Product Review Column from *QST* Magazine

May 1998

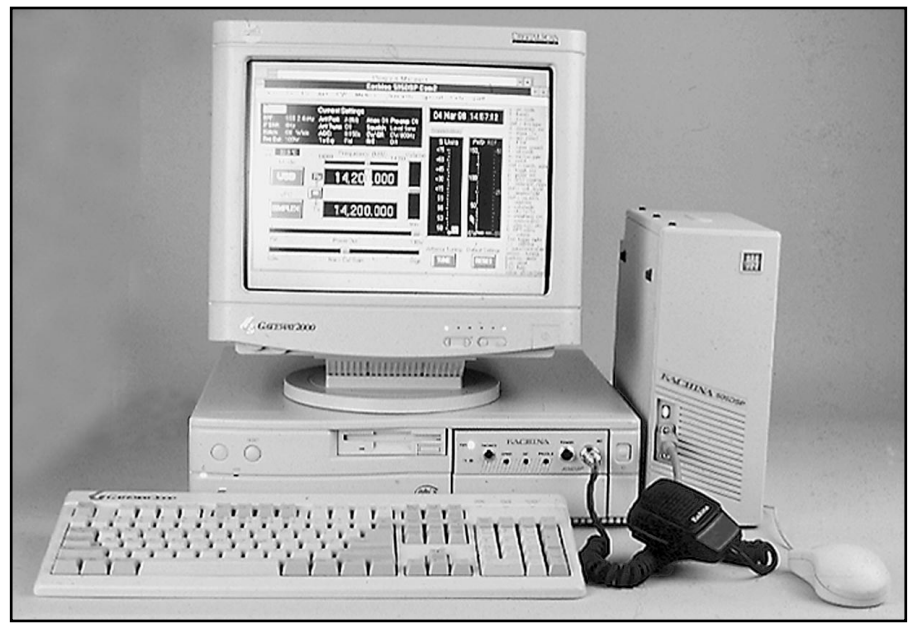
Kachina 505DSP HF Transceiver

Cherokee AH-50 6-Meter Hand-held Transceiver

Edited by **Rick Lindquist, N1RL**• Senior Assistant Technical Editor

Kachina 505DSP HF Transceiver

Reviewed by Larry Wolfgang, WR1B
Senior Assistant Technical Editor



Why use knobs if you have *Windows*?" Kachina Communications asks on its Web site. "Sometimes there's nothing quite like a tuning knob," many hams would respond. Simply put, the only "knobs" on the 505DSP exist on the *Windows*-interface screen of the user-supplied computer that controls the radio. Make no mistake, however. The 505DSP might be novel in the ham radio world, but it's no mere novelty. This is a "real" radio with lots of features, flexibility, and performance.

Everyone agrees that Kachina—an Arizona-based company that's been building commercial transceivers for 20 years—has taken a pretty radical approach with its first Amateur Radio offering. If the Kachina 505DSP doesn't mark the next paradigm shift in Amateur Radio transceiver design, it certainly represents a major leap in user-interface design. The notion was intriguing enough to attract hundreds—perhaps thousands—of hams to the Kachina booth at last year's Dayton Hamvention—just for a look at the radio that some already are calling the future of Amateur Radio transceivers—where hardware takes a back seat to software, and a new radio is only another "rev" away. Indeed, we encountered this phenomenon while reviewing the 505DSP.

The Hardware Side

Two boxes comprise the Kachina 505DSP. The larger box is the actual transceiver "guts." It's about the size of a Kenwood TS-450. The much smaller box is the "control head." Designed to fit into a spare drive bay on your computer, the only actual "control" is a push-button power switch! Jacks are provided for the microphone, speaker, headphones, key and paddles. A connector wired to the computer's back panel provides for the serial port connection to the radio and the computer. (The control head also can be used externally, but with a different wiring interface.)

On the radio box itself are a front panel connector for the control cable (we wondered why Kachina didn't put it on the rear apron; it gets in the way if you put the radio box on your operating desk) plus a green LED to indicate that the radio is turned on. The rear panel of the radio box includes a power connector, a ground stud with thumbscrew, and two SO-239 antenna connectors. Via the menu you can assign ports to specific bands or set one antenna port for transmit and the other for receive. A DB-25 connector is available for audio accessory connections, such as for a multimode communications processor or modem. A DB-9 connector provides connections for an external automatic antenna tuner (our unit had the optional, built-in tuner), and a 15-pin sub-D connector lets you hook up an external power amplifier. An RJ12 connector (similar to a modular telephone connector) is used with an optional cable to connect the radio to the computer when you mount the control head outside of a computer.

Yes, in addition to the radio, you'll also need a computer, but system requirements are pretty minimal—a '386DX or higher processor and 4 MB of memory (8 MB recommended), at least 2 MB of free hard disk space, and a serial port. Your computer must be running Microsoft *Windows* 3.1, *Windows 95* or *Windows NT*. This is just the place for that now outmoded castoff to enjoy a second life, but a decent monitor is a must.

You will also need a 4 or 8-Ω speaker. It's possible to use your computer sound card if you have one, but you will have to feed the audio from the control head front panel to the sound card via an external cable, even if you mount the control head in a computer drive bay. You will only get audio on the left channel, however.

What's in the Box

Kachina provides no schematics with the radio (they're available free of charge by request), but there's an interesting description of the operating theory on Kachina's Web site, **http://www.kachina-az.com**. Here are some highlights. The 505DSP is a dual-conversion radio, with IFs at 75 MHz (for good image rejection) and 40 kHz (for IF DSP). The first IF uses a 20-kHz wide roofing filter to remove the second image component and nearby interference. The 40-kHz IF section has a 15 kHz bandwidth. The signal is amplified, and the digital signal processing unit provides additional selectivity and processing. In other words, the 505DSP relies heavily on DSP, not crystal filters, for bottom-line selectivity enhancement. The Kenwood TS-870S (see "Product Review," *QST* Feb 1996) is the only other transceiver on the market that depends this heavily on DSP.

Bottom Line

The first virtual front panel, PC-controlled HF transceiver, the Kachina 505DSP offers solid performance that compares favorably with other radios in its price class. The relegation of functionality from hardware to software and firmware opens broad vistas of future capability with this transceiver. This could be the paradigm shift we've been anticipating. Kachina is to be commended for its first Amateur Radio offering.

Table 1 —Kachina 505DSP serial number 91900105

Manufacturer's Claimed Specifications	***Measured in the ARRL Lab***
Frequency coverage: Receive, 100 kHz to 30 MHz; transmit, 1.8-2, 3.5-4, 7-7.3, 10.1-10.15, 14-14.35, 18.068-18.168, 21-21.45, 24.890-24.990, 28-29.7 MHz.	Receive, 30 kHz to 30 MHz; transmit, as specified.
Modes of operation: SSB, CW, AM.	As specified.
Power requirement: Receive, 2 A; transmit, 25A (maximum).	Receive, 2 A; Transmit, 21 A.
Size (height, width, depth): 11.6×4.5×12.6 inches; weight, 11.6 pounds.	
Receiver	*Receiver Dynamic Testing*
CW sensitivity: Not specified.	Minimum discernible signal (noise floor), 500 Hz filter (see text): *Preamp off* / *Preamp on* 1.0 MHz: –134 dBm / –146 dBm 3.5 MHz: –133 dBm / –140 dBm 14 MHz: –133 dBm / –142 dBm
AM sensitivity (60% modulation): Preamp off, 1.0 μV; Preamp on, 0.6 μV.	10 dB (S+N)/N, 1-kHz tone, 30% modulation: *Preamp off* / *Preamp on* 1.0 MHz: 1.8 μV / 0.4 μV 3.5 MHz: 1.9 μV / 0.6 μV
Blocking dynamic range: Preamp off, 115 dB at 20 kHz spacing; 118 dB at 50 kHz spacing.	Blocking dynamic range, 500 Hz filter: *Preamp off* / *Preamp on* 3.5 MHz: 96 dB / 100 dB 14 MHz: 103 dB / 103 dB
Two-tone, third-order IMD dynamic range: Preamp off, 96 dB typical.	Two-tone, third-order IMD dynamic range, 500 Hz filter: *Preamp off* / *Preamp on* 3.5 MHz: 98 dB / 94 dB 14 MHz: 99 dB / 97 dB
Third-order intercept: Preamp off, +18 dBm typical.	*Preamp off* / *Preamp on* 3.5 MHz: +14.0 dBm / +1.0 dBm 14 MHz: +15.5 dBm / +3.5 dBm
Second-order intercept: Preamp off, +49 dBm typical.	Preamp off, +49 dBm; preamp on, +30 dBm.
S-meter sensitivity: Not specified.	S9 signal at 14.2 MHz, preamp off, 46 μV; preamp on, 11 μV.
Squelch sensitivity: Not specified.	At threshold, preamp on: SSB, 14 MHz, 0.8 μV.
Receiver audio output: 2 W at 5% THD into 4 Ω.	2 W at 5% THD into 4 Ω.
IF/audio response: Not specified:	Range at –6 dB points, (bandwidth): CW-N (500 Hz filter): 628-1370 Hz (742 Hz); CW-W (1 kHz filter): 432-1610 Hz (1178 Hz); USB (3.5 kHz filter): 436-3276 Hz (2840 Hz); LSB (3.5 kHz filter): 436-3066 Hz (2630 Hz); AM (6 kHz filter): 152-2570 Hz (2418 Hz).
Spurious and image rejection: 80 dB.	First IF rejection: preamp off, 84 dB; image rejection, preamp off, 156 dB.
Transmitter	*Transmitter dynamic testing*
Power output: SSB, 100 W; AM, 25 W carrier.	As specified.
Spurious and harmonic suppression: 60 dB	53 dB. Meets FCC requirements for spectral purity for equipment in its power output class and frequency range.
CW keyer speed range: 5-80 WPM.	As specified.
CW keying characteristics: Not specified.	See Figure 3.
SSB carrier and undesired sideband suppression: 55 dB.	As specified.
Third-order intermodulation distortion (IMD) products: Not specified.	See Figure 4.
Transmit-receive turn-around time (PTT release to 50% audio output): Not specified.	S9 signal, 24 ms.
Receive-transmit turn-around time (tx delay): Not specified.	SSB, 31 ms. Unit is suitable for use on AMTOR.
Composite transmitted noise: Not specified.	See Figure 5.

Note: All dynamic range measurements are taken at the ARRL Lab standard spacing of 20 kHz unless otherwise noted.

The Kachina 505DSP generates and detects SSB signals using the phasing method—the same method used in the early years of SSB. Kachina uses DSP to introduce the required 90° phase shift to cancel one sideband and reinforce the other. Unlike the phasing systems of years ago, however, the DSP is able to maintain a *constant* 90° phase shift for all frequencies through the system. Many believe a phasing sideband signal has better audio quality than one produced using the now-common filter method. The excellent audio reports we got tend to bear that out.

A direct digital synthesis (DDS) and phase-locked loop (PLL) hybrid frequency synthesizer forms the first local oscillator. The design allows tuning steps of less than 0.5 Hz, but the control software limits you to 1-Hz steps. The reference oscillator is microprocessor-compensated against temperature variations. A built-in test feature permits using a reference signal such WWV to automatically calibrate the oscillator.

The radio is constructed computer-style, with a motherboard and plug-in cards. The DSP features are included in the radio's firmware using Motorola HC-16 assembly-language programming. During the review period, our radio had to be returned to Kachina for repair due to an operator error (more on this later). When it came back, Kachina had upgraded our unit with the latest firmware. Kachina Senior Design Engineer Doug Smith, KF6DX, told us that Kachina's policy is to upgrade the firm-

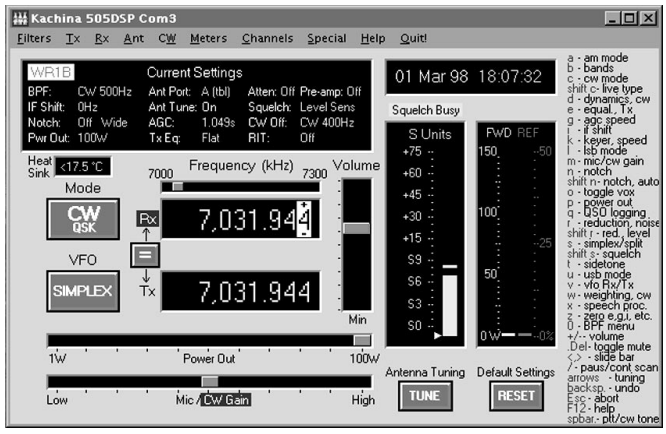


Figure 1—The 505 DSP's virtual "front panel."

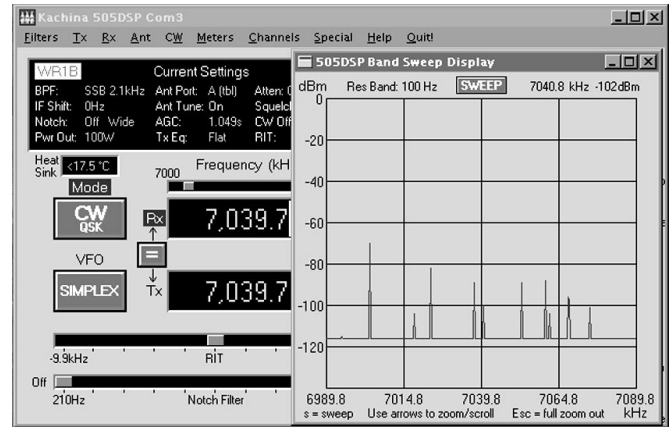


Figure 2—The Band Sweep mode.

ware (within the limitations of any hardware changes) whenever a radio comes back for service. Smith also said that 505DSP owners will be able to upgrade their own radios by using a plug-in PCMCIA card. This is a credit-card sized board that plugs into one of two slots on the microprocessor board.

Software and Documentation

Software for the 505DSP arrives on $3^1/_2$-inch floppies. As with most *Windows* software, it's a snap to install the Kachina control and interface software on your computer. Just run the install program, and follow the directions. Software upgrades for the Kachina 505DSP are free and downloadable from the company's Web site.

The *Installation and Operation Guide* is a top-notch, glossy publication. It presents information about the radio in a clear, concise manner. Unfortunately, at only 17 pages, that information is pretty thin! The instructions for connecting the radio and control head are easy to follow. Clear illustrations show how to wire the various plugs and connectors. What you won't find there, however, are detailed descriptions about how to use the software that creates the user interface. The booklet does contain a brief description of features and even a handy reference card listing the various keyboard "shortcuts" to commonly used commands. But information about how to properly adjust many of the controls is lacking. Where do I set the mike gain slider bar, for example? How do I set up the radio to operate RTTY or other digital modes?

As with much computer software these days, you can call up a Help screen describing just about any software feature or radio "control." While these descriptions covered what I intuitively knew about the control or feature by reading its label, they didn't supply enough information about how to actually use the feature or adjust a control. Only by chance did I discover that clicking on the TX frequency display allows you to listen on the transmit frequency during split-frequency operation.

Kachina Communications has been very responsive in this regard. The company now posts a series of *Application Notes* on its Web site that discuss the radio and how to use various features. This information answered more questions than I even realized I had about how to use the radio. (It also introduced me to a newer version of the control software, but more about that later.)

I even found a document that describes the command structure used to control the various radio features. Presumably, a veteran programmer could write the code to control the radio from within their own application, creating a custom user interface.

All of this suggests that the 505DSP is hardly cast in stone but a dynamic product that will grow and develop as Kachina receives more user feedback and comes up with new features. Kachina plans to incorporate the *Application Notes* onto the Help screens in its next software revision.

Imagine the Possibilities

Since the radio has no controls, there is no need to locate the transceiver box on your operating table. In fact, you don't even have to locate the box in your *shack*!

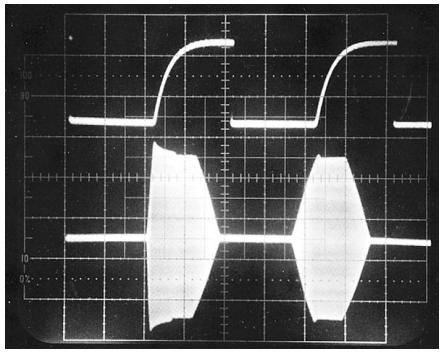


Figure 3—The default CW keying waveform for the Kachina 505DSP showing the first two dits in full-break-in (QSK) mode using external keying. The equivalent keying speed is 60 wpm. The upper trace is the actual key closure; the lower trace is the RF envelope. Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output at 14.2 MHz. .

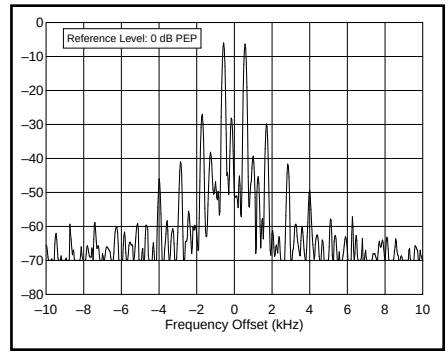


Figure 4—Worst-case spectral display of the Kachina 505DSP transmitter during two-tone intermodulation distortion (IMD) testing. The worse-case third-order product is approximately 36 dB below PEP output, and the worse-case fifth-order product is approximately 44 dB down. The transceiver was being operated at 100 W output at 24.950 MHz.

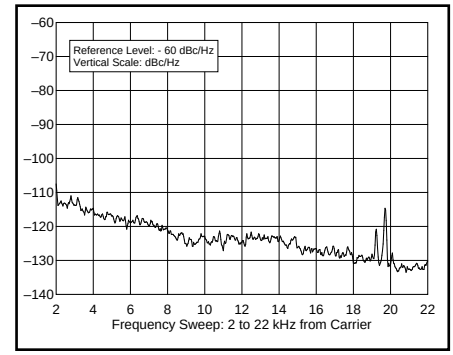


Figure 5—Worst-case tested spectral display of the Kachina 505DSP transmitter output during composite-noise testing. Power output is 100 W at 3.5 MHz. The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 2 to 22 kHz from the carrier.

Kachina supplies an 8-foot control cable and offers optional 25 and 75-foot cables. Using the 75-foot cable (the maximum) means you could locate the radio in your basement—next to the antenna-cable entrance, for example—while your computer and control head remain in your first or second-floor shack.

Several operators who tried the 505DSP speculated about remote control over a telephone line or the Internet. Kachina reports it's done some testing using pairs of both commercial digital simultaneous voice and data (DSVD) and analog simultaneous voice and data (ASVD) modems. While their system worked, design engineer Smith indicated that the transmitted voice quality was not as good as they wanted. Kachina says it's close to announcing its own SVD system using standard modems and external analog/digital converters.

It's All About the User Interface

Besides solid performance and interference-fighting features, front-panel layout is the most critical issue that determines how much I'll enjoy operating a radio—and this holds true even for radios employing a "virtual" front panel. If the control knobs and buttons are too close together or illogically positioned, I'll always feel as though I'm fighting with the radio. In this regard, the 505DSP has a number of things in its favor.

By using almost the entire computer screen to display operating conditions and control positions (see Figure 1), Kachina has found a way to appeal to my clumsy side. I can position a mouse cursor with sufficient precision to click on a menu item or control display area. The huge frequency readouts (one for transmit, one for receive) are easy to read even if I lose my glasses! I can read the S meter without squinting, and I can grab the mike gain slider bar with the mouse and drag it to a new position quickly without bumping another control.

Some areas can display data or information in a variety of ways. For example, the S meter (a vertical bargraph) can display received signal strength in S units, volts or dBm (try *that* on your conventional rig!). There are two transmit meters. The left side can display ALC or forward power while the right side can display reflected power or VSWR. A Current Settings box at the top left—just above the frequency readouts—shows which features are enabled. A mouse click can activate these features or call up the slider bar for a particular control. For example, clicking on **PRE-AMP** toggles the preamp on and off. Clicking on **RIT** brings up the RIT slider control. Clicking on **BPF** (bandpass filter) brings up a list of DSP filter choices.

For those uncomfortable with mousing around, a list of keyboard shortcuts and other keyboard commands runs down the right side of the display. Type **K** and the keyer-speed slider pops up. Type **C** to change to CW mode or **B** to bring up the band list. It takes a bit of getting used to, but you can control many features without the mouse. The transmit and receive meters and frequency displays occupy most of the screen's center.

But old habits die hard. The one place I missed a conventional knob most was for tuning the radio. It's not that it's *difficult* to tune the Kachina 505DSP—it's just different. There are a couple of ways. The 505DSP lets you enter a frequency directly by using the Rx or Tx menus and selecting the Rx or Tx Frequency option. This is a quick and easy way to jump to a specific frequency. Or, click on any digit to make it active, then click on the **+** or **–** symbol above or below the highlighted number to tune up or down, respectively. Or, tune using the cursor (arrow) keys on your keyboard. Left and right arrows move the active digit; up and down keys change the frequency. Holding the **SHIFT** key along with the up or down arrow key changes the selected digit in steps of 5. While I could move up and down the band with ease using this technique, *tuning* up and down the band still left me longing for a real knob. Selecting steps of 100 Hz or more changes the frequency rapidly, but isn't a very good way to listen for activity. Steps of 1 or 10 Hz are much better for tuning the band, but can be painfully slow. Each single key press changes the frequency by one digit. If you hold the key down, the radio will begin to tune at a faster rate.

With a knob, however, you can spin faster until you hear a signal then nearly instantly slow to a fine-tuning pace. With a knob, you can quickly spin across a signal, rocking back and forth to zero in. Doing that using a mouse or cursor keys is a little more cumbersome, but—as with the transition from analog to digital readouts—perhaps it will become second nature, and most hams will get used to the idea. For those who can't or won't, however, Kachina says it soon will offer an optional outboard tuning knob (see Figure 6).

Figure 6—A pre-production model of the Model 505TK tuning knob option for the Kachina 505DSP. Kachina calls the external knob "a concession to certain users and not part of our core design philosophy." Kachina believes that once 505DSP owners get used to mouse-and-keyboard operating, the knob will become "superfluous."

The Model 505TK—which features a large, dimpled knob and a hefty cast-metal base so it will stay in place—uses an additional serial port on the computer. It also carries a hefty $199.95 suggested retail price tag. The pre-production unit we looked at worked well (it required loading another software revision) and fit in nicely on the operating desk, next to the mouse and the keyer paddle. Activating the damping lever adds a fixed amount of drag. The knob will adjust only the digit selected on the screen. For general SSB and CW tuning, it worked well with the 10 Hz digit.

The software boasts 100 memory channels. Selecting Recall on the Channels menu displays four of those channels in the Current Settings window. You can scroll with the arrow keys (but not the mouse) through the 100 listings and select the desired data by clicking on it. The screen will jump back to the Current Settings display with the selected frequency, mode, AGC and BPF settings. When you want to save a memory channel and its associated settings, go to the Save item on the Channel menu. The only way to know which channels already have data that you may not want to overwrite is to recall the channels before saving and selecting the channel number to which you want to save the new data.

You can also save 16 sets of data to the function keys—what Kachina calls "snapshot keys." Keys **F1** through **F8** and **CTRL+F1** through **CTRL+F8** recall the full operating parameters stored in those locations. This can be a real time-saver, similar to "band-stacking registers" on some radios.

Given the broad possibilities of a computerized user interface, we questioned why the 505 DSP software limits you to Kachina's idea of what the display should look like. For example, two Kenwood radios—the TS-870S and the TS-570D (see "Product Review" *QST* Jan 1997)—include Kenwood's *Radio Control Program*. The Kenwood system allows you to customize the interface to suit your needs. It even allows you to create different displays for different applications. Something along these lines for the Kachina would be a real plus.

Users raised other questions: Why can't you view the transmitted power output and the ALC at the same time? Why do the meters have to take up so much space? Do we *really* need separate receive and transmit frequency displays to operate simplex? Why can you only have two control sliders on the screen at any one time (and why does it seem that the one you need never is one of those displayed)?

It would be especially nice to have a CW operator screen with buttons to allow quick access to the nine CW buffers (59 characters max) included in the latest software (they're now available via **CTRL**+<*number*> keystrokes). This would make it a real memory keyer. By the way, the latest software also included "live type" CW capability, some-

thing like the Patcomm PC-16000 offers (see "Product Review," *QST* Feb 1998), but no CW decoding.

Since it's all software, we wondered why didn't Kachina include a digital modem. What about integrated digital mode software for RTTY, AMTOR and PACTOR and maybe even CW? How about a slow-scan TV decoder? Kachina says these are on the long-term drawing board. The goal, Smith says, is to develop "a totally integrated station environment based around a PC."

Some controls didn't work the way we wanted them to. RIT is one good example. Click on **RIT** in the Current Settings box, and drag the RIT slider bar for the appropriate offset for the off-channel signal. Click on **RIT** under the slider and you can quickly return to the original frequency—but the 505DSP "forgets" the RIT setting you'll need when the off-frequency station transmits again. Kachina says one way around this is to use the **Z** key to zero the offset. Then, use the **BACK SPACE** key, which undoes any previous command, and the **SHIFT**+**BACK SPACE** combination to toggle back (a "redo" command, in effect). Provided you haven't issued another command in between, this lets you recall the offset frequency instead of clearing it altogether—although being able to quickly clear RIT is certainly an advantage, especially while contesting. You can also use split mode.

Filter selections are supposed to be mode independent, with the exception of AM, which is always 6 kHz. We found it did not work this way, however. For example, if you set the CW filter default to wide, the filter selection initially stays with the mode. However—no matter how the filter is set—once you toggle through AM, the filter goes back to 2.4 kHz the next time you select SSB or CW.

If you select the narrow CW filter as the default, things really get screwy. Then, you may get either 500 Hz or 2.4 kHz for CW, USB and LSB, depending upon which side of the **MODE** button you click. Kachina says it's fixed this.

Gee, Look What We Can Do With Software!

A few of the Kachina 505DSP's features fall into the "nifty" and "somewhat useful" categories. For example, after using the automatic antenna tuner with your antenna, you can have the radio collect the impedance data for that antenna and draw a Smith Chart display (as far as we can determine, this is the first radio ever to offer this feature). You might use this Smith Chart data to help you design and adjust an impedance-matching circuit for the antenna feed point.

Another nifty feature is the Band Sweep Display (see Figure 2). This display is a spectrum analyzer that measures and visually depicts signals present across a range of frequencies. When you select the Band Sweep Display under the Special menu, a setup screen allows you to enter various sweep parameters. You can enter a sweep center frequency, but the default is the current receive frequency. You can also select the frequency span, the frequency resolution, and single or continuous sweep. Like the Band Scope on the popular ICOM IC-706 transceivers, the 505DSP receiver mutes during the sweep. The resulting display gives you an idea of the number and strength of signals on the band. The really neat part: if you see an interesting signal on the display, just click the cross-hairs mouse cursor on the signal peak and the radio switches to that frequency!

The 505DSP contains a built in logger, a standalone program called *KCLog* that's accessible from the radio control program. It's pretty basic, however. It lets you enter a station call sign, RST sent and received, QTH (15 characters max) and a comment (also 15 characters max). The program automatically reads and logs the time and date from your computer, and the operating frequency, mode and power output from the radio. You can create separate log book files for various activities. Each log only holds 500 entries, however, and the software doesn't allow much editing. Kachina says it's working to upgrade *KCLog* and plans to incorporate the *QRZ* call sign database and supply a CD-ROM copy with every radio.

Kachina says that the next version of Personal Database Applications' *LOGic* program is supposed to be compatible with the 505DSP. We are unaware of any way to use DOS-based computerized contest loggers such as *CT* or *TR Log* with the Kachina, however.

On the Air Impressions

Operating SSB with the 505DSP is a pleasure, although you'll probably want to replace the somewhat clunky mobile microphone with something more suitable. The supplied mike will not operate the unit's VOX as wired; Kachina offers an optional VOX-ready desk mike, however. Setting the proper mike gain and speech compression level was pure guesswork until I found "Tailoring the Transmitter's Audio Response" among the *Application Notes* from the Web page. There I learned that the mike gain setting isn't as critical as with most other radios (we did notice that it didn't seem to make much difference how we set this control). The 505DSP has a speech monitor. It uses the filtered, processed, equalized audio just prior to the modulator. Output level is adjusted using the **VOICE/CW SIDETONE** slider. Audio quality was not particularly impressive compared to monitors on other transceivers.

On-the-air comments indicated excellent transmitted audio. With the mike gain set near the top of its range some of my friends on a local 10-meter net noticed some distortion. Likewise with the speech compressor, the audio sounded excellent with low settings and a trace of distortion at

AGC in the Kachina 505DSP

Compared to other HF radios on the market, this one is just, well—*different*. And it's different in a lot of ways that go beyond the immediately obvious. One difference is that the 505DSP actually has two *completely independent* AGC circuits. One of these is a conventional AGC that you'd find in most modern radios. The second is a digitally controlled AGC circuit that serves a different purpose from the first.

As do other rigs on the market with DSP, the Kachina uses analog-to-digital (A/D) conversion at the low IF to prepare the signal for processing by the DSP circuitry. In the 505DSP, the signal level at the input of the A/D converter is controlled by the *digital* AGC in order to make the most use of the converter's resolution.

This dual-AGC added a bit of complexity to the ARRL Lab testing, because the digital AGC is always active, even at the weakest signal levels. To accommodate this AGC action, we had to use a few different test methods.

So what does this mean to you? Not much, really, but 505DSP users may notice a bit of difference in the audio output. With no signals present, the digital AGC increases the gain, so the noise will *sound* somewhat louder than it really is. When a signal comes along—even a very weak signal—the digital AGC backs down the gain, so the noise gets quieter. The overall result is that the sound level from the speaker or headphones that you are using stays about the same after the AGC has settled.

Another difference between this radio and others is the very wide range of AGC time adjustment. The AGC is continuously adjustable at the Current Settings panel from an ultra-fast 0.004 seconds to a torpid 1.049 seconds. Compared to other rigs, the slowest setting will seem like the flowing of molasses on a cold winter day, whereas the fastest setting is nearly instantaneous, so you won't even notice the AGC change taking place.—*Michael Tracy, KC1SX*

high levels. Other users reported similar experiences. The **TX EQ** settings let you pick the audio response that best suits your voice. For "contest" audio, for example, you can click the slider bar to add 12 dB of high-end (treble) emphasis. To add more bass, move the slider the other way.

To fight QRM, you have a choice of filter bandwidths. For SSB operation, these range from very wide—3.5 kHz—to narrower, 2.7, 2.4, 2.1 or 1.7-kHz. For CW operation you can choose any filter from the 3.5-kHz wide sideband filter down to the 100-Hz CW filter. (Other CW filter choices are 1 kHz, 500 Hz and 200 Hz.)

You can also select a CW offset frequency between 300 and 800 Hz in 100-Hz steps. There is no way to select the opposite (reverse) sideband, something many transceivers offer as a means to avoid QRM on one side of the signal. To ease proper CW tuning, pressing the keyboard space bar generates an audio tone whose pitch matches the offset you selected.

Using the internal keyer for CW is easy. Plug in a miniature ($^1/_8$ inch) stereo phone plug wired to your paddle, set the keyer for right or left-handed operation, and adjust the keyer speed. QSK CW worked well and allows you to hear between code elements. The internal keyer range is from 5 to 80 WPM. It would be nice to have a direct digital readout of the keyer speed on the screen instead of having to estimate from the slider bar.

The 505DSP is the first radio ever to let you adjust its CW keying waveform (see Figure 3). The **CW DYNAMICS** slider lets you change from the default keying shape to either a harder or softer keying waveform. The range (256 steps in all) runs from a very slow rise time that sounds quite mushy to a quick rise time that includes a clicky leading-edge spike. You also can adjust weighting. The default positions looked good to us, but you can change the keying shape as needed for use with an amplifier or for special circumstances.

During the ARRL International DX CW Contest, I wanted to use my memory keyer. (The radio control software version at that time allowed only one CW buffer; I wanted the multiple memories of my external keyer.) After wiring the miniature stereo phone plug required for the straight key input, I connected my keyer and hit the "WR1B" button. Out came some of the worst sounding garbage I could imagine! Eventually I figured out that the keyer speed setting somehow limited the speed of the straight key input. Later we learned that this "feature" was included to help you send better CW! The idea is that the keyer's self-completing feature forces you to send better-timed code. Several other reviewers also were also confused by this feature, and the advantage escaped us. The solution? Simply push the internal keyer-speed slider bar all the way to 80 WPM for external keying.

Using *W95SSTV* software with my SoundBlaster card, I spent an enjoyable Saturday afternoon copying SSTV pictures and sending a few of my own. I had wired a cable using the rear-panel DB-25 connector to obtain audio from the receiver, feed audio to the transmitter, and key the PTT line for RTTY. This connection worked perfectly for SSTV.

Also, I spent quite a bit of time trying to operate RTTY with the 505DSP. Initially, I was unable to tune a signal for proper copy using either my KAM communications processor or Brian Beezley's *RITTY* program. Later (with the help of one of the by-now-invaluable *"Application Notes"*) I discovered that the last two filter selections—DAT Hi and DAT Med—are data filters. DAT Hi is centered at 2210 Hz, while DAT Med is centered at 1700 Hz. Both have a bandwidth of 500 Hz. As soon as I selected DAT Hi, I had perfect copy on either RTTY system!

On transmit, I ran into another problem. The maximum output from my SoundBlaster using the *RITTY* program was insufficient to drive the transmitter. My KAM also was unable to provide enough signal until I removed a jumper on the main circuit board of the KAM. Kachina has built commercial radios for over 20 years. Apparently in the commercial world, data modems are designed to produce an output signal at 0 dBm into a 600-Ω load. This means you will have to supply a signal with almost 2-V peak-to-peak at the rear-panel DB-25 connector—quite a lot for the typical TNC. In my KAM, this involved changing a jumper. In other cases, you might have to make component or wiring changes.

With the KAM set to high output, I was able to make several RTTY contacts. Other digital modes, such as AMTOR, PACTOR, G-TOR or any of the other modes in use should present no further problems. The radio switches fast enough to handle these handshaking modes.

One seemingly glaring omission on the 505DSP was a noise blanker. However, the radio more than makes up for it with its superb noise reduction function. The noise reduction is "simply amazing," said one user familiar with the performance of several external DSP boxes. The NR can cut static crashes considerably without excessive hollowness due to processing. Whether this stands up to the wide variety of pulse-type noise a radio might be exposed to as well as the typical noise blanker does remains to be seen.

The 505DSP includes a manual and an automatic notch. The automatic notch worked nicely on a single heterodyne in the bandpass, but was ineffective in the presence of more than one. Users gave it poor marks. Since this is a DSP radio, our expectations were much higher. Many, if not most, external DSP boxes offer better performance in this regard. The manual notch was quite effective, however. The manual notch provided attenuation of up to 40 dB (it was frequency dependent). The automatic notch provided a bit less attenuation and took approximately 50 ms to latch up.

Given the lack of crystal filters and almost total reliance on IF DSP in this radio, selectivity was roughly comparable to other radios in this price class. The big difference—and this is a somewhat subjective observation—was the impression that the Kachina 505DSP continues to actively "work" on a signal as conditions change. Enabling noise reduction imparts some "processing" hollowness, too and tends to roll off the treble frequencies. Overall, the receiver's audio was satisfactory, but there's no way to tailor the sound. A digital equalizer might be a nice addition for the future. In the meantime, a little IF shift can work wonders.

Performance Measurements

The ARRL Lab encountered some challenges in testing the Kachina 505DSP (see sidebar, "AGC in the Kachina 505DSP") and some pleasant surprises (see Table 1). The worst-case transmitter IMD measurement shows that the third-order products (see Figure 4) compared favorably with the IMD we've seen recently in similarly priced radios.

We noted exceptionally low composite (phase) noise—approximately 10 dB lower across the 2 to 22 kHz range tested than many radios we have tested recently (See Figure 5). In fact, only the Ten-Tec OMNI IV Plus showed lower composite noise across most of the range. This most likely resulted from the direct digital synthesizer design and the computer temperature-compensated reference oscillator.

Given the absence of crystal filters, we were especially interested the receiver's dynamic range performance. Kachina specs its blocking dynamic range based on a 100 Hz filter setting; the ARRL Lab customarily measures this parameter at a 500 Hz bandwidth. With the 500 Hz filter enabled, our best number was 103 dB on 20 meters. The two-tone third-order IMD dynamic range measurements were slightly better than Kachina's spec and in the ballpark with other radios in this price class. Our preamp-off third-order intercept numbers calculated out to be just a tad lower than Kachina's "typical" +18 dBm.

The 505DSP met the 60 dB spec for spurious and harmonic suppression on some, but not all, bands. The worst case was 53 dB.

Conclusion

The Kachina 505DSP offers solid RF performance on a par with other radios in the $2000 price class. While those who used the radio agreed it might not suit the "power users" out there, it could be a good choice for more casual operators who want to experience the cutting edge of

technology. (Even so, noted DXer and contester Martii Laine, OH2BH, used Kachina 505DSP radios in his hugely successful EA8BH operation from the Canary Islands during the 1997 CQ WW SSB Contest.) The 505DSP also could also be an excellent choice for those who are more at home with a computer and mouse than a transceiver with knobs. In addition, a radio such as the 505DSP opens enormous possibilities for operators with disabilities that make a computer interface more desirable than that of a more traditional radio.

The radio is solidly constructed. In a rather bizarre—and unintended—test of ruggedness, one user accidentally pumped 1500 W of RF directly into the radio's antenna port. While the antenna input selector board was literally smoked and rendered nonfunctioning, the radio still worked otherwise—although a smoke film coated everything! Kachina serviced the radio and had it back to us in short order. We certainly don't recommend this kind of test for any radio, nor would we normally expect the typical transceiver to stand up to this type of abuse!

We would like to thank the following people for their comments and assistance with this review: Dean Straw, N6BV, Ric Plummer, KV1W, Mark Wilson, K1RO, Bart Jahnke, W9JJ, Glenn Swanson, KB1GW, Rick Lindquist, N1RL, and Ed Hare, W1RFI, and Mike Tracy, KC1SX, of the ARRL Lab.

Manufacturer: Kachina Communications, Inc, PO Box 1949, Cottonwood, AZ 86326; tel 520-634-7828; fax 520-634-8053; e-mail **sales@kachina-az.com**; **http://www.kachina-az.com** Manufacturer's suggested retail price: Kachina 505DSP, $1995; model 505-AT internal automatic antenna tuner, $239; 25-foot control cable, $57; 75-foot control cable, $115.

Cherokee AH-50 6-Meter Hand-held Transceiver

Reviewed by Rick Lindquist, N1RL
Senior Assistant Technical Editor

BOTTOM LINE

A solid 5-W performer for 6-meter FM that's easy to use and goes just about anywhere.

Since Azden stopped selling ham gear in the US, you'll have to look long and hard to find much 6-meter FM-only gear. And if you want a single-band H-T for 6-meter FM, the Cherokee AH-50—made in South Korea and distributed in the US by Wireless Marketing Corp—is the only game in town. This is why the company could get away with calling it the "world's smallest" portable 6-meter radio—a moot point now with the

Table 2
Cherokee AH-50 6-meter H-T, serial number 97030430

Manufacturer's Specifications	*Measured in the ARRL Lab*
Frequency coverage: Receive and transmit, 50-54 MHz.	As specified.
Power requirements: 7.2-12 V dc. Receive, ≈35 mA; transmit, (max, high power), ≈900 mA.	As specified.
Size (HWD); 5.1×2.1×1.3 in; weight 14 oz.	
Receiver	*Receiver Dynamic Testing*
FM sensitivity, 12 dB SINAD: 0.3 μV.	For 12 dB SINAD: 0.28 μV.
Two-tone, third-order dynamic range: Not specified.	20 kHz offset, 55 dB; 10 MHz, offset, 91 dB
Adjacent channel rejection: Not specified.	20 kHz offset, 61 dB.
First IF and image rejection: Not specified.	IF rejection, 108 dB; image rejection, 83 dB.
Squelch sensitivity: Not specified.	At threshold, 0.15 μV.
S-meter sensitivity: Not specified.	S9=4.5 μV.
Audio output: 400 mW (distortion and load not specified).	661 mW at 10% THD into 8 Ω.
Transmitter	*Transmitter Dynamic Testing*
Power output (H/L): 5 W / 1.0 W with NP-126, 12.0-V battery pack; with external supply, not specified.	6.2 W / 1.2 W with NP-126 12.0-V battery pack; 6.2 W / 1.2 W at 12.0 V dc.
Spurious signal and harmonic suppression: Not specified.	57 dB. Meets FCC requirements for spectral purity for purity for equipment in its power output class and frequency range.
Transmit-receive turn-around time (PTT release to 50% of full audio output): Not specified.	Squelch off, S9 signal, 190 ms.
Receive-transmit turn-around time ("tx delay"): Not specified.	10 ms.

appearance of the ICOM IC-T8A tribander.

Given the paucity of 50-MHz FM activity in this part of New England, I was a little reluctant to look at the AH-50 in the first place. I anticipated having to drive up into Massachusetts or New Hampshire, where we've found 50-MHz FM activity to be much more prevalent. in order to get some signal reports. Then, I figured I'd be hampered by the unit's 5 W output and rubber ducky antenna—no bigger than the one on most 2-meter H-Ts.

It didn't work out that way, however. Since we last checked out any FM-only gear for "The Magic Band" (see "Product Review," *QST*, Aug 1996), a couple of repeaters have sprung up in the area that provide nice coverage and are attracting new users. The AH-50 was able to bring these up with no problems on its own and provide reliable communication. It's a fun little radio!

No, we had not previously heard of the Cherokee brand, either—at least not before we spotted the AH-50 at a local ham radio retailer's. The company has a line of Citizens Band and Family Radio Service products as well as dc-to-ac power inverters. The AH-50 is the company's first—and only—Amateur Radio product, and it's a solid performer. (We're hoping they'll come out with one of these that operates SSB.)

The AH-50 is an H-T built along pretty traditional "full-sized" lines. Compared to the tiny units now available for the other VHF and UHF bands, the AH-50 is a substantial unit, but it has a comfortable size and feel. This unit can run a full 5 W with the supplied battery (actually, we got a bit more than that out of ours with a fully charged battery). There's a 1 W low-power position, too. A 12-V, 600 mAh NiCd battery powers the AH-50. A wall-cube charger is included, and there's a little **CHARGE** LED on the battery itself.

Atop the AH-50 are two rotary controls, **SQ** squelch and **VOL** (this also has the power switch). There are jacks for **MIC** (microphone) and **SPK** (speaker), too, in case you want to use a speaker-mike. A rubber dust flap covers these jacks when they're not in use. The rubber ducky antenna—just $6^1/_2$ inches tall and clearly labeled "52 MHz" so you don't get it mixed up with the one for your *other* H-T—attaches to a BNC connector.

Tuning the AH-50 is by $\wedge$ and $\vee$ buttons on the side of the unit, just above the PTT button. Their location was the only serious complaint I had about this unit—the tuning buttons are too easy to hit by accident when you're going for the PTT button. After using the unit for a while, however, this became much less of a problem. The PTT button has a distinctive feel to it, which you come to recognize. A "real" encoder knob would have been nice, but why quibble?

The face of the unit features an LCD display just large enough to include the necessary information. The readout is nice and bold and easy to read in most lighting conditions and at most viewing angles. The display frame does tend to shadow the top and bottom of the display at some angles, however. The display can show your operating frequency and memory channel (if selected), and tell you if the CTCSS tone, repeater mode (+ or –), 5-kHz tuning step, and low-power modes are enabled. The display also includes a 15-segment LED S-RF indicator. There's a low-battery warning icon. The display also indicates when you're in TX (transmit) mode, when the **F**unction button has been pressed, and if the receiver is busy.

There are six buttons on the front of the AH-50—including a **F**unction button—that provide multiple functions and let you access menus to set things such as CTCSS tone, tuning step, and repeater split. Pressing one of these buttons illuminates the display for nighttime viewing. Other features include a Key Lock mode, Power Save mode, and tone squelch. I enabled the Power Save mode used the unit for several days without ever having to recharge the battery.

The unit has but five memories—not many compared with the dozens available on H-Ts for 2 meters and 70 cm, but probably sufficient to stick in the frequencies of all the 50-MHz repeaters you'd be using on a regular basis. There's a dedicated calling frequency (**CAL**) button—essentially a one-button sixth memory channel—that you can program for the prevailing simplex channel, too. Memories are simple to program, but almost as simple to overwrite. You press the **F** button, then one of the other five front-panel buttons to access a channel you've put into memory. Choice of available repeater splits via the menu is limited to either the common 1-MHz or 500 kHz. As this review went to press, Wireless Marketing announced a new model, AH-50-SF, which permits splits in 100-kHz increments up to 2 MHz.

The unit has limited band and memory-scanning capability. It can scan the entire 50 (yes) to 54 MHz band in approximately 45 seconds and will stop for a few seconds on a busy channel before resuming scanning (unless you stop scanning). It can scan in either direction. In addition, it can scan the memories.

The 23-page *Operating Instructions* booklet is pretty thorough. Wireless Marketing is to be commended for reminding buyers that legal use of the AH-50 requires an Amateur Radio Technician class or higher license. The book also refers users to the American Radio Relay League for more information on licensing. Too bad they made a typo on our "initials" and did not include our address or telephone number. The booklet contains clear graphics and descriptions.

The AH-50 lets you set separate CTCSS tones for transmit and receive (tone squelch). This is not something you're likely to want or need, but our unit must have arrived with a receive tone selected. When I enabled the tone mode to access a local machine that required a CTCSS tone, I was baffled to find I suddenly was unable to hear the repeater, although I could clearly see it "coming back" to me on the **S-RF** meter. I'd read the instructions in the booklet about how to enable the tone mode and set the transmit CTCSS frequency. Obviously, the unit was in tone squelch mode! The retailer didn't know how to disable the tone squelch, so I called Wireless Marketing's toll-free number (800-259-0959). It was a weekend, and no one was there, but I left a message.

Of course, then I decided to take another look at the manual. Aha! After describing how to select the CTCSS tone and going on to talk about scanning is the description of Set Mode, where (among other things) you can set the TX and RX CTCSS tone. I followed these instructions and set the unit for "NO TONE" on receive. Everything worked fine after that. Wireless Marketing called me back Monday morning, however, and seemed very eager to help. I explained that the problem was not in their set but in the operator. The moral of this tale should be pretty obvious.

On-air reports indicated the AH-50 had nice audio, and it was able to hit several area machines with no problem. The area devoted to the speaker "grille" is sizable, and the receive audio was sufficient to fill a small room.

One nice thing about 6 meters is that the band can provide range of the type you don't always find on 2 meters or on 70 cm, so it was not unusual to work stations a couple of states away through a repeater. Enhanced propagation can stretch that distance by hundreds of miles.

The manufacturer's suggested retail price for the AH-50 is pretty steep for a single-band H-T, but we understand the typical street price is *much* more modest. Lots of accessories are available for the AH-50, including a standard battery case that holds 8 AA alkaline or NiCd cells. A drop-in charger is optional, as are a speaker-mike, a carrying case, and a "Super Flex" extended-range antenna that's 28 inches long. You can get a cigarette-lighter adapter cord to run the unit mobile, too.

Manufacturer: Distributed by Wireless Marketing Corp, 1212 Remington Rd, Schaumburg, IL 60173; 800-259-0959; **http://www.wirelessmarketing.com**. Manufacturer's suggested retail price: AH-50 50-MHz FM hand-held transceiver, $400. EX-01 speaker-mike, $33; DC-27 drop-in charger, $110; SA-5 "Super Flex" extended-range 28-inch antenna, $40. QST