A 0.5-Watt 903-MHz Amplifier

By Zack Lau, KH6CP ARRL Laboratory Engineer

he two-transistor amplifier shown in Fig 1 is an inexpensive way to amplify the 10 mW of RF output available from a monolithic microwave integrated circuit (MMIC) to 0.5 W on the 903-MHz band. Q1 and Q2, MRF 559s, are plastic-cased devices selling for less than \$2 each. When driven with an Avantek MSA-0304 MMIC (around 10-mW saturated output), the saturated CW output is 0.5 W as measured with an HP435/8482A power meter and a Bird 10-dB attenuator. A two-tone IMD test indicates that the MMIC saturates before this amplifier does, since the higher order IMD products are down 47 dB. See Fig 2.

The amplifier is built on a 1/16-inch,

thick, double-sided glass-epoxy PC board (Fig 3). All components mount on the etched side. The other side is left unetched to act as a ground plane. The 40-ohm striplines (Z1 through Z4) are made using 0.15-inch-wide traces.

Use good VHF/UHF construction techniques and keep the leads short when mounting components. Drill oversize holes for Q1 and Q2 so the leads lie flush against the board traces. Use copper foil wrapped through the transistor mounting holes to connect the top and bottom ground planes at the emitters of Q1 and Q2. Wrap the board edges with copper foil to connect the top and bottom ground planes.

Use R3 and R7 to adjust bias currents to 22 mA for Q1 and 87 mA for Q2. Note: These are the *total* currents as indicated by the voltage drops across R4 and R8. The bias currents do drift slowly without RF drive, but this is not a problem as long as the supply voltage is switched off during receive. The prototype works fine without a bypass capacitor at the junction of R6 and R7.

Tune-up is simple. Apply drive and adjust C2 and C6 for maximum output. Attempts at matching the output with a tunable network failed to improve gain or output power. Better results may be obtainable by using Teflon® -dielectric board and porcelain chip capacitors.

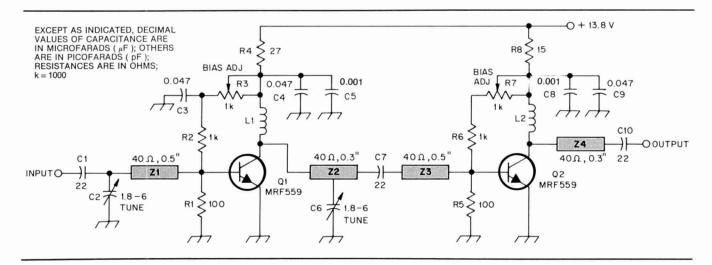


Fig 1—Schematic of an inexpensive 0.5-W 903-MHz amplifier. Resistors are ¼ W. Capacitors are NP0 chip capacitors unless noted, although more expensive porcelain capacitors may work better.

- C2, C6—1.8-6-pF trimmer capacitors. Mouser 24AA070.
- C3, C4, C9—tiny ceramic capacitors or chip capacitors.
- L1—7 turns no. 22 tinned copper wire, space wound; no. 33 drill bit used as temporary form.
- L2—5 turns no. 22 tinned copper wire, space wound; no. 33 drill bit used as temporary form. Q1, Q2—MRF 559.

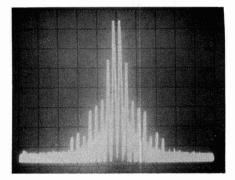


Fig 2—Spectral display of the 0.5-W 903-MHz amplifier during two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 26 dB below PEP output, and fifth-order products are approximately 47 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 10 kHz. The amplifier was being operated at 560-mW PEP output on 903.1 MHz.

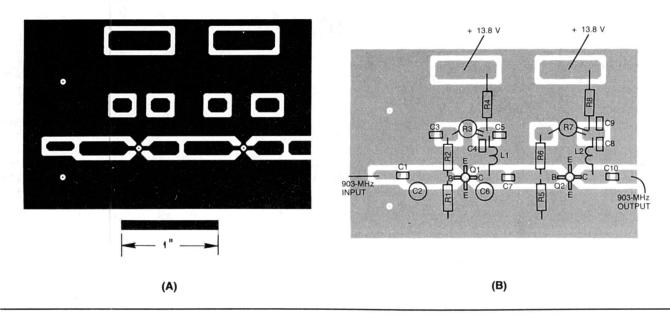


Fig 3—Circuit-board etching pattern (A) and parts-placement diagram (B) for the 0.5-W 903-MHz amplifier. The etching pattern is shown full size from the etched side of the board. Black areas represent unetched copper foil. Board material is 1/16-in. G-10, double sided. The other side of the board is unetched to form a ground plane. The shaded area in B represents the copper pattern. All components are mounted on the etched side of the board.

Bits

Satellite-Tracking Program for Commodore Computers

Many Amateur Radio operators use C64 of C128 computers as part of their satellite communications systems or for receiving TV and weather-satellite signals. In each of these cases, knowing when the satellite is accessible and where to aim their antennas are essential to successful operation.

SATCOMM-64 provides the C64/C128 owner with several useful features: It has a master menu to allows quick selection of any of 12 options, can store information on up to 15 different satellites and quickly confirm W1AW reference orbits. The program will provide a printed report of up to 31 days of access times (for a specific time bracket) for any satellite. Also available is a printed report of a single day's access times for up to three different satellites.

For each user-specified time interval, SATCOMM-64's printed reports include: relative azimuth and elevation, altitude, longitude and latitude, local time, UTC day, geographic areas that are within the satellite's communication range, Doppler shift, minimum and maximum communi-

cation distance, operating frequencies, orbit number and phase.

At this writing, SATCOMM-64 can print out detailed reports covering OSCARS 9, 10, 11 and 12, RS-5, 7, 10 and 11, MIR, Kivant, Salyut-7 and weather/research satellites (GOES/WEFAX, NOAA, Meteor). Whenever desired, you can replace any of these with new satellite choices.

Additional program features include: choice of screen and printed report or screen alone; easily altered defaults (start time, time increment and so on) and automatic changeover from Standard to Daylight time and vice versa (this feature may be bypassed). SATCOMM-64 also handles the annual rollover period during which the previous year's Keplerian elements have not yet been updated.

SATCOMM-64 requires a C64/128 computer, 1541 disk drive and 1525-compatible printer. Price: \$15.95 (Missouri residents add sales tax), plust \$3 for postage and handling. To order or obtain additional information, contact Strategic Marketing Resources, Inc, PO Box 2183, Ellisville, MO 63011, tel 314-256-7814.—Paul K. Pagel, N1FB

Macket Software for Macintosh Computers

Macket provides power and flexibility for the packet-radio operator who uses a Mac®. There are windows for entering text, displaying the receive buffer and logging transmitted text. These windows support all of the features expected by Mac users such as scrolling and text selection. The input window also allows mouse-based editing. Other features include text uploading and downloading, printing and the use of macros.

Macket works with all Pac-Comm TNCs: the TNC-200, -220, Tiny-2 and Micropower-2 as well as any other TNC that is equipped with an RS-232-C port. When used with a TNC-2 clone that supports the RXBLOCK command, Macket can display the user's conversations in a special window so that the conversation will not be mixed with monitored text.

The program, developed by S Fine Software, is available from Pac-Comm Packet Radio Systems, Inc, 3652 W Cypress St, Tampa, FL 33607, tel 800-223-3511 (orders only, except in Florida); technical information, 813-872-2980.—Paul K. Pagel, N1FB