DISCRETE COMPONENT S-BAND POWER AMPLIFIER

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Spacecraft S-band power amplifier development in recent years has faced the problem of developing power over 5 W without encountering undesirable "turn-on" characteristics. Small reductions of either RF driving power or applied dc voltage developed an unacceptably large power output drop. Aging of components in either the RF drive hardware or power source circuitry of a spacecraft could result in a catastrophic loss of output power.

The amplifier shown in Figure 1 has overcome this problem. It achieves stability by use of moderate Q input and output circuits. Previously designed amplifiers have used cavity resonators that suffered from high Q. Another frequently tried approach using microstrip or stripline has exhibited inefficiency and reduced gain. The discrete component amplifier uses distributed inductance and small piston capacitors for resonance and impedance matching of the transistor to 50-ohm input and output.

The amplifier is fabricated by milling an aluminum cube. Piston capacitors can be seen on either side of the transistor. The transistor is silver soldered to the plated cube that is 2½ cm on a side and weighs 34.3 g in nickel-plated aluminum and 93.9 g in copper.

The output power exceeds 8 W, and the collector efficiency is over 40 percent; gain is about 9 dB. Turn-on characteristics are shown in Figure 2. The linearity exhibited has allowed this design to be used on the Nimbus Tracking and Data Relay Experiment. Here, dc voltage level applied to the output amplifier will be varied on command providing power outputs of 2, 4, or 8 W. Two similar stages are cascaded on Nimbus. The pair combined produce 19 dB gain with 36 percent efficiency.

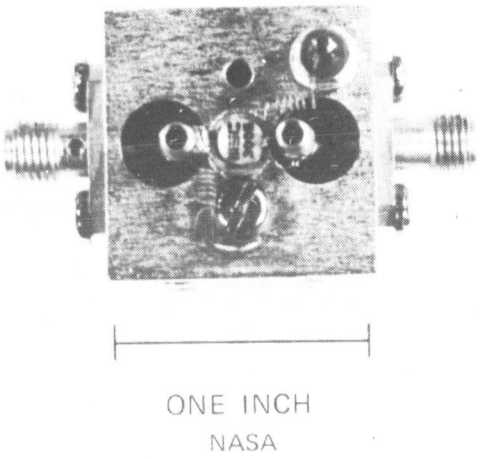

Figure 1—S-band discrete component amplifier (designed and developed by L. Line and R. Rippy).

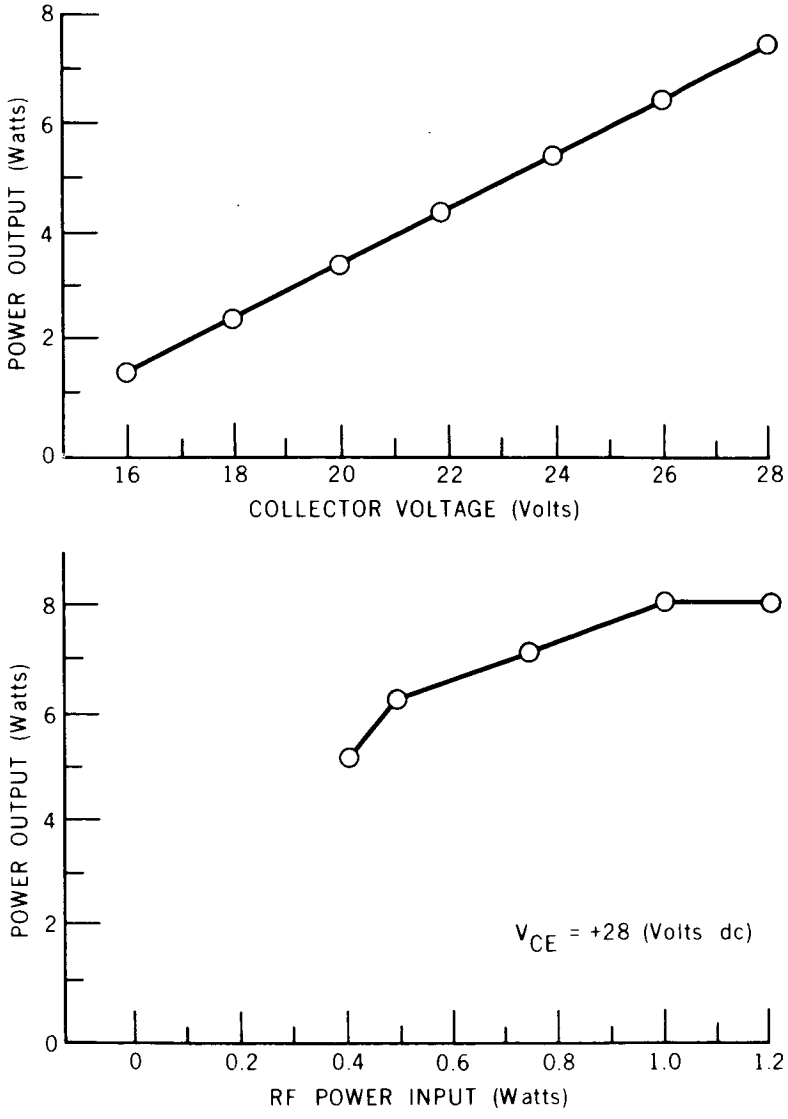

Figure 2—Discrete component S-band power amplifier at 2.3 GHz.