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PRODUCT REVIEW

Patcomm PC-16000A HF Transceiver

Reviewed by Joe Bottiglieri, AA1GW
Assistant Technical Editor

Nearly three years have passed since we completed our evaluation of the previous version of this HF transceiver—the PC-16000—and reported our impressions, experiences and ARRL Lab measurement data in these pages (see *Product Review*, February 1998).

At that time, Patcomm Corporation of St James, New York was a new player in the Amateur Radio market.

Patcomm no doubt recognized from the onset that competing head-to-head with the big manufacturers was going to be tough sledding.

Certainly, the cachet of being an *American* Amateur Radio equipment manufacturer wouldn't hurt. The company's heritage might possibly generate a twinge of "Made in the USA" patriotism on their home turf, and could perhaps help their products attract attention in the crowded world market.

One thing was for sure—their equipment would have to be unique. It would need to offer something that clearly set it apart from the competition.

An Interesting Concept

The product concept they came up with was pretty ingenious, and maybe a little too far ahead of its time!

Patcomm's PC-16000 (initially released as a PC-1610) was—and, with their new "A" version, I should add—*still is*—the world's only amateur HF transceiver that includes a fully integrated digital mode terminal for RTTY (Baudot or ASCII) and CW operation *built right in*. Plug in the included IBM keyboard and switch the transceiver into either of these modes, press a "decode" button, properly tune in a RTTY or CW signal, and *voilá*—the received message text begins scrolling along the top line of the main display window.

When it's your turn to make the call (in RTTY *or* CW), it's a simple matter of engaging the transmit mode with a couple of keyboard strokes and away you go. Message text typed into the 16-character transmit buffer begins marching across the bottom line of the main display and gets sent out.

Patcomm also took advantage of the keyboard hookup to implement a radio-control-from-the-keyboard feature. Nearly all of the control operations accessible from the keys on the front panel of the radio (and even a couple that aren't) can be remotely accessed using keys or key combinations on the IBM keyboard.

Of course, conventional phone and CW operation is also supported.

Are You Calling My Baby Ugly?

The original PC-16000 seemed very promising but, as those of you who read our earlier review might recall, Patcomm initially struggled with some hardware and firmware problems.

In what some might consider "adding insult to injury," our reviewers didn't pull any punches when it came to expressing their opinions on the look, the feel and the layout of the controls.

Fast forward to Dayton Hamvention '99. A prototype of a new model of the '16000—the PC-16000A—made its debut at the show.

In the process of its transformation into the "A" version, the PC-16000 had received a radical facelift, and the results were nothing short of remarkable.

Some of the highlights? The LCD display window, shamelessly ridiculed for being "too small" in the text of our original write-up, had doubled in size—and so had the "tiny" S meter. The main tuning knob had been replaced with a larger and considerably more attractive alternative.

What had once been a single, confusing mass of 31 buttons tagged with difficult-to-read legends had been divvied up into subgroups of related keys and herded off to separate regions of the front panel. Silk-screened borders marked off their individual territories and the legends for all of the controls were larger and much easier to read.

Six machined-aluminum knobs, bunched close together in a tight pack on the original model, were also paired up and shuffled off to the suburbs.

Both aesthetically and ergonomically, the prototype PC-16000A appeared to be worlds apart from the original '16000. We eagerly anticipated the availability of regular production units so that we could purchase one to see how the changes would affect operation.

Bottom Line

With tremendous improvements in both aesthetics and ergonomics over the original radios of this series, Patcomm has once again captured our attention with this unique, and distinctly American, HF transceiver.

PC-16000A Particulars

Electronically, the new version of the transceiver is very similar to the previous model, but a recap is in order.

The PC-16000A covers all of the amateur bands from 160 through 10 meters and is capable of SSB, CW, AM and FSK operation. (An optional FM board is *still* not yet available. Patcomm reports that customer demand for this accessory has been virtually nonexistent). General coverage receive stretches continuously from about 100 kHz up to 30 MHz.

The transmitter harnesses the power of

Joe Bottiglieri, AA1GW ♦ Assistant Technical Editor

Table 1—Patcomm PC-16000A, serial number 25070D0047

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Frequency coverage: Receive, 0.1-29.9 MHz; transmit, 1.8-2.0, 3.5-4, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.89- 24.99, 28-29 MHz.	Receive 0.2-30 MHz[1]; transmit, 1.77-3.0, 3.37-4.59, 6.98-7.32, 10.08-10.17, 13.98-14.37, 18.04-18.19, 20.98-21.47, 24.87-25.01, 27.98-29.72 MHz.
Power requirement: Receive, not specified; transmit, 22 A.	Receive, 3.3 A; transmit, 21.3 A. Tested at 13.8 V.
Modes of operation: SSB, CW, AM, RTTY.	As specified.
Receiver	*Receiver Dynamic Testing*
SSB/CW noise floor: –128 dBm.	Noise floor (MDS), 500 Hz filter: 1.0 MHz –127 dBm 3.5 MHz –123 dBm 14 MHz –127 dBm
AM sensitivity: Not specified.	1.0 MHz 4.8 μV 3.9 MHz 5.8 μV
Blocking dynamic range: 111 dB, spacing not specified.	Blocking dynamic range, 500 Hz filter: 3.5 MHz 112 dB* 14 MHz 118 dB*
Two-tone, third-order IMD dynamic range, 20 kHz spacing, 93 dB.	Two-tone, third-order IMD dynamic range, 500 Hz filter: 3.5 MHz 92 dB 14 MHz 94 dB
Third-order intercept: Not specified.	3.5 MHz +24.1 dBm 14 MHz +17.6 dBm
Second-order intercept: Not specified.	+54.1 dBm.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz: 31 μV.
Receiver audio output: 2.5 W at 10% into 8 Ω.	2.5 W at 10% THD into 8 Ω.
IF/audio response: Not specified.	Range at –6 dB points, (bandwidth)[2]: CW-N (500 Hz filter): 533-975 Hz (442 Hz); CW-W: 286-1111 Hz (825 Hz); USB-W: 286-1000 Hz (714 Hz); LSB-W: 286-1111 Hz (825 Hz); AM: 102-1020 Hz (918 Hz).
Spurious and image rejection: Not specified.	First IF rejection, 14 MHz, 59 dB; image rejection, 14 MHz, 45 dB.
Transmitter	*Transmitter Dynamic Testing*
Power output: SSB, CW, 100 W (high), AM, 40 W carrier (high)	CW and SSB, typically 107 W high[3], <1 W low, AM: typically 40 W high, <1 W low.
Spurious-signal suppression: 45 dB; harmonic suppression, 50 dB.	42 dB. Meets FCC requirements for spectral purity.
SSB carrier suppression: 40 dB[4].	28 dB.
Undesired sideband suppression: 45 dB with a 1 kHz tone.	40 dB.
Third-order intermodulation distortion (IMD) products: 28 dB.	See Figure 1.
CW keyer speed range: Not specified.	5 to 67 WPM.
CW keying characteristics: Not specified.	See Figure 3.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S9 signal, 120 ms.
Receive-transmit turn-around time (tx delay): Not specified.	SSB, 40 ms. Unit is not suitable for use on AMTOR.
Composite transmitted noise: Not specified.	See Figure 2.
Size (hwd): 3.5×13×12 inches; weight, 12 pounds.	

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.
Third-order intercept points were determined using S5 reference.
[1]Sensitivity reduced below 500 kHz.
[2]See text.
[3]Maximum output on 160 meters was 85 W. Output decreases moderately above 29.0 MHz.
[4]Patcomm specifies this measurement relative to 100 W with no audio input. Their specification was met when tested using this method.
An expanded test result report for this transceiver is available to our members on our Web site. Printed copies are also available for those without Web access.

a pair of bipolar RF transistors, rated for up to 100-W *each*, to deliver 100 W for SSB and CW operation, 75 W for RTTY and 40 W (carrier) for AM.

The small rear-mounted heatsink and the rather massive aluminum chassis are said to supply sufficient heat dissipation to allow the lightly loaded finals to keep their cool. No one will be grumbling about the level of the cooling fan noise emanating from this radio—*there is no cooling fan*.

Fixed-level VOGAD (voice-operated gain-adjusting device) RF speech processing; multiple antenna connectors; variable RF power output (down to under 1-W) and the ability to display the RF power and SWR numerically in the LCD window are all included. The PC-16000A does not contain VOX features or a built-in automatic antenna tuner, however.

The receiver is dual conversion with IF stages at 45 MHz and 455 kHz. The radio employs 2.4 kHz and 500-Hz Rockwell Collins mechanical filters at the second IF. A 6-kHz ceramic filter is used for the AM mode. An optional 1.8 kHz Rockwell Collins SSB filter is also available.

The '16000A makes use of digital signal processing to effectively bracket the passband of the mechanical filters and to generate additional audio level DSP-based filter bandwidths of 1.8 kHz, 250 Hz and 200 Hz. The 200-Hz DSP

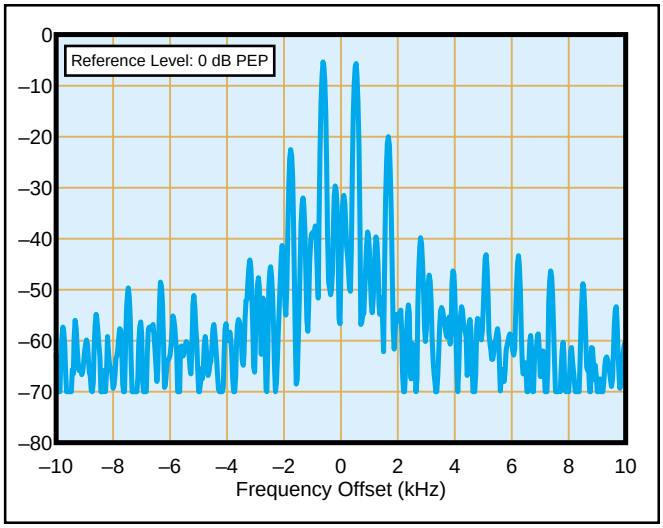


Figure 1—Worst-case spectral display of the Patcomm PC-16000A transmitter during two-tone intermodulation distortion (IMD) testing. The worst-case third-order product is approximately 22 dB below PEP output, and the worst-case fifth-order product is approximately 42 dB down. The transmitter was being operated at 100 W output at 21.250 MHz.

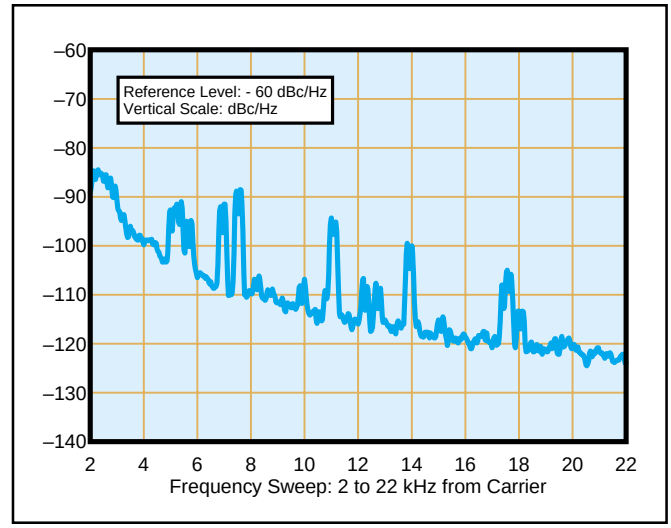


Figure 2—Worst-case spectral display of the Patcomm PC-16000A transmitter during composite-noise testing at 3.520 MHz. Power output is 100 W. The carrier, off the left edge of the plot, is not shown. The plot shows composite transmitted noise 2 to 22 MHz from the carrier. Composite noise is higher than other HF transceivers we've test recently.

filter, available only in the RTTY modes, works in conjunction with the 2.4 kHz and 500 Hz mechanical filters.

In addition to expanding and enhancing the filter capabilities, the DSP also delivers "de-noiser" and "auto-notch" features.

The de-noiser is designed to reduce the level of the background noise. The automatic notch filter, available only when using the 2.4 or 1.8 kHz filter settings, can track and notch up to four constant tones, such as tuning stations and other types of interfering carriers, that appear within the passband of the selected filter. Both features, however, can not be activated simultaneously and are only available in the SSB modes.

Other notables include a manual AF notch filter, an IF shift control, a pulse-type noise blanker, a receive attenuator, selectable AGC, a clock and a 10-minute ID timer.

Easy Now, Big Fella...

The changes that were made in the positions and labeling of the front panel controls makes the PC-16000A much more intuitive to operate.

All of the original 31 control buttons, with the exception of the **MOX**/**CLR** key, now enjoy exclusive membership in one of six key clubs.

Twelve of them, set up in a 4-row/3-column standard keypad configuration, have taken up residence on the far left-hand side of the front panel. Most of these keys perform three different functions.

The label printed above each indicates its primary assignment. These keys are used to control the split frequency, RIT,

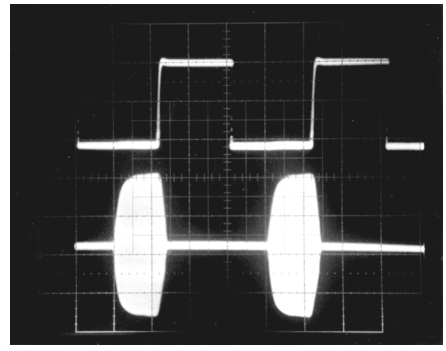


Figure 3—CW keying waveform for the Patcomm PC-16000A showing the first two dits in full-break-in (QSK) mode. The equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14.2 MHz.

QSK, CW spot and RF power/SWR metering features. Most have small red LEDs positioned next to them that indicate the current state of their associated feature.

The button located in the lower left corner of this group, **DIR FREQ**/**E**, is used to evoke the keypad's secondary control capability, direct frequency input. The corresponding digit assignments appear in yellow just to the right of each key.

The button in the lower right, labeled **BAND**/•, enables the keypad's tertiary function—band selection. Touch this key first and the keypad buttons become band keys. The band legends are printed below each key.

Just to the right of this group is a second 7-button set collectively titled **MODE**/**FILTER**. Here you'll find the keys used for mode and filter (mechanical/DSP and DSP-generated) selection, and a button that activates the RTTY/CW decode system.

The primary assignment for these keys is mode selection. Press the **BPF** button (in the 12-button keypad) first though, and five of them will also perform filter selection duties. Vertically oriented pairs of LEDs, located to the right of each key, indicate the present mode and filter setting.

The remaining four less-populated key groups control antenna, memory, tuning and noise reduction related operations.

The first contains just two buttons—**ANT** and **ATTEN**. The **ANT** button is used for antenna connector selection. The PC-16000A provides *three* SO-239 antenna jacks, and you can even program the radio to use separate ones on transmit and receive. Unfortunately, this capability is not available when in the QSK mode. The receive attenuator is specified at 20 dB.

The next group, labeled **MEMORY** and conveniently located just to the left of the main tuning knob, includes **STORE, DIR RCL, SCROLL DN** and **SCROLL UP** keys. The memory arrangement in this radio is unlike any other I've previously encountered. I'll provide details later.

The **TUNING** group, positioned just to the right of the VFO knob, consists of a **LOCK** and a **VST** button. The **LOCK** key disables VFO tuning.

When **VST** (variable speed tuning) is activated, the tuning step size is dependent on the speed of rotation of the VFO knob. The system automatically selects among five different step sizes ranging from 1 Hz for slow rotation up to 10 kHz for rapid spinning. It works *very* well.

The final group, with **AGC**, **NB** and **DSP** keys, is located on the far right hand

side of the front panel. These control the automatic gain control (fast or slow—off is not an option); the noise blanker; and a single key that can activate either the DSP de-noiser or the DSP auto-notch systems.

If anyone should ever doubt the importance of "human engineering" in product development, comparisons made between the ease of operation of the PC-16000A and the PC-16000 would rapidly dispel that suspicion. The PC-16000A is much easier to operate than the PC-16000.

One area that could still stand improvement is documentation. The 27-page manual (in a nice 3-ring binder) is well indexed and thorough, but tables or quick reference cards detailing front panel and keyboard control assignments would be a tremendous asset. A schematic diagram should also be provided.

Motivation for Memorization

The 90 "regular" memories are divided into 9 band-specific groups of 10. Each memory will retain the settings of the operating frequencies (including splits if desired), the mode, the filters, the antenna selector, the tuning speed, the VFO lock, the AGC, the noise blanker, the DSP and the attenuator.

The PC-16000A does not offer band-stacking registers. When you switch bands, the frequency that initially pops up will be the frequency stored in the first of that band's 10 memory slots. This took some getting used too.

With this rig, it's worth the effort to load up the first few positions of each band's memory bank with some strategic "starting" points.

As an example, for the 20-meter memories I programmed in 14.000 MHz (CW), 14.090 MHz (FSK), 14.150 MHz (USB), 14.195 MHz (USB) and 14.350 MHz (USB). Now, when I enter the band by way of the band key, I land on 14.000 MHz (CW) and can immediately begin cranking up through the band. If I want to begin tuning in another part of 20 meters, I use the **SCROLL UP** and **SCROLL DN** buttons to select the memorized frequency that's closest to my target.

In addition to the regular memories, there's also a single "scratchpad" memory. Shortwave and utility listeners should be forewarned that this is the *only* memory that will retain a frequency that's outside the limits of the US amateur bands.

Keyboard Control

For typical phone and conventional CW operation, it's not necessary to attach the included keyboard. I found that operating this radio seemed much easier from the transceiver's front panel controls.

It's conceivable that one might eventually warm up to the idea of using the computer keyboard to control the rig. This would require memorization of the numerous keystrokes and key combinations involved. The keyboard Patcomm provides carries only generic computer keyboard labeling. A keyboard overlay template with radio control assignments printed on it—a suggestion that we offered in our earlier review—sure would help.

Keyboard control however, may offer some advantages to the vision-impaired. They may find it more convenient to key in the radio control sequences on a familiar computer keyboard. One keyboard command that they will undoubtedly appreciate is **Alt-F**. This will initiate an announcement of the transmit and receive frequencies in Morse code. This feature can *only* be accessed from the keyboard.

Computer Connection

The PC-16000A offers keyboard control, but it does not include provisions for controlling the radio via a computer interface for remote control or station automation applications. Cabling the transceiver to your shack computer (or a "dumb" terminal—remember those?) can still offer some advantages though.

There's a 7-pin DIN connector on the back panel that can be connected to your computer's COM port. Make up an interconnect cable, fire up some terminal software and this will allow RTTY and CW text that's being decoded and encoded inside the transceiver to be displayed on the monitor. This can come in very handy.

When I was using the transceiver as a stand-alone digital mode terminal, on a number of occasions I found myself wishing for a way to scroll back through the received text—once it disappears off the left edge of the 16-character LCD screen, it's gone for good. If you forget the other operator's name or call sign, for example, it can't be recovered. With the radio operating in stand-alone mode, you'll definitely want to keep a pad or logbook close at hand for jotting down notes as the text flows by.

With a terminal "buffering" the incoming text, you'll also have an extended opportunity to play "Wheel of Fortune" with text that may have been corrupted by interference or variations in propagation. While the fairly consistent decoding that typically occurs in the RTTY mode doesn't result in too much garbled text, decoding CW by electronic means—particularly under poor conditions—often leads to a need for significant amounts of "text interpretation."

Snakebit

In the early stages of our evaluation of the original version (back in '97), it became apparent that Patcomm was still in the process of ironing out several problems related to the design and manufacture of the transceiver. To their credit, by the time we were ready to publish that review, nearly all of the performance shortcomings that we had encountered and reported to them had been resolved.

Although our criticisms concerning the man/machine interface aspects of the transceiver's design still remained, the underlying performance of the last of several we tested—a transceiver with all the factory updates installed—had been elevated to a respectable level. Most of their claimed specifications were met.

Along the way, Patcomm had managed to improve the CW keying waveform; reduce the phase noise; and increase the spurious signal and harmonic suppression, the blocking dynamic range and the two-tone third-order dynamic range.

This time around, when we initially received our PC-16000A and began our lab tests, we immediately ran into problems with sideband carrier suppression and spot checks of some of the other important performance characteristics turned up several that fell well short of their current published specifications. The transceiver went back to Patcomm for further investigation.

Their service department tracked the difficulties to a couple of cracked surface mount capacitors. Apparently a subcontractor that provides SMD circuit board subassemblies had encountered a bad batch of caps. Patcomm replaced the defective components and sent the radio back to us.

Back to the Bench

Our second series of tests confirmed that the performance of the PC-16000A was as good as—and in some cases, better than—the best of the PC-16000's we looked at back in '97.

The CW keying waveform (see Figure 3) indicated significant improvement. The best keying we observed in the previous model still showed signs of first-dit shortening and very "soft" rise times—not so this time around.

The two-tone third-order IMD dynamic range on 80 and 20 meters scored in the low- to mid-90s and neither measurement was noise-limited. The blocking dynamic range, although noise-limited, topped their 111 dB spec.

Oddly, the IF/audio response measurements for SSB and AM recorded during testing were much narrower than those we observed in any of the earlier units. The Lab investigated further and found that there was a notable frequency roll-off in the audio response that resulted in a decrease in the −6 dB bandwidths. This

made the filters seem—on paper anyway—way too narrow to pass intelligible audio.

On upper and lower sideband, the –6 dB bandwidths measured in the neighborhood of 700 Hz, but a second check at –30 dB revealed that the bandwidths at that lower level were closer to 1850 Hz. For AM, the –6 dB points indicated a mere 900 Hz of bandwidth, but the bandwidth at –30 dB measured 4 kHz. Although a poor IF filter shape factor can lead to this effect, a less than flat audio response (as was the case here) can also produce similar results.

While our Lab data pointed toward receiver audio that would sound seriously constricted, our field observations didn't bear that out. The audio delivered by this radio actually sounds very nice.

Closing Considerations

The PC-16000A exhibits a level of overall performance that's reasonable for a HF transceiver in this price range with basic DSP, built-in Rockwell Collins filters, RF speech processing, keyboard control and an integrated full-featured RTTY and CW digital mode terminal built in.

If you are presently shopping for a conventional HF transceiver and have a particular interest in RTTY and keyboard CW operation, the PC-16000A provides everything you'll need. Simply pull the radio out of the box; plug in the keyboard; lash it up to a suitable power supply and an antenna; and you are in business. No external TNC, no custom-built cabling and *no* personal computer are required.

Thanks to Michael Tracy, KC1SX, and the ARRL Lab for their assistance with this review.

Manufacturer: Patcomm Corp, 7 Flowerfield Suite M100, St James, NY 11780; 631-862-6512; fax 631-862-6529; **patcomm1@aol.com**; **www.patcomm.net/**.

Manufacturer's suggested retail price, $1350.

RadioShack HTX-252 2-Meter FM Mobile Transceiver

Reviewed by Rich Arland, K7SZ
QST *Contributing Editor*

When I contacted *QST* Product Review Editor Joe Bottiglieri, AA1GW, with an offer to do this review, his immediate response was: "How did you manage to get your hands on an HTX-252? RadioShack hasn't even begun *advertising* them yet!"

I had been searching for a 2-meter mobile to install in the very limited space available in my Subaru Outback. When I caught my first glimpse of this radio at the RadioShack booth at the Murgas Amateur Radio Club hamfest back in July, I quickly began to suspect that my quest was nearing an end.

Barry Brutko, the manager of the RadioShack in Wilkes-Barre, Pennsylvania, along with his sales associate Walt Gouse (N3BSX), were manning the booth. Their store had received one of the earliest shipments of HTX-252s. They brought along a few to sell at the show.

I chatted with them, perused the *Owner's Manual*, looked over the list of features and decided to give this little rig a try. Believe me, Barry and Walt didn't have to resort to too much arm-twisting. (We purchased a second HTX-252 to put through ARRL Lab testing and to try out for ourselves. The measurement data presented in Table 2 is from this second unit.—*Ed.*)

Bucking the Trend

Perhaps what is most immediately striking about this transceiver is its diminutive size. The overall dimensions are about $1^{5}/_{16} \times 5^{1}/_{8} \times 4^{7}/_{8}$ inches. This is one *tiny* radio! The weight is well under 2 lbs. I've owned some 2-meter H-Ts that were heavier than this mobile transceiver.

With their introduction of the HTX-252, it appears as if the folks in Fort Worth have decided to carve themselves a niche in the highly-competitive

2-meter FM mobile market by offering an extremely compact, moderately-featured, easy-to-operate transceiver.

This radio represents a refreshing departure from a current trend within the Amateur Radio industry—cram every conceivable bell and whistle into ever-smaller enclosures. Although the resulting products score high on the "Gee Whiz" scale, a significant—and growing—number of hams have voiced their displeasure with the difficulties they encounter programming and operating some of these "fully-loaded" models.

The '252 offers a blend of features that has been distilled down to just a tad more than the bare essentials. You'll find 10 memory channels (11 if you count the "Call" channel); 10 and 25 W RF power output settings; CTCSS encode and decode; extended receive coverage; priority watch, basic memory and VFO scan; and DTMF (for autopatch and repeater control)—and that's about it.

Bottom Line

RadioShack's HTX-252 provides just a smidgen more than the basic requirements for contemporary amateur 2-meter FM communications. What it may lack in "bells and whistles" however, it compensates for with its subcompact dimensions, ease of programming and simplicity of operation.

Some examples of the things that you *won't* find are high RF power output (50 W seems to be typical for VHF mobiles these days), an abundance of memories with alphanumeric tagging, direct frequency input from the microphone keypad and autodial memories. For my requirements, I consider these omissions to be reasonable tradeoffs. We'll revisit this topic shortly, but first let's take a closer look.

Face Front

The front panel of the '252 is remarkably—but somewhat deceivingly—uncluttered. Three rubberized pushbuttons; a volume, squelch and tuning knob; a conventional 8-pin microphone jack and the $^{3}/_{4} \times 1^{3}/_{4}$-inch display window are all you'll find. The "deception" lies in the fact that some of the control operations that are commonly accessed from front panel buttons on other VHF mobile transceivers have been relegated to four control buttons located on the HTX-252's hand mike.

The LCD window displays black segments on an amber background. Icons that show the state of the various settings pop up along the top edge of the window; a 4-section S/RF meter is located in the lower portion. The displayed frequency digits, the memory channel numbers and the icons are large enough for easy viewing. The display illumination level is fixed. Readability is good over a wide range of angles and lighting conditions.

The three chassis-mounted buttons, located just below the display, are labeled **REV**, **VFO/T-SQL** and **MR/MS**. A brief press of the **REV**erse button (when the transceiver is set up for repeater operation) will swap the transmit and receive frequen-

Table 2

RadioShack HTX-252, serial number 203257

Manufacturer's Claimed Specifications	*Measured in the ARRL Lab*
Frequency coverage: Receive, 136-174; transmit, 144-148 MHz[1].	Receive and transmit, as specified.
Power requirement: Receive, 0.6 A; transmit, 5 A (high power).	Receive, 0.71 A; transmit, 4.4 A. Tested at 13.8 V.
Mode of operation: FM.	As specified.
Receiver	*Receiver Dynamic Testing*
Sensitivity, 10 dB S/N: <0.22 μV.	For 12 dB SINAD, 0.14 μV.
Adjacent channel rejection: Not specified.	20 kHz channel spacing: 55 dB.
Two-tone, third-order IMD dynamic range: Not specified.	20 kHz channel spacing: 57 dB. 10 MHz channel spacing: 90 dB.
Two-tone, second-order IMD dynamic range: Not specified.	80 dB.
S-meter sensitivity: Not specified.	Maximum indication: 3.0 μV.
Squelch sensitivity: Not specified.	At threshold: 0.09 μV.
Receiver audio output: 2.5 W into 8 Ω, THD not specified.	2.4 W at 10% THD into 8 Ω.
Spurious and image rejection: 60 dB.	First IF rejection, 94 dB image rejection, 64 dB.
Transmitter	*Transmitter Dynamic Testing*
Power output (H/L): 25 / 10 W.	24 / 9.2 W.
Spurious-signal and harmonic suppression: ≥65 dB	60 dB. Meets FCC requirements for spectral purity.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S9 signal, 220 ms.
Receive-transmit turn-around time (tx delay): Not specified.	95 ms.

Size (hwd): 1.3×5.1×5.5 inches; weight, 1.5 pounds.

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

[1]A special power-on reset procedure, detailed in the manual, will expand the transmit range to 142 to 149.885 MHz for MARS/CAPS operation.

cies. This is a convenient way to quickly determine if a station you are communicating with through a repeater is close enough to attempt simplex (non-repeater) operation.

The **VFO**/**T**one-**SQ**ue**L**ch button is used to move from the memory mode to the VFO mode or, when used in conjunction with a microphone-mounted "function" key, to set and activate the CTCSS encode and decode tones.

The remaining front-panel key—**M**emory **R**ecall/**M**emory **S**tore—switches the radio from the VFO to the memory mode. Hit the function key first though, and this same button will allow you to store any current VFO information—the operating frequency, the duplex value and direction, and CTCSS settings—into one of the 10 memories or the Call channel.

One in the Hand...

The microphone sports a conventional 4-row/4-column DTMF pad. As previously noted, these keys are used for generating DTMF tones only. Frequency or memory channel numbers can not be directly input from this keypad. A slide switch is provided that can disable these keys to prevent accidental DTMF transmission during normal voice operation. None of the keys on the microphone are backlit.

Located just above this keypad is a row of four radio control keys. From left to right, these are **F**/**MHz**, **CALL**/**STEP**, **SCAN**/**PRI** and **LOCK**/**SHIFT**.

Pressing the **F**unction/**MHz** button will evoke the secondary assignments of the other control buttons in this group and those on the front panel. While the radio is in the function mode (this state is indicated by a **FUNC** icon that appears in the display) the main tuning knob and **UP**/**DN** buttons located on the top of the microphone will allow VFO frequency excursions in 1-MHz increments. Touching the PTT button while in the function mode will toggle the radio between the 10 W and 25 W RF power output levels.

Press and hold the **F**/**MHz** button for a second or two and the squelch will open. This is handy for checking for weak signals that may be below the setting of the rotary squelch control or for signals that are obscured by a CTCSS tone squelch setting.

The **CALL**/**STEP** key provides one-touch access to the Call channel. The factory default frequency setting is 146.52 MHz, but the Call channel can be reprogrammed with any simplex or repeater frequency desired. When this same button is pressed while in the function mode, the value of the current tuning step appears in the display. The step size can then be changed using the main tuning knob or the mike's **UP**/**DN** buttons.

The **SCAN**/**PRI**ority key is used to enter the scan mode. If the radio is in the VFO mode, the scan will cover the entire range of the receiver (136 to 174 MHz); when in the memory mode, memory channels will be scanned. Set the squelch knob to an "open" position, and the scan will stop on each frequency step—active or inactive—for 1 second, and then resume. If the squelch threshold is set above the level of the band noise, the scan will pause on an active frequency for 5 seconds before resuming. A specific "memory channel lockout" feature is not included.

Program and enable the priority feature and the receiver will periodically switch to a selected VFO or memory frequency to check for activity.

The **LOCK**/**SHIFT** key can be used to disable five of the seven radio control keys (the **LOCK**/**SHIFT** and the **F**/**MHz** keys are the exceptions). Pressing this same button while in the function mode will permit variations in the duplex magnitude and direction. The factory default setting is 600 kHz (shown as ".60" in the display), but this offset value can be set anywhere between 100 kHz and 8 MHz. Automatic repeater offset (a feature that automatically selects the appropriate duplex direction—+, – or off—for the portion of the 2-meter band to which the radio is tuned) is not included.

The Far Side

The back panel contains a comparatively large heatsink, a chassis-mounted SO-239 antenna connector, a $^1/_8$-inch external speaker jack and a 9-inch long dc power pigtail terminated in a conventional T-type connector. A $5^1/_2$-foot fused power cord with a mating connector is provided for wiring the radio to a 13.8 V dc power source.

An internal speaker is located in the top cover of the enclosure. A simple **U**-shaped mobile mounting bracket, fastened to either side of the chassis with large plastic-capped thumbscrews, facilitates radio mounting above or below a supporting surface and at a range of angles. The thumbscrews make for quick and easy removal or installation—a very convenient setup for those who like to employ one radio for a variety of missions.

And Now, Back to Our Show

Personally, I feel that RadioShack did a pretty good job of condensing the long list of possible features down to the

essentials, but—needless to say—not everyone will be content with their choices.

Folks who like to use the expanded receive coverage of an amateur transceiver for monitoring public service and commercial communications will no doubt whine about the limited number of available memory channels and the lack of a memory channel lockout capability. For my mobile radio shack, I prefer to use a separate dedicated multiband scanning receiver. This leaves my transceiver free for instant (and *simultaneous*) 2-way ham communications.

The expanded receive range, in spite of the limited number of memories, is still handy for *casual* non-amateur listening though—such as for checking a NOAA Weather Broadcast or for listening in on a couple of the local VHF police, fire or emergency medical service frequencies.

Others may be concerned that being restricted to 25 W of maximum RF power output might seriously degrade their effective range. I found that this power level is more than sufficient for my typical communications needs. As most of us know, reducing a transmitter's power from 50 to 25 W only results in a signal strength decrease of about $^1/_2$ of an S unit at a distant receiver. This slight reduction is rarely enough to make a substantial difference in the range of typical FM communications. Pairing this rig with an antenna that provides some gain—such as a $^5/_8$-λ as opposed to a $^1/_4$-λ mobile antenna—could help compensate for this "shortcoming."

An *advantage* of the lower RF power output is the associated reduction in the current requirements. The *Specifications* table in the *Owner's Manual* lists the current needed for 25 W operation as 5 A. This is within the range of what's available from most vehicle cigarette lighter sockets (please refer to your vehicle owner's manual). If you prefer not to have to run dc lines through the firewall and directly to the vehicle's battery, you *may* be able to simply install a cigarette lighter plug on the end of the dc power cord, plug it in, and play. Be aware however, that direct battery connection often alleviates problems with RFI and ignition interference.

While we're on the subject of dc power connection… the power cord that's supplied with the HTX-252 is fused near the *radio* end of the cable. Those making direct connections to the battery terminals (as I did) should fuse the *battery* end of the cable. Otherwise, if the positive lead's insulation is compromised anywhere between the battery terminal and the included fuse holder, and that conductor shorts to ground, the wire will light up like the element inside a toaster! This, my friends, is *not* a good thing.

If you've got packet or APRS applications in mind, you'll be presented with a couple of challenges. The first is programming. You'll want to set your operating parameters—such as the frequency and the power level—*before* you disconnect the hand microphone and connect your radio-to-TNC cable to the 8-pin mike jack. Obviously, the control functions that are accessed from the microphone buttons will not be available once you've unplugged it.

The second challenge is determining the microphone pin configuration for making up an interconnect cable. Unfortunately, RadioShack neglected to include this information in the *Owner's Manual*.

Setting Up Shop

Installation of this transceiver in my Subaru Outback went fairly smoothly, although I must admit that I had to resort to asking a mechanic at my car dealership for his help in locating the fasteners that hold down the center console.

I was able to mount the radio in an existing cubbyhole, but this did require pulling out the console and cutting the back wall out of that compartment. I needed to open up enough space to allow air to freely circulate around the heatsink fins.

I won't go into the specific details of my antenna and dc power cable installations. Needless to say, every vehicle, antenna system and radio mounting configuration will present a unique set of considerations.

Once I had completed my installation, it was time to load the memories. I found the HTX-252 very easy to program. This is not to say that you won't need to refer to the manual initially—you probably will. Once you use the radio for a little while though, you'll be amazed with how quickly you'll become familiar with its programming architecture.

The 39-page $4^1/_4 \times 7$-inch *Owner's Manual* is nicely organized and the programming instructions are simple to follow. A 3-page *Quick Look at the Controls* table is perhaps all that most moderately experienced operators will need to get up and running. About the only deficiencies that I could spot in the included documentation are the aforementioned lack of a microphone wiring diagram and the absence of a schematic.

On the Road and On the Air

What I like most about the HTX-252 (its small size not withstanding) is its ease of operation. This radio's designers did a commendable job of selecting which control buttons to mount on the front panel and which to locate on the microphone. The more commonly needed control operations are readily available from the microphone—a tremendous convenience when operating while underway.

Ergonomically, the only gripe I can come up with is related to the volume and squelch controls. I would have preferred larger knobs and wider spacing, but there is enough "drag" in their action to prevent inadvertent rotation of one while adjusting the other.

Reports from the locals on the quality of the HTX-252's transmit audio have ranged from "very good" to "excellent." Pre-installation checks on my test bench of the available volume level and sound quality using the built-in speaker indicated that these should fit the requirements of most vehicle environments, but my final "cubbyhole" mobile installation necessitated the use of an external speaker. The audio from that speaker sounds marvelous.

ARRL Lab data generated from tests of the HTX-252 that was purchased by HQ (see Table 2) points toward good overall performance.

The FM sensitivity; the 10-MHz offset two-tone, third-order IMD dynamic range; and the first IF rejection numbers all compare quite favorably with those posted by other recently-reviewed VHF FM mobile transceivers. The image rejection figure however, does fall considerably short of the running average for this measurement, but it still easily meets RadioShack's published specification.

Wrap it Up (I'll Take It)

The convenience of having a VHF amateur transceiver permanently available in your vehicle and the capabilities it can offer, especially in an emergency situation, far outweigh the minor hassles you may run into when initially setting up your mobile system.

The RadioShack HTX-252 is a definite "winner" in my book. This rig has just enough features to be really useful but not so many that you have to spend the better part of an afternoon consulting the manual trying to figure out how to change a basic setting.

With the ever-shrinking amount of unoccupied space in today's vehicle interiors, the HTX-252 will surely find a ready market among those of us who really want to install a permanent mobile FM rig in the car, but can't figure out where the blazes to put it.

Manufacturer: RadioShack Corp, Fort Worth, TX 76102; 800-842-7422; fax 718-415-2303; **www.radioshack.com**.

Manufacturer's suggested retail price, $179.95. Typical current street price, $179.95. QST

MMTTY 1.58

Amateur Radio software has been evolving at an astonishing rate. Almost every month we see a new program of one kind or another. What is even more astonishing is that some of the best software is *free*.

MMTTY is an excellent example of high-performance freeware. Like much of the amateur HF digital communication software available today, *MMTTY* utilizes the ubiquitous sound card as its interface to the outside world.

MMTTY Does RTTY

MMTTY is software for radio teletype, better known in ham circles as RTTY. It is *Windows* software, designed and coded by Makoto Mori, JE3HHT, hence the "MM" of *MMTTY*. According to Makoto, *MMTTY* will run on sound-card equipped PCs as slow as 486-100s and under several flavors of *Windows* including *95*, *98*, *NT* and *ME*. In my tests, I was able to run *MMTTY* successfully on a 133-MHz Pentium, but to get it to function on a 486-100 I had to shut down several display functions, and even then it was very slow. My personal recommendation would be to run *MMTTY* on a 133-MHz Pentium or faster for best performance.

You'll be on the air with *MMTTY* very quickly if you have the necessary audio cables and transmit/receive switching (either homebrew or via a West Mountain RIGBlaster unit) to connect your computer to your transceiver. If you're in doubt about how to hook it all up, consult *MMTTY's* English-language help files (translated by KB2EOQ).

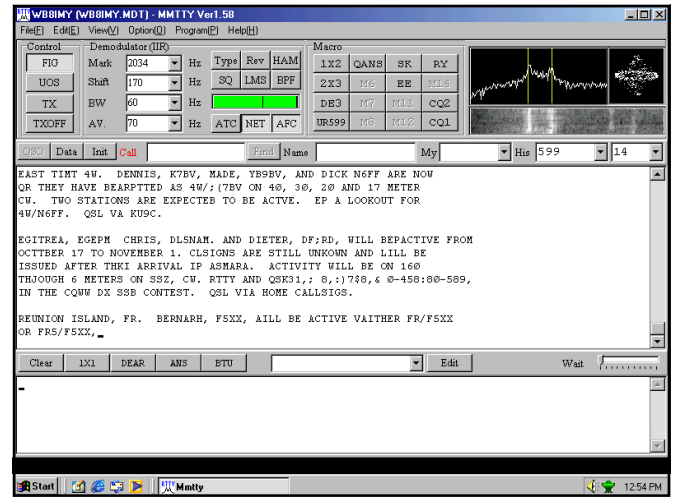
You can route the transmit audio to your transceiver's microphone or accessory input and run AFSK RTTY, or build a simple dual-transistor switching interface and run FSK if your radio supports that function. *MMTTY* allows you to select the mode and COM port of your choice. If you are already set up to run PSK31, MFSK16, SSTV or other sound-card based modes, *MMTTY* will put you on RTTY for no additional investment whatsoever—you simply install the software.

Although designed primarily for casual conversation, *MMTTY* offers a number of enhancements that even "serious" RTTY operators will appreciate. Most functions are selectable directly on the "front panel" through a collection of buttons. You can select from several demodulation settings, depending on conditions. You can program up to 64 macros (does anyone really need 64 macros?). *MMTTY* includes a handy logging function and the ability to choose three different signal displays: waveform, waterfall or traditional "crossed bananas." You can even opt to have all three running simultaneously. Finally, *MMTTY* includes a function that allows you to record the receive audio for later playback.

MMTTY on the Air

In my tests with *MMTTY*, I compared the software to an external multimode processor and several sound-card-based programs. I used MMTTY primarily on my shack computer, a 333-MHz Pentium II running *Windows ME*.

Going up against the external processor, *MMTTY* performed as well or, in some cases, better. With its DSP algorithms,



MMTTY was able to dig deeply into the noise and copy RTTY signals that the processor rendered as gibberish. When it came to signals with moderate strength, *MMTTY* was on par with the processor. *MMTTY's* signal displays seemed much easier to use and interpret than the processor's bouncing LEDs. In fairness, however, the external processor's strength is in its ability to be used with virtually any computer—even ancient Commodores and Tandy Color Computers. (In theory, you don't even need a computer to use a hardware processor; a dumb terminal will do just as well.)

Going up against its sound-card-based brethren, *MMTTY* performed as well or better than anything I threw at it. The one exception was *RITTY* by Brian Beezley, K6STI (see my review in the November 2000 *QST*). *RITTY* seemed to be superior at handing polar flutter and interference.

I found that *MMTTY* was quite easy to use, and having the macro buttons on the main window was convenient. My tendency was to run all three tuning displays at once. I often found myself gazing at the crossed-bananas display for accurate tuning. Actually, the waterfall display was also attractive from an operator's point of view, although it took some practice to get used to it. (I've been spoiled by *DigiPan's* PSK31 panoramic waterfall.)

Conclusion

The disadvantage of freeware is that support is often spotty at best—and for good reason. The author has already given away hundreds of hours of development time for nothing, so it is unreasonable to expect "customer support" as well. As with all freeware, you download and take your chances. Still, you'll find a fair amount of *MMTTY* documentation, hints and tips on line. This is mostly information provided by the author, or collected from the comments of *MMTTY* users.

Makoto Mori should be commended for producing such a capable piece of software *pro bono* for the amateur community. When you download and use *MMTTY*, you'll be as astonished as I was that such a versatile program would be simply given away to anyone who wants it. You can try *MMTTY* yourself by downloading it from the English-language Web site at **www.geocities.com/mmtty_rtty/**.

Next Short Take

Steve Ford, WB8IMY ♦ *QST* Managing Editor

W2IHY Technologies 8-Band Audio Equalizer and Noise Gate

Do other operators say you have "wimpy audio?" Do they taunt you on the air? ("Hey, weasel mouth! Speak up!") Are you tired of having sand kicked in your face by muscle-bound band bullies?

Step up to the bar, son. I have a product for you!

The W2IHY Technologies audio equalizer and noise gate is an extraordinarily useful station accessory for voice operators. It works wonders with the worst microphones imaginable, and with high-quality mikes such as the Heil Goldline, the results are astonishing.

The equalizer section divides a typical voice bandwidth from 50 to 3200 Hz into 8 frequency bands. By adjusting the individual slide pots for each band, you can increase the gain of some frequencies, or reduce others. If your mike audio seems biased to the high frequencies, making your voice sound too crisp and tinny, you can reduce the high frequencies to create a more pleasing sound. At the other end of the spectrum, you can cut the low or middle ranges to clean up muddy audio. In other words, you can create a characteristic "sound" that is uniquely *you*.

Set Up

You begin by plugging your microphone into any of the three available inputs (3-pin XLR, 8 pin or RCA jacks). A three-position rotary switch on the back panel allows you to choose ICOM, Kenwood or Yaesu configurations (you can modify the 8-pin configuration to work with other microphones by using a mike plug adapter that you can make yourself or purchase from W2IHY).

You have your choice of two output jacks (5-pin DIN) on the rear panel. A slide switch selects the one you desire. The cable of your choice (W2IHY sells cables and adapters) connects between the output and your radio. The rear panel also sports a 5-pin DIN jack for dc power (a "wall wart" power supply is included).

If you're using an electret microphone (such as an ICOM SM-6), you'll need to flip the unit over and set the **MIC IN PWR** jumper. Use a pair of needle-nose pliers, but proceed carefully. One slip and you'll drop the tiny jumper block into the unit, which will require minor screwdriver surgery to open.

With the EQ on its side, speak into your microphone in a normal voice and, with a small screwdriver, adjust the **MIC IN GAIN** trim pot until the red LED on the front panel blinks only occasionally as you speak.

One of the fun aspects of using the W2IHY equalizer for the first time involves plugging in a pair of headphones (there is a 1/4-inch jack on the rear panel) and listening to your own voice. Just crank up the **VOLUME** control and talk to yourself while you adjust the equalizer's various bands. Listen to how your audio characteristics change. As a former broadcast DJ, I couldn't resist bumping up the low bands to make my voice something akin to Darth Vader.

Noise Gate

The noise gate function of the W2IHY equalizer adds even greater quality to your transmit audio. With the noise gate activated, you gently increase the **LEVEL** slide pot without speaking until all ambient noise suddenly vanishes. When you speak, the "gate" opens, but then closes again when you stop, effectively preventing those annoying background sounds—barking dogs, amplifier fans, belligerent spouses—from filling the gaps. You can tweak another front-panel slide pot to adjust the gate delay, ranging from almost instantaneous closure to delays that are a bit more "leisurely."

On the Air

I used the W2IHY equalizer with an ICOM SM-6 desk microphone and my ICOM IC-706 transceiver. According to on-air reports, my SSB audio was outstanding. During my first few contacts, I would ask stations to give critical evaluations, and advise whether I needed to increase or decrease certain audio frequency bands. A chat with YO2LEA on 17 meters was particularly helpful. Nelu listened closely, telling me to boost my high frequencies, while increasing a couple of middle range bands as well. When our tweaking session was done, he declared that I sounded "utterly fantastic."

It is interesting to note that my antenna is very close to my operating position. Even so, I heard no RF in the audio while listening to headphones, even when transmitting at 100 W.

Conclusion

If you're a serious voice operator, the W2IHY equalizer and noise gate is a station accessory you should definitely consider. It isn't a matter of simply massaging your audio so that you "sound good." Having a clean audio response is crucial to being understood over the air—whether you're doing battle in a pileup, or passing traffic in an emergency.

The W2IHY equalizer has the versatility to work with almost any radio and microphone on the market. My only wish for future versions of this product is that they would add the ability to hear *receive* audio in the equalizer's headphone jack. With so many modern rigs having receive audio outputs at their microphone jacks, this wouldn't be an overly difficult feature to add. Then, you could hear your radio and yourself through the same set of headphones.

Manufacturer: W2IHY Technologies, 19 Vanessa Ln, Staatsburg, NY 12580; tel (toll free) 877-739-2449; **Julius@w2ihy.com**; **www.w2ihy.com**. *$229.99 (kit $189.99); microphone cable (specify radio make and model) $15.*

Steve Ford, WB8IMY ♦ Managing Editor