Product Review and Short Takes from *QST* Magazine

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Product Reviews:

ICOM IC-7200 HF and 6 meter transceiver

Micro-Node International IRLP/EchoLink Node

Short Takes:

KU4AB Model SQ-50 6-Meter Antenna

PRODUCT REVIEW

ICOM IC-7200 HF and 6 Meter Transceiver

Reviewed by Steve Sant Andrea, AG1YK
ARRL Assistant Editor

The IC-7200 combines some of the IC-7000's brains with the IC-718's brawn.[1,2] With the '7200, ICOM has created a transceiver with many of the digital features users expect in a modern radio, but packaged in a compact, rugged IC-718 size case that just begs to be taken along for the ride. With receiver coverage from 30 kHz to 60 MHz and transmitter coverage from 160 to 6 meters at 100 W in SSB, CW and RTTY and 25 W in AM, the IC-7200 will keep you on the air whether from home, car or boat.

Front Panel

The IC-7200's front panel is neat and uncluttered. On the left are the front-firing speaker, microphone and headphone jacks and two dual function knobs. The center section contains the display, six function buttons and the main tuning dial. The right hand section contains a group of 17 buttons and a dual function knob.

As with all microprocessor controlled radios, the number of controls belies the complexity beneath. Most of the buttons serve two functions. The primary function is selected with a short *press* of the button; the secondary function by *holding* it down for about a second. Each action, *press* or *hold*, activates a different set of functions. This control philosophy has been used on ICOM radios for quite a while and quickly becomes second nature.

Additionally, ICOM has made the front panel water resistant. While not waterproof, it will tolerate an occasional blast of spray on your boat or a spilled coffee cup during a contest.

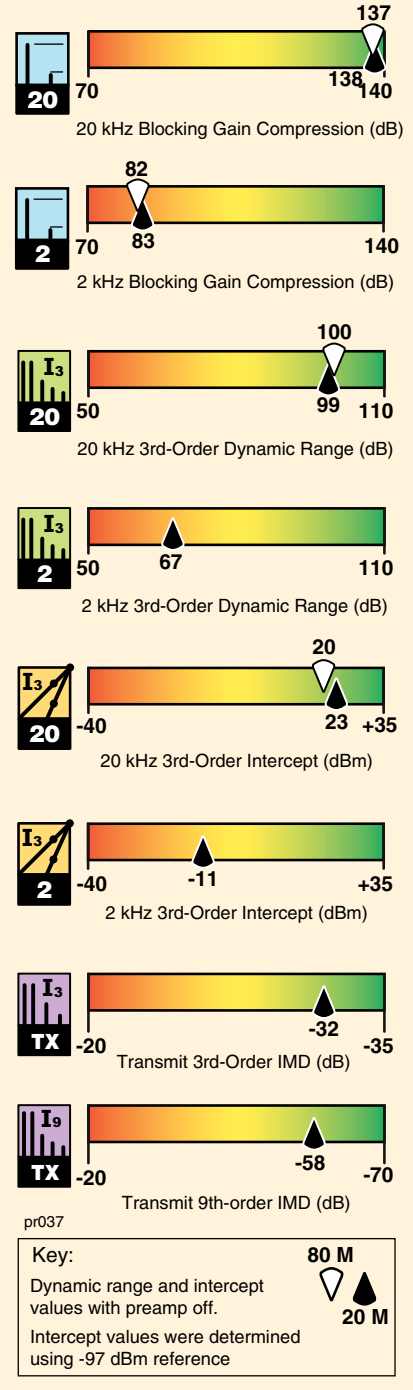
Rear Panel

The '7200 runs on 13.8 V dc and requires about 20 A. A fused power cable is supplied. The radio incorporates an electronic keyer with the KEY jack on the rear panel. The external speaker jack accepts a 3.5 mm plug. A single SO-239 UHF connector is provided for the antenna connection. The rear panel has a bumper that protects the connectors from rough handling.

Here's a new feature: a universal serial bus (USB) interface. Transmit and receive audio can be sent over the USB interface, along with CI-V commands for transceiver control. In order to use the USB interface, you must download free driver software from ICOM, and a detailed manual is available too. This driver looks like a standard sound card to applications software, so your existing digital mode software should work

[1]M. Wilson, K1RO, "ICOM IC-7000 HF/VHF/UHF Transceiver," Product Review, *QST*, May 2006, pp 64-71. *QST* Product Reviews are available on the Web at **www.arrl.org/members-only/prodrev/**.
[2]S. Ford, WB8IMY, "ICOM IC-718 HF Transceiver," Product Review, *QST*, Jul 2000, pp 63-67.

Key Measurements Summary



Bottom Line

The IC-7200 is a compact, easy-to-operate HF and 6 meter transceiver that offers many features for voice, CW and digital mode operating. Rugged, water-resistant packaging makes it attractive for portable and emergency stations.

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with this interface — eliminating the need for an external computer/radio interface for digital modes such as PSK31 or RTTY.

A traditional ICOM REMOTE jack provides another means for control of the '7200 from your computer if you have the appropriate CI-V interface and software. Jacks for ALC (automatic level control) and SEND (TR relay control) are available for connection to a linear amplifier. A TUNER connector provides an interface to control an optional external antenna tuner.

The ACC jack is a 13-pin connector that provides a transmit control line, a data line and keying line; ALC voltage line; a 1 A, 13.8 V dc output; RTTY keying control; a modulation input; an audio line output and a squelch control output. A matching plug is supplied with the '7200, providing a set of color-coded pigtails for the accessory connector inputs and outputs.

Band Selection

The '7200 includes a stacking register for each band, selected with the numeric keys. Holding the BAND button activates stacking register selection and the word BAND is displayed. Pressing the numeric key for the band you want will automatically set the active VFO to that band with the same configuration (frequency, mode, filter, preamplifier, and so on) that you last used on that band.

The '7200 has two separate VFOs (A/B) and a 7 + 1 digit frequency display (a 1 Hz digit is displayed in some situations). Frequency can be set manually with the main tuning dial or entered directly using the numeric keys. A one button equalizer copies VFO A into VFO B.

While using the main tuning dial, there are three methods of controlling the tuning step (rate) of the main dial: tuning step, auto tuning step and ¼ tuning function. The dial can also be locked by holding the SPCH button. The default is a 10 Hz step.

Pressing the TS button activates the tuning step, which is indicated by a ▼ symbol. Holding the button gives you the choice of five tuning steps: 0.1, 1, 5, 9 and 10 kHz.

The auto tuning step function senses when you are rotating the main dial rapidly and increases the tuning step. This is convenient, for example, to move from the CW to the phone portion of the band more quickly. The auto tuning step speed varies between two and five times the normal rate, depending on its settings.

Finally, the '7200 includes a ¼ tuning function used in the SSB data, CW and RTTY modes. While ¼ tuning is active, the tuning step of the main dial is reduced to about 370 Hz per turn. This permits the precise tuning required by some digital modes.

Direct frequency entry is activated by pressing the F-INP ENT button, entering the frequency and pressing the F-INP ENT again to set the active VFO to the entered frequency. If you make an error, pressing SET returns you to the previous frequency.

The receiver incremental tuning (RIT) feature permits you to "trim up" the sound of a received signal to maximize readability. The RIT control is located at the lower right and can adjust the receive frequency about ±10 kHz.

A final tuning aid is a band edge marker. When activated, the '7200 will issue a beep whenever you cross the edge of the current amateur band.

Modus Operandi

The '7200 has seven mode choices: LSB/USB, CW/CW-R (CW Reverse; shift to the opposite sideband), RTTY/RTTY-R and AM; FM is not included. Pressing the MODE button changes the operating mode in a circular fashion, LSB-CW-RTTY-AM-LSB and so on. To access USB and the reverse modes, press MODE to select LSB,

Table 1
ICOM IC-7200, serial number 0201073

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.03-60 MHz; transmit, 1.8-2, 3.5-4, 5.3305, 5.3465, 5.3665, 5.3715, 5.4035, 7.0-7.3, 10.0-10.15, 14.0-14.35, 18.068-18.168, 21.0-21.45, 24.89-24.99, 28.0-29.7, 50-54 MHz.	Receive and transmit, as specified. Reduced receiver sensitivity below 500 kHz.*
Power requirement: 13.8 V dc ±15%; receive, 2 A (max audio); transmit, 22 A (100 W out).	At 13.8 V dc: 1.15 A receive (max audio), 16.5 A transmit (100 W out). Operation confirmed at 11.7 V (max 75 W out).
Modes of operation: SSB, CW, AM, RTTY.	As specified.

Receiver

SSB/CW sensitivity, preamp on, filter shape sharp,10 dB S/N: 1.8-29.7 MHz, <0.16 μV; 50-54 MHz, <0.13 μV.

Noise figure: Not specified.

AM sensitivity, 10 dB S/N: 0.5-1.799 MHz, <13 μV; 1.8-29.7 MHz, <2 μV; 50-54 MHz, <1 μV.

Blocking gain compression: Not specified.

Reciprocal Mixing (500 Hz BW): Not specified.

ARRL Lab Two-Tone IMD Testing**

Band/Preamp	*Spacing*	*Input level*	*Measured IMD level*	*Measured IMD DR*	*Calculated IP3*
3.5 MHz/Off	20 kHz	–31 dBm	–131 dBm	100 dB	+19 dBm
		–19 dBm	–97 dBm		+20 dBm
14 MHz/Off	20 kHz	–33 dBm	–132 dBm	99 dB	+17 dBm
		–17 dBm	–97 dBm		+23 dBm
		0 dBm	–51 dBm		+26 dBm
14 MHz/On	20 kHz	–44 dBm	–141 dBm	97 dB	+2 dBm
		–25 dBm	–97 dBm		+11 dBm
14 MHz/Off	5 kHz	–49 dBm	–132 dBm	83 dB	–7 dBm
		–34 dBm	–97 dBm		–2 dBm
		0 dBm	–28 dBm		+14 dBm
14 MHz/Off	2 kHz	–65 dBm	–132 dBm	67 dB	–31 dBm
		–36 dBm	–97 dBm		–11 dBm
		0 dBm	–20 dBm		+10 dBm
50 MHz/Off	20 kHz	–34 dBm	–135 dBm	101 dB	+17 dBm
		–22 dBm	–97 dBm		+16 dBm

Second-order intercept: Not specified.

Receiver Dynamic Testing

Noise Floor (MDS), 500 Hz bandwidth:

	Preamp off	*Preamp on*
1.0 MHz	–121 dBm	–131 dBm
3.5 MHz	–131 dBm	–141 dBm
14 MHz	–132 dBm	–141 dBm
50 MHz	–135 dBm	–142 dBm

14 MHz, preamp off/on: 15/6 dB

10 dB (S+N)/N, 1-kHz, 30% modulation:

	Preamp off	*Preamp on*
1.0 MHz	4.8 μV	1.5 μV
3.8 MHz	1.6 μV	0.5 μV
50 MHz	0.9 μV	0.4 μV

Gain compression, 500 Hz bandwidth:

	20 kHz offset Preamp off/on	*5/2 kHz offset Preamp off*
3.5 MHz	137/133 dB	101/82 dB
14 MHz	138/135 dB	102/83 dB
50 MHz	135/125 dB	89/76 dB

20/5/2 kHz offset: –103/–92/–85 dBc.

Preamp off/on: +78/+78 dBm.

Receiver	Receiver Dynamic Testing
DSP noise reduction: Not specified.	Variable, 10 dB maximum.
Notch filter depth: Not specified.	Manual notch: > 75 dB, Auto notch: 50 dB†; attack time 168 ms.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: preamp off, 67.8 μV; preamp on, 14.3 μV
Squelch sensitivity; SSB: Not specified.	At threshold, preamp on: SSB, 1.0 μV
Receiver audio output: 2.0 W into 8 Ω at 10% THD.	2.3 W at 10% THD into 8 Ω.
IF/audio response: SSB BW = 2.4 kHz: >2.4 kHz/–6 dB, 3.6 kHz/–60 dB; CW BW = 500 Hz: >500Hz/–6 dB, <900 Hz/–60 dB.	Range at –6 dB points, (bandwidth):‡ CW (500 Hz): 384-816 Hz (522 Hz); Equivalent Rectangular BW: 486 Hz USB: (2.4 kHz) 279-2756 Hz (2477 Hz); LSB: (2.4 kHz) 273-2750 Hz (2477 Hz); AM: (6 kHz) 188-3049 Hz (2861 Hz).
Spurious and image rejection: HF and 50 MHz: 50 MHz: >70 dB.	First IF rejection, 14 MHz, 113 dB; 50 MHz, 94 dB; image rejection, 14 MHz, 62 dB; 50 MHz, 76 dB.

Transmitter	Transmitter Dynamic Testing
Power output: HF and 50 MHz: SSB, CW; 2-100 W; AM carrier power, 1-25 W.	SSB/CW, 1.4-103 W typical; AM, 0-28 W typical.
Spurious-signal and harmonic suppression: >50 dB on HF, >63 dB on 50 MHz.	HF, >57 dB; 50 MHz, 68 dB. Meets FCC requirements.
SSB carrier suppression: >50 dB.	>70 dB.
Undesired sideband suppression: >50 dB.	>70 dB.
Third-order intermodulation distortion (IMD) products: Not specified.	3rd/5th/7th/9th order (worst case band): HF: –32/–31/–43/–58 dB PEP; 50 MHz: –30/–36/–44/–61 dB PEP.
CW keyer speed range: Not specified.	6 to 58 WPM.
CW keying characteristics: Not specified.	See Figures 1 and 2.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, 30 ms. Unit is suitable for use on AMTOR.
Receive-transmit turnaround time (tx delay): Not specified.	SSB, 13 ms.
Composite transmitted noise: Not specified.	See Figure 3.

Size (height, width, depth): 3.8 × 9.5 × 12 inches, incl protrusions, without rack handles.

Weight: 12.1 pounds.

Price: $1100.

*Preamp off/on: 505 kHz, –121/–128 dBm; 137 kHz, –116/–95 dBm; 30 kHz, –77/–66 dBm. The preamp does not improve sensitivity below approximately 250 kHz.

**Receiver testing was performed with the bandwidth set to 500 Hz and the filter shape to sharp. ARRL Product Review testing now includes Two-Tone IMD results at several signal levels. Two-Tone, 3rd-Order Dynamic Range figures comparable to previous reviews are shown on the first line in each group. The "IP3" column is the calculated Third-Order Intercept Point. Second-order intercept points were determined using –97 dBm reference.

†Single beat note. Reduces two beat notes by 40 dB with attack time of 230 ms.

‡Default values, medium filter, sharp setting. Bandwidth is variable; smooth setting is available. CW bandwidth varies with PBT and pitch control settings.

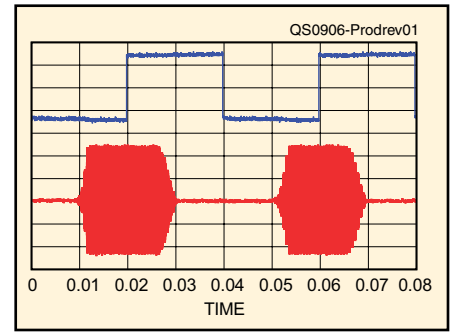

Figure 1 — CW keying waveform for the IC-7200 showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output on the 14 MHz band.

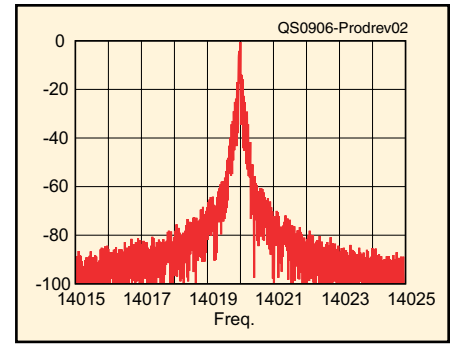

Figure 2 — Spectral display of the IC-7200 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 100 W PEP output on the 14 MHz band, and this plot shows the transmitter output ±5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

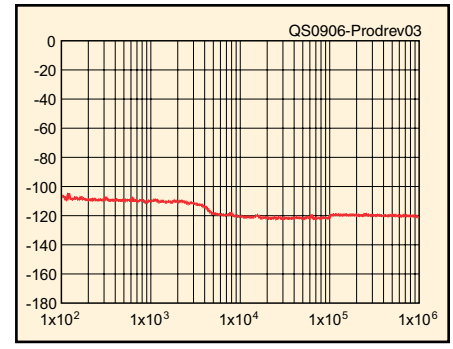

Figure 3 — Spectral display of the IC-7200 transmitter output during composite-noise testing. Power output is 100 W on the 14 MHz band. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier. The reference level is 0 dBc, and the vertical scale is in dB.

CW or RTTY and then hold MODE to access the alternate mode.

For CW operation, pitch, sidetone level, key type, break-in type, keyer speed and CW sideband (LSB/USB) can all be configured. For RTTY, the '7200 includes a twin peak filter, preset for 2125 Hz and 170 Hz shift; three FSK mark tones, four shift widths and selectable keying polarity are also available.

To further improve the flexibility of the '7200, each mode (SSB, CW, RTTY and AM) can be separately disabled. So, for example, if your operating style doesn't include RTTY, you can disable it and it will not be included when stepping through the modes. The '7200 also has a data mode for SSB and AM. When activated, the modulation for SSB and AM is taken from the MOD input of the accessory connector or the USB interface.

CW-R and RTTY-R, once selected, will remain selected even after changing modes; SSB mode defaults to the normal mode, LSB on 160, 75/80 and 40 meters, USB elsewhere for each go-around.

Keeping Track

The IC-7200 is equipped with 201 memory channels. Channels 1 through 199 are memories that can store the transmit and receive frequencies and the operating mode. The remaining two (P1, P2) are band edge channels used as upper and lower frequency limits for the scanning feature.

Programming the memory channels is simple. In VFO mode, set your frequency, rotate the M-CH knob to select a channel and hold the MW (memory write) button. The '7200 will respond with three beeps when the frequency is stored. That's it! Now you never have to look up that net frequency again. Programming memory channels in memory mode is similar except you first select the channel to program and then set up the frequency.

Recalling the channel is just as simple — press the V/M button to activate the memory mode; MEMO will display. Use the M-CH knob to select the channel you want and you're there. In less time than it takes to say DX, the selected frequency is transferred to the active VFO and you are ready to radio!

Once you have 201 frequencies stored, a scanner becomes a necessity. The '7200 is equipped with two scanning modes: programmed and memory. The programmed scan uses the band edge channels (P1 and P2) as its lower and upper limits, scanning each frequency between those two points. The memory scan steps through only those frequencies stored in memory channels. It starts from the lowest programmed channel and continues to the highest, then jumps back and starts over.

When it reaches an active frequency, it stops. The scan resume function controls the stop time. With scan resume OFF, the scan stops at the first active frequency and the scan is canceled. If scan resume is ON, the scan will stop on the active frequency and wait. If the frequency remains active for 10 seconds or goes quiet for 2 seconds, the scan will resume.

Configuring the Radio

There are many aspects of the '7200's operation that can be customized to meet your operating style. The Set Mode (SM) menu is where you convert the stock radio into *your* radio. The Set Mode includes 41 items that are of the set-and-forget type. This is where you adjust settings such as LCD backlighting, meter peak hold and the internal keyer's dot/dash ratio.

There is also a Quick Set Mode (QSM) in addition to the regular set mode. QSM is where you find those items that change often, RF power output or keyer speed for instance. QSM items vary according to the operating mode in use. Pressing SET opens the QSM, and holding SET opens the SM.

Figure 4 — The rear panel of the IC-7200 includes antenna and power connectors, ALC and TR control for a linear amplifier, provisions for digital modes and computer control.

Interfering with Interference

The '7200 has many interference fighting features, most of which use its digital signal processing (DSP) system. The IF passband width is DSP controlled, according to the operating mode, from 50 Hz to 8000 Hz. Each mode has three filter widths — narrow, middle and wide. Each width is separately adjustable. I'm primarily a phone operator and found the default phone widths of 1800, 2400 and 3000 Hz to be very good choices. For those CW folks out there, the narrow CW filter default is 250 Hz. This is thoroughly up to date compared to the IC-718 with its limited selection of optional crystal filters and DSP add-on for notch filter and noise reduction

Passband Tuning

The DSP passband tuning (PBT) feature allows you to shift the entire IF passband slightly higher or lower in frequency or to narrow and enlarge the passband width.

PBT is controlled by the TWIN PBT dual knob located on the upper left of the front panel. The inner knob adjusts PBT1 (the high frequency edge of the passband) and the outer knob PBT2 (the low frequency edge). The manual's description of the PBT is somewhat thin, so some clarification is in order.

The neutral position for the PBT is with both the inner and outer knobs at detent. In this position the IF passband is centered on the IF frequency and the width is set to the filter passband width setting. If you move both knobs simultaneously counterclockwise (ccw), you move the passband *lower* in frequency without changing its width. Moving both knobs clockwise (cw) shifts the entire passband *higher* in frequency. So if an interfering station appears slightly below your receive frequency, rotating both knobs cw will move the passband higher in frequency, eliminating the interfering signal.

The width of the passband can be changed by adjusting the knobs separately. If you turn the inner (high edge) knob cw you are *raising* the *upper* frequency limit — widening the passband. If you turn the outer (low edge) knob cw you are *raising* the *lower* frequency limit — narrowing the passband.

Notch Filters

The automatic and manual notch filters are DSP functions used to notch out a very narrow sliver from within the IF passband. This allows you to remove an interfering carrier that is too close to your desired signal for PBT manipulations to eliminate. The digital notch filters are more useful against heterodynes, CW and digital signals than voice modulation.

The automatic notch filter (ANF) scans the IF passband, detects up to two interfering signals and notches them out with between 40 and 50 dB of attenuation. The ANF will also track interfering signals as they move across the passband.

The manual notch filter (MNF) is operator controlled using the MNF knob at the lower right. You rotate the knob, moving a stationary notch of 75 dB attenuation across the passband, until the interfering signal is removed. The MNF can only notch one signal at a time and will not track a moving signal, but it provides a noticeably deeper notch. The width of the MNF can be adjusted. The ANF and MNF cannot be used together.

Noise Reduction

The DSP noise reduction (NR) feature distinguishes between noise and a signal and then acts, digitally, to reduce the noise with minimal effect on the signal. It will only take one evening of operating on 80 or 160 meters to appreciate its usefulness. With a signal tuned in, just press the NR button to activate the feature, and then hold NR to open the adjusting menu. Turning the dial will vary the NR value between 0 and 15. Don't be tempted to crank the NR up to 15 and just leave it there, though. At low levels of NR, audio quality is not affected, but at the higher levels some audio quality will be lost. Begin with the lowest level of NR and raise it to get the best balance between noise and readability.

Last but not least is the noise blanker (NB) This is the great granddaddy of all noise controls and limits pulse type noise.

The NB will act on any strong signal and will distort a loud, nearby station so it should only be used when needed. The '7200's NB has two adjustments, level and width. These can be accessed directly from the NB key. NB level sets the level above which the DSP blanks out the noise spike; NB width sets the time the attenuation is applied.

Lab Testing

The bar for receiver performance in transceivers at all price points has been raised in the nine years since we reviewed the IC-718. Although test procedures and reporting have changed as well, checking comparable numbers in Table 1 against the IC-718 lab tests shows significant improvement in the IC-7200's dynamic range performance. The transmitter's third-order IMD is improved as well.

ARRL Test Engineer Bob Allison, WB1GCM, took this opportunity to visit Synergy Microwave and check the accuracy of the Lab's HP-3048 Phase Noise Test System against newer instrumentation. Dr Ulrich Rohde, N1UL (Synergy Microwave founder and chairman), and Michael Tracy, KC1SX (former ARRL test engineer and now on the Synergy staff) found good correlation between their equipment and the ARRL Lab test results shown in Figure 3.

Regular readers of this column will remember that Dr Rohde donated the HP-3048 to ARRL to replace the Lab's original setup, which was nearly 20 years old. (See May 2006 *QST*, page 70, for details.) ARRL greatly appreciates the technical assistance, consultation and equipment that Dr Rohde has provided over many years.

Operating Experience

My HF station uses a wire antenna and manual antenna tuner for multiband operation. I set the IC-7200 output to 20 W during adjustment, and the radio didn't seem to be disturbed by the momentary high SWR my antenna presents on some bands.

I began operating using the supplied hand microphone. I set the internal meter to ALC and found the audio was very low at the default setting of 50%. Ultimately I found that I needed to raise the microphone gain to 100% in order to get reasonable audio reports. At this point I decided to try using the internal speech compressor. I adjusted the compressor per the manual instructions operating into a dummy load and found that audio reports were much improved.

This issue also affects the voice operated transmitting (VOX) feature. Even with the VOX GAIN at 100% I still had to hold the hand microphone within a few inches of my mouth for reliable operation. I also noted a tendency to hit the UP/DN buttons on the microphone accidentally changing the frequency; this is further complicated by the fact that the dial lock doesn't lock the UP/DN buttons, although if set to act as a keyer, they will not do anything except in CW mode.

Figure 5 — The IC-7200's amber display is small but very readable. It includes indicators for often-used features and settings.

When trying CW I was flummoxed since keying the transmitter produced a sidetone but no output. I checked my cabling to be sure no problem had developed and found none. A few minutes digging in the manual revealed the solution. The default mode for CW is break-in OFF. With break-in OFF, an outboard TR switch (such as a foot switch) is required. The switch connection is prominently displayed in the manual's "Connections for CW" section. Having used the rig on SSB, I just plugged in a key expecting to configure the CW later. Lesson learned — read your manual.

The '7200 will accept straight key, bug or paddles. It has an internal keyer adjustable from 6 to 60 WPM, or you can use your favorite external keyer or computer software. While operating in either break-in mode, the clatter of the TR relay is quite noticeable. If you enjoy operating CW at speeds over 20 WPM in full break-in (QSK), I would suggest using headphones and closing the shack door.

For DXing, split frequency operation is accomplished using two buttons. Just tune in the DX station on VFO A and hold the SPLIT button to copy VFO A to VFO B. Then press the A/B button to display VFO B and tune it to the transmit frequency. That's it — you're split.

The 1 × 2.5 inch amber LCD is similar to the IC-718's display. It's definitely not the dazzling full color screen found on the IC-7000, but it's readable without difficulty and contrast is very good using the LO backlight setting. I found the HI setting too bright for indoor use, but for outdoor, bright sun venues it would probably be fine. The front-firing speaker produces unusually clear sound for a small, internal speaker. As an added aid, pressing the SPCH button generates a female voice that recites the radio's frequency, received signal strength and mode.

The IC-7200's utility as a portable rig will make it a good fit for emergency operations. I found its controls easy to understand and had the rig operating fairly quickly. A "cheat sheet" of basic procedures in the hands of an operator experienced with modern transceivers should allow them to get to their mission quickly. I must stress, however, that the '7200 should have its settings configured *before* the emergency as these settings greatly impact the rig's operation.

Thermal issues need to be kept in mind when operating the '7200. When operating high duty cycle modes, the heat sink on the rear panel will get quite hot. The fan is audible but quiet and produces a brisk air flow. ICOM says it is normal for the radio to get hot during high duty cycle modes and the radio does not require a reduction in power output. The transceiver includes thermal protection so that if the radio senses it is getting too hot, the drive is reduced automatically.

The Hard Stuff

The IC-7200 includes a hardcopy manual, which gives you a firm grounding in the transceiver's operation. The manual is of the cookbook variety that explains how to wire up the '7200 for various types of operation and options, basic operating procedures for getting on the air, advanced procedures to guide you with its finer points and general information about programmable features and troubleshooting. The manual includes little snippets of theory but primarily consists of the step-by-step operating procedures. The procedures are straightforward and include illustrations of the controls used, the displays that should appear and, in some cases, additional diagrams to help explain a particular function.

It does lack directions for the initial setup. I would suggest that once wired up, you start by reviewing the "Basic Operations" chapter to get a quick feel for the rig. When you are comfortable, hook up a dummy load and go to the "Receive and Transmit" chapter, then follow the referenced procedures to set up such basics as microphone gain, compressor level, CW pitch and other necessary adjustments for the modes you operate. This will make your initial excursions onto the bands much more enjoyable.

Last Thoughts

The IC-7200 is a rugged, compact rig that is packed with more digital flexibility than can be discussed here. It is well suited for portable operations and will make a good HF solution for your EmComm group. It should also be considered for recreational vehicle or apartment locations where its solid performance and small footprint will be an asset.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; tel 800-872-4266, fax 425-454-1509, **www.icomamerica.com**.

Micro-Node International IRLP/EchoLink Node

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Smaller is better in the case of Micro-Node. This series of products is what developed when Mark Guibord, K7IZA, a microelectronics embedded systems engineer, was introduced to VoIP (Voice over Internet Protocol) communications. He collaborated with software engineers Brent Sylvester, K6IB and Rob Pectol, KK7AV, and mechanical engineer Hans Ehlert, AE6TV, to develop what they call "the world's smallest plug and play IRLP/EchoLink embedded solutions." Let's briefly review some background on amateur VoIP modes before getting to the details of the Micro-Node offerings.

VoIP Systems in Amateur Radio

VoIP is generally accepted as a tool to enhance the Amateur Radio experience. By using Internet links instead of HF radio links, a ham with a modest VHF FM radio can reliably communicate with stations hundreds or even thousands of miles away at any time of the day or night. The most common form of amateur Internet linking involves the exchange of audio using VoIP technology. This is the same technology used by Internet telephone services and by online voice "chat" applications. For more information, check out *VoIP: Internet Linking for Radio Amateurs* by Jonathan Taylor, K1RFD.[1]

The two most popular VoIP protocols are the Internet Radio Linking Project (IRLP, **www.irlp.net**) and EchoLink (**www.echolink.org**). Both operate networks of dedicated servers and nodes offering predictable worldwide voice communications.

[1]Available from your ARRL dealer or the ARRL Bookstore, ARRL order no. 9264. Telephone 860-594-0355, or toll-free in the US 888-277-5289; **www.arrl.org/shop**; **pubsales@arrl.org**.

Bottom Line

The Micro-Node line of IRLP/EchoLink embedded solutions offer an easy and compact way to establish a fixed station VoIP node or maintain communications on the go. You can get a unit that works with your radio, or one that includes a simplex transceiver or duplex repeater.

Each system has its unique features and applications. With the software installed on a sound card equipped computer, any ham can create an EchoLink node that others can access by radio. Hams can also join the network directly without using radios. They simply plug microphone/headsets into their computers.

IRLP also uses the Internet to establish VoIP links. The difference is that IRLP only permits access via RF nodes at repeaters or on simplex frequencies (all IRLP nodes are interlinked via a central Internet server). You must use a radio to access the IRLP network. *EchoIRLP* is a software add-on for IRLP that enables an IRLP node to operate either as an IRLP station or as an EchoLink station in sysop mode.

IRLP and EchoLink each have thousands of users worldwide. Many hams, like me, use both systems.

The Micro-Node Product Line

Micro-Node International offers a growing number of products for amateurs looking for a plug-and-play solution to establishing an IRLP or IRLP/EchoLink node. The product line includes a stand-alone package for use with your existing transceiver or repeater (see Figure 6) along with several versions that include integrated transceivers or repeaters.

All Micro-Node products are based on the Intel 1 GHz Mobile Celeron M processor with 4 GB flash drive and 512 MB RAM. They are shipped with the Micro-Node software package and *CentOS 4.7 Linux* operating system installed. The software includes an assigned IRLP node number (new or existing). A welcome feature of this software package is that it lets you set up, monitor and operate all aspects of the unit entirely in a visual point-and-click environment using any Web browser. You are never required to understand or deal with *Linux*.

The Micro-Node software package currently includes 45 built-in user-customizable functions. This means that you get all the add-on features that you are going to want without ever having to debug scripts or try to download and assemble a program in *Linux*. Some of the functions include "speaking" various parameters such as node status, time and date or last call received and enabling/disabling control features. APRS location reporting is built in.

Software updates are free, and they can be installed automatically as they become available. There's quite a bit of information available on the Micro-Node Web site, so

Figure 6 — The Micro-Node MN-1000 stand-alone embedded system measures only 2.4 × 6.9 × 7 inches and is ready to connect to your equipment for simplex or repeater operation.

Figure 7 — The Console is the main screen for monitoring and controlling all operations.

Figure 8 — The IRLP setup screen.

you can read about these features in detail.

Micro-Node Repeater

The version I use is the Micro-Node MN-3200 Rack Repeater Unit shown in the title photo. It is a fully integrated IRLP/EchoLink node computer and 70 cm repeater. The rack-mountable package includes a commercial grade, programmable full-duplex repeater that can run up to 10 W, along with a six-cavity duplexer rated for 50 W. Add an antenna, a 12 V dc power source, a broadband Internet connection and you ready for complete access to the IRLP and EchoLink VoIP systems.

The MN-3200 measures 3.5 × 17 × 12 inches (height, width, depth), small enough that I can mount the repeater in my SUV for mobile IRLP/EchoLink connectivity. A mobile broadband Internet connection makes the repeater truly mobile.

User Friendly Software

To access the Micro-Node interface program, you log on to the administration tool by pointing your Web browser to the IP address of your node. At that time you are presented with a Web page that shows your call sign and IRLP node number, as well as links to various screens for monitoring, control and set up.

The *Console* (Figure 7) is the main operation screen of the administration package. From here you can monitor and control the unit. It displays the node's current status, including the call sign of any connected node. The node's last connections, including call signs and when they occurred, are displayed. You can enter and execute any dual-tone, multi-frequency (DTMF) command directly from this screen. User defined buttons are included for direct connection to favorite nodes and to control special functions.

The *Audio* setup screen uses slider controls to adjust transmit and receive audio levels, as well as the CW ID pitch and audio level. It also has buttons to output several test tones and a test ID. From the *Schedule* screen you can program any function or node connection to run at a fixed date/time, or set up recurring schedules (for example, make a connection for a net each Tuesday at 7 PM). In addition to a time you may specify certain conditions be met, such as the node being idle or connected.

There is an IRLP setup screen (Figure 8) that allows you to set all of the IRLP environment variables as well as many other variables to customize the unit's built in features. These are set using a scrollable screen that contains an explanation of each variable and a box where the value is entered. Having the explanation on the screen for these variables makes the setup quite simple.

An EchoIRLP setup screen is provided to enable EchoLink operation on the unit. You just enter your EchoLink node information using this screen and click install. This automatically sets up the EchoIRLP software and EchoLink operation is ready to go.

Other screens set up DTMF tones to be used to control various functions, show a map of connected nodes, allow or deny node access, record voice and text messages, set network or server settings and reboot the system. The basic control of the node connections and selected voice status messages is also possible by sending DTMF commands from the user radio to the node receiver.

Easy Portability

Taking your Micro-Node into the field is quite easy, especially with one of the versions that includes an integrated radio or repeater. All that is needed is a broadband Internet connection and a travel router. With mobile broadband readily available in most cities and along major highways, you are good to go. I like the idea of being able to drive my VoIP linked repeater to any location where it might be needed to fill gaps in coverage for emergency communications purposes.

I took my Rack Repeater Unit with me in my SUV for a Thanksgiving vacation trip from Las Vegas to Sacramento. I was interested in trying the Micro-Node repeater in a mobile environment because I wanted to stay in contact with the IRLP Western Reflector (9250), which I own (see **www.narri.org**). I thought it would be much easier to enter the same DTMF 9250 on the same frequency to stay connected, as opposed to trying to locate IRLP equipped repeaters over the course of my 12 hour trip.

I use a Sprint Novatel Ovation U727 USB broadband card plugged into a Cradle Point CTR350 Mobile Router, which in turn plugs into the Micro-Node unit via a short CAT5 cable. The CTR350 also serves as a mobile wireless 802.11b/g router that can be used as a portable hot spot. I can run my laptop computer from the car, or in an emergency situation other amateurs equipped with wireless laptops can access my portable system.

The Micro-Node has a GPS input for use with your compatible GPS receiver. This setup allows for APRS transmission into the Internet giving the location of the mobile node. When traveling outside my repeater coordination area, I run the repeater RF output to a small dummy load to avoid causing interference to other systems. (As with any other repeater, you *must* work with your local coordination group before putting a Micro-Node repeater on the air.)

I was able to make VoIP connections for at least 90% of my travel time to and from California. There are a few mobile broadband coverage holes on the Interstate system. Thus, the only weakness is that mobile broadband it is not always available on the road, but that's improving with time.

For most users, I'd recommend a low-power simplex unit rather than a repeater for routine VoIP mobile operation. For example, the MN-2200 Mini Simplex Radio incorporates a 300 mW Alinco dual band handheld and is smaller, simpler and less expensive. That is the perfect power level for transmitting between the front seat and the trunk of your car using a handheld or installed mobile radio.

Manufacturer: Micro-Node International, 1000 N Green Valley Pkwy, Suite 300-249, Henderson, NV 89074; tel 702-528-4700; fax 702-263-9243; **www.micro-node.com**. *Price*: MN-1000 stand-alone node, $1195; MN-2200 Mini Simplex Radio, $1495; MN-3200 Rack Repeater Unit, $1995. QST

SHORT TAKES

KU4AB Model SQ-50 6-Meter Antenna

In the April 2005 "Short Takes" we introduced the amateur community to KU4AB's innovative 2 meter and 70 cm loop antennas. In the four years since that review, Phil Brazzell has expanded his product line substantially. With Field Day and springtime sporadic-E band openings in mind, I thought it would be a good time to take a look at his Model SQ-50 6 meter antenna.

Simple Design, Simple Installation

The SQ-50 is a square (32 × 32 inch) loop antenna made of high-grade 6061t aluminum rod. The mounting hardware is stainless steel and will accommodate your typical 1½ inch mast.

The antenna arrives completely preassembled and there is no tuning required. You simply remove it from its shipping box, slap it onto a mast, connect your coaxial cable and you're on the air.

The ease of installation makes the SQ-50 particularly attractive for portable operating, either at a Field Day site or on the road as a VHF contest "rover." For this review, I attached the SQ-50 to a 20 foot mast among the trees in my backyard, feeding it with a length of 9913 coaxial cable. With an adjustable wrench in hand, the installation required all of 10 minutes. The finished product is relatively stealthy (read: hard to see), which is a definite plus.

Back at the radio, I measured the SWR curve, with the result shown in Figure 1. As you can see, the SQ-50 is designed for the low end of the band. It is possible to perform some limited adjustment if you need to shift the SWR curve higher, but I didn't attempt this. Unless you intend to try FM, most activity on 6 meters is well below 52 MHz.

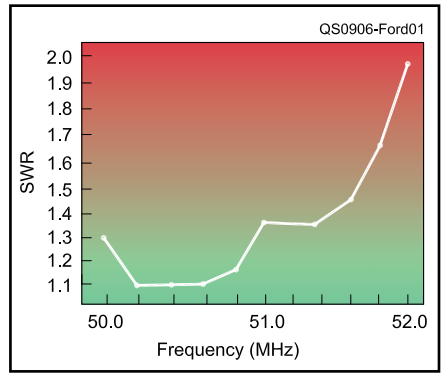

Figure 1 — The measured SWR curve of the SQ-50 installed at a height of 20 feet.

How Does it Play?

It had been a while since I had dabbled on 6 meters and I had forgotten what a difference a good antenna can make. Yes, the SQ-50 is omnidirectional; you can't expect the same performance you'd achieve with a directional antenna such as a Yagi. Even so, I was very impressed with this little loop.

Six meters is a quirky band. Much of the time it is dead quiet — until it suddenly bursts wide open and you hear signals from hundreds or even thousands of miles away. And then there is meteor scatter, which is relatively easy on 6 meters. You'd be surprised how far your signals will travel when they bounce off the ionized trails of disintegrating space debris. Digital meteor scatter makes this activity possible around the clock.

During the January ARRL VHF Sweepstakes I routinely worked distant stations while running only 100 W output. (The SQ-50 is rated at 1 kW, but I don't have that much RF muscle at my station.) Considering that no propagation "enhancements" were involved, I was pleased.

A week later the band lived up to its unpredictable reputation. As I listened during a quiet Saturday afternoon, signals began rising like ghosts out of the noise — a sporadic E opening was unfolding before my eyes! Within minutes I was working stations up and down the band. One of my contacts was W9ILY in Illinois who was also using a loop antenna (not an SQ-50). According to John, my signal was a solid S9 and I was receiving him equally well.

At other times I used the SQ-50 to work meteor scatter with the *WSJT* software suite (**http://physics.princeton.edu/pulsar/K1JT/**). Using *WSJT's* FSK441 mode, I successfully completed numerous contacts with the SQ-50. At the time this review was written, my best DX via meteor scatter with the SQ-50 was about 1000 miles.

A Rugged Performer for the Magic Band

The SQ-50 survived a particularly harsh New England winter without complaint. Ice and snow did increase the SWR at times, but those were temporary conditions. And with its 100 MPH wind rating, the SQ-50 had no difficulty handling the icy blasts.

If you are looking for more gain, it's possible to vertically stack two SQ-50s, so long as you can keep about 12 feet of separation between them. I didn't try this for the review, but the possibility is intriguing.

Since many HF transceivers now include 6 meters, all you need is a good antenna to enjoy the captivating strangeness of what some hams call the "Magic Band." The SQ-50 is one such antenna. It's small enough to fit into any setting and the price is easy on the budget, too.

Manufacturer: KU4AB.COM, 5664 State Route 849 East, Boaz, KY 42027, 901-270-8049; **www.ku4ab.com**. *$73.95.* QST

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