Signal Conditioning: NIRP sub-module

Grzegorz Jabłoński

About me

Grzegorz Jabłoński

Ph.D. in Electrical Engineering

- Role
  - RFPI project contractor
  - FPGA/software engineer
- Relevant experience
  - DESY/XFEL: FPGA/software engineer (since 2008)
  - ESS-ERIC: FPGA/software engineer (since 2018)
  - ITER: system analyst, FPGA/software engineer (since 2010)
  - Ericpol Sp. z o.o.: FPGA/software Engineer – ARUZ Large-scale, FPGA-based Analyzer of Real Complex Systems (2015-2017)

Agenda

- The Non-Ionizing Radiation Probe (NIRP) module requirements,
- The PoC version specification and scope,
- The sub-module design details,
- Implementation,
- Test results discussion,
- Full scale design plans,
- Summary

The NIRP requirements

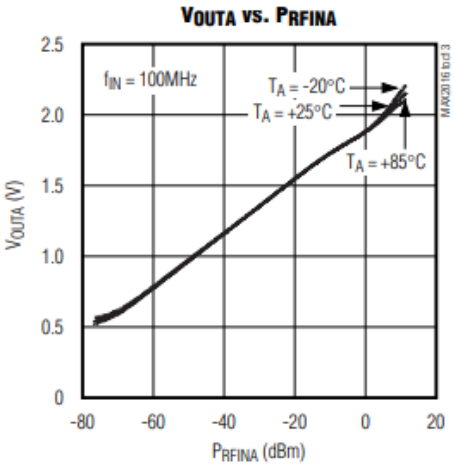
- Signal level: -70 – 0 dBm
- Frequencies: 325 MHz, 650 MHz
- Output bandwidth: 10 MHz
- 50 Ohm input impedance
- 10 ms response time

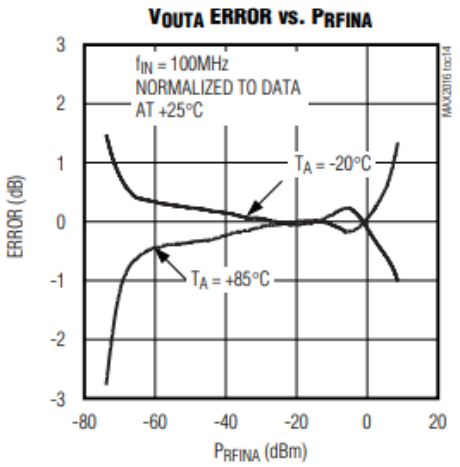
The PoC version specification and scope

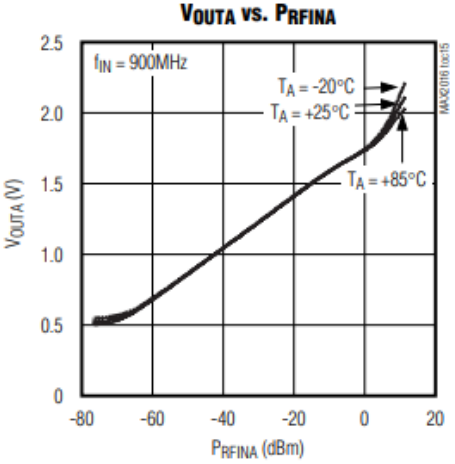
- 4 channels
- 4 different filters

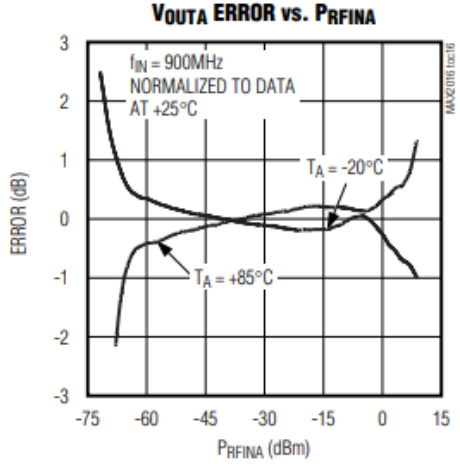
Design details

- Originally planned to use LT5537 RF/IF Logarithmic Detector
  - 10 MHz to 1000 MHz
  - -76 dBm to 14 dBm at 200MHz with ±3 dB nonlinearity
  - IC not available until June 2023
- Finally selected MAX2016ETI
  - -70 dBm to +10 dBm
  - up to 2.5 GHz
  - Dual channel



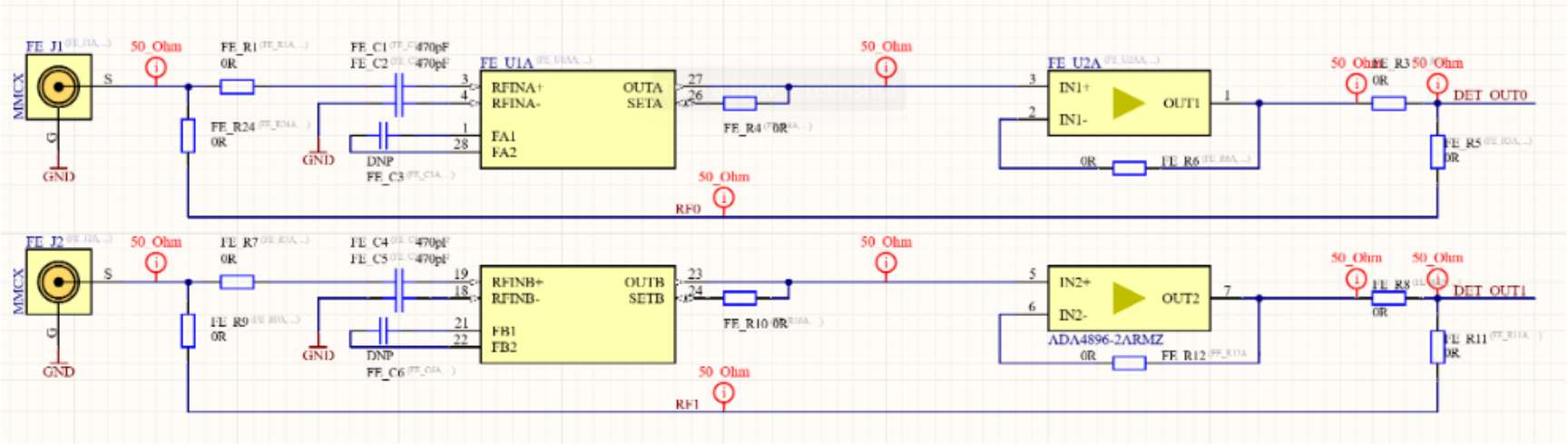






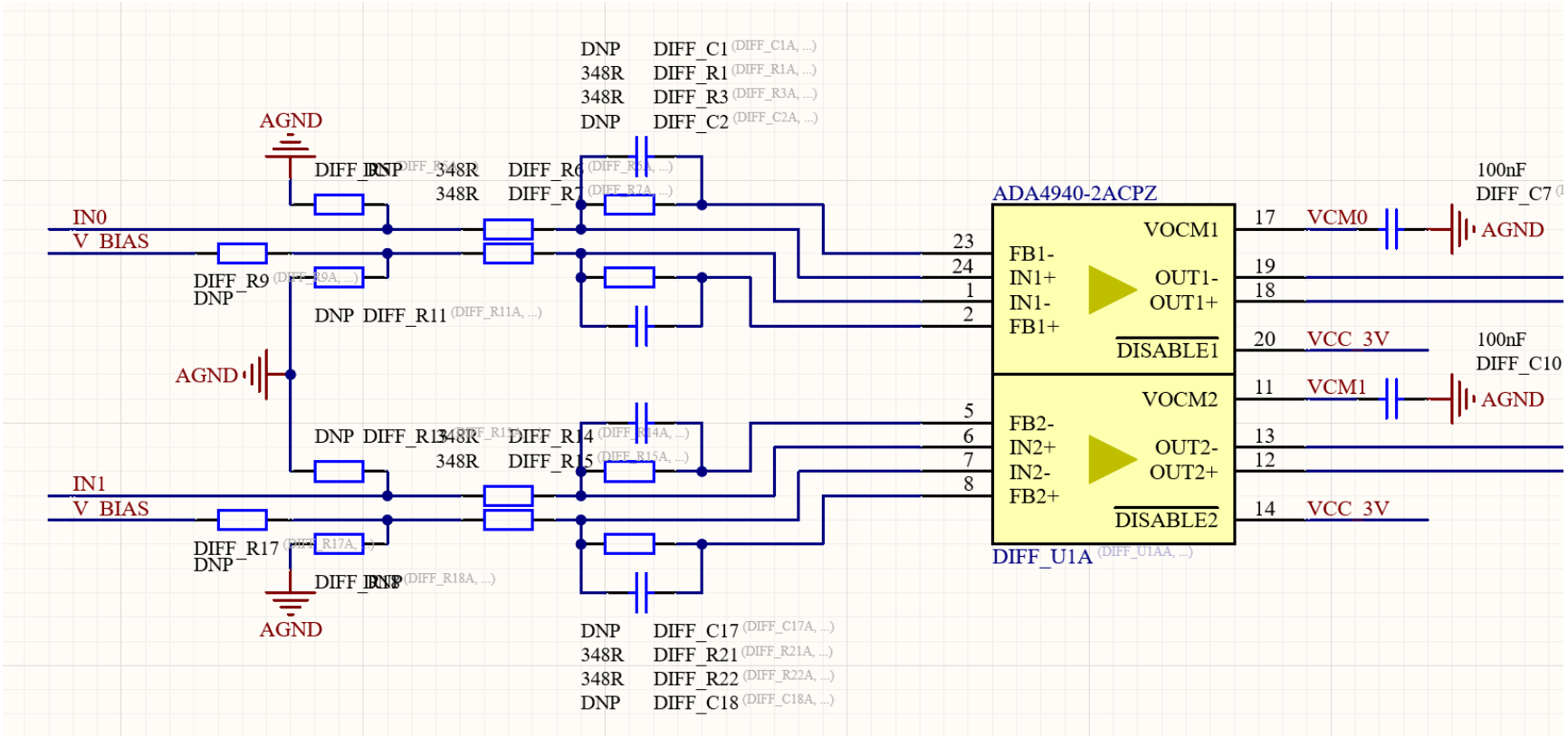
Design details

- Requires buffering due to high current requirements of the next stage



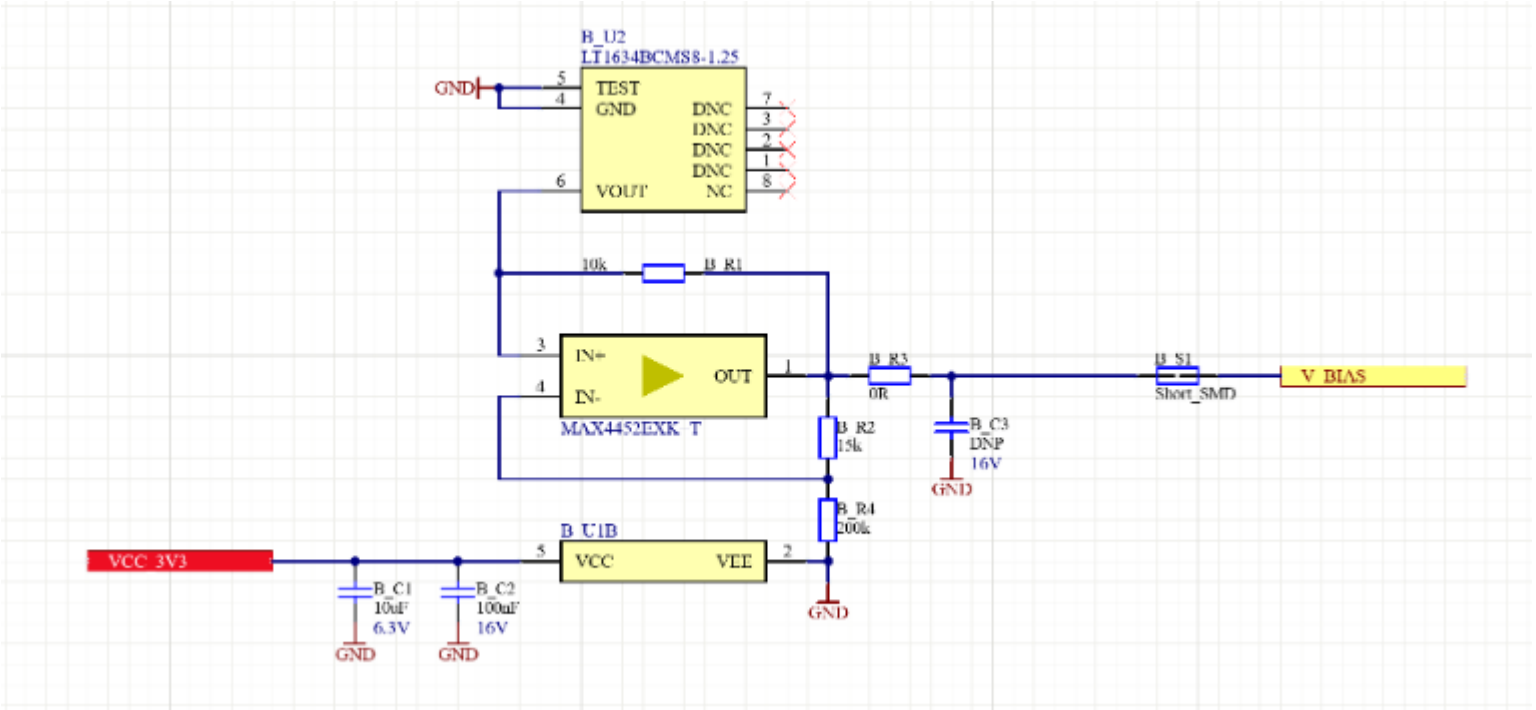
Design details

- Output scaled, shifted to use full ADC range
- Converted to differential due to ADC requirements



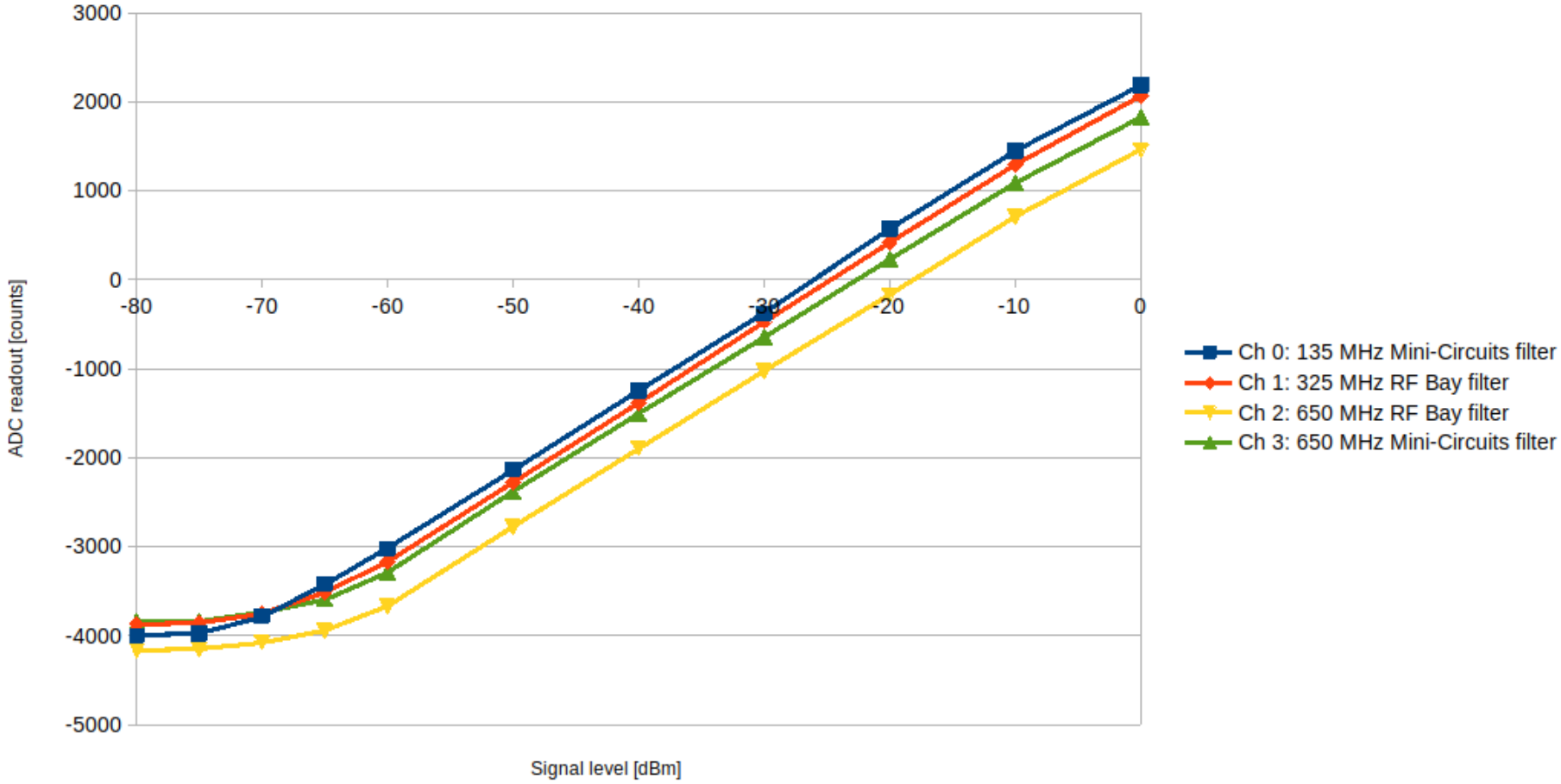
Design details

- Precise voltage reference used as the source of bias



Measurements results

- Obtained using Rohde & Schwartz SMA100B generator



Conclusion

- NIRP front-end works
- Good linearity down to –70 dBm for 135 MHz, to –60 dBm for higher frequencies
- The analog front-end will be used in final design


That's all Folks!
SUPERB wallpapers