Product Review & Short Takes Columns from *QST* Magazine

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Product Reviews

Kenwood TH-F6A Triband FM Handheld Transceiver
Cushcraft A627013S 6-Meter/2-Meter/70-Cm Yagi Antenna

Short Takes

RIGblaster Plus
The Protector

Kenwood TH-F6A Triband FM Handheld Transceiver

Reviewed by Rick Lindquist, N1RL
ARRL Senior News Editor

My very first handheld transceiver was a Heath 2021 for 2 meters. It was bulky, balky and fickle. "Features" included the ability to select from among a few crystal-controlled channels and the fact that it was pretty hard to misplace. It permitted me to communicate with nearby repeaters albeit with marginal reliability.

The Kenwood TH-F6A epitomizes the sort of quantum leap that H-T technology has taken in the intervening decades since the Heath 2021 was considered state of the art. While this latest edition to the Kenwood FM line is not only the first handheld to cover the 146, 222 and 440 MHz bands, it is also proof that H-Ts are not just for repeater work anymore. This one offers multimode receive-only coverage of a considerable portion of the viable RF spectrum—starting at 100 kHz and extending all the way to 1.3 GHz (cellular reception excluded, of course).

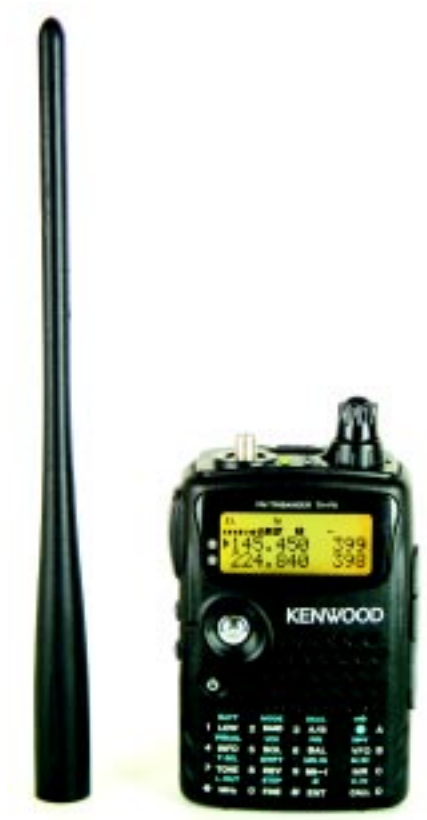
In a package that's probably one-quarter the size—and substantially lighter—than my old Heathkit H-T, the TH-F6A cranks out five times more power—a full 5 W on the three FM bands—yet fits neatly in the average palm. We measured almost 0.5 W of audio to the small, but clear and efficient, speaker, too. It's quite well-endowed for such a tiny package.

Add such niceties as direct frequency selection via the keypad, a display that remains quite readable despite its compactness, and memories that are a snap to program and label and you can quickly come to the conclusion that Kenwood did it right with the TH-F6A.

Let's review its strengths and weaknesses.

Highlights

The TH-F6A is a rugged little unit that offers all the features you'd expect to find in an H-T and then some. The ability to receive on two bands at the same time plus the "split-screen" display were welcome features. We're always amazed to see what the designers and manufacturers are able to squeeze into packages that seem to shrink a bit more with each new outing. There are tradeoffs with such a



compact form factor. For example, the TH-F6A can't dissipate heat as easily as a larger H-T; it will automatically shut down if it gets too warm. Some of the tiny topside display legends were a challenge to decipher as well.

The TH-F6A transceives on three amateur bands—2 meters, 1.25 meters and 70 cm—on either A Band or B Band. So, you can be listening on one band while set up to transmit on another (or on another frequency in the same band). A Band is optimized for best ham-band performance while B Band includes the expanded coverage. On the three ham bands on which it can transmit, the TH-F6A's receiver sensitivity is slightly better on A Band.

But wait, there's more! And *less*! Like others of its ilk, the 'F6A covers the HF shortwave bands. Kenwood has taken this capability to the next level by including LF bands and LSB, USB and CW modes in addition to AM and FM reception (I'm listening to my favorite AM talk show on the TH-F6A as I write). The downside here is that if you'd hoped to be able to troll around on the HF ham bands using the built-in antennas to keep abreast of the latest chatter, you're likely to be disappointed in its performance. We'll have more to say about this in a bit.

With the TH-F6A, if you weary of working FM, you can put on your SWL cap and just listen (that, itself, is a novelty for many amateurs more used to having a ready finger on the PTT button).

Need to catch up on the latest news? Tune in your favorite FM or AM radio station with the TH-F6A. Hundreds of memory channels let you file away your pet stations for quick retrieval and name the memories for easy identification. More on that later, too.

On a mountaintop or trekking the forest trails but just can't miss the latest episode of "Survivor," "Millionaire" or "The Weakest Link"? The TH-F6A lets you listen to both VHF and UHF TV audio (handy charts in the *Instruction Manual* reveal the channel frequencies in the US and several other parts of the world). Using the 7.5-inch rubber-duckie antenna, I got decent TV audio from all stations in the Springfield-Hartford market. Need a weather forecast or enjoy listening to police calls? The 'F6A offers those too.

Given the two VFOs on the TH-F6A, users also can program many functions separately. For example, you can set different frequency step parameters on each. Of course, mode is also independent. You can have a repeater set up on A Band, a local broadcast station on B Band, and be able to listen to both. In a more practical vein, in a disaster or emergency response situation where both VHF-UHF and HF nets were active, a participant could be active on VHF while monitoring a local HF net at the same time.

You can set squelch levels independently on each band, too. Not only that,

Bottom Line

With FM transceive capabilities on the 146, 222 and 440 MHz bands and multimode receive on a huge chunk of the RF spectrum, the Kenwood TH-F6A elevates the H-T to a whole new level.

Joe Bottiglieri, AA1GW ♦ Assistant Technical Editor

Table 1
Kenwood TH-F6A, serial number 30500061

Manufacturer's Claimed Specifications	Measured in the ARRL Lab
Frequency Coverage: Receive, 0.1-50 MHz (CW, SSB, AM, FM), 50-470 MHz (CW, SSB, AM, FM, WFM), 470-1300 MHz (AM, FM, WFM), cell blocked; transmit, 144-148, 222-225, 430-450 MHz (FM only).	Receive and transmit, as specified.
Power requirements: External dc, 12.0-16.0 V[1], receive, 0.17 A[2]; transmit, 2.0 A (maximum, high power); 7.4 V battery, 5.5-7.5 V[1], receive, 0.17 A[2]; transmit, 2.0 A (high power).	External dc: receive, 0.29 A (maximum volume, no signal), transmit, 1.9 A, tested at 13.8 V; PB-42L, 7.4V battery pack, receive, 0.27 A; transmit, 1.8 A.
Size (HWD): 3.4×2.3×1.2 inches; weight, 8.8 ounces.	
Receiver	**Receiver Dynamic Testing**
CW/SSB Sensitivity[3], 10 dB S/N: 3-30 MHz, 0.45 μV; 30-50 MHz, 0.4 μV; 144-148 MHz, 0.22 μV; 430-450 MHz, 0.22 μV.	Noise floor (MDS)[3]: 3.5 MHz, –125 dBm; 14 MHz, –125 dBm; 50 MHz, –127 dBm.
AM Sensitivity[3], 10 dB S/N: 0.3-0.52 MHz, 7.08 μV; 0.52-1.8 MHz, 2.24 μV, 1.8-50 MHz, 0.89 μV, 118-250 MHz, 380-500 MHz, 0.4 μV.	AM, 10 dB S+N/N[3]: 1.02 MHz, 1.9 μV; 3.8 MHz, 0.95 μV; 29 MHz, 1.1 μV; 53 MHz, 0.82 μV; 120 MHz, 1.1 μV.
FM Sensitivity, 12 dB SINAD, A Band: 144-148, 222-225, 430-450 MHz, 0.18 μV. WFM (30 dB S/N): 50-108 MHz, 3.16 μV; 150-222 MHz, 2.82 μV; 400-500 MHz, 3.98 μV. B Band: 5-108 MHz, 0.4 μV, 118-144 MHz, 0.28 μV, 144-225 MHz, 0.22 μV; 225-250 MHz, 0.89 μV; 380-400 MHz, 0.4 μV; 400-450 MHz, 0.22 μV; 450-520 MHz, 0.4 μV; 520-700 MHz, 7.08 μV; 800-950 MHz, 1.26 μV; 950-1300 MHz, 0.4 μV.	FM, 12 dB SINAD[3], A Band: 146 MHz, 0.16 μV; 222 MHz, 0.17 μV; 440 MHz, 0.17 μV. B Band: 29 MHz, 0.44 μV; 52 MHz, 0.33 μV; 902 MHz, 0.45 μV; 1240 MHz, 0.47 μV. WFM, 100 MHz, 1.4 μV.
FM Two-tone, third-order IMD dynamic range: Not specified.	20 kHz offset from 146 MHz, 60 dB*[4]; 10 MHz offset from 146 MHz, 73 dB. 20 kHz offset from 222 MHz, 57 dB*; 10 MHz offset from 222 MHz, 75 dB. 20 kHz offset from 440 MHz, 57 dB*; 10 MHz offset from 440 MHz, 72 dB.
FM Adjacent-channel rejection: Not specified.	20 kHz offset from 146 MHz, 60 dB. 20 kHz offset from 222 MHz, 57 dB. 20 kHz offset from 440 MHz, 57 dB.
Spurious response: Not specified.	IF rejection, 146 MHz, 83 dB; 222 MHz, 86 dB; 440 MHz, 100 dB; image rejection, 146 MHz, 59 dB; 222 MHz, 84 dB; 440 MHz, 73 dB.
Squelch sensitivity: 0.13 μV (A band).	At threshold, VHF, 0.16 μV; UHF, 0.17 μV.
Audio output: 300 mW at 10% THD into 8 Ω.	405 mW at 10% THD into 8Ω.
Transmitter	**Transmitter Dynamic Testing**
Power Output: With PB-42L 7.4 V battery pack, 5.0 W / 0.5 W / 0.05 W; with external dc (13.8V), 5.0 W / 2.0 W / 0.5 W.	With PB-42L battery pack: 146 MHz, 5.3 / 0.4 / 0.05 W; 222 MHz, 4.8 / 0.5 / 0.07 W; 440 MHz, 4.9 / 0.4 / 0.1 W; with external dc (13.8V), 146 MHz, 5.4 / 2.3 / 0.5 W; 222 MHz, 4.7 / 2.0 / 0.5 W; 440 MHz, 5.0 / 2.0 / 0.5 W.
Spurious signal and harmonic suppression: 60 dB.	VHF, 70 dB; UHF, 63 dB. Meets FCC requirements for spectral purity.
Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified.	Squelch on, S9 signal, VHF and UHF, 68 ms.
Receive-transmit turnaround time ("tx delay"): Not specified.	200 ms.
Bit-error rate (BER), 9600-baud: Not specified.	146 MHz: Receiver: BER at 12-dB SINAD, 2.1×10^{-3}; BER at 16 dB SINAD, 5.9×10^{-5}; BER at –50 dBm, $<1.0\times10^{-5}$; transmitter: BER at 12-dB SINAD, 2.5×10^{-3}; BER at 12-dB SINAD + 30 dB, $<1.0\times10^{-5}$. 440 MHz: Receiver: BER at 12-dB SINAD, 1.1×10^{-3}; BER at 16 dB SINAD, 4.9×10^{-5}; BER at –50 dBm, $<1.0\times10^{-5}$; transmitter: BER at 12-dB SINAD, 1.8×10^{-3}; BER at 12-dB SINAD + 30 dB, $<1.0\times10^{-5}$.

*Measurement was noise limited at the value indicated.
[1]External dc, 13.8 V nominal; battery voltage, 7.4 V nominal.
[2]Receive, no signal, dual-band operation.
[3]Measurement taken on the B Band unless otherwise noted.
[4]Dynamic range measurements were all performed on the A Band.

pressing the BALance button and turning the tuning knob (or using the joystick) lets you determine how much audio you want from each channel. Want A to be loud and B to be in the background? It's simple to do.

It is to Kenwood's credit that it decided to include 222 MHz on this unit (the European unit, the TH-F6E, covers only 2 meters and 70 cm on transmit). With 2 meters overwhelmed with traffic in some regions, the 1.25-meter band is a viable, but underutilized, alternative, and it's one that would be even more handy during emergencies and disasters if only equipment were readily available.

The failure of manufacturers to offer more multiband gear that includes the 222 MHz band relates to the fact that it's not an international allocation. But for US licensees, this is a band that all hams—including Novices—can use. (Novices may transmit voice, CW, MCW, RTTY, data and image from 222 to 225 MHz running up to 25 W.)

While the TH-F6A will receive on the 6-meter and 23-cm (1.2 GHz) bands, it does not transmit on either. Still, the addition of 222-MHz band transceive capability is a step in the right direction, and perhaps Kenwood will consider a *quadbander* for its next H-T model.

Ode to the Joystick

Beyond offering three bands, what's probably *the* standout feature on the TH-F6A is its multi-function joystick—actually, more of a thumb stick—on the front panel. The joystick—Kenwood calls it a MULTI-SCROLL KEY—adds considerable convenience to accessing and setting up menu items and making adjustments. It also incorporates the traditional UP/DWN button function.

The menu offers 31 setting choices. Getting to these is as simple as pressing down on the joystick itself, which, you'll notice—if you have really good eyesight—bears the legend MNU. Then, you scroll up or down until you reach the menu item you want. Joyfully, they're all in plain language.

At first I was a bit apprehensive to see this joystick controller on the 'F6A. I was relieved to discover that it worked quite smoothly—unlike a similar implementation in a fairly recent offering from a competing manufacturer that yielded unpredictable results. It was super convenient to have the transceiver's menus so close at hand. Pushing the MULTI-SCROLL KEY toward OK selects the item to change. Pushing it toward ESC (escape) lets you back out when you get yourself into a corner or are done using a menu.

Kenwood's advertising says the TH-F6A is designed for one-handed operation. I'm right-handed, but I found the radio a tad easier to control while holding it in my left hand. The joystick was an enormous help in this regard.

Single-handed operation is quite possible for most things you'll need to accomplish, although I did find that trying to press the F (function) button and the MON/ATT button at the same time taxed my dexterity. My only gripe about the ergonomics concerns the concentric TUNING (ENCoder) knob and surrounding VOLume ring. It was just too easy to inadvertently alter the volume setting while tuning.

A 16-key keypad offers one-touch access to most-commonly used functions. Each button is dual-function.

Rousting the Repeater

I employed the tried-and-true method of seeing how much I could figure out on my own about the TH-F6A with minimal assistance from the *Instruction Manual*. It's remarkably easy to figure out—and I say that as someone who remains baffled by his current dualband H-T even after owning it for more than five years now. Getting the TH-F6A up and running on a couple of the local machines was straightforward. To make this painless, the *Instruction Manual* includes a page called "Your First QSO" that outlines the bare essentials to get you on the air on simplex. It's not a big leap to accessing your local machine.

Repeater operation is simplified by the inclusion of the automatic repeater offset feature (in the US version only) that follows the ARRL band plan. Dial up or enter a recognized repeater frequency, and the TH-F6A automatically adds or subtracts the proper offset on transmit. It took a couple of minutes more to figure out how to set the CTCSS tone, mainly because the H-T expects you to activate the tone function on a given channel before you select the necessary tone from the 42 available (some VHF-UHF transceivers offer 50 different tones).

The 'F6A offers a feature I don't recall seeing before (although it seems I'm always more than a few degrees behind the curve anymore). It's called *Automatic Simplex Check*, or ASC. When communicating with someone through a repeater and with ASC enabled, the H-T periodically checks the strength of the other station's simplex (input) signal. If the system determines that the signal is strong enough for direct contact, a blinking "R" will appear in the display. The trick here—at least for someone my age—is seeing the tiny blinking icon, but it's a neat idea—despite the fact that my experience has been that few operators who already know they're within simplex range actually will elect to vacate the repeater. Whether this phenomenon owes to sloth or poor operating habits I'll leave for you to decide, gentle reader.

Tone scan is a feature users have come to expect and even rely on these days, especially as more and more repeaters have enabled CTCSS tones for access. On the TH-F6A engaging this is as simple as pressing the F (function) key then holding the TONE button for a second. You can reverse the scan direction with the TUNING knob or by using the MULTI-SCROLL KEY.

When the unit identifies the CTCSS tone on the signal, it beeps. But that's not all! The 'F6A then lets you program the CTCSS tone it detects (to replace one already programmed). One caveat here: for this to work, a repeater has to "pass" the tone (some repeaters filter the tone from signals before re-transmitting them). Otherwise, you'll have to scan another station's input signal. A similar feature lets users scan and identify DCS (digital code squelch) tones too, using the *DCS Code ID* feature.

A Multiplicity of Memories

You could eat up gobs of time just trying to come up with enough frequencies to fill the 400 memories the TH-F6A has to offer. These are arbitrarily divided into eight groups of 50 apiece (GP 0 through GP 7). While it really does not take that much cranking on the tuning (ENC) knob to whip through the memories, there's a much easier way to access a programmed memory slot (I discovered upon closer reading of the *Instruction Manual*). You can use the keypad to simply enter the number of the desired memory channel. Unfortunately, this works only for channels that have already been programmed; you can't use the keyboard to jump to an open memory slot. You also cannot use the keypad to recall the program scan, information or priority channels, either. Bummer!

If you've got a lot of channels in memory, you can take advantage of the memory group function to access the desired memory channel more quickly. This gets you to the lowest memory channel number in each group (assuming you've programmed at least one channel in that falls into a given group).

The TH-F6A also lets you copy data from a memory channel to the VFO or from one memory channel to another. Dedicated *Call* channels can be programmed on 2 meters, 1.25 meters and 70 cm for your favorite repeater or simplex channel for quick access via the

CALL button (naturally).

Under typical circumstances, you can store the expected parameters in any memory—including receive, transmit and tone frequencies, whether the tone (CTCSS or DCS) is enabled, offset, step, mode, and even reverse on and fine tuning on. Exceptions include the inability to store "reverse on" or offset frequency or direction when programming an "odd split" (think W6NUT repeater here).

Let's not forget the dedicated memory channels. There are 10 information (I) channels—default programmed for the NOAA weather radio band channels—plus 10 program upper (U) and 10 lower (L) scan limit channel pairs and two priority (P) channels.

I derive great pleasure from applying "labels" to memories. The TH-F6A lets you apply alphanumeric labels of up to eight characters to memory channels using both upper and lower-case letters plus numerals and a wide range of other characters. The TH-F6A can be set to display the name whenever you go to the memory recall (MR) mode (this is the default), although you can opt to display the actual frequency with a single keystroke.

If you like the military approach—or if you have selected tactical channels for a public service or emergency event and want everyone reading from the same sheet of music—you can set up the 'F6A to display just the memory channel numbers. This is a power-up mode that also limits the functions you can access from the keypad controls. This could prove extremely convenient if someone else, say a fellow club or ARES member, needs to borrow your H-T in a pinch for an event or activation.

One menu item lets you determine whether you want the TH-F6A to recall any and all memories—regardless of band—or only the memory channels in the band that's currently active. This is handy, especially if you have programmed multiple channels (and possibly in no particular order) in various parts of the spectrum. Enabling "ALL BANDS" for memory recall is a bit like pressing the random play button on your CD player. It lets you scroll through adjacently programmed AM stations, TV audio channels, shortwave broadcasters and repeaters with impunity.

Scan City

The TH-F6A offers scads of scanning options, including an all-memory-channel scan, band scan or programmed scan. It's really simple to set up scan limits (upper and lower) for programmed scans. This works very smoothly. You also can do a MHz scan at the press of a button. It will scan the 1-MHz segment you happen to be tuned to.

In addition, the little unit gives you the ability to scan a memory group or to select two or more groups to scan using the *Memory Group Link* function, plus you can do a call scan or priority scan, an information channel scan and something called *Visual Scan*. This lets you visually monitor frequencies near your operating frequency. It graphically displays the busy status of frequencies (five above and five below, depending on the frequency step size you have selected). The height of the vertical bars relates to their signal strength.

Performance Notes

Size, ease of use, extended receive and great battery life are among the best features of this little H-T. In terms of those liabilities alluded to earlier, I'd have to include the rather mediocre dynamic-range numbers measured in the ARRL Lab (see Table 1). On 2 meters, for example, it was 60 dB (noised-limited) at the Lab's standard 20-kHz offset. At 10-MHz spacing, you'd expect the dynamic range number to be significantly higher, but it only went up another 13 dB.

A recent "basic" 2-meter H-T we reviewed had dynamic range of more than 90 dB at the 10-MHz offset.

For those with little appreciation for numbers, let's just say the lower figures we measured (they were comparable on the other VHF and UHF bands) mean the 'F6A is less immune to the effects of nearby signals.

IF image rejection was rather modest on 2 meters as well, but better on 222 and 440 MHz. I quickly discovered that a strong repeater will "bleed" considerably into the adjacent channels. For example, the nearby 146.94 MHz repeater slopped over 10 kHz or so on either side. It's also possible that this H-T could run into difficulties in the presence of multiple strong signals in the VHF or UHF spectrum as a result of what's commonly called "intermod," although I didn't experience this while I was using the unit.

I did notice the presence of certain signals that were audible without any antenna attached—so-called "birdies." Kenwood acknowledges that the A Band receiver generates "internal spurious harmonics." The manual outlines numerous cases for "internal beats." These primarily occur when the A Band receiver is a multiple of 59.85 MHz (the A Band's first IF).

One of the major reasons someone would buy an H-T like this is because of the expanded receive coverage, which—as already mentioned—includes HF. The TH-F6A uses only the B Band for wideband reception.

A little digression here: There are two onboard antennas on the 'F6A. Kenwood calls the rubber duckie a "wide-band helical antenna." For reception above 10.1 MHz, the unit uses the rubber duckie; below that frequency, an internal ferrite-loop antenna automatically switches in (Kenwood calls it a "bar" antenna). The user can enable or disable the "bar" antenna via a menu setting.

The good news is that you can flip on the TH-F6A with just the rubber duck or "bar" antenna enabled and usually hear a few signals on the HF amateur and broadcast bands. The bad news is that they'll have to be at rock-crushing signal strength for you to hear them very well. Using just the attached flexible whip or the internal "bar" antenna, I got fair results on the HF broadcasting bands, but amateur signals were much harder—and often impossible—to detect. Since we'd measured reasonable sensitivity on HF (–125 dBm—maybe 10-15 dB worse than the desktop transceiver I have sitting at home), I found this a bit puzzling.

Kenwood concedes in an *Addendum* to the manual that the supplied flexible whip "may not be suitable for the frequency you want to receive" and advises users to "use an appropriate antenna for the frequency if the sensitivity is low." Kenwood failed to further explain what it considers an "appropriate antenna," however.

Connecting the TH-F6A to an HF multiband dipole (you'll need an SMA adapter) only made things worse. It sounded as though every signal in the HF spectrum were coming through—all at once! Even engaging the attenuator didn't help. The answer turned out to be a compromise. I obtained satisfactory results—particularly on the amateur bands—while using an HF mobile antenna system. The TH-F6A does not have single-signal reception, so on either SSB setting, you'll hear the signal on both sides of zero beat.

Given the rather limited IF filtering (Kenwood calls it a "general purpose" IF filter), HF SSB or CW reception is pretty "broad." Even with an optimal antenna attached, you'll find selectivity is compromised, although we did not test for two-tone, third-order dynamic range on the HF bands. Anyway, the HF reception is almost a gimme on this radio, so as long as your expectations aren't too high, you'll enjoy what it has to offer. And to borrow a phrase from Dirty Harry, an H-T's gotta know its limitations.

Other Really Neat Stuff

- The 76×16 dot matrix LCD display is small but commodious, and you can il-

luminate it and adjust the contrast—although some legends are pretty tiny.

- The display includes a multisegment S/power meter. It reads out in S units in receive.
- The radio comes with a 1550 mAh 7.4 V lithium ion battery pack. It seemed to hold up quite nicely under typical use.
- A simple display gauge—available at the touch of two buttons—lets you monitor the battery level: three bullets for high, two for medium and one for low (no bullets mean it's time to recharge or the battery's dead—but you'd probably already know that). If you're charging the battery, the display will show CHARGE. You can engage a feature that will change this indication to STANDBY once the battery charging cycle is complete.
- The DTMF audiodialer is convenient for autopatch or other repeater control functions. You also can name the DTMF memory positions.
- The fine-tuning feature is necessary for trying to listen to CW or SSB signals. The step size is adjustable—from 33 Hz to 100 Hz (the default), 500 Hz and 1 kHz. Fine tuning only works below 470 MHz and it does not work in the FM mode.
- There are two choices for FM deviation. The default is ±5 kHz, but if necessary, you can drop it down to ±2.5 kHz.
- A *Beat Shift* menu function lets the user slightly shift any spurious signals from the CPU clock oscillator from interfering with a desired signal. I came across a loud "birdie" on 157.3 MHz. Actuating the beat cancel function shifted the heterodyne to 157.270 MHz.
- VOX (voice-actuated transmit) is a potentially handy inclusion on the TH-F6A and permits hands-free operation of the H-T—great for public service applications. You need to use a headset to use VOX, since there's no anti-VOX feature. You can set the VOX gain and VOX delay via the menu. When using VOX, you lose the second band display. It's replaced by the VOX gain and VOX delay settings.
- It's possible to use the TH-F6A to remotely control certain models of Kenwood multiband mobiles using control codes.
- The 'F6A is particularly easy to pack for travel, although you'll probably be forced to bend the flexible antenna at least a little. The rubberized radiator is a little sticky, however, and I found that it quite quickly collected a coating of lint and pet hair.
- You have a choice of three transmit-power levels. With the battery pack, high is around 5 W, low is around 0.5 W and extra-low is almost too low to be measured with known instruments. Well, not quite. With the battery pack, we measured the output at the "EL" setting to be anywhere from 50 to 100 mW. With external power, the low and extra-low settings jump to around 2 W and 0.5 W respectively.
- You can program the VFO to tune only a particular range.
- It's possible to use an optional interface cable plus software to manage the memories in the TH-F6A using your PC. The best part here is that Kenwood offers the software free for downloading via its Web site!

Odds and Ends

- Portions of the *Instruction Manual* are very elementary—sometimes annoyingly so—although it's never cute. The manual offers solid examples of how to perform basic functions. The edition that came with our unit was in English and Spanish. Curiously, the only languages the menu on our unit lets you select are English and Japanese.
- The TH-F6 can operate at up to 14 V. Kenwood says it considers 12 V to be the "optimal voltage."
- The attenuator is nominally 20 dB. It works on both bands at the same time; it cannot be set independently on each band.

The "key beep" that sounds when you press a button on the H-T emits an aural cue when direction is involved, such as when using the joystick controller in the UP/DWN function. The tone is higher when going "up" and lower when moving "down."

- The charger that comes with the TH-F6A is larger and heavier than the H-T. In fact, it's almost as large as the charger/power supply for my older laptop PC. The manual cautions against using it to charge batteries other than the lithium ion pack.

Wind It Up, Baby!

On balance, the Kenwood TH-F6A offers a lot of features for a unit in this price range—most notably transceive ability on three bands plus wideband receive—while still maintaining reasonable all-around performance.

I found this radio as simple and straightforward to program and use as any you're likely to find, and most of the others won't have nearly so much to offer in the way of frills.

Kenwood followed the Goldilocks principle here, by and large. Most hams will find that the TH-F6A is "just right."

Manufacturer: Kenwood Communications Corp, 2201 Dominguez St, Long Beach, CA 90810; 310-639-4200, fax 310-537-8235; **www.kenwood.net**. Manufac-turer's suggested list price: $449.95 Typical current street price: $390. List prices of selected optional accessories: BT-13 alkaline battery case, $25.95; PG-3J cigarette lighter cord, $36.95; PG-4P PC interface cable, $32.95.

Cushcraft A627013S 6-Meter/2-Meter/70-Cm Yagi Antenna

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Assistant Technical Editor

Over the last few years we've seen an ever-increasing variety of multimode/multiband HF/VHF/UHF transceivers appear in the ham radio marketplace. Assembling a fixed-station antenna farm that will allow you to take full advantage of the frequency agility of these modern marvels, however, can be challenging.

The most common "bonus" bands on this relatively new breed of radios are 6 meters, 2 meters and 70 cm. If you're fortunate enough to be one of the many whom have recently added one of these rigs to their collection—and already have antennas up for the HF bands—you are now likely in search of some effective radiators for VHF and UHF. Let's see what the Cushcraft A627013S can bring to the party.

Bottom Line

A great match for the new multiband wonders! The Cushcraft A627013S can add respectable 6-meter, 2-meter and 70-cm capabilities to your existing HF-only antenna farm.

Three Yagis, One Boom

The A627013S embodies three separate multi-element arrays. Five-element 70-cm and 5-element 2-meter Yagis are mounted vertically on opposite sides of the boom. A 3-element 6-meter Yagi is positioned perpendicular to these—the director and driven element actually pass through the planes of the other arrays.

Those already familiar with Cush-

Table 2
Cushcraft A627013S
Triband Yagi Antenna

Manufacturer's Claimed Specifications

Frequency Coverage: 50-54, 144-148, 430-450 MHz.
Number of Elements: 6 meters, 3; 2 meters, 5; 70 cm, 5.
2:1 Bandwidth (MHz): 6 meters, ≥1; 2 meters, ≥4; 70 cm, ≥10.
Power Rating (PEP): 6 meters, 1000 W; 2 meters, 350 W; 70 cm, 350 W.
Boom Length: 103.5 inches.
Longest Element: 119 inches.
Turning Radius: 74 inches.
Mast Size Range: 1.25 to 2.0 inches.
Wind Load: 2.52 square feet.
Weight: 9.5 lbs.

craft's amateur antenna line may recognize the A627013S as an amalgam of two of its other products: the A270-10S 2-meter/70-cm Yagi and the A50-3S 6-meter Yagi. Close comparisons will reveal that the 70-cm antenna elements are positioned slightly farther forward on the boom of the '13S than they are on the '10S—most likely to reduce interaction with the 6-meter array.

Piece By Piece

Cushcraft's nine-page *Assembly and Installation* instructions are excellent. (Have a look for yourself; a PDF version is available on the company's Web site.) The booklet starts out with a page of tips on antenna location, mounting, grounding, assembly and tuning. Next is a "Master Parts List" that provides "key" designators and Cushcraft parts numbers for the antenna's 189 parts. (*Don't panic!* A significant portion of these is screws, nuts and washers.)

The assembly process is divided into seven steps. Each step is about a page long and includes some brief text and very detailed "exploded view" line drawings. The specific components called out in that stage of assembly conveniently appear in tables on the same page. The tables include pictorial depictions of the individual parts—right down to the hex nuts and washers! The parts shown in the exploded-view drawings are clearly identified by their corresponding two- or three-digit key numbers.

Tooling Up

Assembly requires only a few common hand tools: a medium-sized standard screwdriver; $^{11}/_{32}$, $^{5}/_{16}$, $^{7}/_{16}$ and $^{1}/_{2}$-inch hex wrenches; and a tape measure. All dimensions are given in both US and metric units of measure.

I recommend that you get nut drivers for the two smallest hex sizes. These work much better than wrenches for tightening the small fasteners used on this antenna, and are the perfect tool for cranking stainless steel worm clamps. You'll need some electrical tape and a knife as well.

Let's Dig In!

The antenna comes packed in $10^{1}/_{2}$-pound $4^{1}/_{2} \times 4^{1}/_{2} \times 51$-inch shipping carton. After popping the box open and spreading its contents out on my patio, I began to have serious doubts that I had enough parts to put together the impressive-looking array pictured on the front of the instruction booklet.

I spent a couple of minutes sorting out the various element and boom components into associated groups (see Figure 1). Things were already looking much better.

The bulk of the small hardware pieces—screws, nuts, washers and clamps for example—come packaged in two double-bagged factory-sealed plastic bags. This made me feel confident that I could dive right into the assembly process without taking the time to perform a full-blown inventory of every tiny piece. Cushcraft didn't disappoint me...much. When all was said and done the only thing missing was a $1^{1}/_{4}$-inch plastic end cap that seals the back end of the boom. While I'm sure Cushcraft would have been happy to send me one, I found a suitable replacement at my local home center.

Assembling this antenna will take awhile. From the time the parts hit the patio blocks to the point when I was ready to clamp the finished antenna to a mast and hook up the coax cables was a little over two hours. Allow me to offer a few tips that might serve to enhance your enjoyment of the assembly experience.

Assembly Tips, Tricks and Techniques

Choose your location for this project carefully. A driveway or garage floor is much less likely to swallow up a handful of the 60-some-odd small nuts and washers than a grassy knoll. At the very least, spread out a large drop cloth before you rip open any hardware bags.

Perhaps the most challenging phase of construction is Step 2: "Reddi-Match

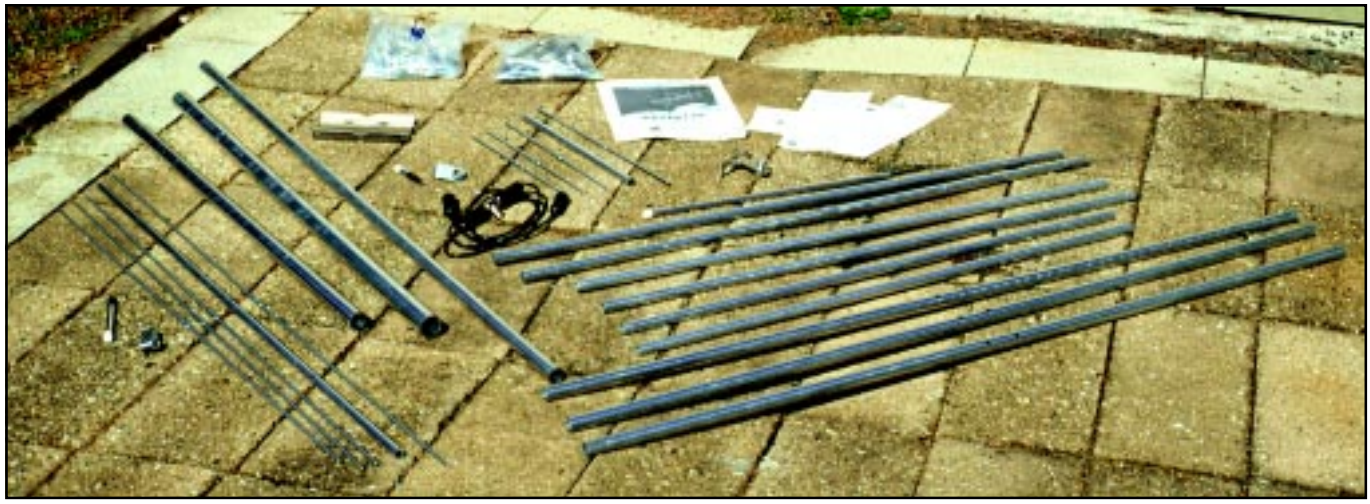


Figure 1—The parts of the A627013S presorted into piles of associated components and ready for assembly.

Assembly." In this stage you'll be building the driven elements/gamma match assemblies for the 2-meter and 70-cm arrays. Gather up all the pieces shown in the corresponding table (measure the machine screws to verify that you've got the right ones), grab your screwdriver, 5/16-inch nut driver, tape measure and page 4 of the *Instructions*, and head for a workbench.

There are several different ways to put these together upside down or backward (I'm convinced I stumbled on *all* of the possible combinations). Begin by passing the long screws that secure the coax connector mounts to the driven elements—and eventually the boom—through the holes in the components and temporarily thread nuts on them (if you don't—*well, you'll see!*). Before you head back to the assembly site with these completed components, carefully compare them to the diagrams and make absolutely darn tootin' you've got everything pointing in the right directions. (Yes, I know the photograph of the antenna that appears on the cover of the booklet has the matching arms pointing in the exact opposite directions as those shown in the instructions. It probably doesn't make a lick of difference—but stick with the way they're depicted in at least two of the diagrams in the assembly steps just in case! Careful inspection will reveal that the antenna in the cover photo also has the entire 70-cm array positioned farther back on the boom—*hmmm*…)

Once you've got all of the 2-meter and 70-cm elements fastened to the boom, you'll encounter your next obstacle. Until this point, the project was essentially one-dimensional. In order to fasten the three 6-meter elements perpendicular to the already-installed elements, you'll need to come up with a way to support the boom so that the 2-meter and 70-cm elements are in a vertical position. After pondering the situation for several minutes (think "807") I came up with a solution. I located a 5-foot section of mast I had kicking around and hammered one end of it into the ground a foot or so. I skipped ahead in the instructions a couple of steps, mounted the boom-to-mast clamp, and fastened the partially constructed antenna to this temporary support. At this point it was a simple matter to bolt on the 6-meter elements and (using a tuning chart in the instructions) set the lengths of the elements and position of the tuning strap on the gamma match for resonance in my favorite part of that band.

It immediately became apparent that the completed A627013S is very "front heavy." The center of gravity is considerably further forward on the boom than the point where the boom-to-mast clamp is located. The antenna is designed this way to avoid interactions between the 2-meter and 70-cm arrays and your (most likely) conductive mast material. While this really isn't a big deal, it will translate side forces to antenna supports and rotators. Cushcraft recommends using a medium-duty rotator to turn this relatively small antenna, and I suspect that this is partially due to the added strain that results from the unbalanced load.

Take extra care when you are handling this antenna on a roof or tower. While the total weight is under 10 pounds, the offset center of gravity and the 3-dimensional shape of the '13S makes it a bit unwieldy—particularly at that point when you are attaching the boom-to-mast clamp to the mast. *And wear safety glasses*—it's a real "porcupine." (I don't *wanna* be a pirate!)

The Wide World of VHF and UHF

I set up the antenna on a 20-foot portable mast. Two separate feedlines are required—one connects to a "T" harness that feeds the 2-meter and 70-cm arrays, and a second attaches directly to the 6-meter array. Use the lowest-loss coax you can afford. While you might be tempted to settle for RG-8X, the loss through 50 feet of that cable at 70 cm is nearly 3 dB (half of your power—and receive signal strength—will be lost in the feedline!).

I made some informal checks of SWR and 2:1 bandwidth with both a common VHF/UHF SWR meter and a popular antenna analyzer. I observed measurements that closely coincide with Cushcraft's claimed specifications for these parameters (see Table 2). With the tuning bars of the gamma matches set precisely at the positions recommended in the instructions, my antenna's 2-meter resonant point was close to 147 MHz. The 70-cm resonant point was in the neighborhood of 434 MHz. The instructions include a section on making adjustments, if so desired.

The vertically polarized 2-meter and 70-cm arrays on this antenna are particularly well suited for FM repeater and FM simplex applications. Repeaters and mobile stations will almost always employ vertical antennas. Weak-signal (SSB and CW) operators on these bands, however, will often set up their antennas for horizontal polarization. Cross polarization over relatively short paths (where a station using a horizontally-polarized antenna is communicating with a station using a vertically-polarized antenna) can result in a whopping 20 dB of additional path loss. Longer paths and enhanced propagation mechanisms—such as ducting and E-skip for example—will skew a signal's polarization, though, and this makes station antenna polarization less of an issue. What this all boils down to is that while you may not be the strongest signal into the regional 2-meter or 70-cm CW or SSB net, when the bands are open over enhanced paths you'll be on pretty equal footing—at least polarization-wise—with the rest of the weak-signal gang.

Using parallel (or perhaps this would be "perpendicular") reasoning, I'd say the 6-meter portion of this array is probably best suited for weak-signal operation on that band. While you can definitely use it for casual local 6-meter FM repeater and simplex operations, its horizontal polarization coincides with that more typically used for CW and SSB operation.

Cushcraft's claimed forward gain and front-to-back ratios—while perhaps optimistic for these interlaced arrays—are on the order of what could be expected from optimized individual Yagis of the same boom lengths and numbers of elements. (See Chapter 11 of *The ARRL Antenna Book* for a more complete discussion of this topic.)

It's also important to note that the claimed performance figures are at the specific design frequencies of the individual arrays. While the telescoping 6-meter elements allow for precise length adjustment of all three elements, the 2-meter and 70-cm element lengths are fixed. As you tune those two arrays away from their design center frequencies (down to the extreme low end of band for weak-signal work on 2 meters, for example), the gain and front-to-back ratio will—of course—be somewhat degraded.

Nevertheless...

Overall, I think the A627013S is a great choice for adding 6 meters, 2 meters and 70 cm coverage to an antenna arsenal. Its relatively small size and light weight would allow you to easily stack it on the same mast above an existing HF Yagi. It can also be partially disassembled for occasional hill topping or Field Day use.

If you're looking for a decent directional antenna to connect to the 6-meter/VHF/UHF antenna jacks on one of those new multiband wonders, perhaps Cushcraft's got you antenna!

Manufacturer: Cushcraft Communications Antennas, 48 Perimeter Rd, Manchester, NH 03103; 603-627-7877, fax 603-627-1764; **sales@cushcraft.com**; **www.cushcraft.com**.

Price: $169.95. QST

RIGblaster Plus

Computer sound card interfaces began as basic units—they offered transmit/receive switching, audio matching and little else. But as more amateurs discovered that they could put their computers to work as multimode tools (PSK31, RTTY, SSTV, etc), there was a need for interfaces that could streamline station operations.

The RIGblaster Plus from West Mountain Radio represents this new interface generation. The RIGblaster Plus essentially automates the entire interfacing process, bringing all switching and audio-routing functions under its control.

Installation

At about the size of a small paperback book, the RIGblaster Plus can find a home on just about any station desk or table. You're supplied with all the cables you need, along with a "wall wart" 12-V dc power supply. As they say on TV, no additional purchase required.

The first thing you have to do is configure the RIGblaster's internal jumper block according to the wiring of your radio's microphone jack. The RIGblaster Plus manual only provides jumper positions for radios with eight-pin round screw-on connectors. If your radio uses an RJ45 mike connector, you'll need to get optional adapter cables. West Mountain Radio can provide details on the proper jumper settings for those transceivers.

The rest of the installation is straightforward—a cable between the accessory jack on your transceiver and the computer sound card input for receive audio, and a cable from the sound card output to the RIGblaster Plus. There is a small potentiometer on the back panel that you can use to adjust the audio level to the interface. As long as you don't change the sound card settings on your computer, this is a set-once-and-forget operation.

One Serial Port, Three Applications

Unless an interface uses VOX switching, you need to run a serial cable between your computer COM port and the interface. This allows the computer to send transmit/receive switching pulses to the radio. The only problem arises when you want to use the computer serial port for FSK RTTY or CW keying. Now you have to disconnect the interface serial cable and install another, or use a serial switch to select between the sound card interface and your FSK or CW keying device. Not so with the RIGblaster Plus.

The RIGblaster Plus automatically isolates and routes FSK and/or CW keying pulses from a *single* serial cable to ports on the back panel of the interface. So, a single serial cable does triple duty: microphone PTT switching (for modes such as AFSK RTTY, PSK31, MFSK16, SSTV and so forth), FSK keying and CW keying. When you have the RIGblaster installed, all of this is transparent. You simply boot up the software for the mode you desire and go—at least that's how it should work.

In my case, pilot error intervened. I had blithely ignored the little serial jumper block (separate from the main block) because I assumed that its default settings would work just

fine for keying my transceiver using FSK in the RTTY mode. Wrong! Instead of the dulcet songs of RTTY, I was transmitting dead carriers. The problem boiled down to the fact that both of the RTTY programs I use (*WriteLog* and *MMTTY*) do their FSK keying using the TXD line on the computer's serial port. I needed to reconfigure the RIGblaster Plus serial jumpers to allow the interface to work with the signals on the TXD line. The bright diagnostic LEDs inside the RIGblaster were a huge help. The moral of the story is to check and re-check the jumper blocks. Assume nothing.

Automatic Microphone Switching

If you operate the digital modes, you've probably heard *hot mike syndrome* more than once. That's the condition where the operator is sending in his or her mode of choice (PSK31, for instance) without realizing that the microphone is on and operating at the same time. Hot mike syndrome treats the world to a symphony of audio from the unknowing ham—background music, *very* private conversations, you name it.

Fortunately, this can't happen when you're using the RIGblaster Plus. Your microphone plugs into the RIGblaster and the RIGblaster controls audio routing to your radio. When you're transmitting from your computer, the microphone is automatically cut off. However, you can still grab the mike and transmit, which will seize control of the interface and instantly interrupt the audio stream from your PC. I love this feature for SSTV contacts. I can hold the mike in one hand, click my computer mouse to send an image after I announce the mode, and then be ready to resume talking after the image is sent. Once again, no cables to connect or disconnect and no switches to manipulate.

Conclusion

Other RIGblaster Plus features worth noting include the 1/4-inch headphone jack on the front panel and a PTT/footswitch jack on the back panel. The RIGblaster Plus also comes with a CD-ROM that includes over 65 programs including freeware for almost every digital mode plus voice and analog modes.

Besides performance and good looks, the RIGblaster Plus sets a new standard for convenience and elegance. Thanks to the RIGblaster's ability to centralize the all audio and switching connections between your computer and your transceiver, what may have been a phone-only station can easily become a facility for CW, packet, SSTV, PSK31, RTTY, MFSK16 and more. *Manufacturer: West Mountain Radio, 18 Sheehan Ave, Norwalk, CT 06854; 203-853-8080;* **www.westmountainradio.com**. *$139.95.* QST

Steve Ford, WB8IMY ♦ *QST* Editor

The Protector

Think of *downconverters* as your rungs on the ladder to microwave. They're elegantly simple in function. A downconverter receives signal energy at one frequency and converts it to a lower frequency. This makes it possible for you to listen to, say, a 2.4-GHz signal on a radio that only receives as high as 2 meters. The downconverter conveniently transforms the microwave signal so that you can eavesdrop with your "normal" receiver—or, more likely, *transceiver*.

And there's the rub.

If you're receiving microwave signals using one of today's HF/VHF multiband transceivers (the ones that usually include all-mode capability on 2 meters), you are undertaking a certain amount of risk. You may be the most careful operator on the face of this planet, but I'm willing to bet that the day will come when you accidentally key the wrong radio. You may be working OSCAR 40, transmitting on 435 MHz and listening to 2.4 GHz with your nifty downconverter feeding your HF+6+2-meter rig. In a scramble to work that new DX station you'll grab the wrong microphone and blast substantial wattage into the downconverter, instantly dispatching it to radio heaven.

I've done this myself. The funny thing about RF energy is that you rarely get a second chance. Unless your downconverter is built like battleship, just a few watts is all it takes to roast the sensitive components. In a fit of impatience I once managed to key 100 W into a microwave downconverter. I recall shouting "No!" at the very instant when I recognized what I was doing—as if that would somehow prevent the inevitable. Before the sound of my cry even reached the drywall in front of me, the downconverter was gone.

In my OSCAR 40 article in the September 2001 *QST* ("OSCAR 40 on Mode U/S—No Excuses!") I opined the following:

"Perhaps some clever amateur will come up with a circuit to sense RF from the transceiver and automatically protect the downconverter."

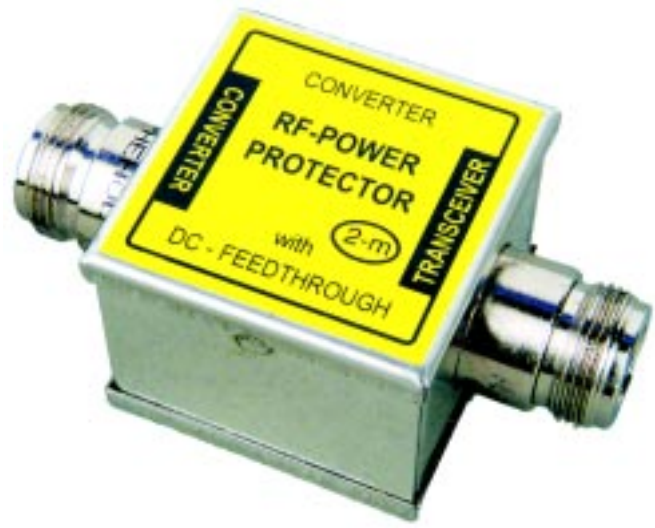
Guess what? The remedy has arrived from SSB Electronic and it's called *The Protector*.

The Protector

You can hold The Protector in the palm of your hand with room to spare. It only measures $1^1/_2 \times 1^1/_2$ inches. The Protector's tiny metal cube is sealed, so I couldn't get a peek inside, but it feels remarkably dense. There is a female N connector on one end marked "Converter" and a female N on the opposite end marked "Transceiver."

The Protector installs at the output of your transceiver, typically with a short coax jumper. Once that's in place, the coax to your downconverter attaches to the "Converter" connector and you're all set. Insertion loss is less than 0.1 dB. The Protector also passes dc, so it won't present a problem if you use the coax to feed power to your downconverter.

The Protector is rated for 50 W SSB/CW and 30 W FM. This may not sound like much, but it is adequate for most applications. Even if you blast higher levels of RF into The Protector, chances are it will still save your downconverter. This is because most modern rigs include SWR protection circuitry that automatically reduces RF output when the SWR rises above 2:1. When The Protector is active, it not only acts as a limiter, it also creates a gross mismatch, forcing the output to nearly nothing in a fraction of a second. If you're uncertain about whether your transceiver includes SWR protection, check the manual before you depend on The Protector to shield your downconverter. If you choose to use The Protector with a non-SSB Electronic downconverter, check with the manufacturer and make sure its output stage can safely tolerate 150 mW of RF at 2 meters.



ARRL Lab Testing

We turned The Protector over to ARRL Laboratory engineer Mike Tracy, KC1SX, for testing. He placed The Protector between a Kenwood TS-2000 transceiver and a 50-W dummy load with a microwattmeter (accuracy 2% of reading) to measure the actual RF power reaching the load. Subjecting The Protector to 50 W from the TS-2000 at 145 MHz, Mike determined that the dummy load was shielded from all but 150 mW of power.

Can a downconverter safely withstand 150 mW of RF? It depends on the design. The worst-case scenario is a downconverter that consists of a bare mixer—nothing between the mixer and IF output but some low-loss coax and connectors. In that instance you could see damage at 150 mW, but most downconverters place an IF stage between the mixer and the output. A well-designed IF should be able to handle 150 mW.

It is important to point out that The Protector is designed for use with SSB Electronic downconverters and 144 MHz IFs. The Protector is *not* guaranteed to protect downconverters purchased from other manufacturers, regardless of whether the IFs are at 2 meters. Even so, The Protector has already saved my modified Drake 2.4-GHz downconverter at least once. It is a small investment for a great return in peace of mind.

Manufacturer: SSB Electronic, 124 Cherrywood Dr, Mountaintop, PA 18707; tel 570-868-5643; **www.ssbusa.com/**. *$60.*

Steve Ford, WB8IMY ♦ QST Editor