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A 5-WATT CARRIER–CURRENT TRANSMITTER

Build this license-free AM transmitter that operates into the power line.

BY DR. JIM S. HARMON

WOULD you like to operate, legally, your own five-watt unlicensed AM broadcast transmitter? It is possible.

Everyone seems to know that the FCC controls restrict the operation of non-licensed transmitters. A close look at the regulations, however, indicates a greater concern for antennas than for actual transmitter power. One interesting regulation is that, while a conventional antenna is generally forbidden, one is permitted limited use of the 117-volt ac power line within a building as a low-frequency, carrier-current "antenna." All radios plugged into the 117-volt antenna circuit receive the signal and communication is usually limited to the utility transformer for the building.

Several wireless intercoms operate on this principle and at least one commercial unlicensed 50-watt output, carrier-current AM transmitter is manufactured for use on broadcast frequencies. Although the price of that transmitter is over $800, it's range is probably not much more than that of the transmitter described here.

How It Works. A schematic of the transmitter is shown in Fig. 1. Tube *V1* is used as a crystal-controlled oscillator operating at a quiet spot in the local broadcast band. The r-f signal is then amplified by *V2* and coupled to the power line through capacitors *C7* and *C8*. The audio section starts with *V3*, connected as a conventional voltage amplifier which drives modulator *V4*.

The modulator supplies dc power to the r-f amplifier through an arrangement known as Heising modulation. The dc power to *V2* goes through the primary of *T1* (whose secondary is not used) and is modulated by the output of *V4*. Thus, as the audio content varies, the amount of power applied to the r-f amplifier is varied.

For safety, be sure to use high-quality, high-voltage (about 400 V) disc capacitors for *C7* and *C8*. These capacitors are coupled directly to the power line.

Construction. Since this is an r-f circuit, the parts should be laid out so that there are short leads in the r-f section. Inductors *L1* and *L2* should be at least five inches apart and preferably at right angles to each other. These two coils are conventional loopstick antenna coils such as Radio Shack 270-376. For a crystal frequency between 1000 and 1100 kHz, remove the slug from *L1* and unwind 55 turns from *L2* (leaving the slug in the coil form). Should another type of loopstick be used, it may be necessary to use a grid-dip meter to set them to resonance. The output coupling coil of *L2* consists of 21 turns of wire, such as that removed previously. Coils *L3* and *L4* are plain loopsticks.

After choosing a suitable chassis, mount all components so that lead lengths are minimum, using terminal strips for *L3* and *L4*. The other two loopsticks can be mounted on the chassis using the mounting spring locks on the coil forms.

Tune Up. Start by adjusting *C1* for maximum transmitter output. A simple tune-up device can be made from a one-turn loop coupled near *L1* and connected to an oscilloscope (that will respond to about 2 or 3 MHz) or a suitable field strength meter. A conventional BCB receiver can also be used if it is equipped with a signal strength meter.

Once *C1* has been set for maximum output, adjust the slug of *L2* for maximum output in a similar manner. The slug in *L2* should be approximately half way into the coil. If maximum output occurs when the slug is removed from the coil form, add a few turns to *L2* and repeat the tune-up. Similarly, if maximum output occurs when the slug is completely within the coil, remove a few turns and repeat the tune-up.

Once the r-f portion has been adjusted,

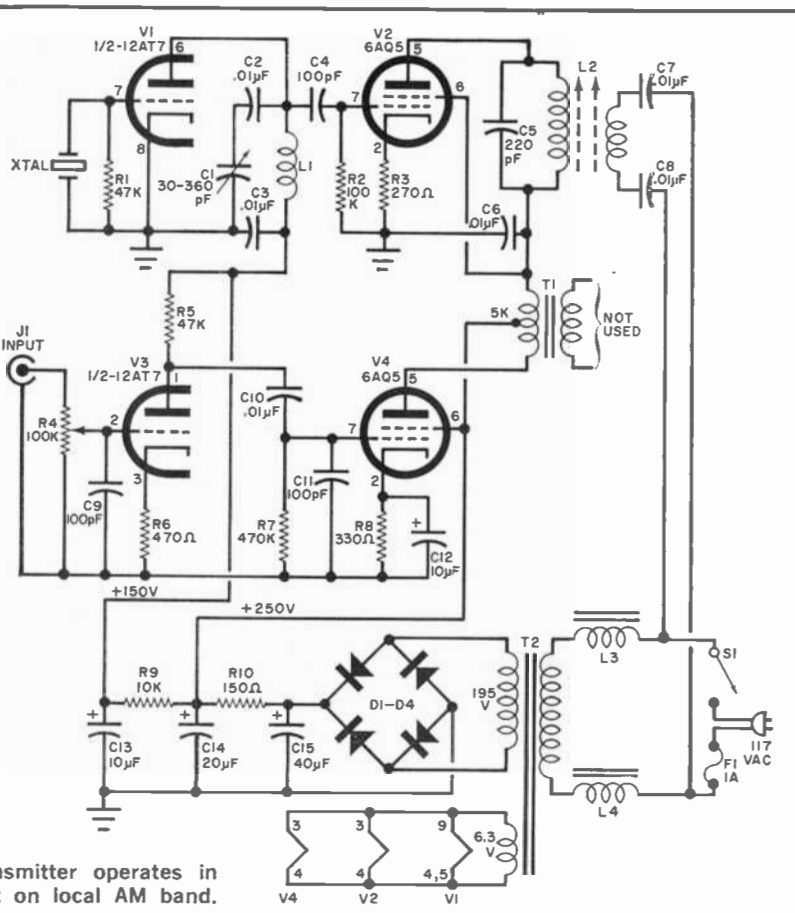

Fig. 1. Transmitter operates in a quiet spot on local AM band.

PARTS LIST

C1—30-360-pF variable capacitor
C2, C3, C6, C7, C8, C10—0.01-μF disc capacitor (see text for C7 and C8)
C4, C9, C11—100-pF capacitor
C5—220-pF capacitor
C12, C13,—10-μF, 400-volt electrolytic capacitor
C14—20-μF, 400-volt electrolytic capacitor
C15—40-μF, 400-volt electrolytic capacitor
D1-D4—600-PRV, 1-A silicon diode
F1—1-A fuse and holder
J1—Phono connector
L1-L4—Loopstick antenna (see text)
R1, R5—47,000-ohm, ½-watt resistor
R2—100,000-ohm, ½-watt resistor
R3—270-ohm, 1-watt resistor
R4—100,000-ohm potentiometer
R6—470-ohm, 1-watt resistor
R7—470,000-ohm, ½-watt resistor
R8—330-ohm, 1-watt resistor
R9—10,000-ohm, 2-watt resistor
R10—150-ohm, 2-watt resistor
S1—Spst switch
T1—Push-pull, 10-watt audio output transformer (BA 13A862 or similar)
T2—Power transformer; secondaries: 195 V rms and 6.3 V (McGee TR8-5 or similar)
XTAL—1050-Hz crystal (JAN Crystals 2400 Crystal Drive, Ft. Meyers, Fla.)
Misc.—Suitable chassis, crystal microphone, line cord, terminal strips, mounting hardware, etc.

the carrier can be tuned in on a BCB radio set to the crystal frequency. The audio signal required for modulation can be from almost any source that can deliver 1 volt. For low-output microphones or a turntable, a preamplifier is required.

With both the transmitter and receiver operating and an audio signal applied to *J1*, turn up gain control *R4* for maximum signal before noticeable distortion occurs. This final measurement should be made with the receiver plugged in at least 50 feet from the transmitter. A lesser distance may result in receiver overloading.

Be sure that all radiation from the transmitter is confined to the power line. The FCC Rules covering this type of operation are covered in Manuals OCE-11 and OCE-12. They are free and perhaps should be investigated before starting on this project. ◈