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Characterizing the performance of waveguide technologies for microwave-frequency quantum communication PHILIPP KURPIERS, TOBIAS FREY, ANDREAS WALLRAFF, ETH - Zurich — In circuit quantum electrodynamics (QED) systems quantum communication over distances beyond chip-scale requires low-loss waveguides. We measure the loss per unit length and the phase stability of commercially available waveguide technologies down to Millikelvin temperatures and single photon levels. More specifically, we characterize the frequency dependent attenuation and dispersion properties of a range of semi-rigid microwave cables and waveguides. We study the properties of various, commonly used conducting and dielectric materials with high accuracy in resonant structures to extract the internal quality factor which is inversely proportional to the loss per unit length. Furthermore, we compare our data with corresponding loss models. The results of our characterization are relevant to applications in which quantum communication is needed between nodes of a small network, e.g. between quantum circuits realized on different chips within the same or in distinct cryogenic systems.

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