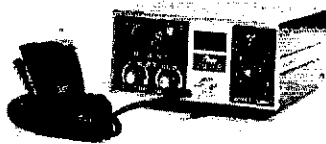


# Recent Equipment



To acquaint you with the technical features of current amateur gear.

## Clegg FM-27B FM Transceiver



**R**ECENT EQUIPMENT reviews are always difficult to write because what may be the reviewer's cake could be the reader's poison. Sometimes it is difficult to be objective. This was certainly the case when testing the Clegg FM-27B.

Anyone who has operated 2-meter fm knows that it is primarily a crystal-controlled type of operation. One usually buys crystals for the local repeater and then hopes that he will find the same frequencies in use when traveling to another area. It can be frustrating to take a trip and discover there are plenty of repeaters along the way, but they all operate with different frequencies than the ones available in your transceiver.

The number one feature of the FM-27B is that it covers *all* frequencies, both transmit and receive, from 146 MHz through 148 MHz. When the reviewer first got into ham radio (quite a few years ago!) all of his transmit operation was with crystals. That first VFO was a real joy and opened a whole new world of amateur radio. Using the FM-27B provides the same effect.

### Transmitter Circuit

Fig. 1 is a simplified block diagram of the transmitter. Clegg uses the term "Crystiplexer" in describing both the transmitter and receiver frequency-controlling circuits. There are ten crystals used in an oscillator with 100 kHz steps from 25.55 to 26.45 MHz. The output from this oscillator is fed to the first mixer. The "fine-tuning" circuit consists of a voltage-controlled

oscillator using Varicap tuning that covers 4.45 to 4.54 MHz (shown schematically in Fig. 2). Output from this oscillator is fed to the first mixer. This energy is then routed through a band-pass filter (30.5 MHz) to the second mixer. Output energy from a crystal-controlled oscillator (116 MHz) is also fed to the second mixer; the resulting output is in the 146-MHz range. The signal is then filtered and amplified.

Phase modulation is used in the transmitter. The FM-27B is capable of 10-kHz deviation and 12-dB peak clipping. The transmitters are factory adjusted for 5 kHz of deviation with 3 dB of clipping.

### The Receiver

If one took Fig. 1 and reversed the conversion process, he would have a diagram for the receiver. There is one exception, however. A third mixer is employed to convert the signal to the last i-f (455 kHz). Output from the last mixer is fed through a 10-pole ceramic filter and then to an IC limiter (a CA3076) and on to the discriminator (a CA3075). The discriminator current can be monitored via a panel-mounted, zero-center meter. This same meter is switched to read relative output when transmitting.

There are two frequency-setting controls mounted on the panel for the receiver (also two similar controls for the transmitter). The first control is a switch and is used to select the appropriate crystal oscillator in the 25.55- to

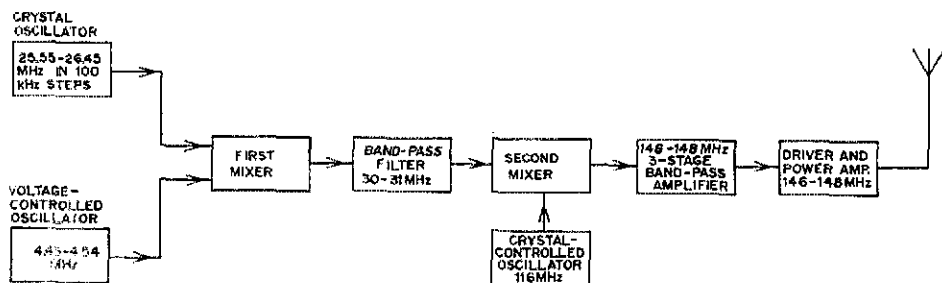
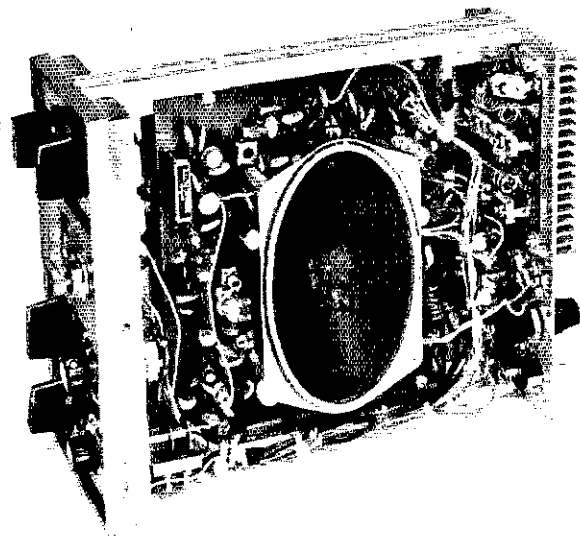


Fig. 1 - Simplified block diagram of the FM-27B transmitter.



This view shows the receiver board. At the upper left-hand corner is the 10-pole ceramic filter.

26.45-MHz range. This control is numbered from 0 to 9. The second control is a linear potentiometer in the Varicap oscillator circuit. The dial for the control is numbered from 0 through 9.

If, for example, one wants to listen to "146.94," he switches the 100-kHz receiver selector control to 9 and the receiver tune control to 4. With a signal coming in, the tune control should be adjusted so the needle on the discriminator meter reads zero. This indicates that the receiver is tuned exactly to the repeater's output frequency.

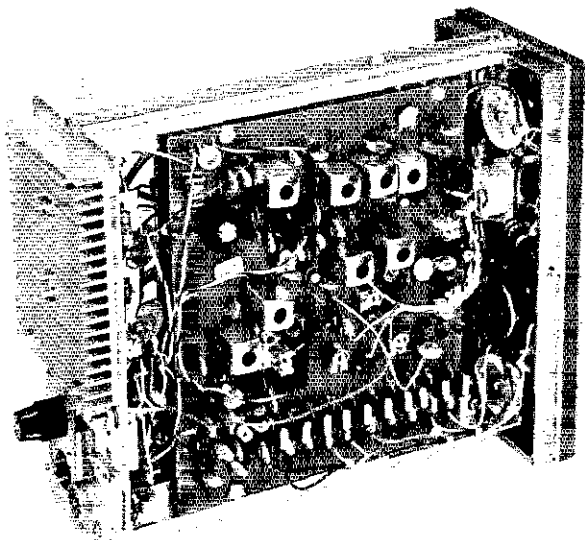
The transmitter adjustments are similar. For "146.34," set the 100-kHz transmitter selector switch to 3 and the transmitter tune control to 4. A push-pull switch is mounted on the rear of the volume control. When the volume control knob is pulled forward, the spotting switch is activated. This turns on the low-level stages of the transmitter. With the switch activated, adjust the 100-kHz transmitter tune control so that the discriminator meter is zeroed. This puts the transmitter exactly on frequency (assuming of course that the repeater is on frequency in the first place!).

With the spot switch on and the microphone push-to-talk button depressed, the operator can monitor his own modulation quality. No signal is radiated since the spot switch deactivates the antenna relay.

The logical question would be, "How does the operator know his transmitter is on the correct frequency?" This is where the Clegg Crystiplexer goes to work. The receiver crystal that is controlling for 146.94 is 26.45 MHz. The 26.45 MHz frequency plus the Varicap tuned oscillator (VCO) at 4.035 MHz, (plus the i-f at 455 kHz) and the fixed oscillator at 116 MHz adds up to 146.94. When the spot control is turned on, diode switching shifts the transmitter to the same (or almost the same) frequency as the receiver. The 26.45 MHz oscillator is controlling the transmitter. The transmitter VCO is then adjusted so that the transmitter is zero beat with the receiver as indicated by the discriminator meter. When the spot switch is turned off, diode switching shifts the transmitter back to 146.34 MHz by reactivating the 25.95 MHz crystal. Since the transmitter VCO is not switched, its setting is not affected by the change from spot to operate. The accuracy of the transmitter frequency is dependent on the crystal tolerances used in the Crystiplexer. We found that in several tests, using a frequency counter, the error was less than 100 Hz.

#### *Other Information*

The earlier model of the transceiver, the FM-27A, was designed to cover 146 to 148 MHz in one Megahertz steps for receiving but would



The 10 crystals in the Crystiplexer circuit are visible along the bottom of transmitter board. The heat sink for the final amplifier stage is mounted on the rear wall.

EXCEPT AS INDICATED, DECIMAL VALUES OF CAPACITANCE ARE IN MICROFARADS ( $\mu\text{F}$ ); OTHERS ARE IN PICOFARADS ( $\text{pF}$  OR  $\mu\text{F}$ ); RESISTANCES ARE IN OHMS;  $k = 1000$ ,  $M = 1000000$ .

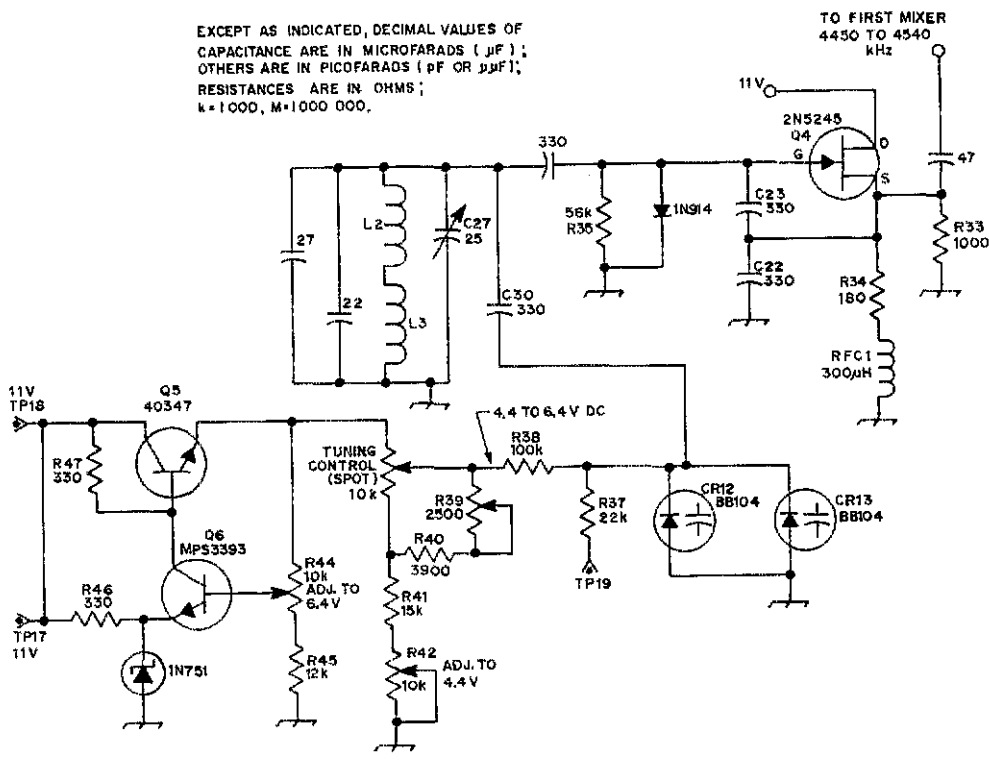


Fig. 2 -- Circuit details of the transmitter Varicap-tuned oscillator section.

transmit only in the 146 to 147 MHz region. The FM-27B however, is capable of receiving and transmitting in both one-MHz segments or receiving in one range while transmitting in the other.

The transceiver is fully transistorized and is rated at 25 watts output. The unit we tested actually produced slightly more than 25 watts. The rf amplifier has inherent protection against damage from mismatched loads.

In the Hartford area there are repeaters operating from 146.64 to 146.94 MHz on every 30-kHz assignment. Some receivers we have checked have shown severe cross-modulation tendencies. However, the FM-27B has been exceptionally clean in this respect. One crazy problem did crop up when using the unit, but it is hard to fault the manufacturer for this one. We had an occasion to use the transceiver, but had no regular antenna available. A wire, 19-inches long, was inserted into the coax fitting and the rig was turned on. We could hear each local repeater and managed to trigger them but received reports of no audio or poor audio. After much head scratching and checking it was discovered there was rf from the antenna getting back into the audio circuits. A simple ground-plane antenna with about two feet of coax feed solved the problem. As stated, it is hard to fault the manufacturer because instructions

clearly point out that a 50-ohm coaxial load with less than a 2:1 SWR should be used.

The FM-27B comes with a mounting bracket that is unique. It is equipped with a lock and key. The transceiver can be quickly installed and locked in place. A thief with a crowbar could steal the set, but it wouldn't be easy! — *WIICP*

#### Clegg FM-27B 2-Meter FM Transceiver

- Power output: 28 watts at 13.5 V dc.\*
- Sensitivity: 0.37  $\mu\text{V}$  for 20 dB of quieting; 0.13  $\mu\text{V}$  to open the squelch.\*
- Frequency stability: Less than 100-Hz frequency change at 146 MHz, transmit and receive, with a voltage change from 12 to 14.5 V from the supply.\*
- Dimensions (HWD) and Weight: 7-3/8  $\times$  3-1/2  $\times$  9-1/4 inches, 4.5 pounds.\*
- Power requirements: 12 to 14 V dc; standby 0.4 A, receive 1.2 A, transmit 6 A.\*
- Price class: \$480, includes microphone and mounting bracket.
- Manufacturer: Signal and Control, International Corp., Clegg Division, 3050 Hempland Rd., Lancaster, PA 17601.
- \* Tested in ARRL Lab.