The droplet-dispenser circuit (see figure) includes power supply PS2, which energizes DC-to-DC converter PS4 to produce the bias voltage. A bias voltage of the order of 3 kV has been found to be effective. PS4 charges capacitor C2 through current-limiting resistor R9. Bleed resistor R8 discharges C2 for safety when the circuit is not in use. Diodes D5 and D6 protect PS4 from inductive voltage spikes. The droplet is charged via steering diode D4 and current-limiting resistor R7.

Power supply PS1 energizes DC-to-DC converter PS3 to charge capacitor C1 via current-limiting resistor R1. Charging C1 to 100 volts has been found to be effective. Bleeder resistor R2 discharges C1 for safety when the circuit is not in use. Silicon controlled rectifier SCR1 conducts when push-button switch S1 is closed momentarily, producing a microsecond pulse in the primary winding of transformer T1. Diodes D1 and D2 protect SCR1 from inductive spikes. When C1 has been charged to 100 V, a pulse of 12 kV is produced at the secondary winding of T1; however, the circuit is capable of generating a pulse of as much as 40 kV. The pulse provides ionization energy to the droplet via steering diode D3 and current-limiting resistors R3, R4, R5, and R6. This energy causes the release of the droplet. The four current-limiting resistors (instead of only one resistor with four times the resistance of one of them) are used here to enable this part of the circuit to withstand the high-voltage pulse.

Before the circuit is turned on, PS1 and PS2 are set to the minimum voltage levels. Then they are turned on along with PS5. Next, PS1 and PS2 are set to the desired voltage levels. Finally, S1 is closed momentarily to release the droplet. The circuit as described here was designed for manual control, but is readily adaptable to control by a microprocessor.

This work was done by Dennis J. Eichenberg of Glenn Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Commercial Technology Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-17190.
MMIC HEMT Power Amplifier for 140 to 170 GHz
Circuits like this one could be useful in radiometers for probing the atmosphere.

NASA's Jet Propulsion Laboratory, Pasadena, California

Figure 1 shows a three-stage monolithic microwave integrated circuit (MMIC) power amplifier that features high-electron-mobility transistors (HEMTs) as gain elements. This amplifier is designed to operate in the frequency range of 140 to 170 GHz, which contains spectral lines of several atmospheric molecular species plus subharmonics of other such spectral lines. Hence, this amplifier could serve as a prototype of amplifiers to be incorporated into heterodyne radiometers used in atmospheric science. The original intended purpose served by this amplifier is to boost the signal generated by a previously developed 164-GHz MMIC HEMT doubler (which was described in "164-GHz MMIC HEMT Frequency Doubler" [NPO-21197], NASA Tech Briefs, Vol. 27, No. 9 [September 2003], page 48.) and drive a 164-to-328-GHz doubler to provide a few milliwatts of power at 328 GHz.

The first two stages of the amplifier contain one HEMT each; the third (output) stage contains two HEMTs to maximize output power. Each HEMT is characterized by gate-periphery dimensions of 4 by 37 µm. Grounded coplanar waveguides are used as impedance-matching input, output, and interstage-coupling transmission lines.

The small-signal S parameters and the output power (for an input power of about 5 dBm) of this amplifier were measured as functions of frequency. For the small-signal gain measurements, the amplifier circuit was biased at a drain potential of 2.5 V, drain current of 240 mA, and gate potential of 0 V. As shown in

Such delays result from finite signal-propagation speed and are unavoidable. Notwithstanding such delays, the bus network extender is well suited for protocol and interface integration testing, even on slower links. On faster links, some systems equipped with the extender can cycle MIL-STD-1553 frames at full speed, subject to only inevitable data delays. Some systems equipped with bus network extenders may seem to operate in real time on high-speed links.

The bus network extender is equipped with utility software that, upon command, displays the status of all BCs, remote transmission queues, and RT message queues. The software also provides a configuration file for all connected systems to provide error-free configuration at all locations, a configuration file that contains an entire system interface control document, and an input file that performs extensive error checking. Since slave BCs are configured automatically, remote configuration data are totally eliminated when remote simulations are not required. Should a slave network server be unreachable, the extender attempts to re-establish network connections automatically while maintaining adherence to real-time-response requirements for all MIL-STD-1553 messages.

This work was done by Julius Marcus and T. David Hanson of GeoControl Systems, Inc., for Johnson Space Center. For further information, contact the Johnson Commercial Technology Office at (281) 483-3809.

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