Duisburg-Essen University
Faculty of Engineering
Department of Electrical Engineering and Information Technology
Institute of Microwave and RF Technology

300 MHz IQ-Demodulator for 7-Tesla MRI Smart Amplifier

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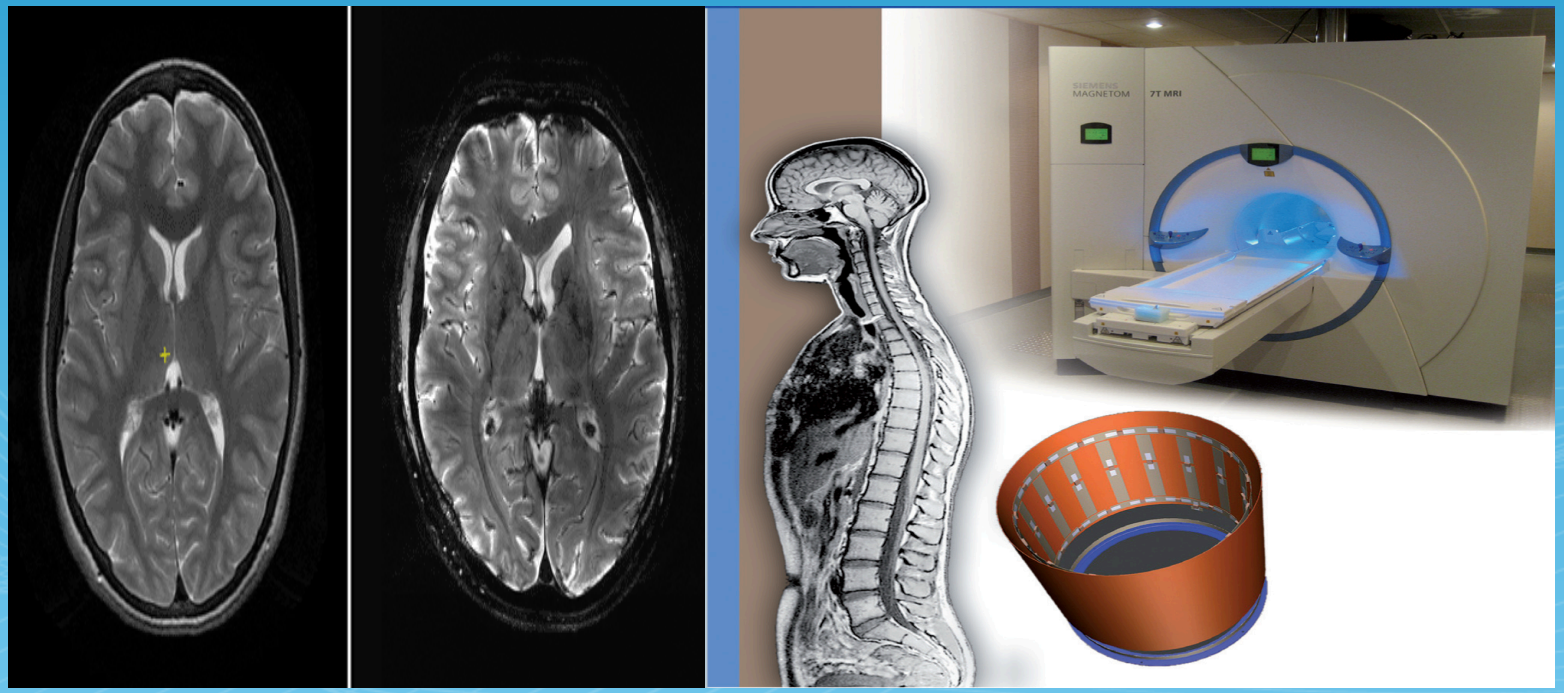
Introduction

- Task assignment
- 7-Tesla MRI
- I/Q-demodulator
- Circuit design
- Test and results
- Conclusion

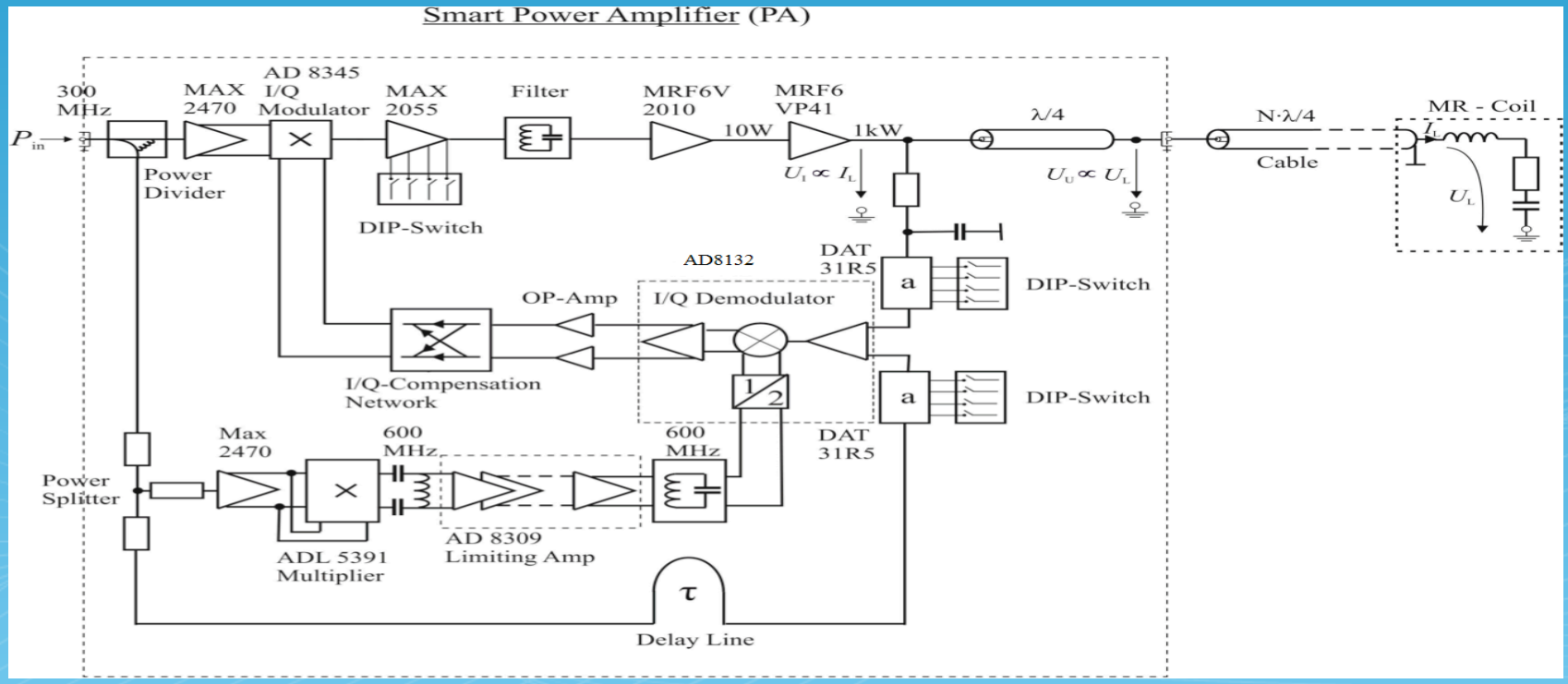
Assignment

to design a printed circuit for the I/Q-demodulator using the ICs and other surface-mount device (SMD) components and using microstrip line on a dielectric laminate as the printed circuit technology and using SubMiniature version A SMA coaxial connectors for signal input and output.

7-Tesla MRI

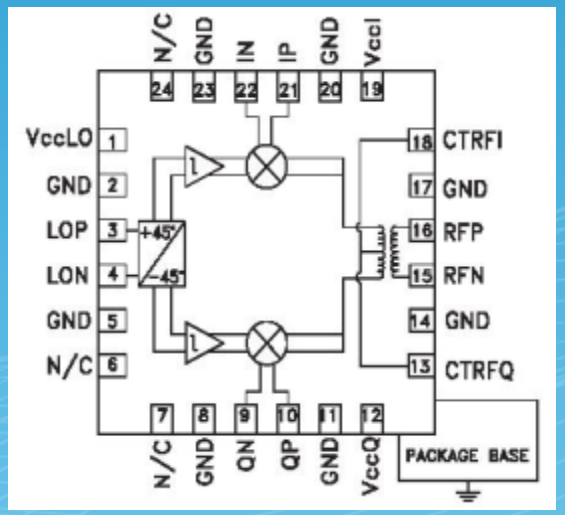


The System


Smart Power Amplifier (PA)
300 MHz
MAX 2470
AD 8345 I/Q Modulator
MAX 2055
Filter
MRF6V 2010
MRF6 VP41
10W
1kW
λ/4
N·λ/4
Cable
MR - Coil
Power Divider
DIP-Switch
AD8132
DAT 31R5
OP-Amp
I/Q Demodulator
DIP-Switch
I/Q-Compensation Network
DAT 31R5
Max 2470
600 MHz
600 MHz
Power Splitter
AD 8309 Limiting Amp
ADL 5391 Multiplier
Delay Line

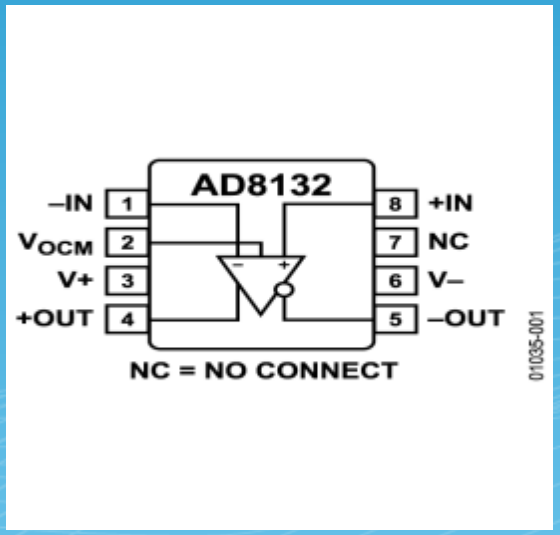
I Q Demodulator

- HMC597LP4
  - HIGH LINEARITY
  - Low noise figure

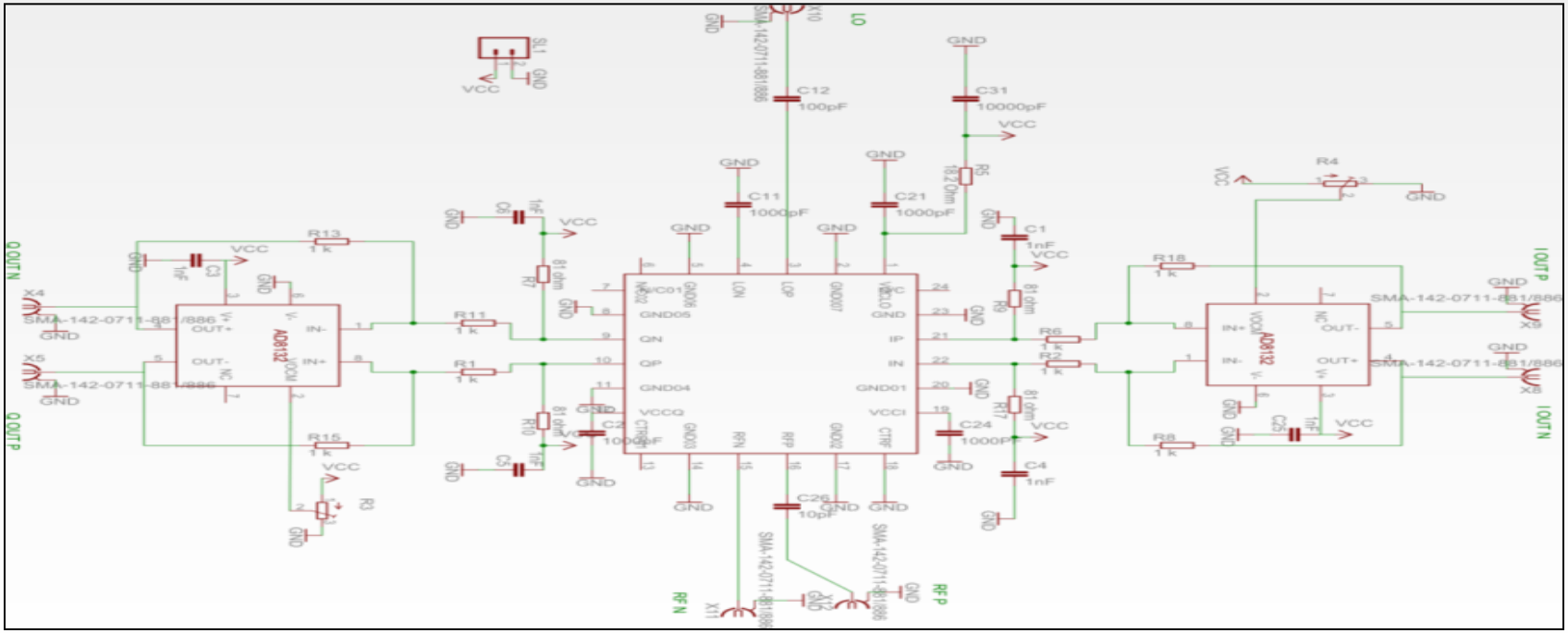


AD8132

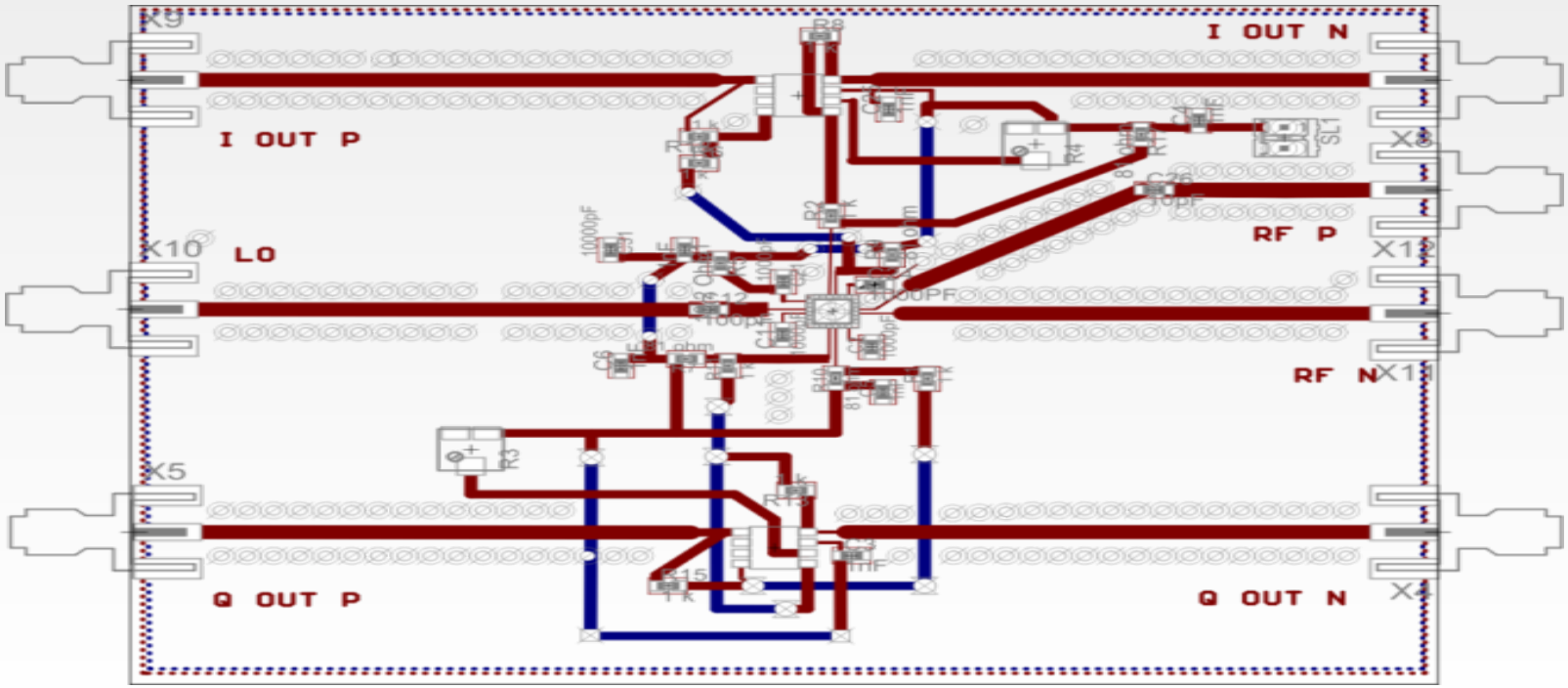
- AD8132 Differential amplifier
  - Low cost – High speed
  - Internal common-mode feedback



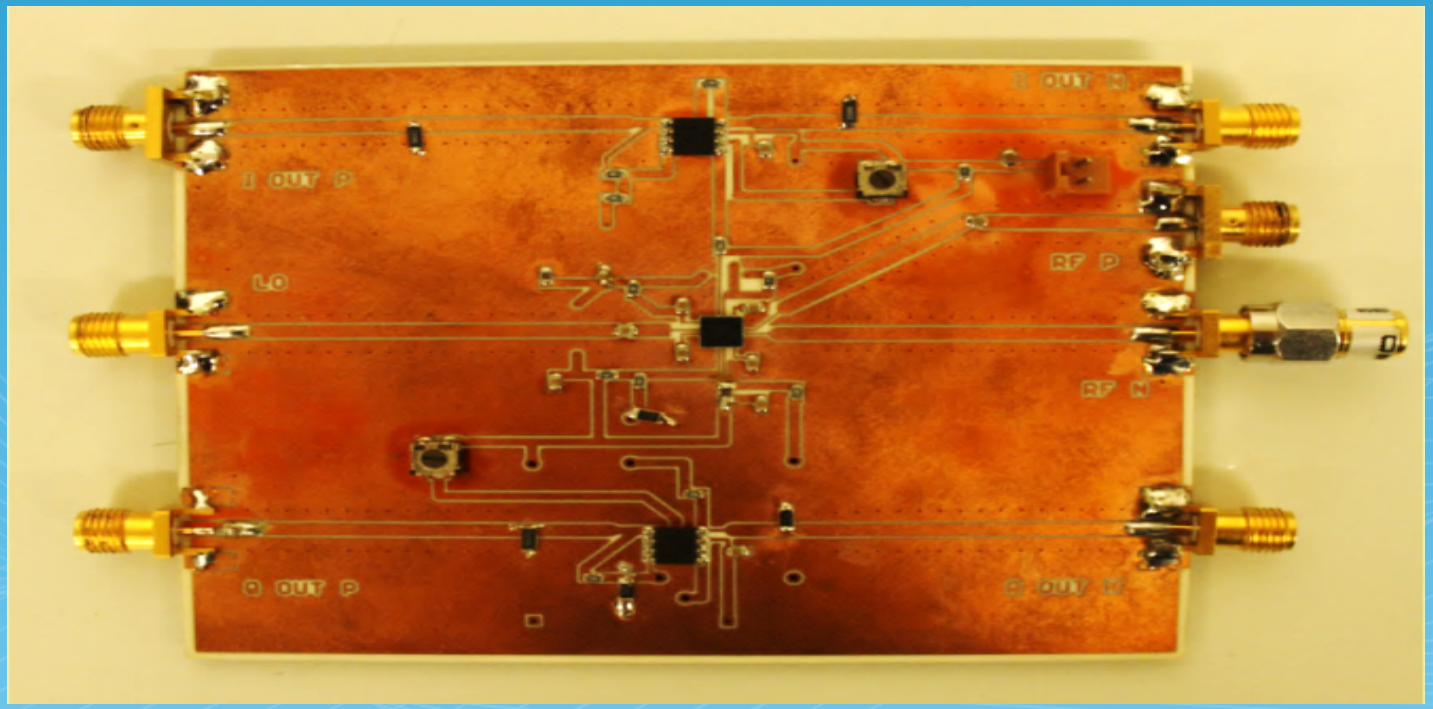
Final Schematic Design



Layout Design

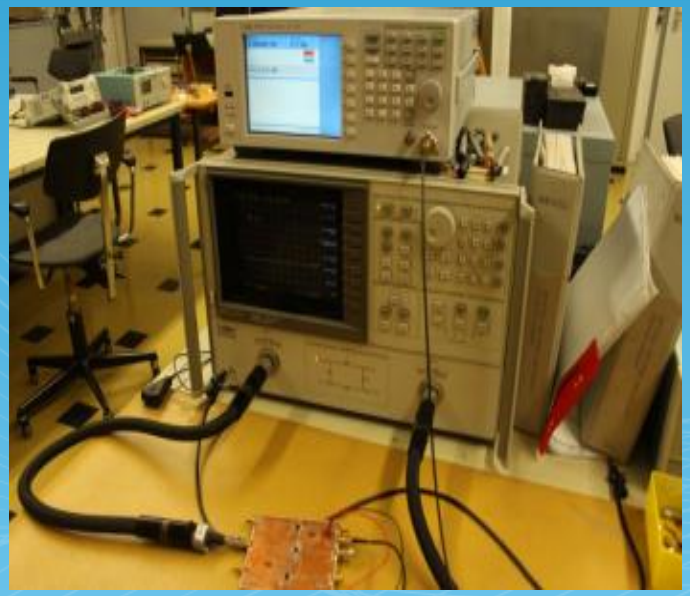


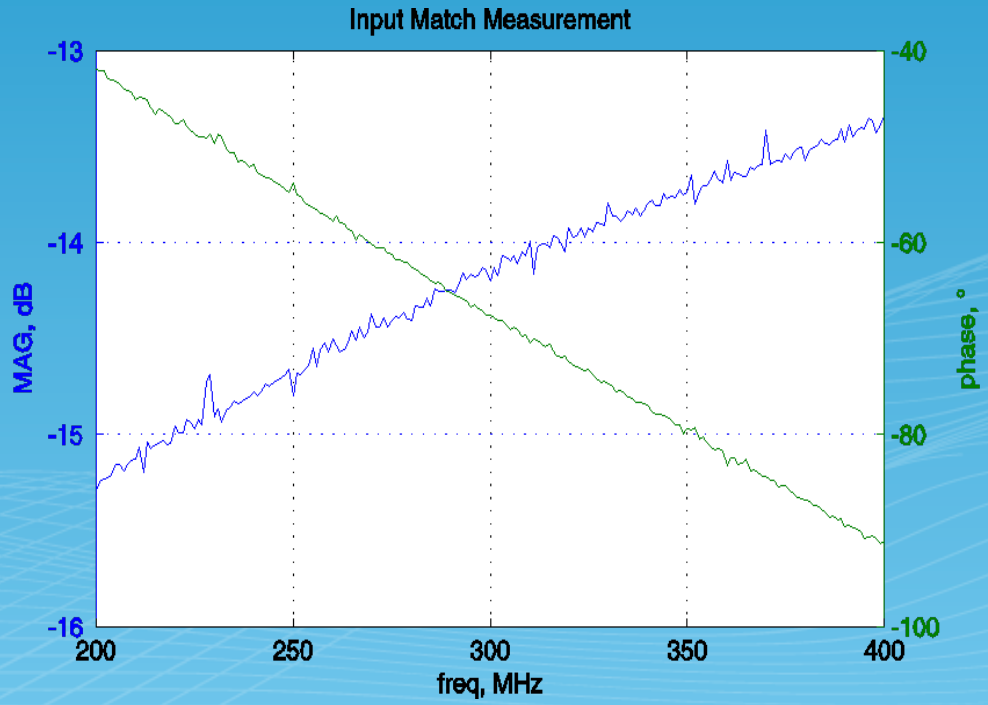
Printed Circuit Board



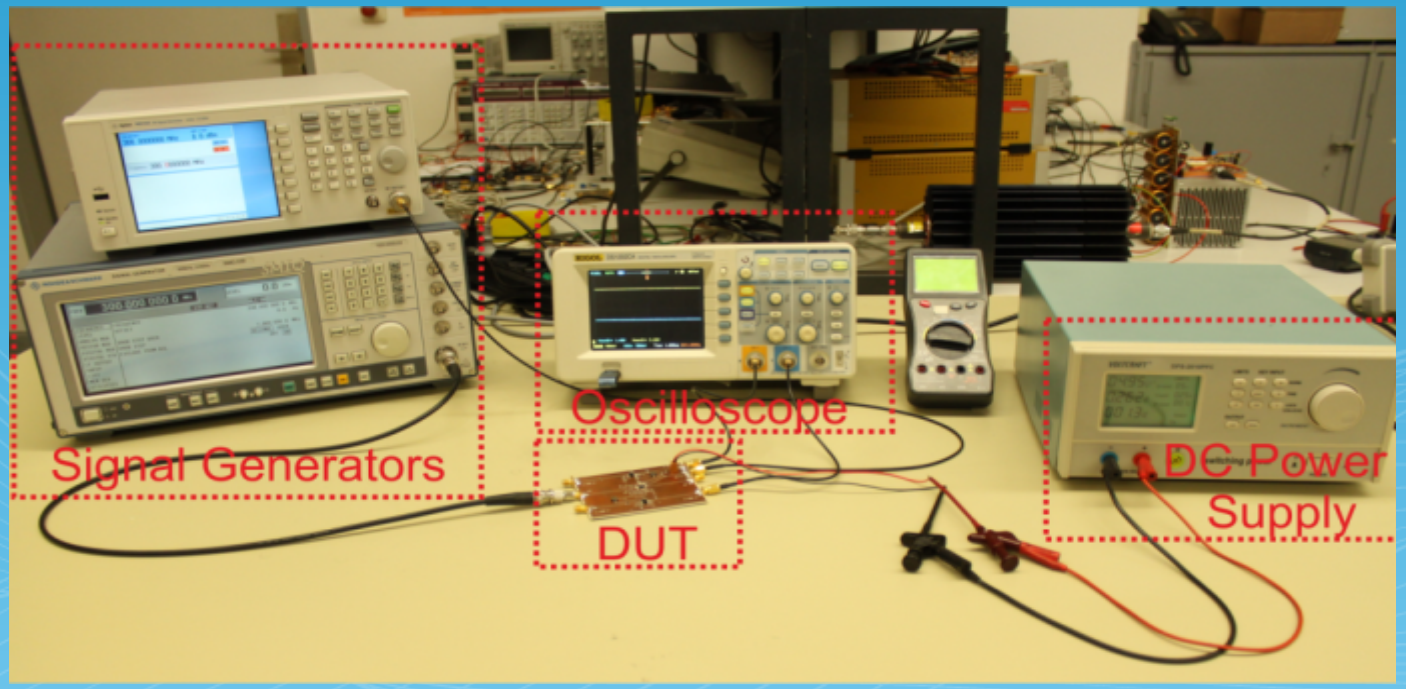
Test Measurement and Results

Input Matching



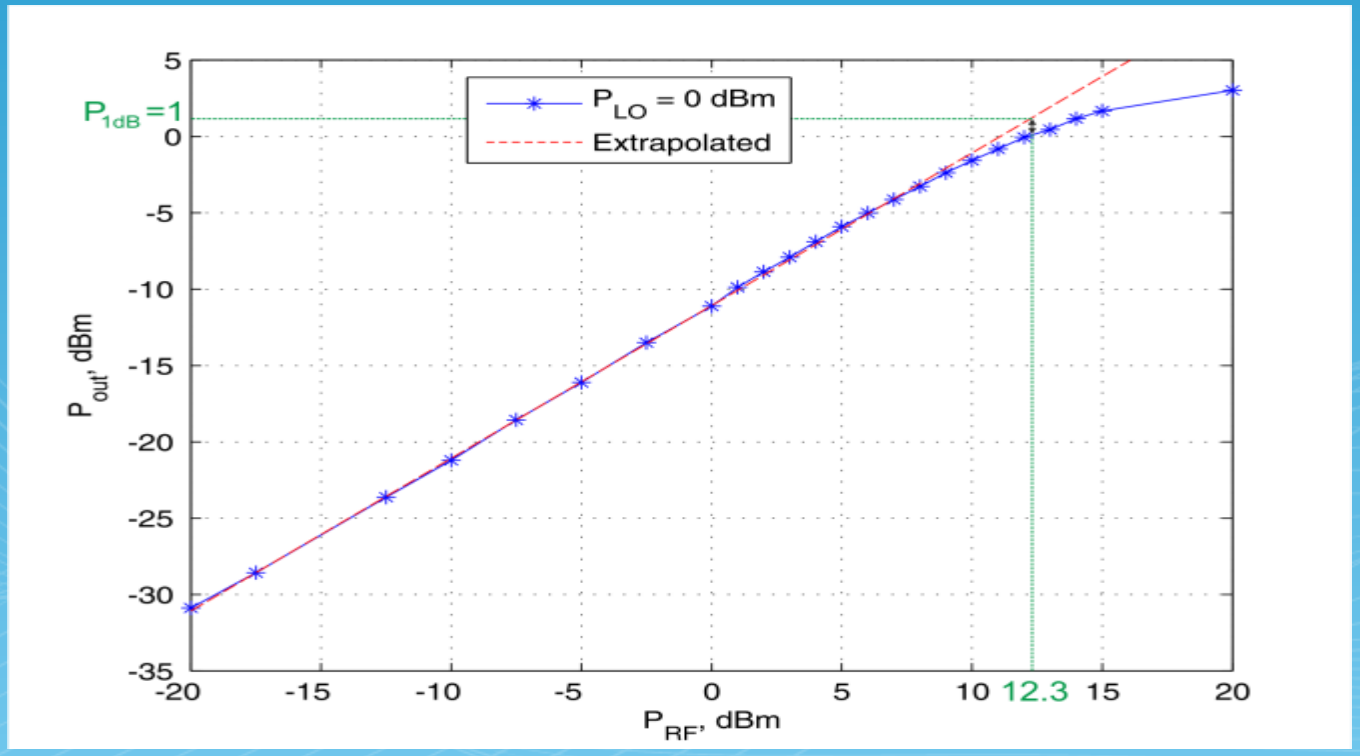


Measurment Setup

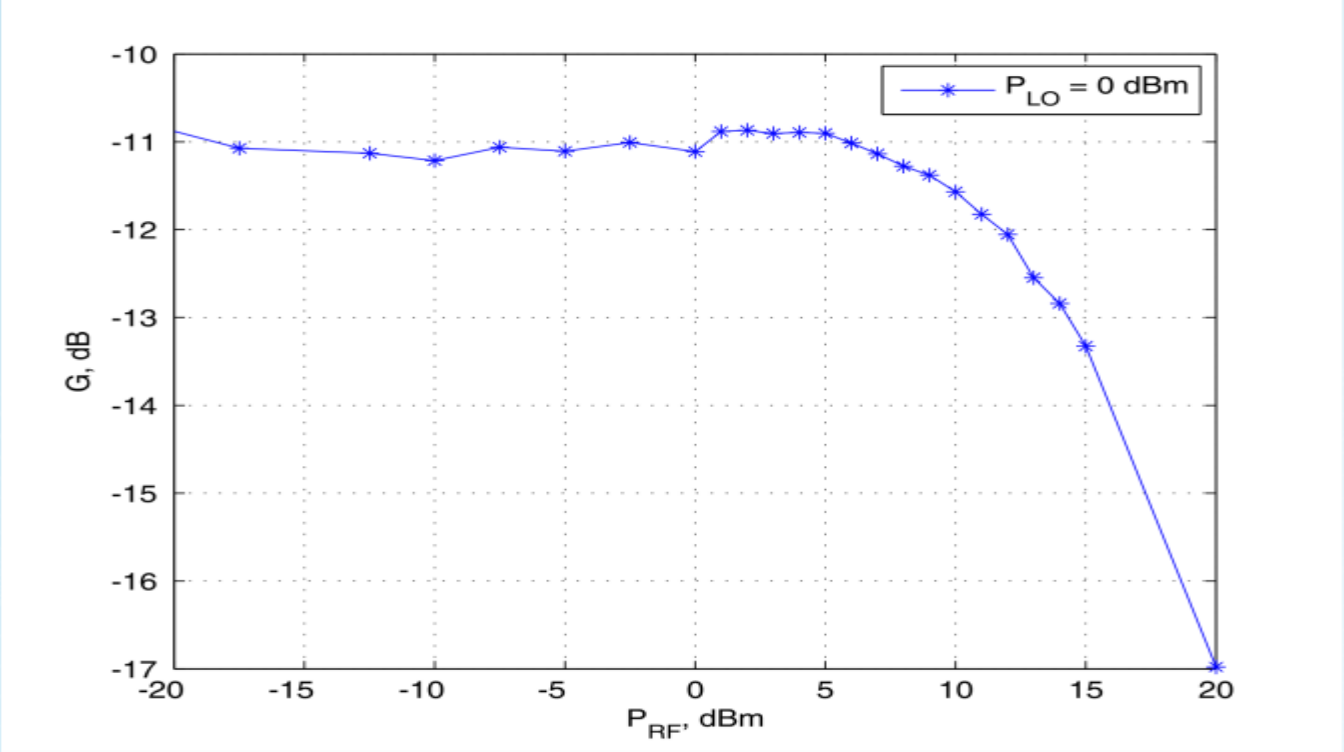


Common Mode Rejection Ratio

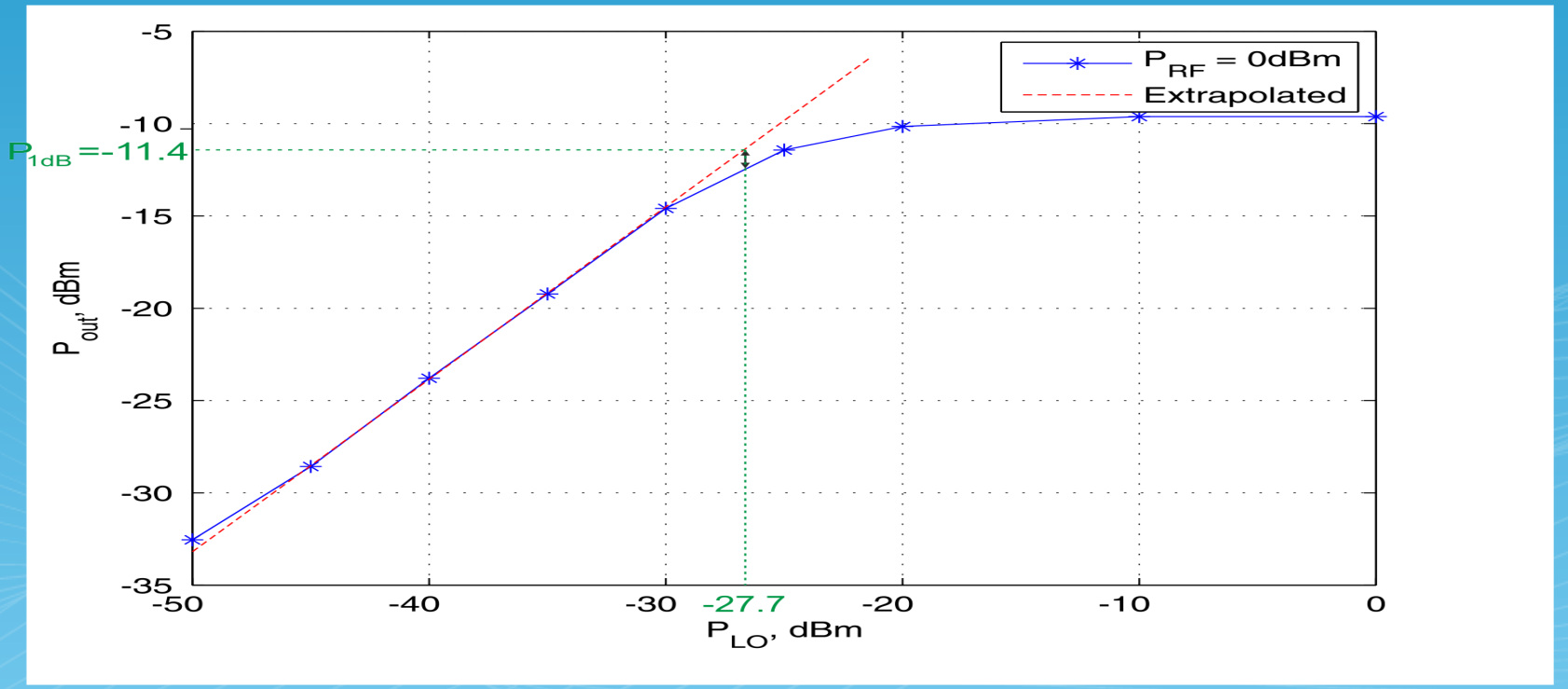
Output Power RF



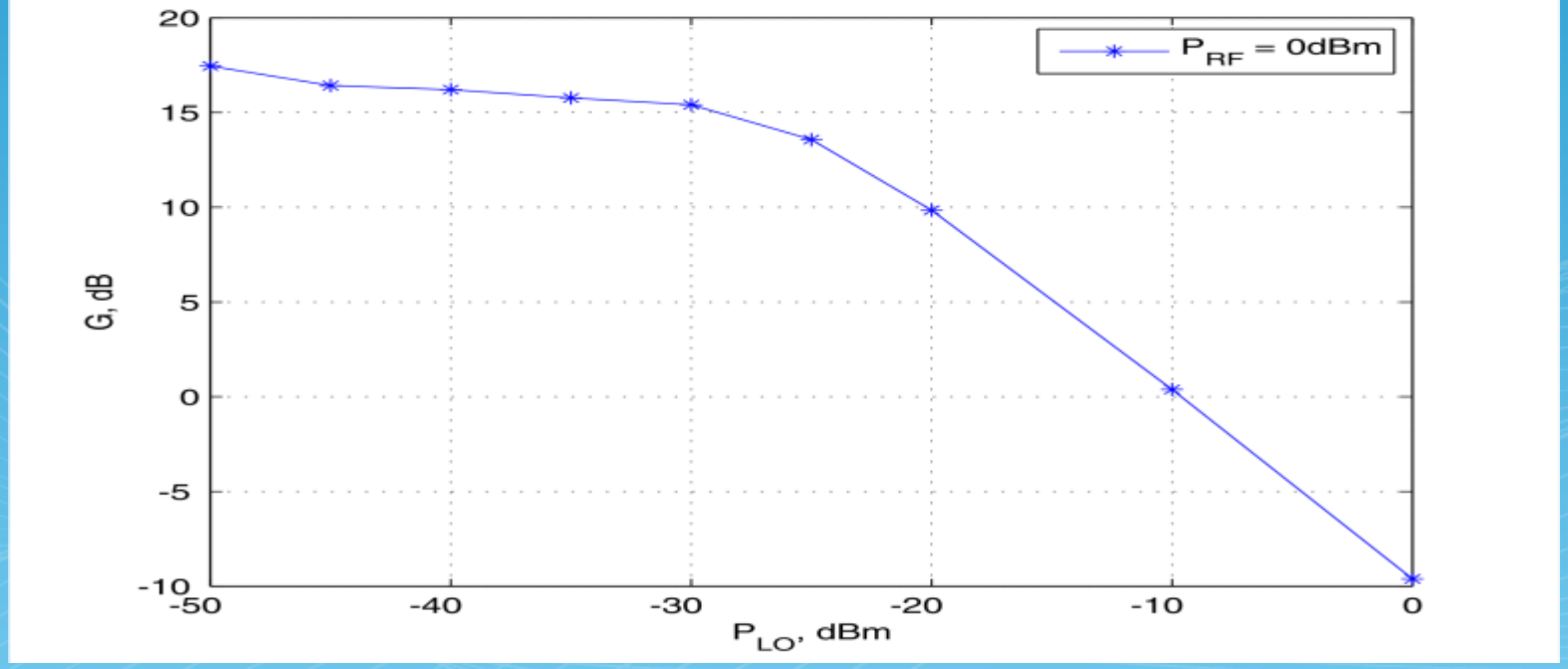
RF Gain Measurment



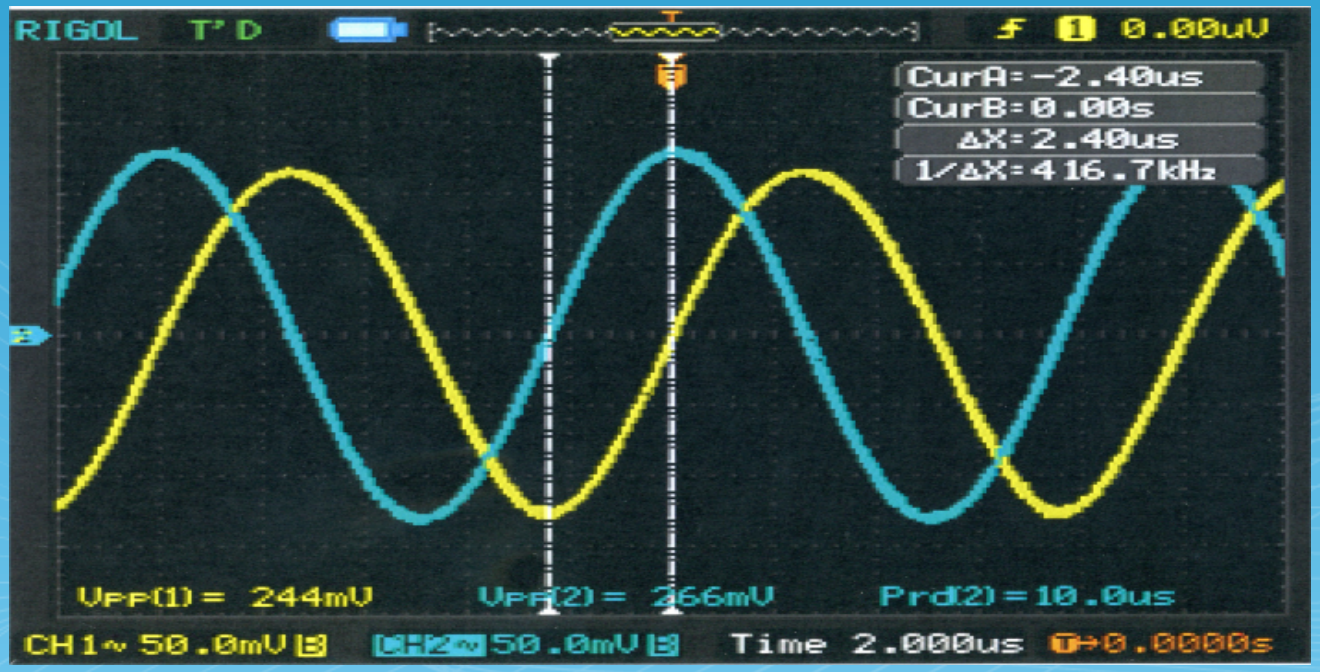
Output Power LO



LO Gain measurment

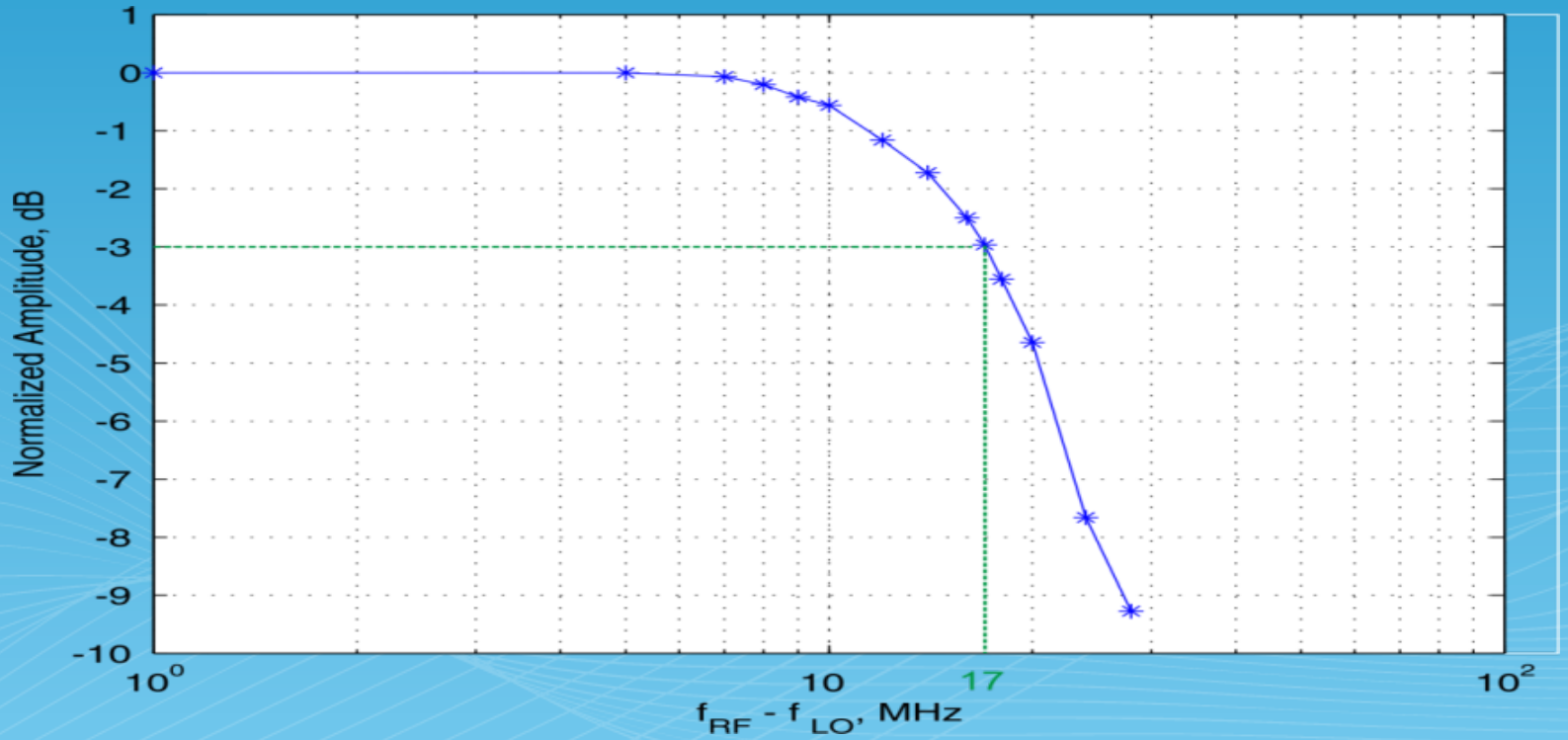


Quadrature Accuracy



Δø=86.4°

Baseband Bandwidth



Conclusion

- An I Q Demodulator was designed for the 7 tesla
- The layout was designed by eagle
- The RF gain -11.3 dBm
- The baseband bandwidth 17 MHz
- The 1 dB compression point 12.3 dBm