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Temporal and spectral mode conversion of microwave signals with a mechanical resonator ADAM REED, REED ANDREWS, University of Colorado, Boulder/JILA/NIST, TAUNO PALOMAKI, University of Washington, KATARINA CICAK, JOHN TEUFEL, NIST, Boulder, KONRAD LEHNERT, University of Colorado, Boulder/JILA/NIST — Microwave fields are a powerful means for carrying information between separate quantum devices. Different devices, however, typically emit and capture fields with distinct frequencies and temporal envelopes. This spectral and temporal mismatch presents a challenge when wiring these elements into a fully functional information processing network. Here we show that this mismatch can be overcome by using an electromechanical circuit to arbitrarily alter the temporal envelope and center frequency of microwave signals, while at the same time acting as a storage medium. We demonstrate a protocol that shifts the frequency of 7 GHz microwave signals by 250 MHz, and converts an exponentially decaying temporal envelope into a Gaussian envelope. To characterize our signal conditioner in the quantum regime, we inject signals with a few quanta of energy to extract the total added noise and storage lifetime of the conditioner.

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