**Introduction**

A system has been developed to emulate expected LLRF signals generated from superconducting RF cavities. The purpose of this simple analog emulator design is to meet the cavity bandwidth requirements, high quality factor and to provide tuning errors for emulating Lorentz force detuning and microphonics for all cavity types.

**Objectives and Features**

- Frequency 650MHz
- High quality factor $\sim 1.3 \times 10^7$ and bandwidth 77Hz
- Emulates cavity, dual directional coupler at cavity input and cavity transmitted power signals
- Output amplitude is proportional to input RF drive signal level
- Lorentz force detuning and Microphonics proven with simulation-under development
- IQ modulation for upconversion to RF from IF for cleaner output RF

**Test Results**

The cavity emulator was tested to benchmark its performance as compared to an RF superconducting cavity.

**Design Details**

The crystal filter board is the heart of the emulator design and is developed in ADS to achieve impedance matching and bandwidth.

**Application**

Cavity emulator has demonstrated its ability to be used in checkout of LLRF hardware, software and firmware at PIP-II Test Facility and at PIP-II Spoke Test Cryostat Test facility at Fermilab.