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ICOM IC-275A 2-Meter Multimode Transceiver

RF Concepts RFC 2-317 2-Meter Amplifier

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ICOM IC-275A 2-Meter Multimode Transceiver

The ICOM IC-275A is the 2-meter offering in ICOM's latest line of VHF/UHF transceivers. The new rigs are noticeably smaller than the last generation, yet they pack a number of added features. If you didn't know that this was a VHF transceiver, you would think it was an HF rig at first glance.

Like the previous generation of ICOM 2-m multimode transceivers, there are two versions of the IC-275 available in the US marketplace. The IC-275A features SSB, CW and FM operation from 140.1 to 150 MHz, 25-W-plus output and a GaAsFET front end. In addition, there are 99 memories, a versatile scanning system, passband tuning and notch filter, subaudible tones and full-break-in CW operation!

A switching power supply is built in, but there is a jack on the rear panel if you want to use an external 13.8-V source (at 6 A). The IC-275H offers the same features as the IC-275A, except that power output is 100 W.

It would take many pages to describe *all* of the features of the IC-275A. I'll highlight some of the significant and not-so-obvious features.

Frequency Control

The IC-275A features ICOM's direct-digital synthesizer. This allows the transceiver PLL to lock up in just 5 ms. Fast lock-up time is important for modes (such as AMTOR) that require fast TR turn-around time. We measured turnaround times of 7 ms using the DATA (quick TR) feature in the USB or LSB mode (typically used for RTTY or AMTOR). See Fig 1.

The IC-275A shares many of the elaborate frequency-control features found on other ICOM HF and VHF rigs. There are provisions for VFO A/B selection, a scanning mode that allows scanning of selected portions of the band or preset memory channels, RIT and complete flexibility in selecting standard repeater offsets or programming oddball ones.

With such a large frequency range to cover, the main tuning knob does yeoman duty. For large frequency excursions, punch in the MHZ button to the right of the main tuning knob, and each revolution of the knob moves you 10 MHz. Once you're in the right MHz range (for example, 144 MHz for SSB and CW or 146 MHz for repeater operation), you can tune around at several rates. On SSB or CW, normal tuning is in 10-Hz steps at 10 kHz per knob revolution. Normal tuning for FM is 5-kHz steps and 500 kHz per revolution. Pressing the TS switch in any mode changes the tuning rate to 1-kHz steps at about 100 kHz per revolution. For SSB and CW, the TS feature is handy for large frequency excursions, while for FM it is useful for tuning odd splits.

The IC-275A has VFO A/B capability that may be used for split-frequency operation, one for receive and the other for transmit, or they may be used independently. The VFOs need not be set to the same part of the band or even for the same mode.

Repeater offsets are controlled by the DUP button. Press the DUP button once and the transmit frequency automatically shifts *down* 600 kHz from the displayed receive frequency. Press it again, and the transmit frequency shifts *up* 600 kHz from the receive frequency. Press it again and you're in the simplex mode. You press the CHK button to listen on the repeater input frequency (your transmit frequency).

If you want to use a split other than the standard ±600 kHz, you have two choices. You can use the SET switch in conjunction with the main tuning knob to set the offset to anything up to 9.999 MHz, or you can use the SPLIT switch and set one VFO to the input frequency and the other to the output. With this much flexibility, you can work *any* repeater.

The display tells you at a glance whether your offset is DUP+ or DUP−, and always shows the operating frequency (transmit or receive). The display also shows when you're in the SPLIT mode.

Memory and Scanning

When the MEMO switch is pressed, the MEMO DN/UP knob below the RIT control allows you to switch through the IC-275A's 99 memories. Each memory stores not only the frequency, but also the mode of operation and any information on repeater splits or subaudible tones. For example, memory 1 might store 144.200 USB; memory 2 could store 145.010 FM, DATA mode (simplex); memory 3 could store 146.780 FM (duplex, standard −600-kHz offset); and memory 4 could store 146.100 FM (duplex, +850-kHz offset). The possibilities are endless.

Memory information is written from the VFO dial with the MW switch, and memory information is cleared with a touch of the M-CL switch. If you want, you can turn frequency control over to the VFO at the memory channel selected by pressing the M>VFO switch.

This transceiver can scan! There are four powerful, yet easy-to-use scanning modes, each of which is designed for a distinctly different purpose.

1) If you press the MEMO and then SCAN buttons, the IC-275A automatically scans through all programmed memory channels, skipping the ones with no information programmed into them.

2) You can select any two frequencies (memories P1 and P2) and scan continuously between them. For example, you can let the transceiver scan 144.080 to 144.250 MHz, if you anticipate a band opening, but don't want to sit in front of the rig turning the knob all evening. The TS switch will speed up or slow down the scanning rate.

3) Using the MODE-S switch, you can scan only those memories that are programmed with a specific mode (for example, FM).

4) By using the SKIP switch, you can lock out any memory channels that you don't want to scan. For example, you can program the scanning function to check only memories 1 through 9, 67 and 85.

The receiver scanning speed is adjustable by a switch inside the top cover. In any of the four scanning modes, the scan will stop when a signal breaks the squelch. You can use the main tuning knob or press the SCAN switch to remain on that channel. If you don't press the switch, scanning resumes after 3 or 10 seconds (user selectable).

Receiver

The IC-275A has several useful receiver features. The squelch works in all modes. I found the noise blanker to be very effective against automobile ignition noise, but it often didn't do much for power-line noise. Unfortunately, with the noise blanker in operation, the receiver's dynamic range is reduced and strong local signals create noise and spurious signals that mask weaker signals. If interference is a problem, you can try the passband tuning (PBT) feature or the notch filter. Both are reasonably effective in combating nearby interference on CW and SSB. The AGC switch affords two choices—fast or slow.

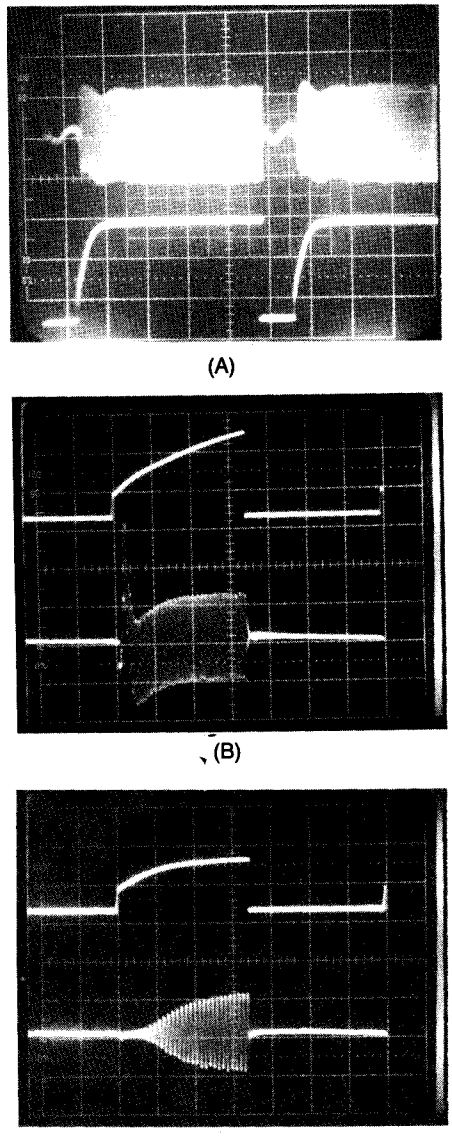
Transmitter

Like most current multimode VHF radios, the IC-275A offers 25 W (and more) output on all modes. This power level is convenient for local "barefoot" operation, and will drive a number of popular solid-state and tube-type power amplifiers.

The COMP button switches in a speech compressor. You can adjust the compression level with a rear-panel COMP LEVEL control. Another interesting rear-panel control is the MIC TONE adjustment. By using a combination of the tone and compression-level controls, I was able to get a clean-sounding signal with a little added punch. This is a step forward for VHF transceivers. (Of course, I was also able to adjust these two controls for a truly awful sounding signal! It's important that you or a friend monitor your transmitted signal

ICOM IC-275A 2-Meter Multimode Transceiver, Serial No. 01182

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: Transmitter, 140.10 to 150.00 MHz; receiver, 138 to 174 MHz.	As specified.
Modes of operation: FM, USB, LSB, CW, digital.	As specified.
Frequency display: 7-digit LEDs, black on a yellow background, 3/8-in-high digits.	As specified.
Frequency resolution: 100 Hz.	As specified.
Frequency stability: ±5 ppm (0° to 50°C).	Less than 100-Hz drift after 30 min.
S-meter sensitivity (μV for S-9 reading): Not specified.	6.1 (USB mode). Note: S meter was not accurate; 10-dB increase in signal results in approximately 20-dB increase on meter.
Transmitter	*Transmitter Dynamic Testing*
Power output: 2.5 to 25 W, adjustable.	2.7 to 34.8 W.
Spurious signal and harmonic suppression: Greater than 60 dB below peak power output.	−66 dB (see Fig 4).
Third-order intermodulation distortion products: Not specified.	See Fig 5.
Keying waveform: Not specified.	See Fig 2.
Receiver	*Receiver Dynamic Testing*
Receiver sensitivity: SSB and CW, less than 0.1 μV for 10 dB S/N; FM, less than 0.18 μV for 12-dB SINAD; less than 0.25 μV for 20-dB quieting.	Minimum discernible signal (Noise floor), (dBm): −139
Receiver dynamic range: Not specified.	Blocking dynamic range (dB): 111 Note: Measurement may be in error because AGC could not be defeated. Two-tone, 3rd-order intermodulation distortion dynamic range (dB): 89 Note: Measured at 40-kHz spacing. The measurement was noise-limited at the normal 20-kHz spacing. Third-order input intercept (dB): −5.5 Receiver quieting (μV for 12-dB signal + noise + distortion/signal + distortion): 0.165
Receiver recovery time: Not specified.	See Fig 1.
Squelch sensitivity: SSB/CW, less than 0.56 μV; FM, less than 0.1 μV.	Min 0.07 μV, max 0.28 μV.
Receiver audio output at 10% total harmonic distortion: More than 2 W.	2 W
Color: Black.	
Size (height, width, depth): 4.25 × 9.6 × 11.6 in.	
Weight: 13.6 lb	



(A)

(B)

(C)

Fig 1—Receiver recovery (turnaround) time waveforms for the IC-275A. Shown at A is the turnaround time in USB mode using the DATA feature. This combination might be used for AMTOR operation. Each horizontal division is 100 ms. The lower trace shows the PTT release. The upper trace is receiver audio output. The receiver is tuned to an S1 signal. Upon key opening, the delay from opening to 90% audio output is measured. The turnaround time is 7 ms. A similar measurement is shown at B, but in the FM mode using the DATA feature. This combination might be used for packet radio operation. Each horizontal division is 10 ms. The upper trace shows PTT release, while the lower trace shows receiver audio output. There is some audio at 3 ms after PTT release, but it is lost in a spike. At 5 ms, there is usable audio. The turnaround delay is about 13 ms until audio is at the 90% level. For comparison, the photo at C shows turnaround time in the FM mode, but without using the DATA feature. Note the absence of the audio spike. Turnaround time here is 24 ms.

to get the right settings.)

The IC-275A has new features for the CW operator. Although full-break-in (QSK) CW operation is standard on most of the newer HF transceivers, I'm not aware of any 2-m transceivers other than the IC-275A that offer this feature. A three-position rear-panel switch allows you to choose between SEMI and FULL break-in, and also allows you to turn the break-in feature OFF. After careful listening tests, it quickly became obvious that the QSK mode really works! You can hear signals in the receiver between characters, and there is only the slightest shortening of transmitted characters. Of course, you'll have a tough time finding a power amplifier and mast-mounted preamplifier that can support QSK on this band.

The CW signal sounds good in either full or semi-break-in, and I couldn't hear any clicks while listening to a second receiver located in the shack. See Fig 2. If you're serious about CW operation, you'll want the optional 500-Hz filter. An 800-Hz sidetone-monitor level control is located on the rear panel, but there is no pitch control.

Packet operation with the IC-275A is a snap. There is no need to disconnect your microphone when you want to operate packet—there are connections for audio IN and OUT for your TNC on the rear panel. The DATA switch mutes the microphone input. Using the DATA feature and FM mode, we measured receiver recovery (turnaround) times of 13 ms—quick enough for efficient packet operation. Fig 3 shows that the carrier has a remarkably quick fall time (45 μs) in the FM mode using the DATA feature. This quick fall time as the PTT is released causes a click that could cause interference to nearby stations.

ICOM has included a subaudible tone encoder with a choice of 32 frequencies. To dial up the tone frequency, press the TONE and SET buttons, then turn the main tuning

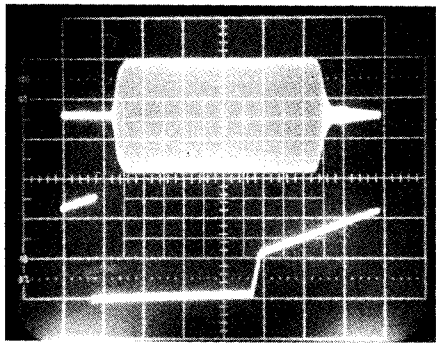


Fig 2—CW keying waveform for the IC-275A. The upper trace is the RF output; the lower trace is the actual key closure. Each horizontal division is 5 ms.

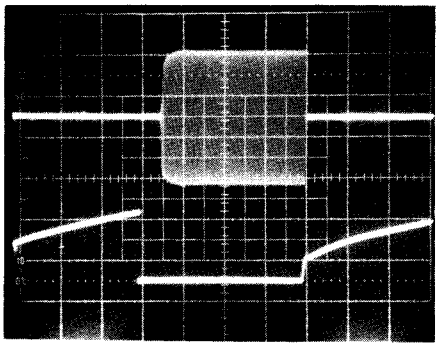


Fig 3—Photograph of the transmitted waveform of the IC-275A in the FM mode using the DATA feature. The upper trace is the RF output; the lower trace is the PTT line closure. Each horizontal division is 5 ms. The rise time is about 300 μs, and the fall time is about 45 μs.

knob until the correct tone frequency appears on the display.

The Manual

The IC-275A manual does an excellent job of explaining the rig's many features, and uses a unique method of combining text with graphics to describe the controls and operation. In the "Control Functions" section, miniature outline drawings of the front or rear panels are shown for each control, with an arrow locating the control and a brief description of its function. A "Beep" beside the drawing designates those controls that produce an audible tone when the control is used. In many cases the control's use is explained in detail later in the "General Operation" or "Function Operation" sections, so appropriate reference to the page is given.

This same approach is followed in detailed descriptions of operations, and illustrations are included to show which controls are exercised and the method of doing so. This manual is probably the most understandable I have ever seen.

Operation

I used the IC-275A during late winter and early spring. The rig holds its own at the weak-signal end of the band. The receiver is sensitive enough to hear plenty of signals around New England, in Canada and south as far as Virginia.

FM operation is convenient, thanks to the memory features. After the initial setup, there is little to do except recall your most-used channels. Most of the time I used the rig by itself, or with an RF Concepts Model 2-317 solid-state power amplifier. The 30 W or so from the IC-275A is plenty for local QSOs, but the amplifier helped on the longer-distance contacts.

The acid test for the IC-275A came during the 2-m ARRL Spring Sprint. John Lindholm, W1XX, and I traveled to a Rhode Island hilltop, mainly to try out his new hilltopping van and generator. The transceiver proved to be well suited for such portable operation. Space is at a premium in the van, so the IC-275A's compact size and built-in power supply really helped out. The receiver held up reasonably well under strong-signal conditions. Although the IC-275A has a sensitive receiver, the preamplifier in the RF Concepts amplifier made a noticeable improvement on some weaker signals. All in all, though, the IC-275A held up well on a crowded band during the Sprint.

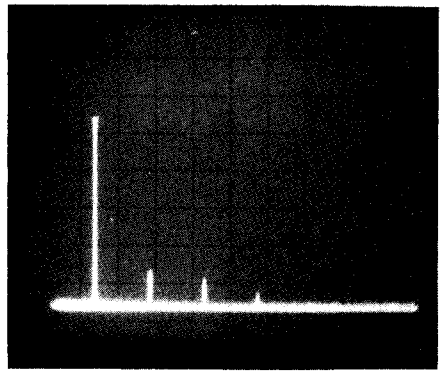


Fig 4—Spectral display of the IC-275A operating at full output. Horizontal divisions are each 100 MHz; vertical divisions are each 10 dB. The output power is approximately 35 W at 147 MHz. The fundamental has been reduced in amplitude approximately 25 dB by means of notch cavities to prevent spectrum analyzer overload. All harmonics and spurious emissions are at least 66 dB below peak fundamental output. The IC-275A complies with current FCC specifications for spectral purity.

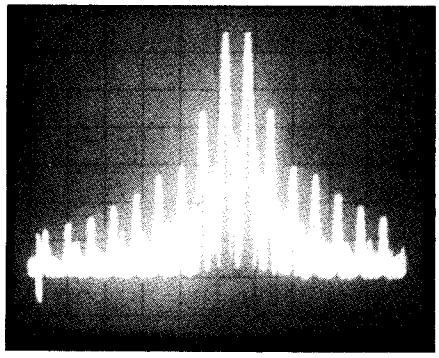


Fig 5—Spectral display of the IC-275A during two-tone intermodulation distortion (IMD) testing. Third-order products are approximately 25 dB below PEP output, and fifth-order products are approximately 40 dB down. Vertical divisions are each 10 dB; horizontal divisions are each 2 kHz. The transceiver was being operated at approximately 35-W PEP output on 144 MHz.

ICOM has made some improvements over the last generation (the IC-271A) that really make this transceiver easier to use. There is provision for a CW filter. I prefer a narrow CW filter for weak-signal work. Also, there is now provision for keying an external power amplifier. The ACC jack on the rear panel provides a ground on transmit for this purpose. In addition, I had no trouble keying this rig with either of my keyers. I still would like to see a ¼-in KEY jack rather than the present 1/8-in jack, though.

One feature that I had not experienced in a 2-m transceiver before is the ability to monitor public service frequencies outside the amateur band (the receiver covers 138 to 174 MHz). It is interesting to use the IC-275A to hear police and fire calls, as well as listen to NOAA weather broadcasts. Such a broad receiving range gives you something to put in all those memories! The IC-275A can be the basis for a comprehensive 2-m station.

Manufacturer: ICOM America Inc, 2380-116th Ave NE, Bellevue, WA 98004, tel 206-454-7619. Price class: IC-275A, $1200; FL-83A CW filter, $35; AG-25 preamplifier, $95; UT-36 voice synthesizer, $34; UT-34 tone squelch unit, $50.—*Mark J. Wilson, AA2Z*

RF CONCEPTS RFC 2-317 2-METER AMPLIFIER

What's new in VHF and UHF equipment? For one thing, a new line of RF power amplifiers from a new company—RF Concepts of Gilroy, California. Always anxious to try out a new piece of VHF gear, I wanted to test the RF Concepts RFC 2-317 as a companion to the IC-275A reviewed in this month's column. This "brick" amplifier features 170 W output for about 25 W drive, which is just about right for most of the current crop of 2-m multimode transceivers. If your rig operates at a different output-power level, check out similar RF Concepts amplifiers with different drive requirements. They have a complete line of amplifiers with different drive/output specifications.

Circuit Highlights

The power amplifier is a single-stage design using a pair of SRF3897 power transistors in parallel. There is room on the board for another amplifier stage; this space is probably used in other models requiring less drive power. The receive preamplifier is a two-stage design using a CF300 dual-gate GaAsFET driving a U309 FET. The result is 20-dB gain with a noise figure of about 1 dB—not bad for a "free" preamp!

The RFC 2-317 is always biased for linear operation, even when the front-panel mode-select switch is set for FM. The only difference between the SSB and FM mode settings is the TR relay dropout time delay. The relay drops out instantly in FM, but dropout time delay may be increased so that the relays do not "chatter" during SSB operation. It's easy to vary the dropout time by adjusting a potentiometer that is accessible through the side panel.

RF-sensed switching is standard in the RFC 2-317, but there are several ways to key this amplifier. Whenever the POWER switch is ON and RF drive is applied to the RADIO (input) jack on the rear panel, the amplifier automatically switches into the transmit mode. In this mode, the power amplifier is switched into the line and the preamplifier (if the PREAMP switch is ON) is switched out of the

circuit. A phono jack is provided on the rear panel for "hard wiring" the antenna relay to control it from the transceiver. You have a choice of two hard-wired keying options: Ground the center pin to transmit or apply a positive voltage to transmit. The choice depends on the requirements of your transceiver. As it comes from the factory, the RFC 2-317 requires a positive voltage to transmit.

RF-sensed switching is convenient, and in this amplifier it works very well. The manual suggests taking advantage of the manual keying feature if you plan a lot of SSB operation. If you hard wire the relay, you won't have to worry about it dropping out during pauses in your transmission.

RF Concepts has made it very difficult for you to hurt this amplifier. Protective circuitry includes:

- A built-in thermostat to shut off the amplifier if the heat-sink temperature reaches 175 °F; it will not come back on until the heat-sink temperature drops to a safe level.
- SWR protection. If the SWR exceeds 3:1, the amplifier automatically shuts off. You must toggle the POWER ON/OFF switch to turn it back on.
- A 35-A fuse in the dc power line in case of a catastrophic failure.
- Reverse-polarity protection.
- A pair of diodes to protect the preamplifier from strong signals.

All components are mounted on a single high-quality glass-epoxy circuit board. The chassis, PC board and power transistors bolt to a low-profile heat sink that is surprisingly heavy for its size. There is evidence of high-quality contruction throughout. For example, plated through-holes are used on the board; the RF interconnections are made with miniature Teflon® coaxial cable; book-mica fixed capacitors and ceramic trimmers are used in the matching circuits; and liberal use of RF chokes and decoupling capacitors are in evidence.

There are three switches and four LEDs on the front panel. The POWER ON/OFF switch controls the power amplifier. As described earlier, the SSB/FM switch changes the time delay. The PREAMP ON/OFF switch controls the preamplifier. The power amplifier and preamplifier may be used separately or simultaneously, as operating conditions dictate. The four LEDs tell you when the power is ON, when the preamp is ON, when the amplifier is in the transmit mode and when the SWR protective circuitry has come on.

The rear panel is equally straightforward. There are two SO-239 connectors for input (RADIO) and output (ANTENNA), a phono jack for TR control, a five-pin DIN remote-control jack, a four-pin Jones receptacle for dc power, and the fuse holder.

If you wish, you can mount this amplifier in a remote location—say in the trunk of your car—and control it from your operating position. The five-pin DIN jack on the rear panel allows you to remotely turn the POWER and PREAMP switches ON and OFF, as well as switch between SSB and FM modes. Although RF Concepts does not provide a remote-control head, all that's required is a few switches and a 10-μF capacitor.

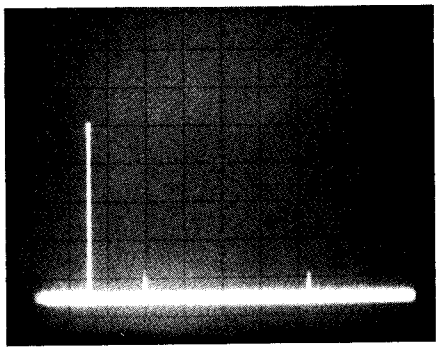


Fig 6—Worst case spectral display of the RFC 2-317 operating on the 2-m band. Vertical divisions are each 10 dB; horizontal divisions are each 100 MHz. Output power is approximately 175 W at a frequency of 146 MHz. The fundamental amplitude has been reduced approximately 28 dB by means of notch cavities to prevent spectrum analyzer overload. All spurious emissions are at least 68 dB below peak fundamental output. The RFC 2-317 complies with current FCC specifications for spectral purity.

RF Concepts RFC 2-317 2-Meter Amplifier, Serial No. 1114

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency coverage: 143 to 149 MHz.	Tested only from 144 to 148 MHz
Modes of operation: FM, CW, SSB.	As specified. Also works packet radio.
Power output: 170 W with 30-W drive. Input power: 0.2 to 30 W.	175-W output with 30-W drive; 130-W output for 10-W drive; 90-W out for 5-W drive.
Spurious signal and harmonic suppression:	See Fig 6.
Receive preamplifier: 20-dB gain with 1-dB noise figure.	22.93-dB gain, 1.02-dB NF at 146 MHz.
Power requirement: 13.8 V dc at 22 A.	13.8 V at 21.5 A for full output.
Size (height, width, depth): 3 × 6 × 11.5 in.	
Weight: 5 lb.	

Hookup and Operation

The RFC 2-317 requires approximately 22 A at 13.8 V dc, so the manual recommends using no. 8 or 10 wire between the power source and the amplifier. If possible, the wires coming out of the back of the brick should be connected directly to the battery or ac-operated supply.

There really isn't much to hooking up the amplifier. Connect a short piece of coaxial cable between the amplifier and transceiver, connect a power supply and antenna, and you're on the air! Because the RF-sensed keying scheme suits my needs, I didn't bother to wire up a hard-keying cable.

I used the '2-317 with an ICOM IC-275A 25-W multimode transceiver. Although I made a few test QSOs on FM, I didn't have much call to use the amplifier during normal operation from my home. The ICOM is a 25-W radio to begin with, and because I live in a fair VHF location, I can work most of the local repeaters barefoot.

I do enjoy 2-m SSB and CW operation, though, so the RFC 2-317 got quite a workout on that part of the band. Near the end of the review period, I took the IC-275A/RFC 2-317 combination on a couple of portable operations at Buck Hill, Rhode Island, in grid square FN41. Using this pair makes for a compact, yet powerful and easy-to-assemble portable station. The first operation, during the ARRL 2-meter Spring Sprint, netted more that 100 QSOs in an hour and a half of operation. During this period of constant operation, the amplifier got *mildly* warm to the touch. It just sat there quietly and worked, requiring no attention whatsoever. During this contest, I had no problem working stations from northern Maine to Virginia, and out west to Ontario. During the second operation, the 902-MHz Spring Sprint, the same setup served as a liaison radio for setting up contacts on 902 MHz. Again, the amplifier performed flawlessly in the field.

I am impressed by the preamplifier in the RFC 2-317. In the past, I've found that although preamplifiers in solid-state bricks help on some contacts, for the most part they increase noise and just make the S-meter readings higher. This preamplifier, however, made a noticeable difference in readability for many QSOs, and is well worth using.

The RFC 2-317 is a well-built piece of gear that deserves consideration if you want to add some punch to your 2-meter signal. With nearly 200-W output, it's within a few decibels of 4CX250-class power amplifiers, and it takes up a lot less space. If you like to work DX, this power level is enough for aurora and meteor-scatter QSOs—and for moonbounce too, if you want to work W5UN!

RF Concepts offers a 5-year warranty on the RFC 2-317 (except for power transistors, which are warranted for 6 months). Price class: $264. Manufacturer: RF Concepts, 2140 Jeanie La, Gilroy, CA 95020, tel 408-847-7373.—*Mark J. Wilson, AA2Z* QST