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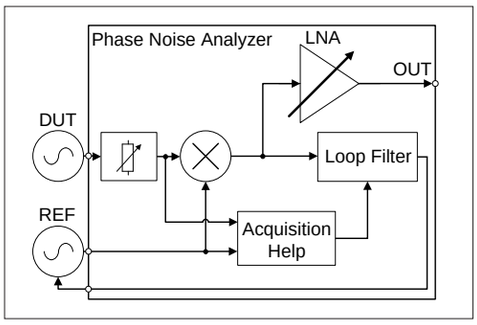
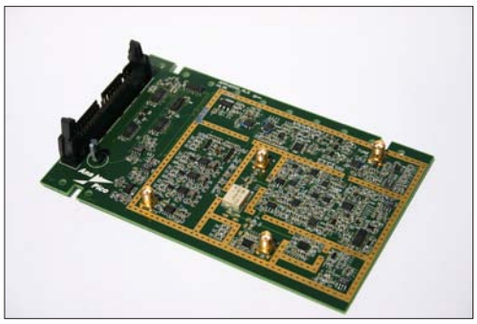
Subject Area	Mobilkommunikation
Project Partner	AnaPico AG, Zürich

Quadrature-Method Phase Noise Measurement

27 Implemented with Variable Bandwidth PLL, Acquisition-Help and Selectable-Gain Low-Noise Amplifier



Simplified system overview



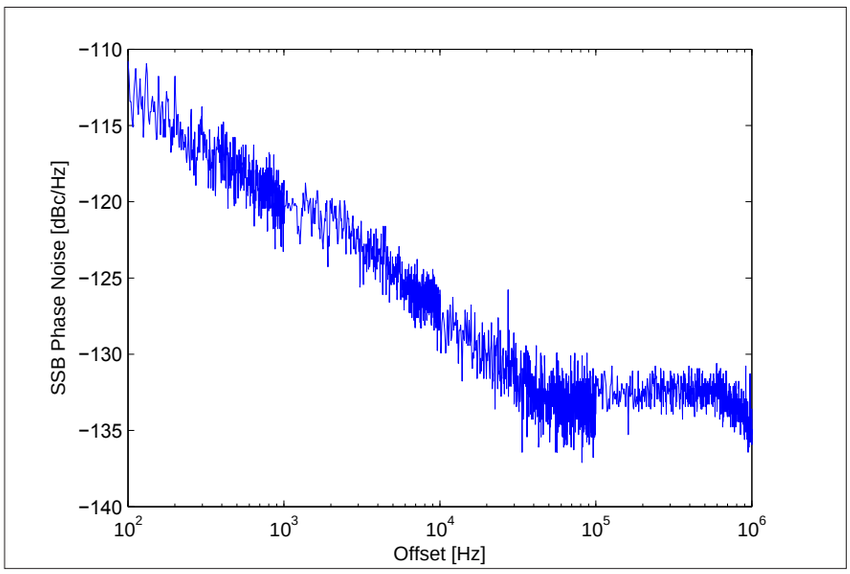
Assembled PCB

Task: Phase noise is a critical parameter in modern communication systems, as it directly affects the bit error rate. AnaPico manufactures very low phase noise RF signal generators. Dedicated hardware is necessary to measure the phase noise performance of these generators. Commonly, the source to be measured is down-converted by a reference source of equal frequency, which is held in quadrature by a PLL. The task of this thesis is to develop, build and test the analog part of such a phase-noise measurement system, incorporating:

- RF level measurement and control
- Broadband phase detector (mixer)
- Low-noise, variable-gain, baseband amplifier
- Variable bandwidth PLL with acquisition help
- Frequency detection

Approach: The system has been developed as an extension to the AnaPico platform and is controlled by a Linux controller board via an SPI bus. Acquisition help and frequency detection are implemented using broadband digital PFD ICs. The variable bandwidth PLL utilizes digital potentiometers in conjunction with precision low-noise OpAmps. For the baseband amplifier, lowest-noise OpAmps were selected and cascaded to achieve 60 dB gain over a wide bandwidth.

Result: Fast acquisition of phase-lock over a wide range of different VCO-gain sources was verified by testing. The baseband amplifier exhibits very low input-referenced noise and a bandwidth of 2 MHz. Frequency detection and phase noise measurements were carried out successfully.



Measured phase noise of a signal generator at 1 GHz