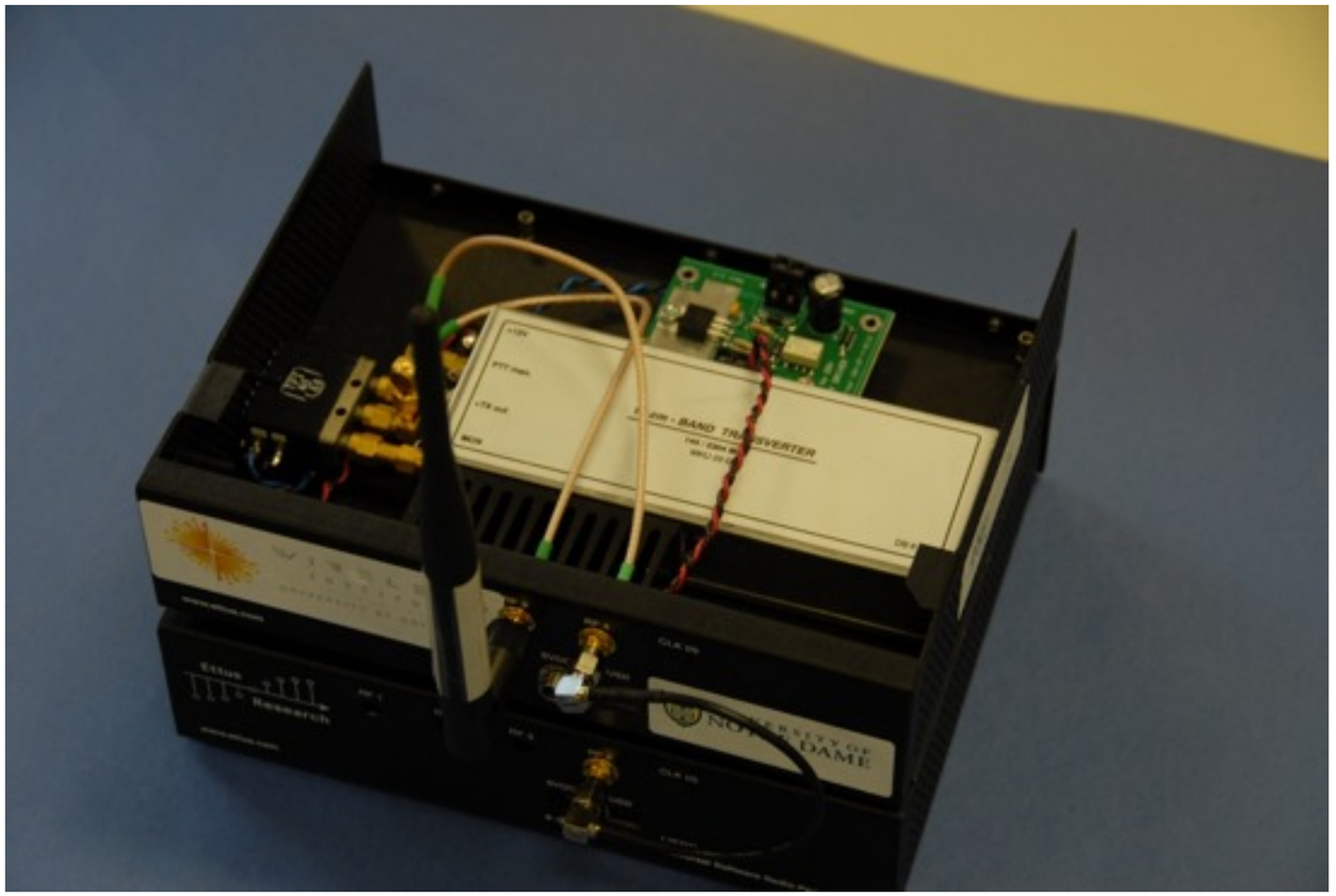
- Frequency range: 50 to 500 MHz
- Standard configuration: 144 MHz (2 m)
- +18 dBm output power
- Fully integrated with GNU Radio/USRP

➡ Trading some flexibility for performance

Transverter Configuration

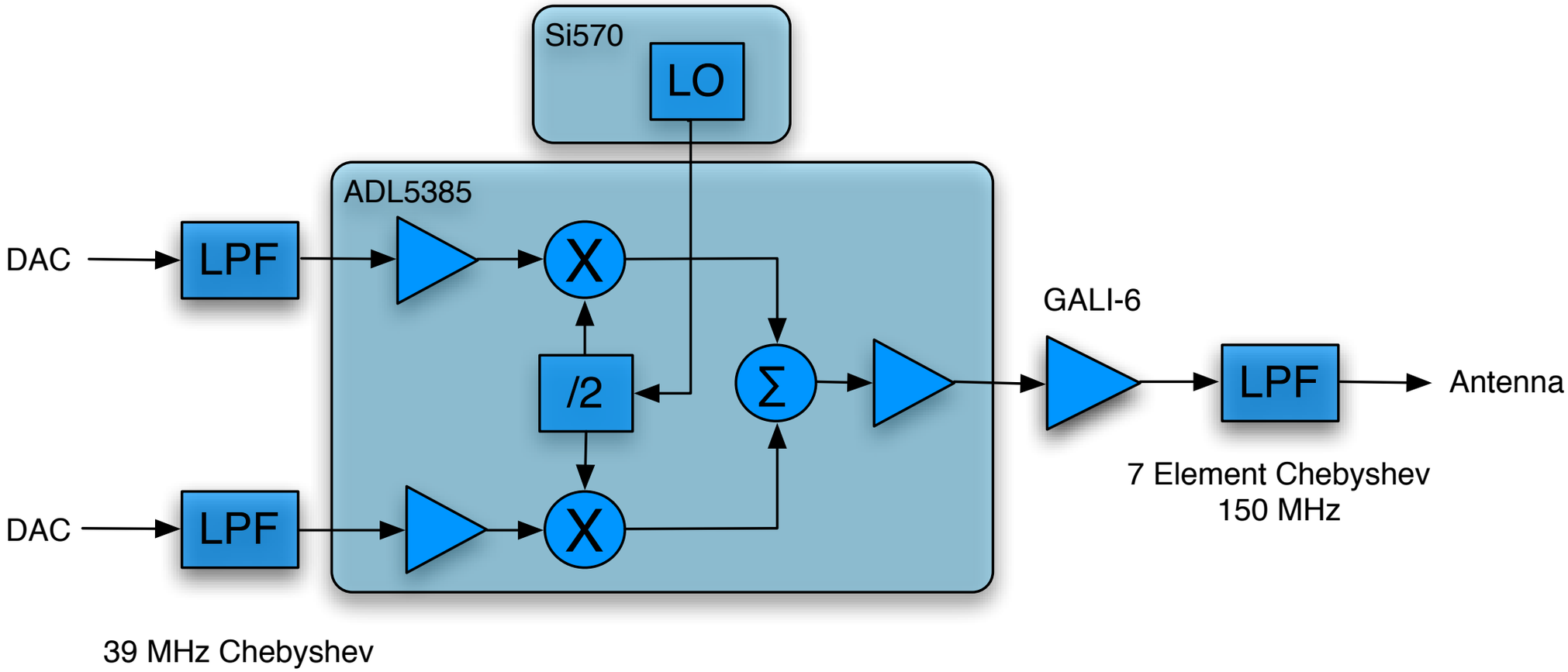


Transverter Configuration



Kuhne Electronics MKU 23 G2

UND 144 Transmitter

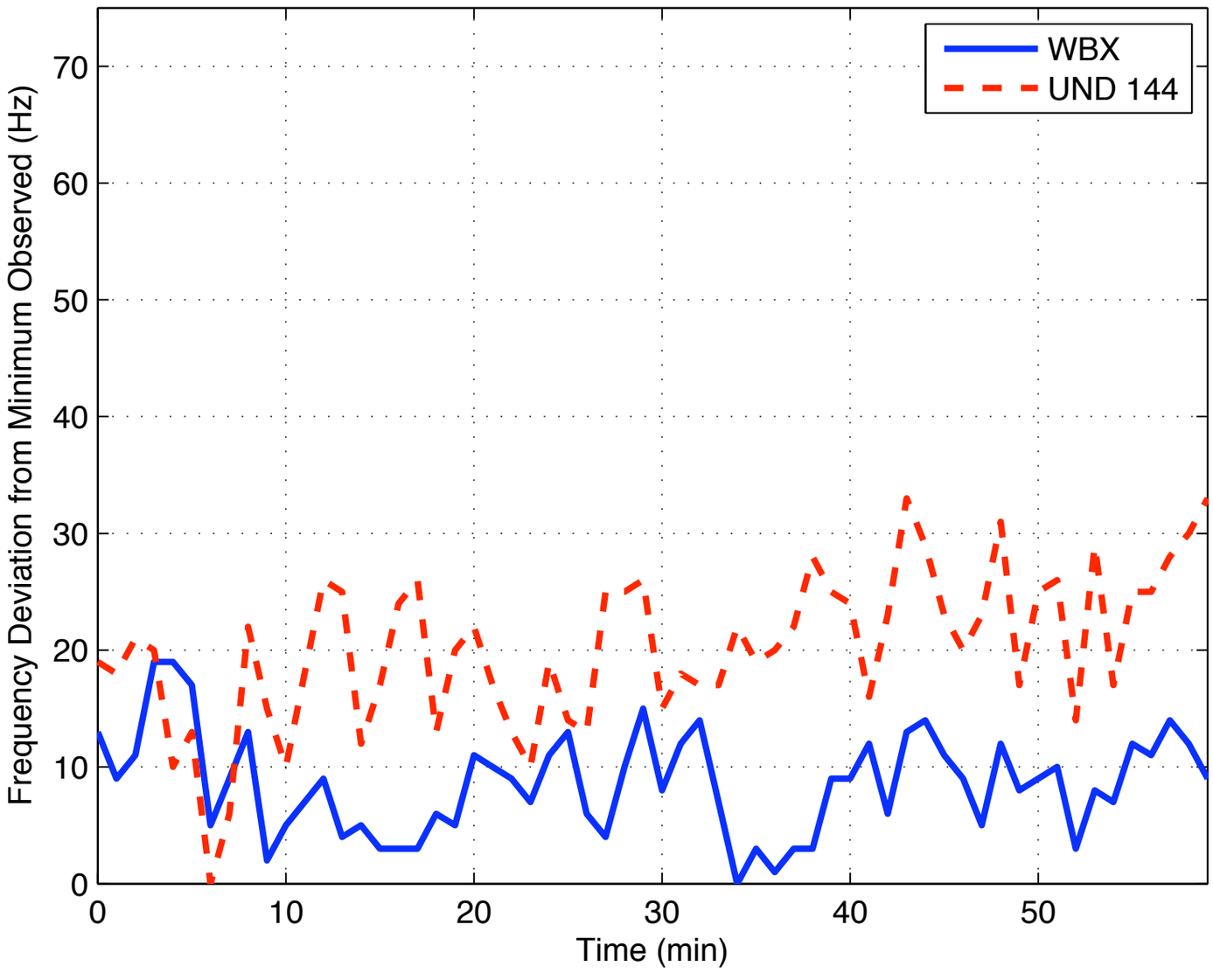


Local Oscillator

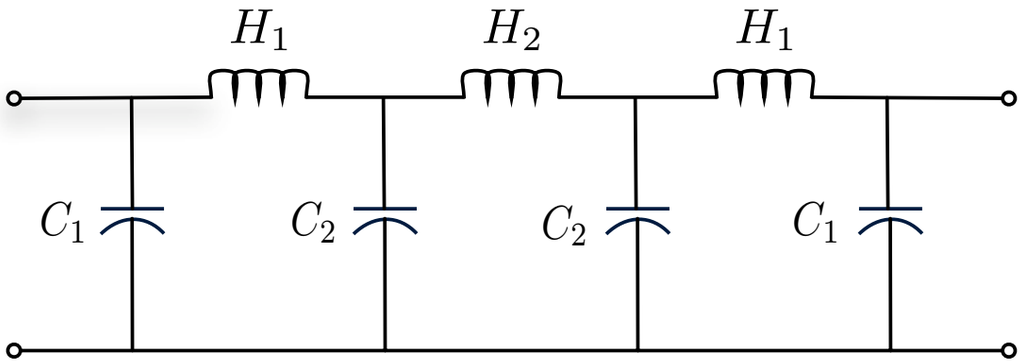
Silicon Lab's Si570 XO

- Numerically controlled oscillator: 10 MHz to 1.4 GHz
- Very low jitter
- Sub-Hertz tunability
- Divide-by-two phase splitter in quadrature modulator

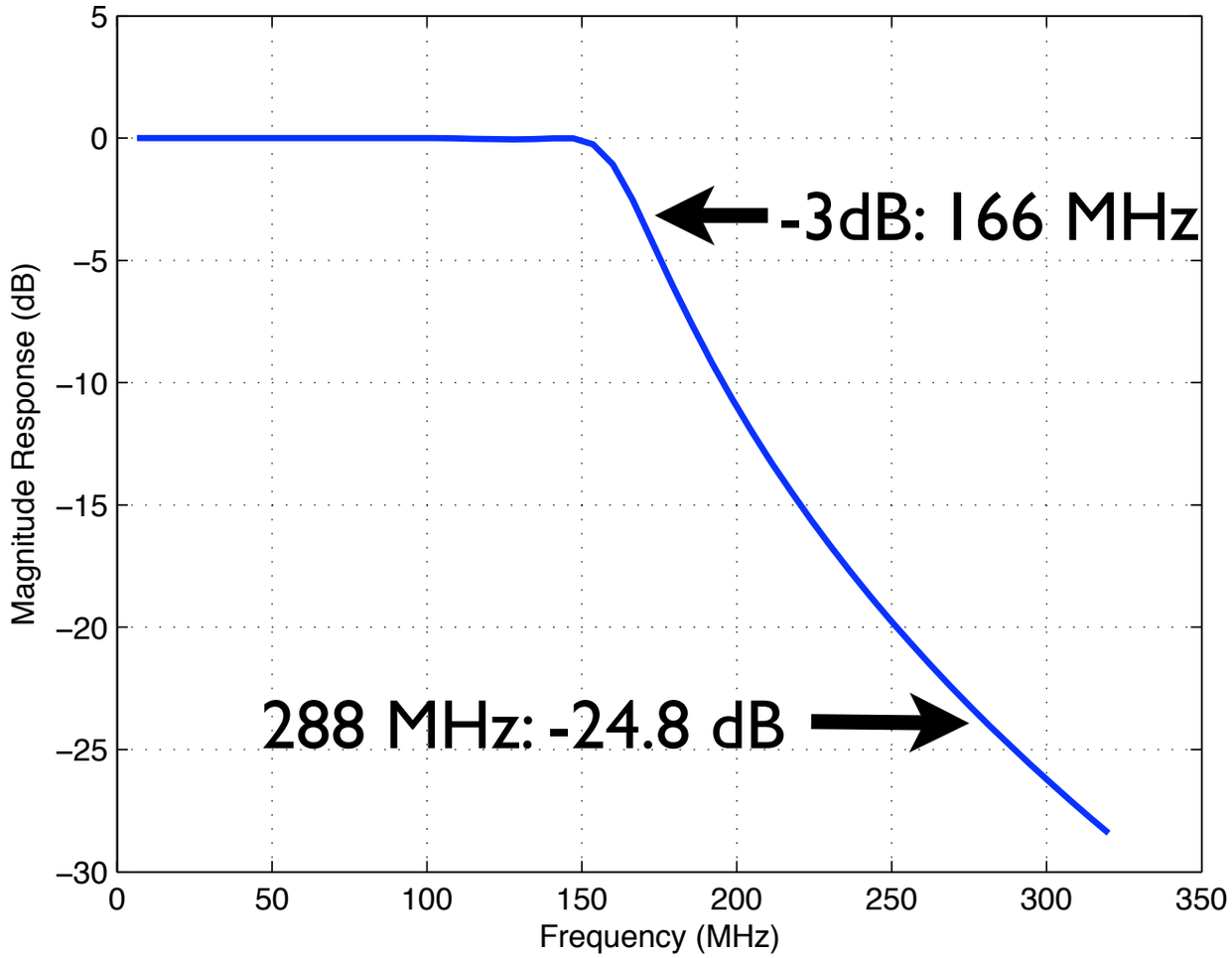
Frequency Stability



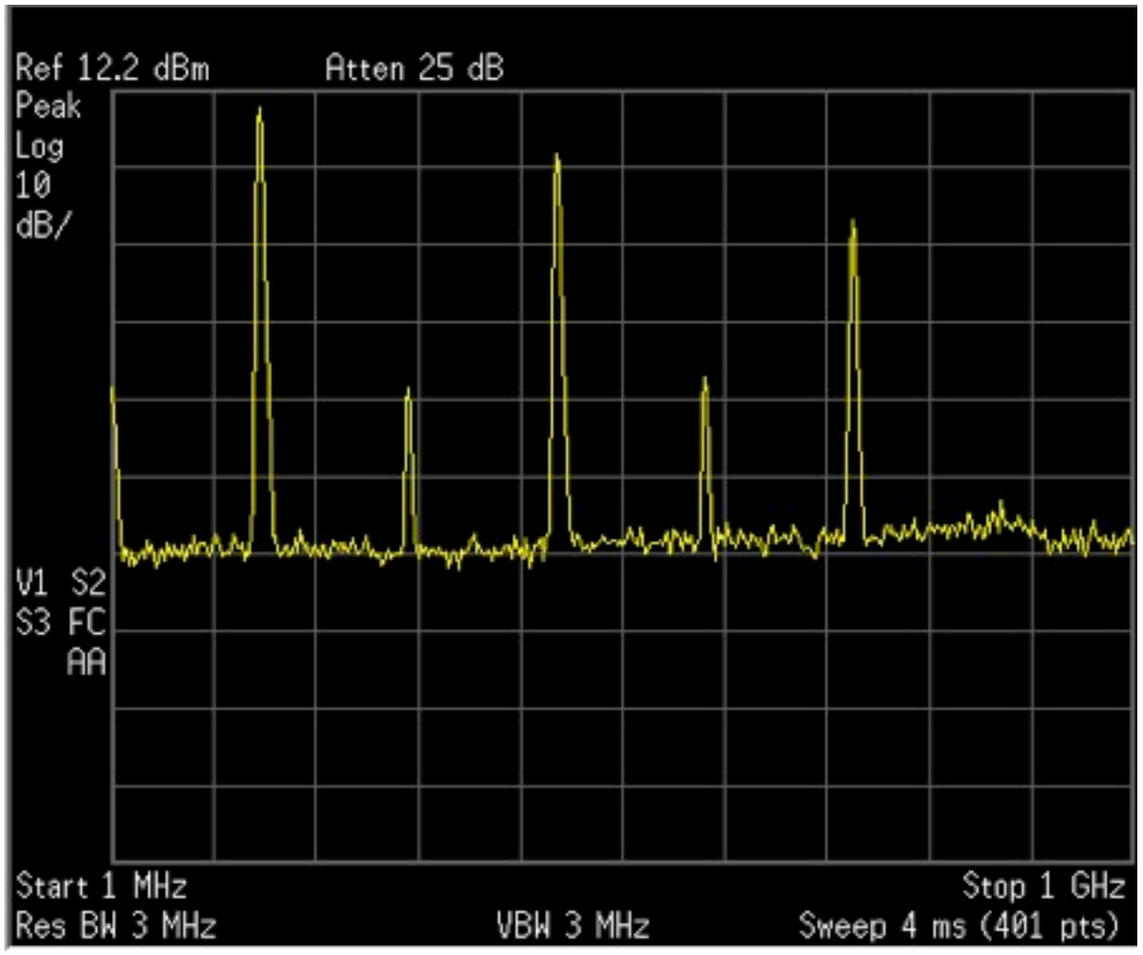
Post-Mixer Filtering



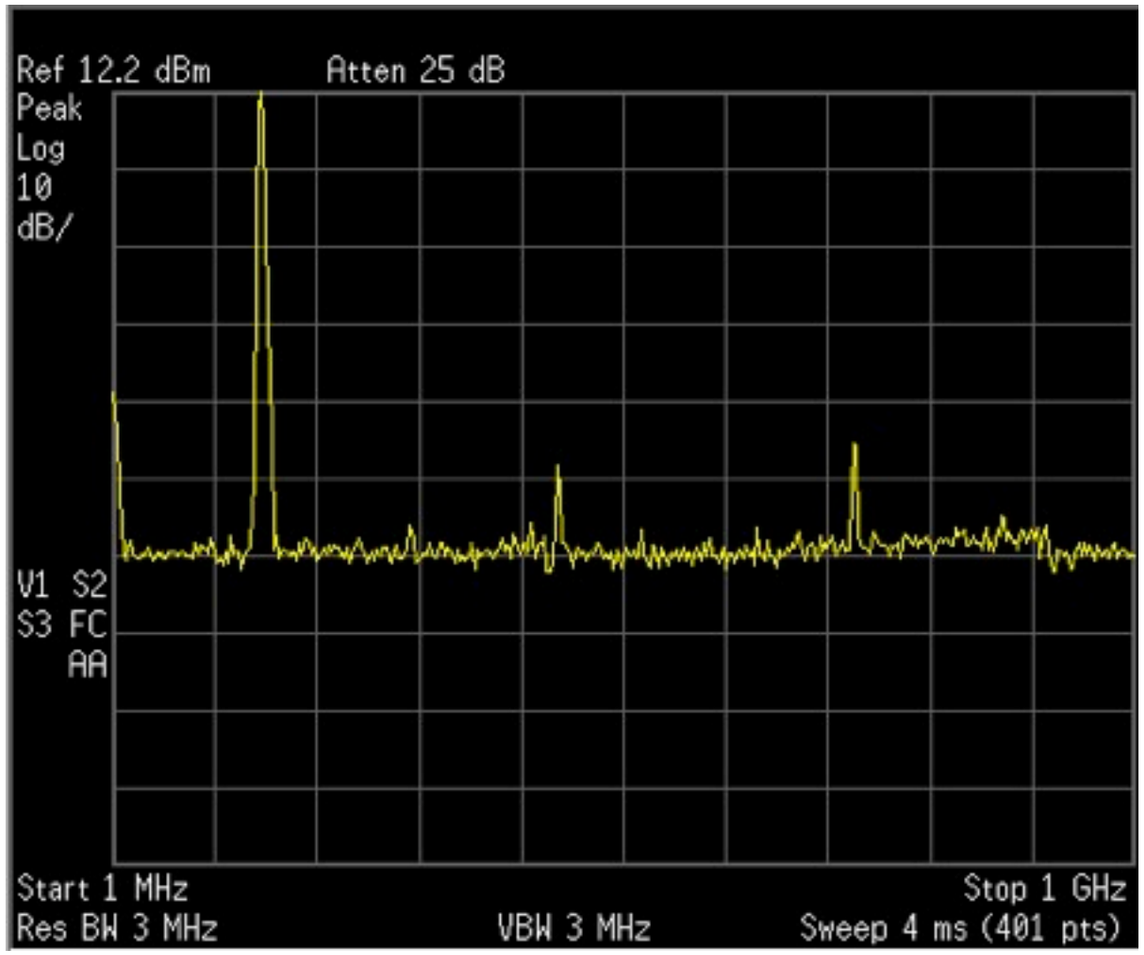
7 Element
Chebyshev LPF



Spectral Purity



WBX Transmitter



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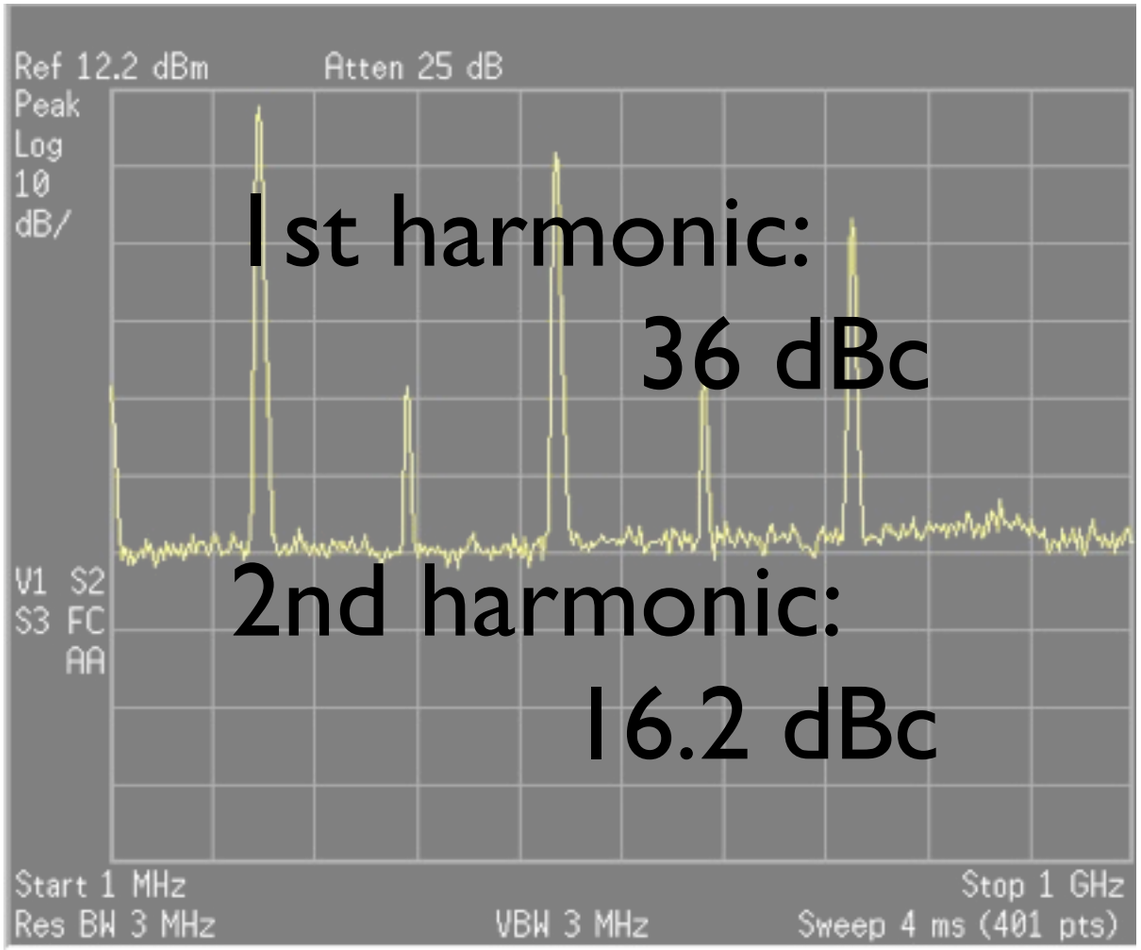
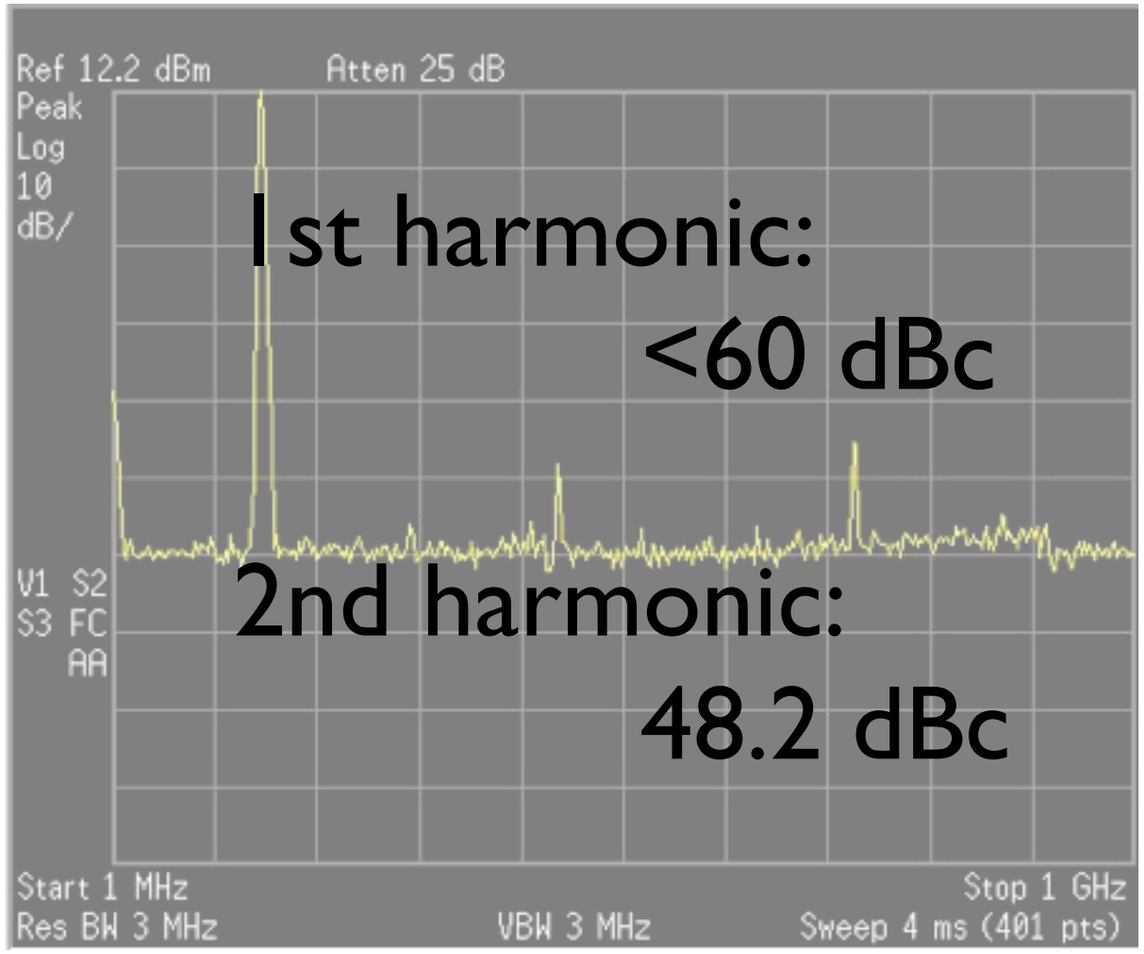
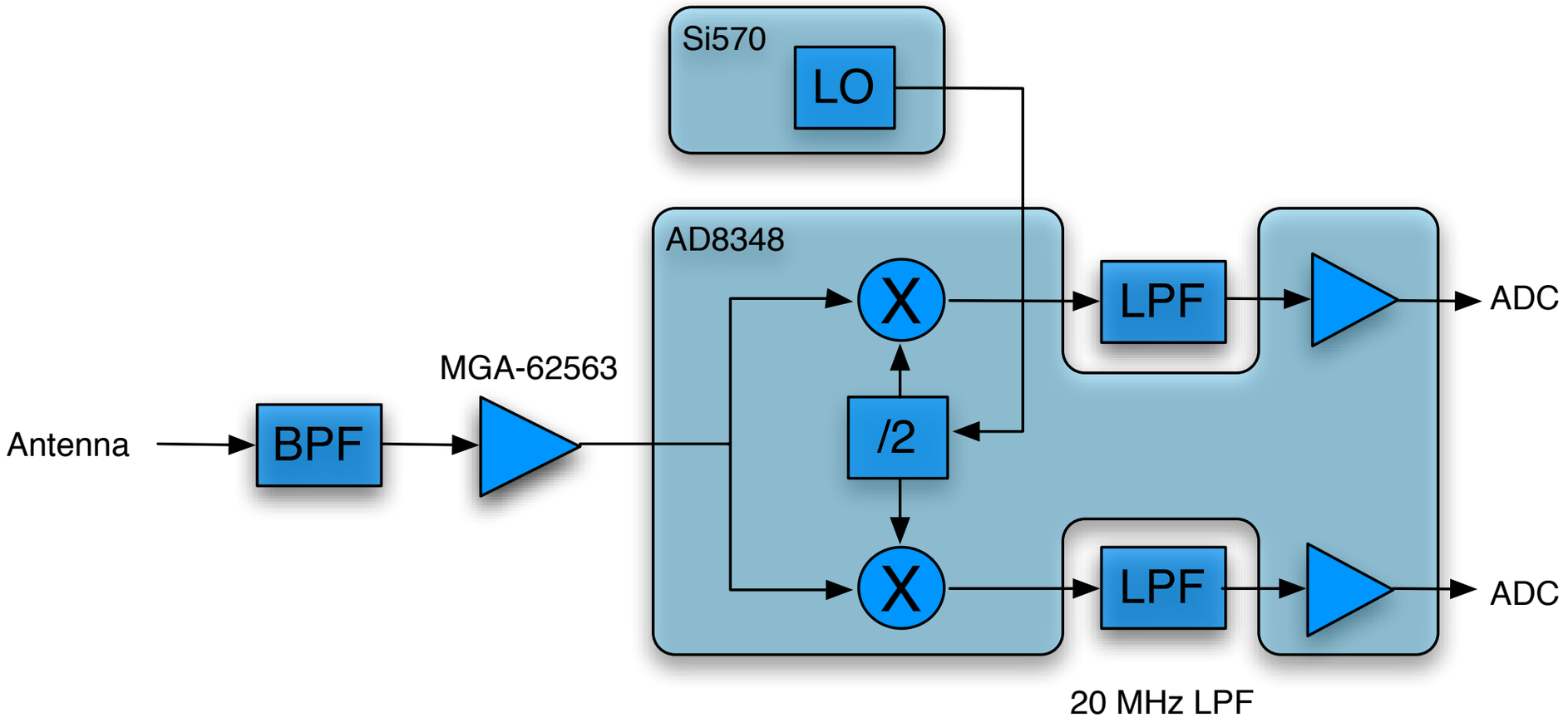


WBX Transmitter

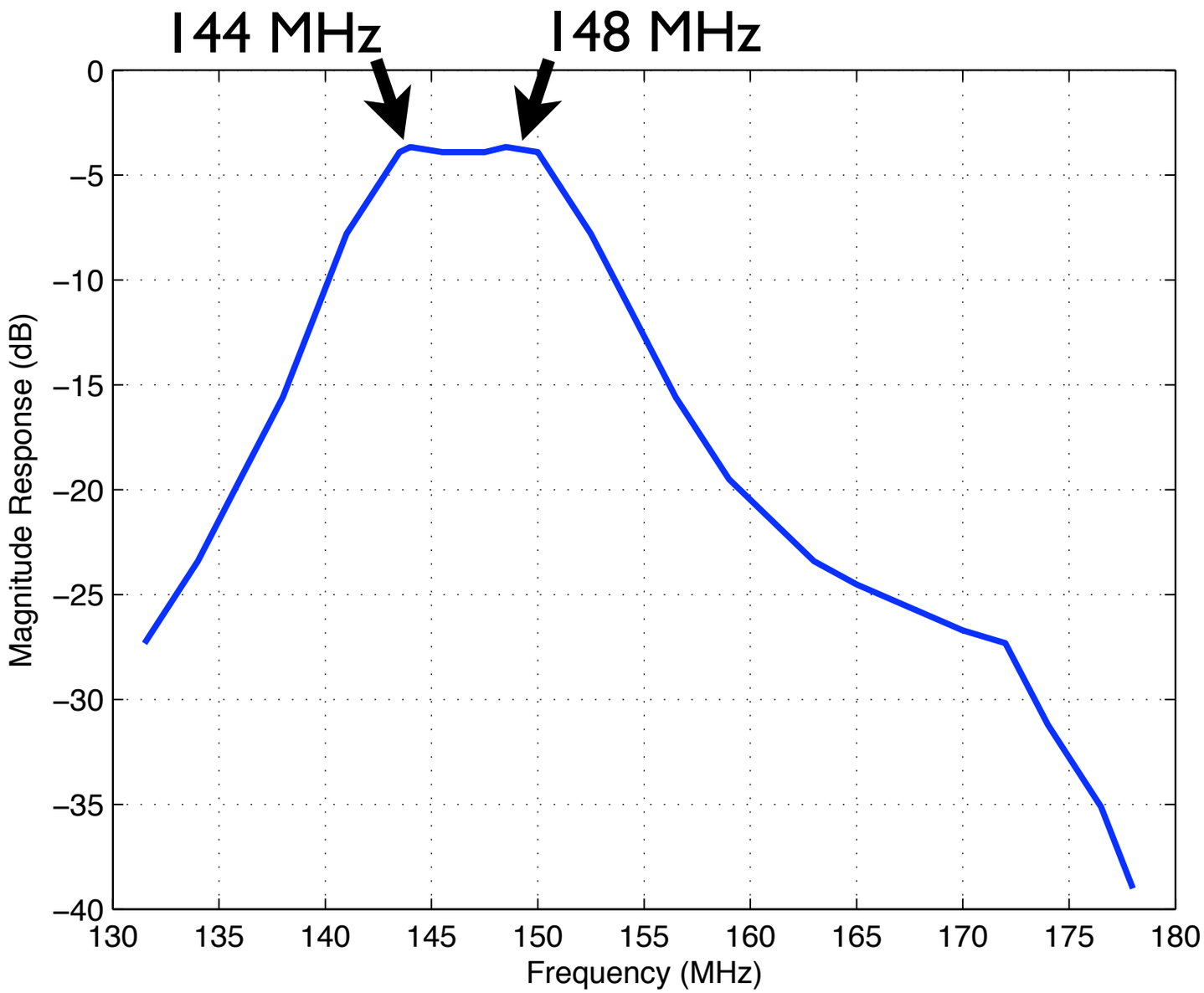


UND 144 Transmitter

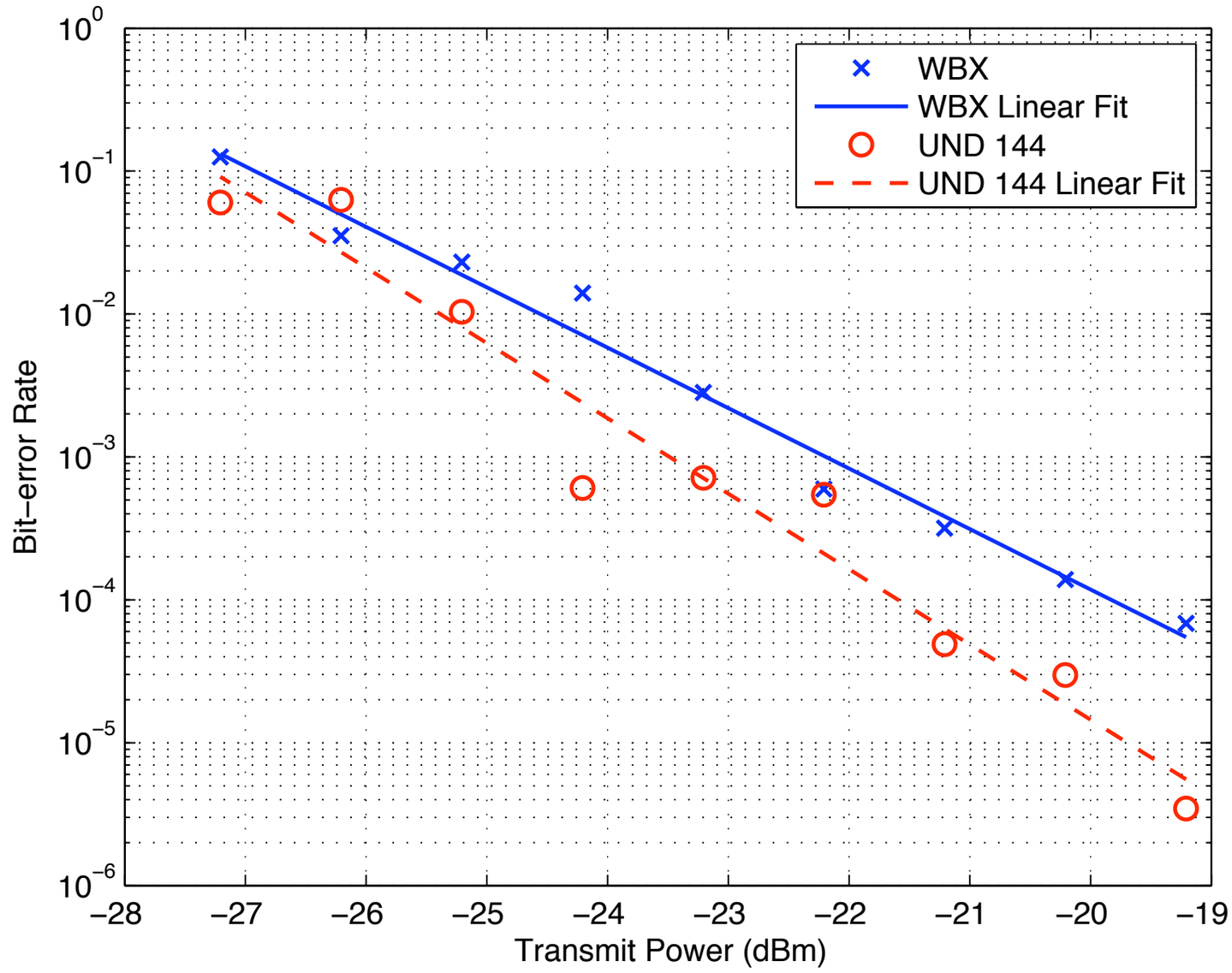
UND 144 Receiver



Pre-Mixer Filtering



Bit-Error Rate



Conclusion

- Development of custom RF transceiver for USRP/GNU Radio
  - Increased use of filtering
  - High quality local oscillator
  - Improved performance at cost of flexibility
- A number of tests illustrate performance gains

Thanks!