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A Full Circuit Model for SuperSpec Spectrometers GEORGE CHE, Arizona State University, CHARLES BRADFORD, Jet Propulsion Laboratory, SEAN BRYAN, Arizona State University, STEVEN HAILEY-DUNSHEATH, California Institute of Technology, PHILIP MAUSKOPF, Arizona State University, CORWIN SHIU, California Institute of Technology, SUPERSPEC TEAM — SuperSpec is an on-chip, millimeter-wave, astronomical spectrometer designed to provide the requisite bandwidth, sensitivity, and compactness to perform the next generation of spectroscopic observations, which promise to significantly deepen our understanding of star formation and galaxy evolution in the early universe. Instead of a traditional diffraction grating, SuperSpec employs a series of lithographically-patterned spectral channels (SCs) implemented as narrow-band resonant filters coupled to kinetic inductance detectors. Ongoing measurements of prototype spectrometers imply complex interactions between neighboring channels, behavior that cannot be captured by the simple single-channel model that informed current designs. In order to fully characterize the electromagnetics of our devices and guide future work, we have developed a Python-based full-circuit model, which assembles a full filter bank from its constituent SCs and transmission lines, taking into account all internal reflections. Fitting model spectra to measured spectra will explain the discrepancy between design and measured values for our three design parameters for each SC: resonant frequency, coupling quality factor, and internal quality factor.

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