ABSTRACT

Cryogenic W Band Power-Combined Amplifier Designs for Applications in the Range of 71 to 106 GHz

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Five versions of a W Band power amplifier design are presented to cover the frequency range of 71 to 106 GHz. These amplifiers have been shown to operate from 300K to as low as 100K and amplify a W band LO source to a minimum level of +23.6 dBm, or ~240 mW.

Key design issues include design to fit available space, MMIC chip designs which had a variety of oscillation propensities (mostly out-of-band), signal splitter and combiner development and matching across the band, matching of chip characteristics for those chips installed in the parallel power combined arms of the amplifier, power output leveling across the band, moding problem solutions for the microstrip line sections installed between MMICS and for moding in the MMIC cavities, both in-band and out-of-band. Operation over such a wide temperature range introduces many challenges that will be discussed.

The HIFI Power Amplifier design uses 0.1um GaAs(Gallium Arsenide) HEMT(High Electron Mobility Transistors) MMIC(Monolithic Microwave Integrated Circuit) amplifier chips. Six such devices are required to achieve the gain and output power delivered by these amplifiers.

The Power Amplifier design embodiment is based on a single silicon-aluminum package design. Internal changes to the amplifier which include device selections, and changes in splitter/combiners, transitions, and RF substrates differentiate the frequency of operation of the amplifiers. Manufacturing issues, as well as electrical performance of the amplifiers will be discussed.