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Advanced Electronic Applications AEA DSP-2232 Multimode Communications Processor

ICOM IC-R7100 HF/VHF/UHF Communications Receiver

Terlin Outbacker JR8 HF Mobile Antenna

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AEA DSP-2232 Multimode Communications Processor

Reviewed by Steve Ford, WB8IMY

Most of us associate digital signal processing (DSP) with audio-filtering applications. Receive audio is first *sampled* at a high rate and then translated into digital data. The DSP software then processes the data in whatever manner we choose. Like a lump of clay on a potter's wheel, the sampled data is massaged into the shape we desire. A DSP notch filter, for example, examines data for the telltale signatures of sustained tones. Whenever one is discovered, its corresponding data is altered, reducing the tone substantially or eliminating it altogether. At the end of the process, the data is translated back into analog audio and fed to our speakers or headphones. DSP audio filters can be designed to reduce noise, or to create band-shaping filters for use in various applications (CW, RTTY, AMTOR, etc).

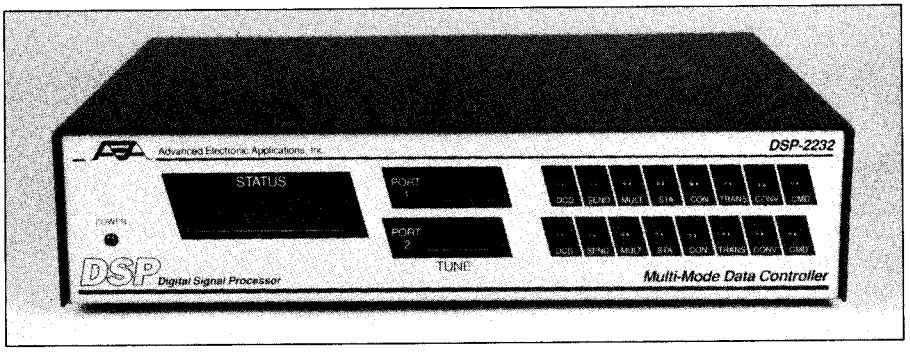
Audio DSP can also be used to modulate and demodulate signals through the use of *software modems*. This type of DSP application is beginning to have an impact in the world of Amateur Radio multimode communications processors, or *MCPs*.

The multimode processor concept has been around for some time. MCPs offer the advantage of combining several digital communications modes in one box. A typical MCP provides packet (HF and VHF), Baudot and ASCII RTTY, AMTOR, CW and sometimes other modes. Although traditional MCPs are convenient, they have a serious limitation: They can only be "multi" within the fixed framework of their *modem* circuitry. You can add another mode to an MCP only if the signals used by that mode are compatible with the existing modem *hardware*.

DSP multimode communications processors aren't bound as tightly by hardware limitations. Since all of the signal processing is performed by modem-emulating software, a DSP-based MCP can operate in just about any digital mode you like (and some analog ones, too). The result is a processor with a wide variety of digital-mode options. What's more, new modes can be added by simply installing the appropriate software. This extraordinary flexibility is at the heart of the Advanced Electronic Applications DSP-2232 MCP.

Operating Features

The DSP-2232 is a dual-port MCP. In other words, it allows you to simultaneously operate different modes on two separate rigs. For example, you can monitor your local VHF packet node on port 1 while hunting RTTY DX on port 2. The DSP-2232's software offers 34 modem configurations, depending on the desired signal format and/or operating port. That's enough to keep any digital communications enthusiast occupied for hours on end! The supported modes include:



- AX.25 packet (300, 1200 and 2400-bit/s AFSK; 1200 and 4800-bit/s PSK; 9600-bit/s FSK)
- Baudot and ASCII RTTY
- AMTOR
- CW
- Facsimile (HF and APT)
- SSTV
- NAVTEX
- TDM (time division multiplex)
- KISS (for TCP/IP and other special applications)

The SSTV and fax modes require software *not provided with the DSP-2232* to process the resulting signals.

Inputs and Outputs

The DSP-2232's equipment requirements are the same as those for any multimode communications processor. You must have a computer or data terminal capable of providing RS-232-C serial communications to the DSP-2232. The DSP-2232 can interface to computers or terminals at data rates from 110 to 19,200 bit/s. The manual provides instructions for connecting the '2232 to a number of popular machines, including IBM PCs, Macintoshes, Apple IIs, Commodores, Tandy Color Computers and so on. A serial cable (with DB9 and DB25 connectors) is included. If you need to make a special cable for your computer, the manual helps by giving pin designations for several different models.

The '2232's terminal software requirements are also basic. Almost any terminal program will work with the DSP-2232. I used *Procomm*. AEA offers terminal software packages that further streamline operation with the '2232.

The Bottom Line

A model of versatility and forward-looking design, the DSP-2232 offers excellent performance and two-port connectivity in a wide variety of digital modes.

The DSP-2232 is shipped with two multiconductor shielded cables to interface the MCP to the transceivers of your choice. I was pleased to discover that the manual contains an appendix with wiring instructions for many rigs. I use Kenwood transceivers on HF and VHF, so all I had to do was check the appropriate table.

Audio output levels to the transceivers are adjusted by two pots accessible from the side panel. Be sure to read the manual carefully before attempting to adjust these pots. Their access holes are *not* labeled and they are adjacent to the access holes for two AGC pots, which are set at the factory and should *not* be adjusted.

The rear panel is neatly designed and every port is clearly labeled. The input/output ports for the transceivers are labeled **RADIO 1** and **RADIO 2.** There are two separate CW keying ports as well as a dedicated FSK output (RTTY/AMTOR aficionados will love this!). Packet satellite users will be pleased to know that frequency **UP/DOWN** outputs are provided for automatic Doppler-shift compensation. The DSP-2232 even includes a parallel printer port.

Front-Panel Layout

The front panel seems intimidating at first, but this is an illusion created by the fact that it's a dual-port unit: The LED status indicators are duplicated in two rows—one for each port. Each port also has its own LED bar-graph tuning indicator.

The left side is dominated by an illuminated status display. In the packet modes, the status display indicates the connect and packet status, the call signs of stations received and the call sign of the last station monitored. I found the status display to be especially handy for RTTY and AMTOR operating. As you're tuning a RTTY signal, for instance, you'll see the received text marching across the indicator. This sure beats glancing back and forth between the tuning indicator and your data terminal or

computer monitor! You simply watch the status display and tuning indicator simultaneously, adjusting your rig until you see readable text. When the text prints properly on the DSP-2232's status display, it's printing on your monitor, too.

The Manual

The DSP-2232 manual is excellent. I expected it to be complicated and filled to the gills with digital techno-babble. Not so! Each operating feature and mode is discussed clearly and simply. In fact, the chapters for various modes begin with discussions of what the modes *are*, along with tips on how to use them on the air. This aspect of the DSP-2232 makes it great for newcomers. New packeteers, for example, will enjoy the detailed descriptions of nodes, packet bulletin-board systems (PBBSs), proper operating practices, and so forth.

A lengthy command summary and helpful appendixes round out the manual. Detailed schematic diagrams are also included.

On the Air

With so many operating modes available, you'd think it would be difficult to choose among them. The DSP-2232 makes this task easy. At the **cmd:** prompt, simply enter "DIR" (directory) and you're presented with a list of every available modem configuration. Each configuration is tagged with a number. To select 1200-bit/s AX.25 packet, the 13th modem choice in the menu, you enter "MODEM 13." From that moment onward, the DSP-2232 functions as a VHF-packet TNC. Any other modems, or combinations of modems, can be selected in the same manner. The modems are *not* numbered sequentially; although 34 modem configurations are available, the selection numbers range from 1 (170-Hz-shift RTTY/AMTOR on port 1) to 60 (2400-bit/s MSK packet on port 2).

The DSP-2232's terrestrial packet performance—HF and VHF—is outstanding. I used it to access local PBBSs on a regular basis and to work some HF packet DX. The DSP-2232 exhibited better noise immunity than traditional MCPs I've used. This was most noticeable on HF packet. The DSP-2232 copied noisy HF packet signals remarkably well, keeping the number of retries to a minimum. As with most other MCPs on the market, the DSP-2232 features a packet mailbox, where friends can leave messages when you're away from the keyboard.

If you've used an MCP on packet before, you'll be comfortable with the DSP-2232. The command syntax is the same as other AEA packet products (the PK-232MBX in particular), as well as TNC-2 clones. The packet emulation is so smooth, it was easy to forget that I was using an elaborate DSP controller.

The DSP-2232 also acquitted itself well in PSK PACSAT operation. I used it to communicate through the Fuji-OSCAR 20 satellite, transmitting MFSK on the 2-meter FM uplink and receiving PSK on the 70-cm downlink. It seemed too simple to enter this mode by simply typing "MODEM 23," but that's all there was to it!

I adjusted for Doppler shift manually, although I used a multimeter to monitor the activity of the **UP/DOWN** frequency-compensation ports. Sure enough, the DSP-2232 began sending compensation commands to the ports whenever the signal drifted even slightly off frequency.

At the end of the OSCAR 20 pass, I switched to modem 31 to do some AMTOR operating. AMTOR is pure pleasure with the DSP-2232. Performance is excellent, even under high noise and interference conditions. I enjoyed a lengthy conversation with a ham in Louisiana on 40 meters—*at night*. Despite the horrendous QRM, the link was maintained with ease. Modem 31 also permits simultaneous VHF packet operation on the other radio port. I connected with the local *PacketCluster* node so I could keep an eye on the DX activity during our QSO. It's worth noting that the DSP-2232 can operate in the simultaneous dual-port mode only with packet, RTTY and AMTOR. However, this may change as new software becomes available.

The DSP-2232's *personal AMTOR mailbox*, or PAM, is a convenient feature for AMTOR enthusiasts. When the PAM is active, friends can read or enter messages when you're not at the keyboard (although at present, FCC rules require a control operator to be present during HF operation). At the conclusion of an AMTOR QSO with a ham in Germany, I asked him to try linking to the DSP-2232's mailbox. The test went off without a hitch. It was fun to sit back and watch as he accessed the PAM and left a short message.

RTTY performance was also quite good. I found the bar-graph tuning indictor a bit misleading at times, however. If the RTTY signal is weak, it's difficult to separate the indications of the signal from the background noise and QRM. When properly tuned, however, the DSP-2232 seemed to exceed the RTTY performance of its traditional MCP cousins. I used it during the ARRL RTTY Roundup and was more pleased with the results than I have been with the traditional MCPs I've used.

The DSP-2232 offers CW with a center frequency of 750 Hz and an audio bandwidth of 200 Hz. Keying performance is adequate, as is the '2232's receive copying capability. When tuning strong, machine-generated CW signals, the DSP-2232 offers nearly 100% copy. When conditions deteriorated, or when the human factor entered the picture, I found the unit's receive performance to be comparable to other MCPs. Despite the wonders of DSP, no one's yet found a way to emulate the human brain when it comes to the adaptive skills necessary to copy human-generated Morse code!

SIAM

AEA MCP users may be familiar with the PK-232's SIAM (*Signal Identification and Acquisition Mode*). SIAM allows you to tune an unknown RTTY, AMTOR/SITOR or packet signal and identify it. When an unknown signal is tuned properly, the DSP-2232 software analyzes it and compares it to a list of known modes. If it finds a match, the '2232 tells you on the screen. At that point, you can opt to decode the signal or continue tuning.

SIAM is handy when you're exploring outside the amateur bands. I used SIAM to uncover a few unusual SITOR transmissions, although nearly all of these were encrypted. Within the ham bands, SIAM is useful when you find a signal that you can't seem to decode. For example, two hams may be conversing in RTTY using an 850-Hz shift rather than the more common 170-Hz shift. SIAM lets you know exactly what they're doing so you can choose the correct modem.

Of course, SIAM can't decode signals that aren't in its inventory of modes. I tuned across some PacTOR signals which seemed to thoroughly confuse it! When I tuned in a CLOVER QSO, SIAM identified it as an "unknown mode." AEA has announced plans to add PacTOR to the DSP-2232's operating modes and SIAM list.

Conclusion

The beauty of the DSP-2232 is its versatility. With so many modems in one box, the DSP-2232 can become the nucleus of a growth-oriented multimode digital communications station. I was quickly spoiled by the luxury of being able to operate HF and VHF RTTY, AMTOR, packet, CW, fax, SSTV, and packet satellites by pressing a few keys. And unlike traditional MCPs, the DSP-2232 can easily keep pace with digital communications advancements.

Despite its dizzying array of modem choices, the DSP-2232 is quite suitable for use by beginners. The software is friendly and straightforward. As I've already pointed out, the manual fills many information gaps.

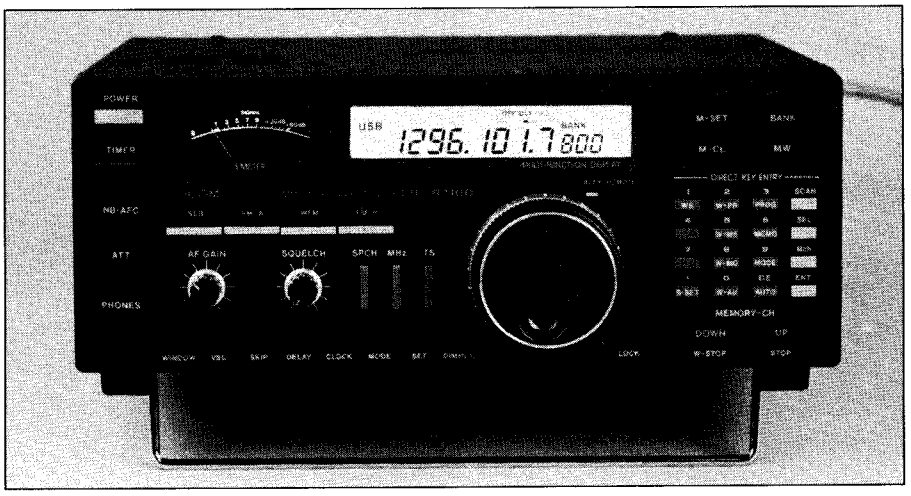
I balked initially at the DSP-2232's cost, but then I considered the benefits. When I calculated the cost of equipping my station for all of the modes offered by the DSP-2232 using more traditional options, the total far exceeded the DSP-2232's price. With the '2232, you're buying *convenience* as much as performance. Rather than grappling with a multitude of specialized boxes—and the resulting rat's nest of wires—you have everything you need in one place.

Even if you don't use some of the modes offered by the DSP-2232, it's nice to know they're at your fingertips whenever the spirit moves you—and that you can add other modes that interest you by simply upgrading the modem software when it becomes available!

Manufacturer's suggested retail price: $899. Manufacturer: Advanced Electronic Applications, PO Box C2160, 2006 196 St SW, Lynnwood, WA 98036, tel 206-774-5554.

ICOM IC-R7100 HF/VHF/UHF Communications Receiver

Reviewed by David Newkirk, WJ1Z, and Rus Healy, NJ2L



Its N-connector **ANTENNA** jack should give you a clue: The IC-R7100 receiver picks up where MF/HF transceivers leave off, receiving USB, LSB, AM and FM from 25 to 2000 MHz. Appropriate to its tuning range, it includes 920 memories, a multi-event clock/timer, powerful scanning features, a noise blanker and selectable automatic frequency control (AFC). What can an IC-R7100 do for hams? This review tells you what to expect from the IC-R7100—both as a scanner and as a receiver for the ham bands at 28, 50, 144, 222, 420, 902 and 1240 MHz. For VHF/UHF DXers, the R7100 can serve as a powerful propagation monitor (ham beacons, broadcast-TV video carriers[1]); weather-satellite reception, broadcast TV and FM stereo reception; and general monitoring of the growing variety of nonham, nonbroadcast utility and service communications in the VHF and UHF spectrum.

What's in the Box

The IC-R7100 is a multiconversion superhet that uses up-conversion from 25 to 512 MHz (using intermediate frequencies of 778.7 and 10.7 MHz, and 455 kHz) and down-conversion above 512 MHz (first IF, 266.7 MHz; other IFs, the same as 25 to 512 MHz). An inboard crystal-controlled converter extends the R7100's basic 25- to 1025-MHz range to 2000 MHz. ICOM guarantees the radio's specifications only from 25 to 1000 MHz and 1240 to 1300 MHz.

Like many MF/HF transceivers, the IC-R7100 gets around the spectrum by means of a tuning knob, keypad, **UP** and **DOWN** switches, and tunable memories. It tunes in steps of 1 MHz; 100, 25, 20, 12.5, 10, 5 or 1 kHz; or 100 Hz; its display resolves frequencies to 100 Hz. Twenty of its 920 memories store band edges for scanning; the remaining 900 memories can be divided into nine banks, 100 memories per bank, for scanning purposes. Each memory channel can store frequency, mode, tuning step, a "skip" flag for scanning use, and a user-selectable "select-number" from 1 through 9. The select-number feature allows you to group channels for specialized scanning.

Unlike most modern MF/HF transceivers, the IC-R7100 isn't billed as having dual VFOs. Its window feature pretty much duplicates this function, though. Of this feature, the IC-R7100's Instruction Manual says:

> The IC-R7100 has 2 windows, front window and back window, to show memory channels. Each window can have one memory channel, and you can exchange the window using the [WINDOW] switch.
>
> Operations are only performed on the front window. You must exchange the window to use the memory channel on the back window.

Despite what this passage says, you can listen to, tune, select and write memory channels regardless of which window you choose—just like dual VFOs. The IC-R7100's display doesn't indicate which window you're in.

The IC-R7100 can scan frequencies (between two programmed limits); memories (all, or in banks of 100) and memories with the same stored emission mode. The R7100 can automatically write busy channels to memory—channels 800-899—during frequency scanning. You can choose whether the R7100 writes this information only to unused channels in that range or overwrites information already there. When the R7100 encounters a signal, it can: stop scanning, listen, and resume scanning about 2 seconds after the signal disappears; pause for a presettable period and resume scanning; or stop scanning and stay put on that frequency. You can command the R7100 to listen for modulation on busy channels and resume scanning if modulation is absent—a plus for avoiding unmodulated carriers, spurs and birdies that would otherwise hang up scanning. If you've installed the R7100's optional speech-readout board, you can choose whether to have the radio announce its frequency each time it encounters a busy frequency during scanning.

The R7100's Window feature does more than act like two VFOs. You can command the radio to merely alternate between windows; or you can have the radio receive a fixed frequency in one window and scan in the other; or you can have the radio time-interleave two different scans, one in each window. You can select how much time the R7100 devotes to each window per cycle in ratios of 5:0.1, 4:0.5, 3:1 or 2:2 seconds.

The R7100's S meter is just that—an analog meter marked with S units from 1 through 9 and decibels over S9 up to +60. The radio's multifunction LCD augments the S meter with a tuning indicator that shows whether you're tuned above, below or right on an AM or FM signal.

The R7100 has two squelches—one that operates on noise and another ("S-meter squelch") that's triggered by the radio's automatic gain control (AGC). The noise squelch is especially useful for weak-signal reception; the S-meter squelch is like that used by most FM communications radios. The position of the R7100's **SQUELCH** control determines which squelch takes precedence. In addition to gating receive audio, the R7100's squelch operates a relay for tape-recorder control. A rear-panel **RECORD** jack outputs fixed-level audio for recording.

The IC-R7100's 24-hour clock/timer can handle up to five on/off events per day. You can assign a memory channel to each of these "timers" for unattended monitoring. A front-panel switch toggles the radio's display between frequency and time; you can't see time and frequency simultaneously.

Like many ICOM base-station radios, the IC-R7100 can be computer controlled via a rear-panel **REMOTE** jack. The rear panel includes two jacks you might not expect: **AGC** and **IF OUTPUT**. These allow connection to the radio's optional TV-R7100 TV/stereo FM adapter. The **IF OUTPUT** jack is

The Bottom Line

Excellent for general listening, propagation monitoring and scanning from 25 MHz through 2 GHz, the IC-R7100 isn't tailored for serious ham-band use as part of a two-way communications system.

[1]For more information on exploiting one of this receiver's biggest assets to weak-signal enthusiasts, see A. Ward, "Using TV Video Carriers to Monitor Propagation," *Proceedings of the 26th Conference of the Central States VHF Society* (Newington: ARRL, 1992), pp 19-29. This book is available from ARRL Publication Sales for $12 plus shipping.

Table 1

ICOM IC-R7100 Receiver, Serial #01017

Manufacturer's Claimed Specifications	*Measured in ARRL Lab*
Frequency range: 25 MHz to 2 GHz.	As specified.
Modes of operation: CW, LSB, USB, AM, FM.	As specified.
Power requirement: 100, 120 or 240 V ac or 13.8 V dc ±15% at 1.9 A max.	1.3 A max at 13.8 V.
CW/SSB sensitivity (10 dB [S+N]/N): 0.2 μV (–121 dBm).	Minimum discernible signal (noise floor): *Frequency (MHz)* — *MDS (dBm)* 28.1 — –134.0 50.1 — –136.6 144.1 — –133.0 222.1 — –133.4 432.1 — –133.1 903.1 — –131.2 1296.1 — –131.9 1806.0 — –125.8
AM sensitivity (10 dB [S+N]/N): 1.6 μV (–103 dBm).	AM narrow, test signal modulated 30% with a 1-kHz tone: *Frequency (MHz)* — *MDS (dBm)* 29 — –106.8 52 — –109.3 98 — –103.0 146 — –105.8 223 — –107.2 440 — –105.9 903 — –104.4 1296 — –105.4 1806 — –98.8
FM-narrow sensitivity (12-dB SINAD): 0.35 μV (–116 dBm).	*Frequency (MHz)* — *MDS (dBm)* 29 — –118.0 52 — –119.7 98 — –112.2 146 — –115.0 223 — –118.4 440 — –117.2 903 — –116.2 1296 — –114.8 1806 — –107.9
FM-wide sensitivity (12-dB SINAD): 1 μV (–107 dBm).	At 98 MHz, –103.8 dBm.
Blocking dynamic range: Not specified.	SSB mode:* *Frequency (MHz)* — *Dynamic Range (dB)* 28 — 91.5† 50 — 89.1† 144 — 91.5† 222 — 88.4† 432 — 91.1† 903 — 91.0† 1296 — 80.5†
Two-tone, third-order IMD dynamic range: Not specified.	SSB mode dynamic range and third-order input intercept:* *Frequency (MHz)* — *Dynamic Range (dB)* — *Intercept††* 28 — 81 — –12.5 dBm 50 — 77.6 — –20.2 dBm 144 — 79 — –14.5 dBm 222 — 79.4 — –13.9 dBm 432 — 80.1 — –13.0 dBm 903 — 81.7 — –8.7 dBm 1296 — 79.3 (500-kHz signal spacing)
IF + AF response: Not specified.	SSB: 2.7 kHz; AM (90% modulation), 3.7 kHz (narrow), 6.2 kHz (wide); FM narrow (3-kHz test-signal deviation), 1.6 kHz; FM wide, 5.9 kHz.
Squelch sensitivity: AM and NFM, 0.35 μV; SSB and WFM, 4.5 μV; WFM (1.24-1.3 GHz), 6 μV.	Exceeds specifications.
S-meter sensitivity: Not specified.	29 MHz: S1, 2.42 μV; S9, 63 μV; S9+20 dB, 496 μV. 903 MHz: S1, 2.45 μV; S9, 40 μV; S9+20 dB, 224 μV.
Audio output: >2 W at 10% distortion with an 8-Ω load.	2.4 W at 10% THD into 8 Ω.
Audio output at **RECORD** jack: Not specified.	29 MHz, USB, S9 signal: 145 mV.
AGC output at **AGC** jack: Not specified.	29 MHz, USB: No signal, 4.11 V; S5 signal, 2.44 V; S9 signal, 2.0 V; S9+20 dB signal, 1.57 V; 0 dBm input, 0.629 V.
IF output at **IF OUTPUT** jack: Not specified.	29 MHz, USB, –30 dBm input: 30 mV RMS.
Size (HWD): 3.7 × 9.5 × 9.4 inches; weight, 13 pounds.	

*Dynamic-range measurements were made at a signal spacing of 50 kHz.

†Noise limited.

††Third-order input intercept (dBm) = MDS (dBm) + 1.5 × third-order IMD dynamic range (dB).

potentially useful for experimentally minded hams because it provides 10.7-MHz output from a point ahead of the R7100's signal-width filtering.

Test Results

Table 1 lists the IC-R7100's specs and how well our test radio met them. Blocking and IMD dynamic range testing revealed that the radio's synthesizer is noisy, as reflected in the table's "noise-limited" measurements. Subjectively, NJ2L feels that although the radio's synthesizer phase noise is noticeably worse at the upper reaches of its coverage than even older multimode, single-band ham transceivers, this limitation doesn't degrade intelligibility of SSB signals or the tonal quality of CW signals. Its phase noise can, however, mask weak signals within many kilohertz of strong ones.

Listening with the IC-R7100

Using the radio's ability to scan for activity and write busy channels to memory, WJ1Z found the R7100's tuning range to be reasonably free of internally generated birdies. Noise-squelch-triggered, 1-kHz-step scanning in the AM-narrow mode revealed fewer than 25 S2-or-stronger spurs; most of the two to three hundred birdies found were too weak to move the radio's S meter and therefore could be "squelched out" during S-meter scan. Since FM scanning uses the S-meter squelch, and since most HF/VHF/UHF utilities use FM, those weak birdies are almost insignificant.

We heard plenty of air-band (AM) and FM utility action during R7100 listening using discone antennas. The IC-R7100 receives FM well, allowing three selectivity/deviation choices: narrow (FM-N, with 6-kHz selectivity), medium (FM, 15 kHz) and wide (WFM, 150 kHz, for TV sound and FM broadcasting). True, 150 kHz is a bit wider than necessary for TV sound, but our full-quieting TV locals sounded fine in WFM. Listeners with special interests like weather satellites and single-channel-per-carrier (SCPC) satellite downlinks need FM-selectivity/signal width choices between 15 and 150 kHz. There's no easy way to add extra filters to the IC-R7100, but its 10.7-MHz IF output seems ideally suited to use by those with such interests.

It's hard to go wrong with communications-quality AM reception—and the R7100 doesn't. The radio lets you select 6- or 15-kHz selectivity filtering for AM.

Some scanners feature "single-sideband" reception that *isn't*—they don't actually reject one sideband. This isn't so with the IC-R7100: Its 2.4-kHz selectivity does a good job on USB and LSB, just as you'd expect with an MF/HF rig. That said, strong SSB signals sound a bit harsh and crackly on the R7100 compared to MF/HF transceivers intended for two-way SSB communication. Its smallest tuning step, 100 Hz, isn't fine enough for comfortably accurate tuning on most SSB signals—a clarifier would be a welcome addition. The beat-frequency oscillator (BFO) alignment in our sample could have been a bit better: Our R7100's carrier frequency differed by a few hundred hertz between USB and LSB. Considering that the radio is primarily an FM/AM scanner in an HF-radio box, though, its SSB performance—though bare-bones—is good.

This radio covers eight ham bands with many kinds of propagation and, largely, regionally defined activity. In most of the eastern half of the US, all of these bands are populated densely enough that the R7100 is valuable as an activity indicator as well as a band-opening gauge. NJ2L finds the R7100 useful in the ham bands despite its limiting 100-Hz tuning steps, and feels that it's a vast step up from most wideband receivers he's used for this application. It's good enough to use as an auxiliary receiver with a microwave transverter,[2] and handles scanning of calling frequencies on the VHF/UHF bands with a wide-coverage antenna. A disadvantage in this application is the inherently low gain of omnidirectional antennas broadband enough to cover more than one ham band. A broadband preamplifier is a good investment with such a setup.

The R7100's noise blanker is effective against many kinds of noise—including some computer hash—in SSB and AM operation.

WJ1Z finds the R7100's audio to be crisp at the expense of low-end punch—exactly what's required for scanning AM and NBFM communications signals. During TV and entertainment FM ("WFM") reception, he found himself wishing for bass boost—even after equipping the R7100 with an external hi-fi speaker. The radio's audio power amplifier is overly hissy. Presumably, the optional TV-R7100 TV Receive Adapter (not tested), which adds TV and FM stereo demodulation to the IC-R7100, goes farther toward extracting hi-fi entertainment audio from the radio.

Documentation

WJ1Z: The IC-R7100's many features, particularly its highly programmable scanning functions, make it a radio that needs an instruction book. Ironically, the IC-R7100's *Instruction Manual* is an instruction book that needs a *radio.* It's heavy on diagrams—a good thing. It's also light on words—not a bad thing if they're well-chosen to complement the pictures. Its text sometimes reflects a bumpy transition from Japanese to English, and requires user experimentation with the radio and diagrams to nail down the *Manual*'s meaning. For instance, I *think* that an IC-R7100 equipped with the optional UT-36 voice synthesizer unit can be made to speak its frequency upon halting at a busy channel. I infer this from one of the parameters togglable in the scan SET mode, "automatic speech frequency," which allows not the setting of a frequency—the action implied by the parameter name—but the *toggling of a triggerable function.* From this, I *guess* that the function toggled is that of announcing the radio's frequency upon halting at a busy channel. I don't think that a person who's just spent over 1200 bucks on a radio should have to guess at its features. IC-R7100 buyers should expect to keep the *Manual* right beside the radio, and to refer to one to explain the other.

[2]Jim Davey, WA8NLC, covers transverter interfacing in some detail in his December 1992 *QST* article, "A No-Tune Transverter for the 2304-MHz Band," pages 33-39.

The IC-R7100 Overall

A receiver that's peachy for scanning and shortwave listening is one thing; a receiver that's suitable for quality HF/VHF/UHF ham communication is another. The IC-R7100, we feel, isn't quite up to the task of acting as the receiving part of a two-way station. Although the radio's documentation pronounces that "transceive operation is possible on the IC-R7100 with an ICOM transceiver such as an IC-970," we consider the R7100's main ham uses to be noncritical bandscanning and band-opening and maximum usable frequency (MUF) checking. Its limited dynamic range, 2.4-kHz selectivity, noisy synthesizer, minimal interference-rejection features and coarse tuning resolution rule out its use for serious CW/SSB reception, and there are other, cheaper acceptable means of ham FM reception.

The IC-R7100 is a pricey, high-quality scanner that qualifies slightly less for two-way work than its appearance might suggest. Other scanners cover much, if not all, of the IC-R7100's tuning range; its scanning features are arguably near the top of the pack in versatility. On the other hand, compared to other scanners, the IC-R7100 receives SSB reasonably well—but with 100-Hz tuning steps. You can buy a good single-band, multimode VHF or UHF transceiver, or a few hand-helds and/or under-dash FM rigs, for the price of an IC-R7100. But they lack the versatility and propagation-monitoring potential the R7100 provides. So a ham-licensed potential IC-R7100 buyer has some thinking to do!

Manufacturer's suggested retail price: IC-R7100, $1479; TV-R7100 TV/FM adapter, $225; UT-36 voice synthesizer, $38; AH-7000 discone antenna, $104; MB-5 mobile mount, $27. Manufacturer: ICOM America, Inc, 2380 116 Ave NE, Bellevue, WA 98004, tel 800-999-9877.

Terlin Outbacker JR8 HF Mobile Antenna

Reviewed by Jeff Bauer, WA1MBK

Be it musical groups, movies or wildlife, Australia seems to offer the truly unique. Outbacker antennas are no exception. One look is all it takes to realize that these are different...radical radiators, if you will. I can almost hear Crocodile Dundee saying, "Now *these* are antennas!"

I've heard two extraordinary stories about Outbackers. One has to do with how the ruggedness of these antennas is demonstrated at hamfests. Like misplaced Louisville sluggers, the sales reps allegedly swing back and repeatedly strike an antenna against the edge of a table. If any chips fly, they're from the table, not the antenna.

The other story involves a Land Rover that rolled over in (where else?) the outback of Australia. The antenna and mount survived the accident—the vehicle wasn't so lucky.

So during the product review period, I was deliberately rough on this antenna, but not out of disrespect, disregard nor dementia. After hearing about the Outbacker and its reputation for being a tough antenna, the Product Review Editor may as well have said to me, "Go ahead...I dare you!"

Here we review the 150-W, 4-foot-long model JR8 for 75 through 10 meters, along with the OBSB spring-base mount. I used the antenna at 100 W and below, as most users would. Models capable of up to 500 W PEP are available.

Antenna Construction

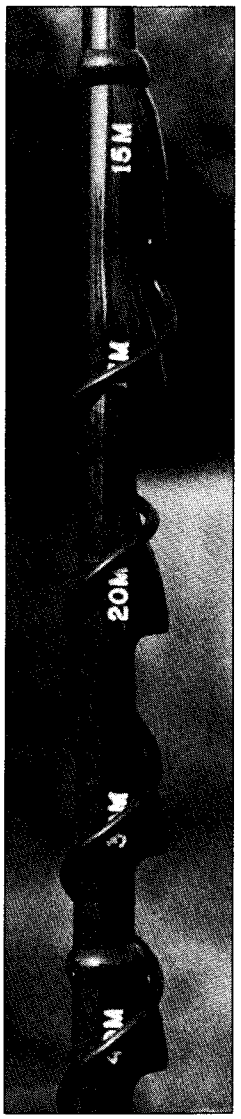
The Outbacker is a lightweight but rugged two-piece antenna that weighs a scant 1⅜ pounds. The bottom section is comprised of a fiberglass rod with a helically wound copper radiator, encased in an epoxy resin. Taps for the eight HF ham bands (80 through 10 meters) are provided for fast band-hopping. These taps point downward so as not to collect water. Band switching is accomplished by changing the band taps on the Outbacker with the "Wander Lead," a cute name for a jumper wire with a plug on each end. Tuning the antenna for resonance in a particular part of a band is done via the adjustable whip at the top. The antenna terminates at the bottom with standard ⅜-24 threads.

Mount

The OBSB (Outbacker spring base) mount is the mother of all mounts. This *serious* unit, weighing in at 4⅝ pounds, is no lightweight, literally or figuratively. The spring portion is zinc-plated spring steel and the base is nickel-plated steel. Both are rustproof. The mount contains an easily weatherproofed integral female UHF connector (SO-239). Mount installation requires a ½-inch-diameter hole for the ¾-inch hex-head bolt.

Installation and Use

So up on the roof of my car it went. I backed up the mounting hole with a 4- × 4-inch piece of ¼-inch-thick aluminum, just to be on the safe side. Although perhaps not much of a problem in the outback of Australia, hitting overhead objects *is* more than an annoyance in many parts of the world. At first, the sound of the antenna's stainless-steel whip, referred to as the "Stinger" by Terlin, frequently hitting tree branches was a bit of a humorous novelty. The novelty wore off in a hurry, though!



Close-up of the Outbacker JR8 antenna showing a few of its band taps and the "Wander Lead" band-changing wire.

Many New England tree boughs now sport whiplash scars from the 'MBK Outbacker. However, one tree, somewhere in Northwestern Connecticut, got the last laugh. Upon arriving home from running an errand, I noticed the Stinger portion of the antenna was missing.

Necessary aside: I have a compulsion for making certain that hardware is tight. This compulsion has earned me the nickname "Torque Meister" in some circles. (I believe I've been called other things as a result of this compulsion.) My father can tell you tales of snapped-off automotive bolt shanks. My wife is constantly wrestling with "welded" jar lids. And retired W1AW Chief Operator Chuck Bender, W1WPR, frequently had to use pliers to loosen PL-259s from SO-239s. Chuck could *always* tell which connectors I had tightened! So it is with confidence I can say that it's doubtful that the loss of the Stinger was due to operator negligence.

A phone call to Terlin's US distributor was all I needed to have a replacement shipped. The rep I spoke with went on to advise that the whip portion of a popular 2-meter, ⅝-wavelength mobile antenna "would do in a pinch" to replace the Stinger. The replacement Stinger appeared to be slightly thicker than the original, though we didn't have the luxury of the original for comparison.

When mounted on the rear bumper of my car, the Outbacker performed fine, except that I had trouble getting it to load on 40 or 75 meters because of the antenna's very low feed-point impedance on these bands. Integral antenna tuners in modern radios can usually compensate for this sort of problem, but the loss in radiation efficiency resulting from the mismatch still exists.

Table 2
Outbacker 2:1 SWR Bandwidth

	Bandwidth	
Band	*Claimed*	*Measured*
80 meters*	25-50 kHz	35 kHz
40 meters	60-85 kHz	88 kHz
30 meters	<1.5:1 across entire band	As specified
20 meters	325-425 kHz	Entire band
17 meters	<1.5:1 across entire band	As specified
15 meters	250-350 kHz	<1.5:1 across band
12 meters	<1.5:1 across entire band	As specified
10 meters	700-800 kHz	1 MHz

*3.6 MHz is the lowest frequency at which a 1:1 match is attainable.

Terlin has done their homework with this problem, though, by designing into the base of the Outbacker a matching coil to provide a 50-Ω feed point on these bands. To put the matching network in line, you simply install a jumper wire. With other manufacturers, such a matching coil, if available, is usually an added-cost accessory. With the Outbacker, it's built in.

A-B testing with two other popular HF mobile antennas revealed essentially identical received and transmitted signal strengths. So, from a performance standpoint, the Outbacker is on par with other manufacturers' offerings.

The Outbacker's tapered profile, light weight, low wind resistance and ease of band switching and adjustment make this antenna stand above the crowd. With it, there's no need for guy ropes or other anti-sway kludges.

The bottom line? Although the Outbacker antennas aren't inexpensive, neither are other popular mobile antennas. The big plus for the Outbacker is that one radiator and one mount does it all. It requires no extra resonating units or matching coils for multiband operation. The Outbacker is the sturdy, well-built antenna that its reputation promises.

I really enjoy using this antenna. It makes mobile hamming a lot of fun. I like it so much that I've given away my other name-brand HF mobile antenna!

Manufacturer's suggested retail prices: OB-JR8, $229; OBSB mount, $69; OB-8 (300 W, 6 feet long, 75-10 meters), $259; OB-8HP (as OB-8, but 500 W PEP), $289; Perth (7.5 feet long, 75-10 meters), $269; OB-M (75, 40, 20, 17 and 10 meters, plus HF marine band), $389. Distributor: Outbacker Antenna Sales, 330 Cedar Glen Cir, Chattanooga, TN 37412, tel/fax 615-899-3390.