THE ELECTROMAGNETIC PROPERTIES OF THE SUPERCONDUCTING CO-PLANAR WAVEGUIDE

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There is no doubt that advances in predicting the electromagnetic properties of superconducting transmission lines have been a major contributor to the recent impressive improvement in the performance of SIS mixers. This progress has mainly manifested itself in two areas: First, it allowed accurate design of a circuit to tune out the capacitance of the tunnel junction and second it made integration of very useful planar circuits on the mixer chip possible. In most cases, those circuits employed microstrip lines whose modal and superconducting properties have thoroughly been investigated.

The reason for preferring the (CPW) over the more familiar microstrip may arise as a result of one or more of the following reasons:

- It offers a wide range of intermediate characteristic impedance values
- It is insensitive to the oxide thickness.
- It can have low conduction losses
- In some cases the deposition of coplanar structure can be simpler then that of two layer structure.

In this paper we present full analysis of the properties of the superconducting coplanar waveguide with thick metallisation. We first calculate the characteristic impedance and complex propagation constant based on a conformal mapping technique. After computing the geometrical factors of the equivalent TEM transmission line we use the Mattis Bardeen equations to include the effect of superconductivity on the electrical parameters. We then use those results to discuses the possible applications of the (CPW) in mixer circuits and make a thorough comparison with the properties of the conventional microstrip. In particular, we shall discuss the potential of this circuit as a tuning stub and a low loss transmission line in SIS mixers at frequencies near the superconducting gap.