Abstract Submitted
for the MAR17 Meeting of
The American Physical Society

Using a Superconducting Qubit as a Millikelvin Vector Network Analyzer MARKUS JERGER, ZÉNON ERIC VASSELIN, ARC Centre of Excellence for Engineered Quantum Systems, The University of Queensland, Brisbane, Queensland, Australia, ARKADY FEDOROV, School of Mathematics and Physics, The University of Queensland, Brisbane, Queensland, Australia — In experiments that require fast electrical control pulses, it is often crucial that the signal reaching the sample is a faithful reproduction of the intended signal. For highest precision, the frequency-dependent transmission coefficient of the control line has to be taken into account. When both ends of the line are accessible, the transmission coefficient is readily measured with a network analyzer, but when one end is inside a cryostat or signal transmission on the sample is to be taken into account that can be challenging. We have developed a method for the in-situ characterization of the response of a cryogenic microwave input line with the aid of a superconducting qubit. By periodically modulating the energy level splitting of the qubit, we determine the amplitude and phase of transmission of the line controlling the level splitting from DC to 100s of megahertz at millikelvin temperatures. This can be directly applied to improve the fidelity of a number of protocols, most notably controlled phase gates between two superconducting quantum bits using magnetic flux frequency control. These gates are the most common way to generate two-qubit operations in superconducting quantum processors and their fidelities rely on frequency control on a nanosecond time scale.

Markus Jerger
The University of Queensland

Date submitted: 13 Nov 2016 Electronic form version 1.4