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NASA TECH BRIEF

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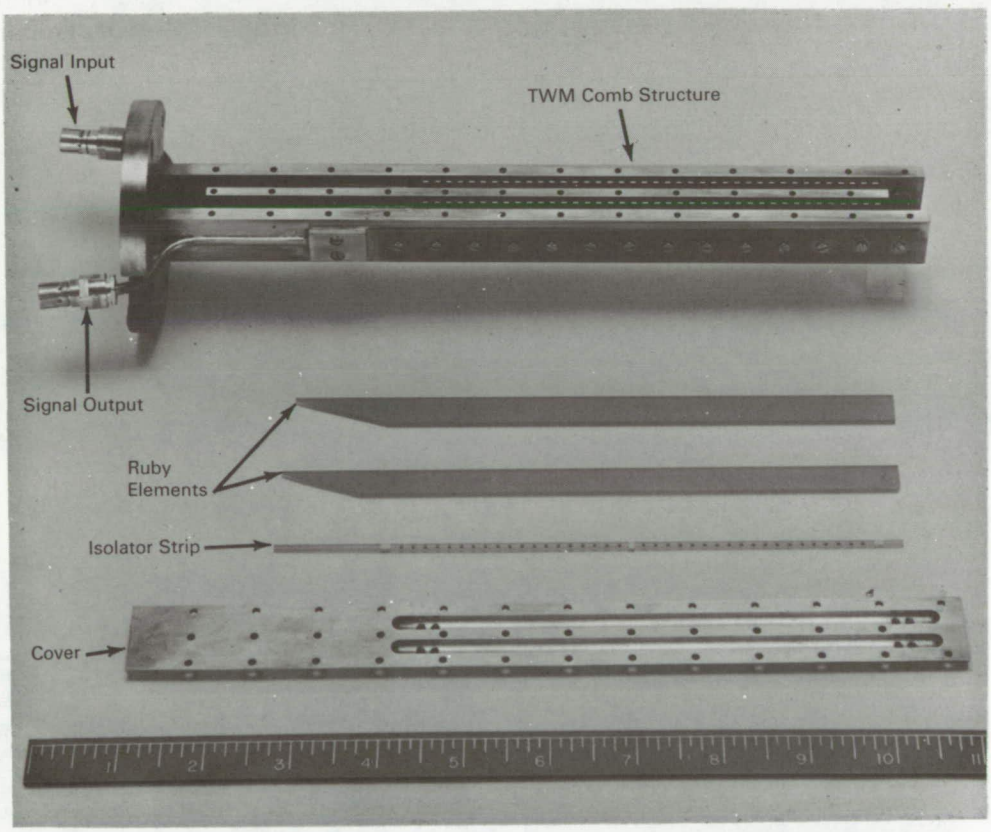
Improved Traveling Wave Maser Amplifier



A traveling wave maser (TWM) that operates at S-band frequencies is characterized by a greatly improved gain-bandwidth product with relatively low equivalent-noise temperature. Tests indicate that its performance exceeds that of any other type of S-band amplifier. The improved performance and easier fabrication of the new maser were achieved by combining the best features of previous designs in a single structure. These features include fabrication of the comb structure from a single piece of copper; use of simple signal-coupling loops; an improved clamping procedure for the ruby elements and isolator; use of higher quality ruby (zero-degree Czochralski ruby); use of single crystal yttrium iron garnet (YIG) isolator material; use of ruby, rather than passive material, to support the isolator discs; use of a comb-tooth shape

(continued overleaf)

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that yields maximum gain; and use of internal field-staggering coils with iron shims to adjust gain and bandwidth of the maser.

The physical appearance and dimensions of the major components of the maser are represented in the illustration. These include the unitary waveguide-comb structure; the ruby elements that occupy the spaces on each side of a comb (four in all); the isolator strip comprised of a ruby element and YIG discs; and the waveguide cover.

The maser amplifier provides 46-dB net gain and a 3-dB bandwidth of 46 MHz when operated at a refrigerator temperature of 4.4°K. The equivalent input noise temperature (at the ambient waveguide interface) was measured to be less than 6°K from 2270 to 2300 MHz.

Notes:

1. This maser could find application in world-wide communication (TV and multichannel telephone) via satellite. The intended use is for deep space communication.
2. Details may be obtained from:
   Technology Utilization Officer
   NASA Pasadena Office
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B68-10244

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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