Product Review and Short Takes from *QST* Magazine

April 2008
Product Reviews:

Elecraft K3 HF/6 Meter Transceiver

Kenwood TH-D7A(G) Dual Band Handheld

Short Takes:

TigerTronics SignaLink USB Interface

PRODUCT REVIEW

First Look: Elecraft K3 HF/6 Meter Transceiver

Reviewed by Bruce Prior, N7RR
ARRL Technical Advisor

Elecraft entered the market with the K2, a rather good multiband low power (QRP) transceiver kit with a well-regarded receiver.[1] Over time, with options the K2 developed into a 100 W SSB/CW radio with digital signal processing (DSP).[2]

Ideas about further improvements eventually outgrew the K2 box, so the folks at Elecraft decided to go back to the drawing board. The result is the K3, a software-defined radio with sophisticated DSP, great receiver performance, and a wide range of features and options in a handsome and ergonomically well-executed, but traditional-looking package.

Unlike the K2, the K3 is not a kit of parts. It comes either factory assembled or as a *solderless kit* of fully tested and aligned modules. Festooned with surface mounted parts, in traditional kit form the K3 would be impractical for most amateurs to build.

With a huge selection of options, K3 configurations range from about $1400 for a basic K3/10 (10 W) radio in kit form to well over $4000 for a K3/100 (100 W), factory assembled with all the options. Check out Elecraft's Web site (**www.elecraft.com**) for full details of the many options and configurations available. With the wide range of possibilities, the *QST* staff decided to review two separate K3 transceivers: a bare-bones modular kit and an as-complete-as-possible factory assembled version.

This review spotlights the basic K3/10 kit with an overview of the kit building process, a description of the features and a somewhat abbreviated battery of ARRL Lab tests. Later this year we'll take a closer look at an assembled K3/100 loaded up with options (some are not yet available) and with more mature firmware, and perform additional ARRL Lab testing.

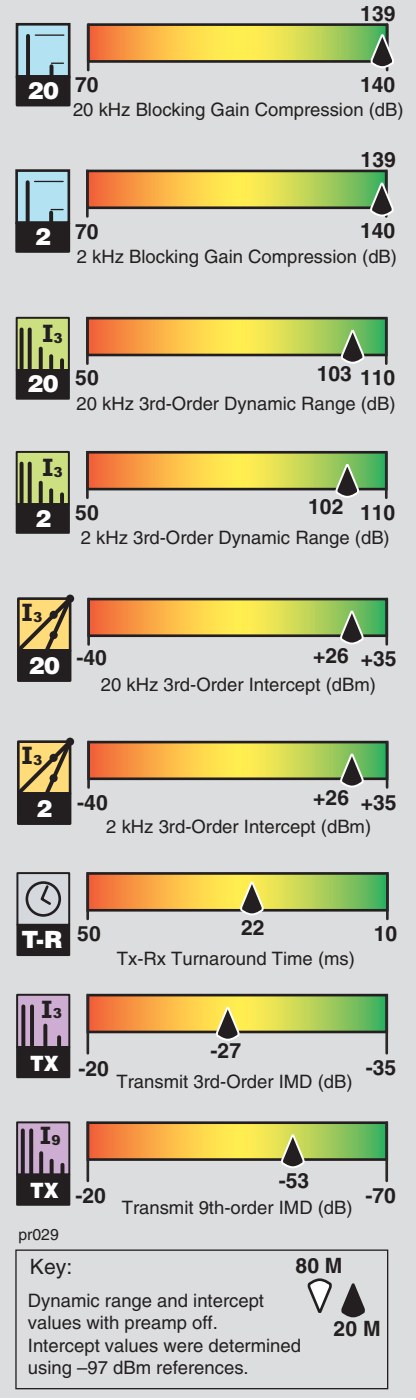
The Basic K3/10: A QRP Super-Rig

Selling for $1399.95 in modular kit form ($1599.95 assembled), the K3/10 probably represents the current summit of QRP level transceivers. The basic K3/10 transmits and receives CW, SSB and data modes on all amateur bands from 1.8 through 54 MHz at the 10 W power level. Adding AM and FM operation requires just two optional filters. Except for the transmitter power, it's the same radio as the K3/100. Any K3 options can be added to the K3/10 model, and it's easily upgraded to 100 W any time you want. Assemble the built and tested modules and you end up with a K3/10 identical to the factory assembled version. No soldering is required.

[1]L. Wolfgang, WR1B, "Elecraft K2 HF Transceiver Kit," Product Review, *QST*, Mar 2000, pp 69-74. *QST* Product Reviews are available on the Web at **www.arrl.org/members-only/prodrev/**.

[2]L. Wolfgang, WR1B, "Elecraft KPA100: A 100 W Upgrade for Your Elecraft K2 HF Transceiver," Product Review, *QST*, Feb 2004, pp 76-80.

Key Measurements Summary



Bottom Line

Elecraft's K3/10 modular kit is easy and enjoyable to assemble. Once built, you're rewarded with a feature-laden transceiver with receiver performance rivaling the best available at any price. You can customize your radio with a wide range of options at any time as your interests and needs change.

Mark J. Wilson, K1RO ♦ Product Review Editor ♦ k1ro@arrl.org

I'm an enthusiastic kit builder who has a well-deserved reputation in the Pacific Northwest QRP Group as "Dr Klutz." If anybody can figure out how to flub a kit assembly, I'm that person. It turned out that the K3 module kit is Bruce-proof. Well, almost.

Taking over the dining room table, I assembled the bare-bones K3, serial number 158, in about 11 hours on a brand new static-dissipating work mat. The egg carton I used to sort the K3 hardware only had 12 compartments. Monday morning quarterbacking tells me that I should have used an 18 compartment carton. Using 12 compartments, I sorted screws by type, but not by size. When I was very close to finishing the kit, I was short three ¼ inch black pan-head screws to attach three transistors for heat sinking. I apparently had used some ¼ inch screws where 3⁄16 inch ones had been specified. Luckily, Elecraft had supplied extra ¼ inch zinc pan-head screws, so I could complete the assembly. Later, Elecraft sent replacements for the screws I "lost."

Building this modular kit with help from its lavishly-illustrated *K3 Assembly Manual* (available as a PDF download from the Elecraft Web site) seemed almost too easy. The only moderately challenging stage was fitting the front panel circuit board assembly to the main RF board. It took me about five minutes of fiddling before they fit neatly together.

I would recommend building the kit to anybody who is physically able. It gave me an appreciation for the superb engineering that has gone into the K3, something I wouldn't have experienced with the factory-assembled version. Once completed, I was amazed how much space was left in the box. Some of that space is reserved for the 100 W amplifier, antenna tuner and subreceiver options, but even with those installed there will still be plenty of space available for further hardware enhancements.

Did it work? Well, not quite at first. I plan to eventually install an FM roofing filter in slot 1, so I put an optional 6 kHz filter in slot 2 and the standard 2.7 kHz filter in slot 3. It turns out that the K3 defaults to expect a filter in slot 1. After enabling the appropriate filter parameters in the CONFIG menu, the K3 sang happily.

The *Elecraft K3 Utility* is available to update the transceiver to the latest firmware versions within a few minutes. It's a good idea to check Elecraft's Web site after assembly to see if there is a newer version available. The K3 can be connected to a computer via a USB-to-serial cable, available as an option from Elecraft, or by an ordinary serial-to-serial cable, and the software can then be instructed to search for new K3 upgrades periodically.

Table 1

Elecraft K3/10, serial number 00158

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive, 0.5-30, 48-54 MHz;* transmit, 1.8-2, 3.5-4, 5.3305, 5.3465, 5.3665, 5.3715, 5.4035, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89-24.99, 28-29.7, 50-54 MHz.	Receive and transmit, as specified.
Power requirement: 11-15 V dc (13.8 nom.); receive, 0.9 A (signal present); transmit, 4 A (10 W out).	Receive, 0.91 A; transmit, 3.1 A; tested at 13.8 V dc. Operation confirmed at 11 V.
Modes of operation: SSB, CW, AM, FM, PSK31, FSK, AFSK.**	As specified.

Receiver

CW sensitivity, 500 Hz bandwidth: –136 dBm (preamp on)	Noise Floor (MDS), 400 Hz bandwidth:†

Preamp	*Off*	*On*
14 MHz	–130	–137 dBm
50 MHz	–128	–135 dBm

Noise figure: Not specified.	14 MHz, preamp off/on: 18/11 dB.
Blocking gain compression: 140 dB typical.	Gain compression, 500 Hz bandwidth:

	20 kHz offset Preamp off/on	*5/2 kHz offset Preamp off*
14 MHz	139/134 dB	139/139 dB
50 MHz	135/135 dB	134/132 dB

Reciprocal Mixing (500 Hz BW): Not specified.	20/5/2 kHz offset: –116/–106/–95 dBc.

Two-Tone IMD Testing

Band/Preamp	*Spacing*	*Input level*	*Measured IMD level*	*Measured IMD DR*	*Calculated IP3*
14 MHz/Off	20 kHz	–27 dBm	–130 dBm	103 dB	+25 dBm
		–15 dBm	–97 dBm		+26 dBm
		0 dBm	–52 dBm		+26 dBm
14 MHz/On	20 kHz	–38 dBm	–137 dBm	99 dB	+12 dBm
		–23 dBm	–97 dBm		+14 dBm
14 MHz/Off	5 kHz	–28 dBm	–130 dBm	102 dB	+23 dBm
		–15 dBm	–97 dBm		+26 dBm
		0 dBm	–52 dBm		+26 dBm
14 MHz/Off	2 kHz	–28 dBm	–130 dBm	102 dB	+23 dBm
		–15 dBm	–97 dBm		+26 dBm
		0 dBm	–52 dBm		+26 dBm
50 MHz/Off	20 kHz	–28 dBm	–128 dBm	100 dB	+22 dBm
		–14 dBm	–97 dBm		+27 dBm

The K3 Driver's Seat

The basic features of the K3 are simple to learn. The three-page Quick-Start Guide in the *K3 Owner's Manual* gets the ball rolling in short order. This feature-rich radio has much more to offer beyond simple receiving and transmitting, however. As with operating a high-performance automobile, these nuanced features take more time to learn. The Basic Operations section gives a lot of detail in 10 pages. The Advanced Operating Features section takes up an additional seven pages. Menu-accessed functions require more than five densely packed pages. Since much of the functionality of the K3 is driven by firmware, the list of features will surely grow and change. Consider this a snapshot of a moving target.

Combating Noise and Interference

Perhaps the single most powerful facility of the K3 is a wide range of interference and noise fighting aids. A classic problem in non-channelized Amateur Radio operation is to dig out a weak signal with one or more strong signals lurking nearby, and the K3 employs several tools to help with this.

Roofing Filters

The K3 provides for selectable roofing filters at the first IF to limit the off-frequency signals getting into the receiver — too many strong undesired signals may overload amplifier and mixer stages, causing internally generated spurious signals that reduce receiver performance. Note that the roofing filter's job is only to protect the rest of the receiver, and that the operating bandwidth filtering is performed by the DSP.

The basic K3 is equipped with a 5 pole 2.7-kHz roofing filter that can be changed to an 8 pole 2.8-kHz unit at time of order. Other 8 pole roofing filters are available for 6, 2.1, 1.8 and 1 kHz, as well as 400 Hz and

Receiver	Receiver Dynamic Testing
Second-order intercept: Not specified.	Preamp off/on: +79/+79 dBm.
S-meter sensitivity: S9, 50 μV (adjustable).	S9 signal at 14.2 MHz: preamp off, 50 μV; preamp on, 14 μV.
Audio output power: 2.5 W into 4 Ω at 10% THD.	2.8 W at 10% THD into 4 Ω.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth): CW (400 Hz): 455-840 Hz (385 Hz),‡ Equivalent Rectangular BW: 364 Hz; USB: 306-2827 Hz (2521 Hz); LSB: 373-2898 Hz (2592 Hz); AM: 202-2802 Hz (2600 Hz).
Spurious and image rejection: 70 dB.	First IF rejection, 14 MHz, 98 dB; 50 MHz, 96 dB; image rejection, 14 MHz, 109 dB; 50 MHz, 71 dB.

Transmitter	Transmitter Dynamic Testing
Power output: 1.8-14 MHz, 10 W; 18-54 MHz, 10 W (CW, FM), 8 W (SSB); AM not specified.	HF: CW, SSB, typically 12 W high, <1 W low; 50 MHz: CW, SSB, typically 8 W high, <1 W low.
Spurious and harmonic suppression: HF, 50 dB; VHF, 60 dB.	HF, 50 dB; VHF, 61 dB. Meets FCC requirements.
Third-order intermodulation distortion (IMD) products: Not specified. (at 8 W)	3rd/5th/7th/9th order (worst case band): HF, –27/–40/–47/–53 dB PEP; VHF, –28/–43/–47/–50 dB PEP.
CW keyer speed range: Not specified.	8 to 65 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, 22 ms (SYNC DATA mode). Unit is suitable for use on AMTOR.
Composite transmitted noise: Not specified.	See Figure 3.

Size (height, width, depth): 4.0 × 10.7 × 11.8 inches; weight, 6 pounds (8.5 pounds for the 100 W version, all options installed, not including power supply or external accessories).

Price: K3/10 kit version, $1399.95 ($1599.95 assembled); KFL3A-6K 8-pole, 6 kHz roofing filter, $120; KFL3A-400 8-pole, 400 Hz kHz roofing filter, $120.

*Reduced sensitivity around the 8.215 MHz IF. The optional KBPF3 bandpass filter is required for full general coverage receive.
**FM and AM require optional IF filters.
†The optional KFL3A-400 8-pole, 400 Hz roofing filter was used for optimum performance. The noise figure is approximately 1 dB less than the 500 Hz filter.
‡Varies with pitch control setting.

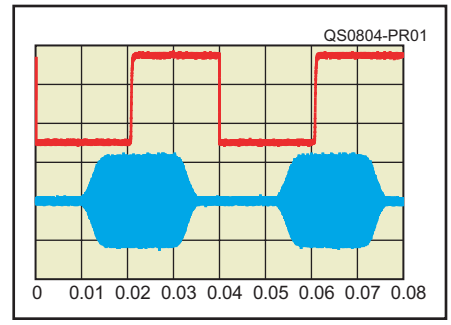


Figure 1 — CW keying waveform for the Elecraft K3/10 showing the first two dits in full-break-in (QSK) mode using external keying. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 10 W output on 14.2 MHz.

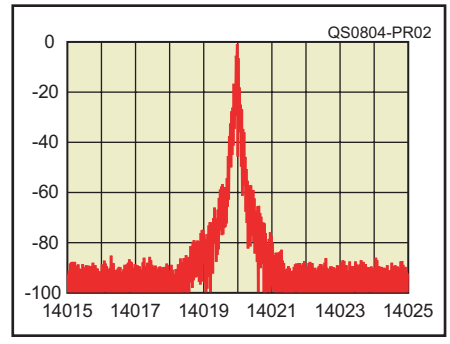


Figure 2 — Worst-case spectral display of the Elecraft K3/10 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 10 W PEP output at 14.2 MHz.

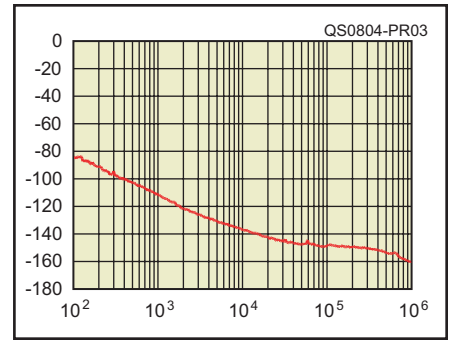


Figure 3 — Worst-case spectral display of the Elecraft K3 transmitter output during composite-noise testing. Power output is 10 W at 14.2 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier.

250 Hz. The 6 kHz filter is required for AM transmission. A wider 8 pole FM-bandwidth filter was not yet available at press time. Other 5 pole roofing filters are available for 500 Hz and 200 Hz.

There are five filter slots available on the main RF board and another five can be used on the forthcoming KRX3 subreceiver. Once again, you don't need a narrow roofing filter to operate at narrow bandwidths (say 500 Hz) in CW or data modes — bandwidth filtering is provided by the DSP. But installing one will improve dynamic range at very close signal spacings. Unless you plan to use the radio in demanding environments with lots of strong signals on adjacent frequencies, you may not need anything more than the stock 2.7 kHz unit. I've ordered the 6 kHz and FM bandwidth filters to be able to operate AM and FM, but am not adding any more for now.

The ARRL Lab added an 8 pole 400-Hz roofing filter for testing. As shown in Table 1, the results are impressive. Overall receiver performance is right up there with the best radios the Lab has ever measured, and this is the first receiver we've tested with better than 100 dB IMD dynamic range at the closer signal spacings.

Bandwidth and Shift Filtering

DSP bandwidth and shift filtering are coordinated automatically with whatever suite of roofing filters is installed. There are four kinds of filtering: bandwidth and shift for CW and phone, dual passband for CW, and dual-tone for RTTY.

The K3 DSP bandwidth filter can be adjusted as narrow as 50 Hz and it still sounds fine without ringing — a remarkable accomplishment. A special dual passband filter designed for CW combines a steep-skirted narrow filter focused on the signal of interest with a broad-skirted variable wide filter that allows the operator to hear adjacent activity as well at a lower volume.

Finally, a dual-tone filter with its two peaks (for mark and space tones) is the standard filter for RTTY operation. The filter shapes are illustrated graphically on the display and their values are displayed momentarily when they are adjusted.

Notch Filtering

The purpose of notch filtering is to remove interfering narrowband interference such as a carrier or CW signal. The K3 has two different kinds of notch filters. The manual notch filter is tunable from 200 to 3920 Hz. It works in any mode. The automatic notch filter will find and attenuate a single tone and works in any voice mode.

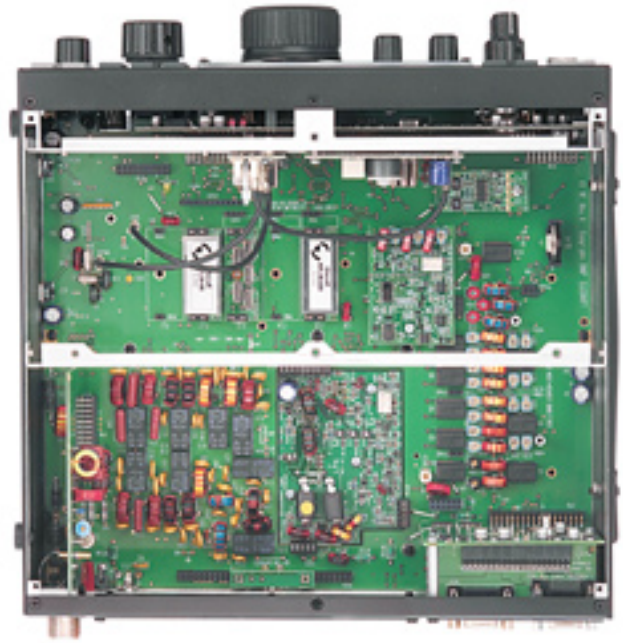


Figure 4 — There's a lot of room inside the K3/10 for options and upgrades such as an antenna tuner, 100 W amplifier or second receiver.

Noise Blanker

The K3 includes a rather traditional 1st IF (8215 kHz) hardware noise blanker with a wide range of adjustments when active. It has width settings — narrow, medium and wide — that determine the width of the offending signal to be suppressed. Another setting controls the relative aggressiveness of suppression in seven steps. As a noise suppressor, the hardware noise blanker creates holes in the waveform. This hardware noise blanker is useful to fight broadband hash originating from sources such as noisy ac power lines and motor vehicle ignition systems.

A DSP noise blanker at the 15 kHz IF also offers a choice of 21 different settings. This system attacks pulse noise by substituting signal in place of the noise instead of creating a hole. It's most effective against artificial electronic noise from sources such as a nearby computer.

Noise Reduction

When the automatic gain control (AGC) is active, a DSP noise reduction (NR) system can be employed with 16 different settings to attenuate the random noise that is ever-present in the radio spectrum. The NR system can produce dramatic changes in the readability of signals in any location and with any antenna system. Time spent experimenting with just the right adjustment for various modes and band conditions is most worthwhile.

Just among the noise blanker and the noise reduction systems there are 7056 active combinations. Noise control engineering is complex, and the operator needs to work with tradeoffs: Heftier noise control is usually accompanied by increased audio distortion, so a compromise needs to be found that results in better intelligibility and lower listener fatigue. Once a sweet spot is found, turning the NR on and off can demonstrate a dramatic contrast.

RIT and XIT

The usual receive or transmit incremental tuning (RIT/XIT) labels show up in the display. Changes in the RIT are shown on the VFO A display and changes in XIT are indicated momentarily on the VFO B display. In addition, three LEDs on the lower-right corner of the front panel indicate whether the adjustment is lower in frequency, centered or higher. Another LED near the PHONES socket lights whenever the transmit and receive frequencies differ.

Tuning Aids

A long-standing problem with CW and digital modes has been accurate tuning, and the K3 has three facilities to help. One is the SPOT button, which emits sidetone audio at the correct pitch, allowing the operator to tune the received signal to match the sidetone frequency. The second facility is the CW/data tuning (CWT) button, which enables a visual tuning display. The incoming signal can then be tuned to coincide with the CWT pointer.

The third facility is the real winner: With the CWT circuit enabled, the SPOT button automatically slides the K3 to join the frequency of the incoming signal. CW operators will appreciate the fact that they can continue copying while the K3 adjusts the frequency for zero-beat. The same auto-spot function works with PSK31, but may require some manual tweaking for fine frequency adjustment.

RTTY Without a Computer

Standard or reversed 45 baud RTTY can be decoded on a scrolling K3 display, and the CW keyer can be used to transmit FSK RTTY directly from the K3 with no computer interface required. Send CW, out comes RTTY. Any of the eight CW message memories can be programmed with RTTY messages.

There is a 5 second pause before the RTTY transmit diddle switches off when controlled by the keyer, giving the operator some ear-scratching time while transmitting. A useful prosign IM can be inserted at the end of transmitted text to switch immediately to receive mode. A nonprinting double-dash (BT) prolongs the diddle time.

Similar receive/transmit facilities are planned for other digital modes such as PSK31. With or without the optional 100 W amplifier installed, the K3 is said to be robust enough to allow full power operation in 100% duty cycle modes.

Visual Morse Decoding

A CW decoding display can be chosen for both transmitted and received Morse code. This display is especially useful for instilling in the CW operator the discipline of leaving proper spacing between words. Operators may chose to have the display operate only while transmitting. This facility can be set manually for a given code speed or allowed to float automatically within presets. Yes, it also allows beginning CW contesters to read Morse code faster than their normal skill level.

Tuning

It's easy to change bands with repeated presses of the BAND up or down buttons, or you can jump to any frequency within the K3 range via direct keypad entry. The large VFO A knob changes receive and transmit frequencies simultaneously unless the K3 is in SPLIT mode, in which case the VFO B knob controls the transmit frequency. If the RIT or XIT is not active, the RIT/XIT encoder can be configured to act as a coarse tuner of VFO A for a very rapid frequency change (QSY) or for quickly "taking the pulse" of band conditions.

Audio Equalization

Some operators care a great deal about receive and transmit audio quality. The K3 features audio equalization adjustments on receive and transmit. Frequency response can

be custom tailored in eight bands in increments of 1 dB within the range of ±16 dB.

These adjustments help compensate for variations in speaker/headphone or microphone frequency responses or the acoustical characteristics of the operational environment to faithfully reproduce the original audio or to enhance intelligibility. The transmit voice signal audio equalization quality can be monitored simultaneously in headphones without transmitting.

Pseudo-Stereophonic Audio

An "Audio Effects" (AFX) mode feeds received audio to stereophonic earphones or stereophonic external speakers with a slight adjustable lag between left and right sides. The result is a textured listening experience that I found considerably less fatiguing than monaural audio, especially during extended operating sessions. Having discovered the AFX, I refuse to turn it off. Both phone and CW listening is much improved, especially using stereophonic headphones.

Upgrades and Changes

Elecraft has an established reputation for listening carefully to user feedback and in many cases responding to that feedback by making changes in their products. That's been the case with the K3, beginning with the early *beta testers* and continuing as radios are delivered and put into use. The K3, very largely a software-defined radio, was designed specifically to allow for changes through firmware, and a number of well documented updates have appeared on Elecraft's Web site.

Some issues have required hardware changes. Initial ARRL Lab testing revealed that transmit-receive turnaround time was too long for AMTOR operation. Elecraft released a modification that solved this problem and improved AGC operation. Another change (a single capacitor) improved the CW keying waveform and fixed an issue with shortening of the first transmitted character. These changes are included in current production radios. Owners of early radios should contact Elecraft for more information.

Initial Lab testing also showed worse than expected transmitter IMD performance. We measured third order IMD products at about –23 dB worst case, and Elecraft indicated that it should be significantly better. We confirmed this by measuring transmitter IMD at the low power amplifier output on a K3/100, and measured the recorded –27 dB with their new guidline (below). At press time we were working with Elecraft to locate the problem in the review K3/10. We'll have more on this in the follow-on K3/100 review. For now, Elecraft recommends that for best SSB transmit IMD performance on 17 meters and higher, set the power output to 8 W or less.

I do have a short "wish list."

- The date formats offered so far are US: MM.DD.YY and EU: DD.MM.YY. The SI (metric) format could also be added as an option — SI: YY.MM.DD.
- It would be great if the Elecraft engineers could find a way to allow auto notch to work on CW, without notching out desired CW signals. This is probably a tall programming challenge, but something that many CW operators would appreciate.
- Nitpicking: I'd like to see a heftier thumbscrew ground post to accommodate heavier wire. The Anderson PowerPole system for the high-current dc power input has a tendency to disconnect with little force. That's only a minor irritant in a fixed installation, but it could become a more significant problem in a vibration-prone mobile environment.
- The *K3 Owner's Manual* is available online. The K3 is complex enough and changes are made often enough that an updateable index would be helpful. As firmware changes are made over time, perhaps new or revised items could be color-coded so that users could scan the revised index and key in on the most recent changes.

Final Thoughts

Finishing the K3/10 can be your final destination, and you'll have a QRP transceiver rich in features and basic radio performance. Or you can view it as a starting point, adding a 100 W amplifier, automatic antenna tuner, more filters, an interface for a transverter or separate receive antenna, a second receiver and more. Full details are available on Elecraft's Web site, along with detailed technical information and explanations of all aspects of the radio's operation and a very active user's e-mail reflector.

Manufacturer: Elecraft Inc, PO Box 69, Aptos, CA 95001; tel 831-662-8345; **www.elecraft.com**.

Kenwood TH-D7A(G) Dual Band Handheld

By Howard Robins, W1HSR
ARRL Contributing Editor

The Kenwood TH-D7A(G) is a unique dual band handheld radio that has integrated Automatic Packet/Position Reporting System (APRS) functionality with a built-in terminal node controller (TNC) and APRS firmware.[3] We reviewed the original version, the TH-D7A, in 1999. Physically, the 'D7A and the 'D7A(G) appear the same, and the FM voice features are comparable.

The big difference is that the G version has significant improvements to the APRS functions, along with some other changes that are addressed in the *Enhanced Features* manual that comes with it. This 28 page supplemental manual is dedicated to explaining operation with the new and changed features. Although the G version has been available for several years, it has not been reviewed in *QST*. We thought it appropriate to look at the G version considering the extent of the changes and the popularity of APRS operation today.

Bottom Line

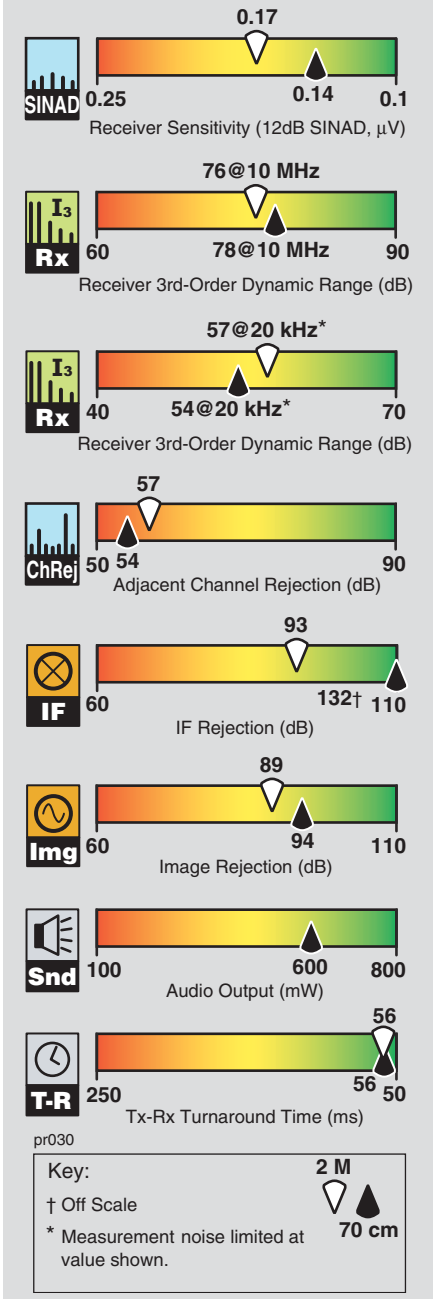
Kenwood's TH-D7A(G) is a full-featured dual band handheld that works well, is easy to use, and expands on the original model's APRS capabilities.

The TH-D7A(G) offers 5 W output, extended receive coverage including the AM aircraft band and NOAA weather channels, CTCSS decode/encode, memories and scanning and repeater options and DTMF dialing and memories. The radio also supports Kenwood's SkyCommand II system for remote control of the TS-2000 series HF radios. The A band receives the aircraft band and VHF, and the B band receives VHF and UHF. As a true dual receiver radio, you can listen to both bands at the same time;

Readers are encouraged to read the thorough review of the original TH-D7A for a presentation of the core features, and to better appreciate the changes incorporated in the G version. ARRL offers several resources that may be helpful to those who are not familiar with APRS operation.

[3]S. Horzepa, WA1LOU, "The Kenwood TH-D7A Dual-band H-T," *QST*, Aug 1999, pp 58-62. *QST* Product Reviews are available on the Web at **www.arrl.org/members-only/prodrev/**.

Key Measurements Summary



Setting up APRS

For fixed location operation, you can enter your coordinates manually and transmit a station icon, position data, position comment and status text. For mobile operation, you need to connect an external GPS receiver to be able to include updated position data, speed, direction and altitude. The 'D7A(G) is compatible with the industry standard NMEA (National Marine Electronics Association) data strings, so it can be used with a variety of GPS receivers.

I've operated APRS extensively and used other Kenwood APRS radios, so my first approach with the 'D7A(G) was to see how difficult it would be to set it up to beacon my position without a GPS and without looking at the instruction manual. I pushed the POWER button to turn the handheld on. I was in VFO mode, so I pushed the ENT button on the keypad, tapped 1-4-4-3-9-0 and was in business, hearing packet clatter on the 144.390 MHz APRS frequency. I then saved that frequency in a memory location.

Pressing MENU and then pushing the jog wheel to the APRS menu brought me to a screen from which I could select and program the options I needed. Programming was pretty straightforward. First, I needed to select which radio band to use for data. I programmed my call sign, selected a station icon, entered my position (geographic coordinates), selected a position comment, selected a transmit method (manual, PTT or auto), set the TX interval (how often to automatically transmit a beacon), entered a packet path (specifies how my data should be transferred via digipeaters) and programmed position ambiguity (allows you to select how precise your location will be known to receiving stations by truncating the coordinates). These settings took just a few minutes to make.

Testing 1, 2, 3

With the parameters set, the next step was to try to send an APRS beacon. To do that, I pushed the TNC button followed by the BCON (beacon) button. Success! Instantly the TH-D7A(G) sent out a beacon, and an instant later I heard *beep-boop*, and MY POSITION blinked on the LCD screen. Pretty neat!

The TH-D7A(G) can store APRS data from up to 40 stations, and the oldest information is replaced once you exceed 40. Pressing LIST brings you to a list of call signs that you can scroll through and select from to see more details. For a map based display, you can connect the 'D7A(G) to a personal computer running APRS software or to the AvMap G5.[4] Kenwood's optional PG-4W programming software kit includes the cable needed to connect the radio to the computer's serial port.

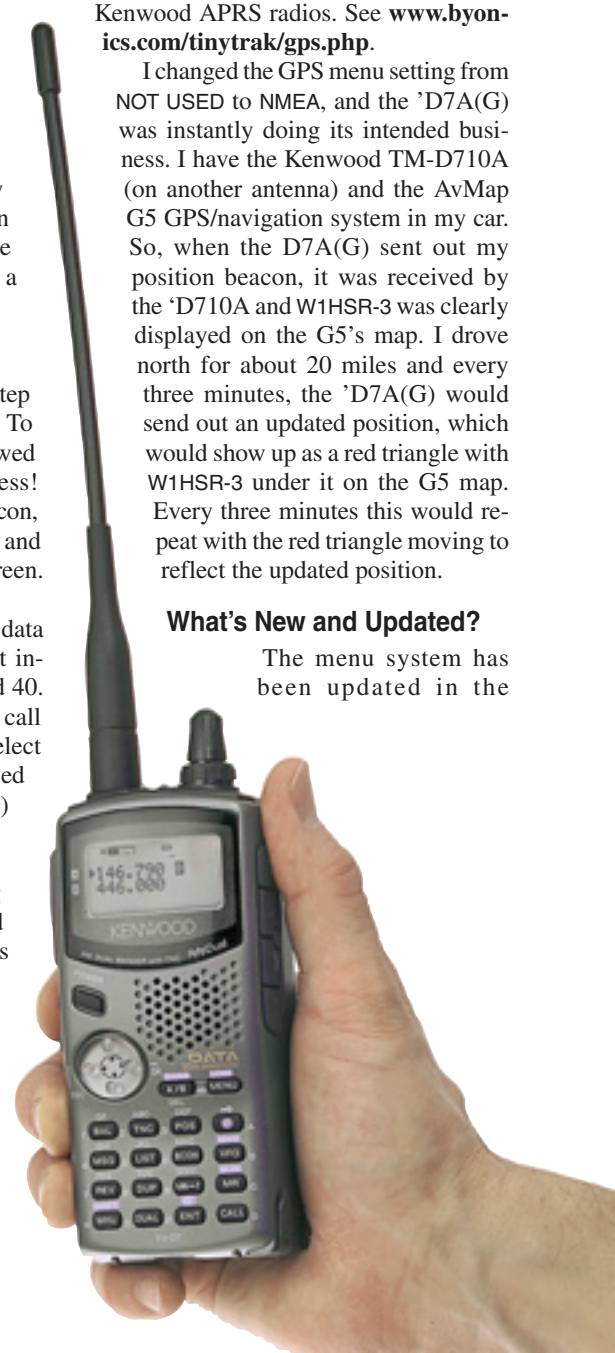
I am in North Broward County in Florida, in a concrete and steel retirement community as I write this. There is a digipeater, WB4QNX-3, operated by Boca Raton ARA that is receiving my 5 W signal and repeating it. Thanks to W6LMJ in West Palm Beach, about 30 miles away, these beacons are being uploaded to the Web through an Internet gateway. Once on the Web, people all over the world can visit **www.findu.com**, look up W1HSR-3 and see where I am. This was done with the stock antenna and battery power. With the standard PB-39 NiCd battery pack (9.6 V, 600 mAh), the 'D7A(G) beaconed on high power every 3 minutes for 15 hours before the battery needed to be recharged.

Time to try mobile operation. In my next foray I attached the TH-D7A(G) to a Byonics GPS1 module and trunk mounted mobile antenna on my car. The GPS1 is a small GPS receiver designed to be used with mapping software and other applications that require GPS data. Byonics offers an interface cable and power cable specifically for use with Kenwood APRS radios. See **www.byonics.com/tinytrak/gps.php**.

I changed the GPS menu setting from NOT USED to NMEA, and the 'D7A(G) was instantly doing its intended business. I have the Kenwood TM-D710A (on another antenna) and the AvMap G5 GPS/navigation system in my car. So, when the D7A(G) sent out my position beacon, it was received by the 'D710A and W1HSR-3 was clearly displayed on the G5's map. I drove north for about 20 miles and every three minutes, the 'D7A(G) would send out an updated position, which would show up as a red triangle with W1HSR-3 under it on the G5 map. Every three minutes this would repeat with the red triangle moving to reflect the updated position.

What's New and Updated?

The menu system has been updated in the



[4]H. Robins, W1HSR, "AvMap G5 Personal Navigator," Product Review, *QST*, Feb 2008, pp 48-49.

Table 2

Kenwood TH-D7A(G), serial number 90500085

Manufacturer's Specifications	Measured in the ARRL Lab
Frequency coverage: Receive and transmit, 144-148, 438-450 MHz.	Receive, 118-174, 400-480 MHz; transmit, 144-148, 430-450 MHz.
Power requirement: 5.5-16 V dc; receive, 0.09 A; transmit, 1.7 A (max).	Receive, 0.2 A; transmit, 1.7 A. Tested with 9.6 V battery.
Modes of operation: FM.	FM, AM (receive only).
Receiver	**Receiver Dynamic Testing**
AM sensitivity: Not specified.	AM, 10 dB S+N/N: 120 MHz, 0.51 μV.
FM sensitivity, 12 dB SINAD: 0.18 μV.	For 12 dB SINAD: VHF, 0.17 μV; UHF, 0.14 μV.
FM adjacent channel rejection: Not specified.	20 kHz offset: 146 MHz, 57 dB; 440 MHz, 54 dB.
FM two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset: 146 MHz, 57 dB*; 440 MHz, 54 dB.* 10 MHz offset: 146 MHz, 76 dB; 440 MHz, 78 dB.
FM two-tone, second-order IMD dynamic range: Not specified.	84 dB.
S-meter sensitivity: Not specified.	S9: VHF, 2.1 μV; UHF, 1.3 μV.
Squelch sensitivity: 0.1 μV.	At threshold: VHF, 0.13 μV; UHF, 0.11 μV.
Receiver audio output: 450 mW at 10% THD into 8 Ω.	600 mW at 10% THD into 8 Ω (dc and battery).
Spurious and image rejection: Not specified.	First IF rejection, VHF, 93 dB; UHF, 132 dB; Image rejection, UHF, 89 dB; UHF, 94 dB.
Transmitter	**Transmitter Dynamic Testing**
Power output (H/L/EL): VHF and UHF, 5/0.5/0.05 W with PB-39, 9.6 V battery; VHF, 6/0.5/0.05 W; UHF, 5.5/0.5/0.05 W with 13.8 V dc.	With 9.6 V battery: VHF, 5.7/0.8/0.09 W; UHF, 5.5/0.8/0.11 W. With 13.8 V dc: VHF, 6.1/0.8/0.13 W; UHF, 6.0/0.83/0.13 W.
Spurious-signal and harmonic suppression: 60 dB.	VHF, 65 dB; UHF, 66 dB. Meets FCC requirements.
Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.	S9 signal, VHF, 148 ms; UHF, 167 ms.
Receive-transmit turnaround time (tx delay): Not specified.	VHF, 79 ms; UHF, 74 ms.

Size (height, width, depth): 4.7×2.1×1.7 inches; weight: 13.4 ounces.

Price: TH-D7A(G), $350; PG-4W programming software/cable, $55.

Note: Unless otherwise noted, all dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz.

*Measurement was noise limited at the value indicated.

Figure 5 — The TH-7DA(G) displays an APRS packet from KB1DFC. The text indicates that KB1DFC is running 4 W power, is 425 feet above sea level and is using a 4 dB omnidirectional antenna.

'D7A(G), with some items streamlined (made easier to use), others enhanced or made more robust and several new options added. New features for APRS operation include:

- *Position Ambiguity* allows you to select the precision of position data sent by masking the last 1, 2, 3 or 4 digits of latitude and longitude.
- *Status Text Transmit Rate* selects how often status text is sent with beacons. It's selectable from every time to once every 8 times, or not transmitted at all. In addition, the 'D7A(G) has two additional Status Text memories (total of three).
- *Auto Answer Reply* allows the operator to automatically send a reply message of up to 45 characters.
- *Message Group* allows you to program alphanumeric codes to filter group messages so you only receive certain types.
- *Data Band* — APRS and packet can be programmed independently. Split band operation is now supported
- *Packet Transfer Rate* supports future 9600 baud APRS.
- *My Position* has been upgraded to include time, speed, direction and altitude. There are two additional My Position memories (total of three), and Time Zone allows the user to select a UTC offset for time.
- *Packet Transmit Delay* lets the user select a delay between keying up and start of APRS data to the transmitter (this helps with receiving stations that miss initial part of packets)

Other changes to the APRS features include support for GPS receivers using the NMEA 9600 baud protocol, seven additional position comments (total of 15), selection of one line or the entire display for received APRS data and additional station icons.

In addition, the radio now permits split band for satellite operation, improves support for DX PacketCluster monitoring, allows direct keypad entry to enter text when programming various parameters and improves 1750 Hz tone operation.

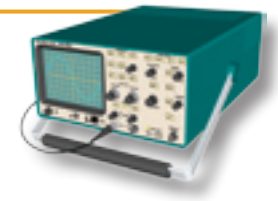
Parting Thoughts

I was skeptical about the practicality of a 5 W handheld transceiver for APRS. My experimenting convinced me that this is fully functional as long as you are in range of a digipeater. There seems to be ample battery to run for the better part of a day without recharge. Of course, this would vary depending upon how much transmitting you do and how fresh the battery is to start with.

The Kenwood TH-D7A(G) provides a quick and simple way to get into APRS. Its portability is a definite plus for certain types of operations such as search and rescue. I could envision setting up a field vest or fanny pack and putting this unit together with a GPS receiver module and battery pack for public service events. It could be set up to send a position as you release the PTT button in environments set up for that type of operation. If you're looking for dual band handheld radio and interested in APRS, consider the TH-D7A(G).

Manufacturer: Kenwood USA Corp, 3975 Johns Creek Ct, Suite 300, Suwanee, GA 30024; tel 310-639-4200, fax 310-537-8235; **www.kenwoodusa.com**. QST

SHORT TAKES



TigerTronics SignaLink USB Interface

Richard Van Wyckhouse, KG4UHC
108 Churchill Dr
Winchester, KY 40391
kg4uhc@arrl.net

When I first started in Amateur Radio a few years ago, I was interested in investigating the various digital modes that were available. The most cost-effective way was to use my computer sound card and the software applications that were available. I purchased SignaLink SL-1+ interface from TigerTronics to function as the middleman between my transceiver and my computer. Not only did the SignaLink provide excellent audio isolation and level management, I particularly enjoyed its ability to sense the transmit audio from the sound card and key the transceiver PTT (push-to-talk) line automatically. That meant that I wouldn't have to dedicate my computer's only serial port to transmit/receive switching.

But even though the SignaLink had freed my serial port for other uses, there was still the question of the audio cables that snaked between the interface and the computer sound card. Like many hams, I use my sound card for a number of different purposes. I have audio cables connected to several devices including a dual tape deck, record player, VCR and a camcorder. Add the SignaLink SL+ to the group and I had a nest of cables that had to be plugged and unplugged whenever I switched applications. The transmit/receive switching benefits of the SL+ notwithstanding, I still had to suffer with tedious cable swapping whenever I wanted to use it on the air.

The USB Solution

When I saw the advertisement for the new TigerTronics SignaLink USB, I realized that my problem was solved. The SignaLink USB interface has a built-in low-noise sound chipset. This means that it doesn't need to connect to your computer's sound card. You simply plug the SignaLink into any USB port and all computer communication is handled through that single connection. No other cable connections to your computer are necessary.

The SignaLink USB brings the A/D, D/A converters and op amp closer to the transceiver interface, which reduces overall noise in the system. Better yet, instead of manipulating the sound levels by using a computer mouse or track ball, traditional pots and knobs have been installed on the front of the unit. This makes it much easier to adjust the receive and transmit levels for the various digital modes.

The SignaLink USB transmit/receive switching time can be controlled by an external time delay pot. The SignaLink even obtains its 5 V dc power from the USB connector, so that's another issue solved. If you have several transceivers you could use a number of these units, each connected to its own USB port.

Connecting the SignaLink USB to your radio is relatively easy. You can connect the unit to the transceiver data/auxiliary ports, or to the mike and speaker jacks. (TigerTronics sells pre-made interconnecting cables for a variety of transceivers.) There is a 16-pin DIN socket on the SignaLink for receive audio, transmit audio, PTT and ground connections.

You configure the SignaLink through the use of internal jumpers. Just do this once and you're good to go unless you change to a transceiver with different input/output wiring. TigerTronics further simplifies the jumper process by offering a pre-wired header for your particular radio.

The SignaLink USB comes with a mini CD-ROM that contains a bundle of software that will get you on the air quickly. Of course, the SignaLink will also operate with other available software. The operating system doesn't matter. If the computer has a USB port, it will work with the SignaLink.

The Proof is on the Air

When it comes to digital operating, I am mostly interested in PSK, RTTY and APRS (Automatic Position Reporting System). Pairing the SignaLink USB with my ICOM IC-746PRO transceiver, along with *Hamscope* software, I had no problem copying RTTY and PSK31 signals at surprisingly low levels. During one PSK31 conversation, I dropped the receive audio level until there was very little background noise on the waterfall display and I was still decoding with no errors. That's a testimony to both the SignaLink's performance as well as *Hamscope*.

Switching radio cables, I hooked up my ICOM IC-910H rig for APRS monitoring on 2 meters using *AGWPE* packet radio software. With the SignaLink USB I could easily decode APRS data signals with the receive audio level control between 20% and 50%.

For an APRS transmit test, I opened the computer's audio mixer window and set the SPEAKER volume to 100% and the WAV output to 50%. With the SignaLink transmit audio control adjusted to 10% of maximum, I could still transmit undistorted decodable packets.

I was curious about the SignaLink's output frequency response, so I used an oscilloscope to measure the peak-to-peak output of a PSK31 signal at several frequencies from 100 to 2500 Hz. The output was adjusted to 300 mV and it remained fairly close to that value throughout the range. It is interesting to note that you can crank the SignaLink USB audio output to 570 mV, and even as high as 2.2 V (through the use of an optional jumper), although I can't imagine that such a high level would be necessary.

TigerTronics has a great product in the SignaLink USB. The only issue you may encounter is getting your hands on one. When this review was written, demand had outstripped supply, but TigerTronics is quickly closing the gap.

Manufacturer: TigerTronics, PO Box 2490, Grants Pass, OR 97528; tel 800-822-9722 (0700 to 1300 UTC); **www.tigertronics.com**. *$99.95.* QST

Steve Ford, WB8IMY ♦ *QST* Editor ♦ sford@arrl.org