You can compensate by hand, but you'll be tweaking the VFO almost constantly. The solution is to allow the TNC to make the correction through the **UP/DOWN** frequency stepping available at the radio's microphone jack. With the IC-820H, however, the minimum up/down step is 100 Hz. A 100-Hz jump is too drastic for this type of operation; 10 Hz would have been much better. My PSK satellite TNC scrambled wildly to resynchronize with the downlink every time the 820H changed frequency. During each scramble I lost data and my throughput suffered accordingly.

When I tried the 9600-bit/s packet satellites, I hit the most serious snag of all. Remember that you must set the internal slide switch to the **PACT** position for 9600-bit/s operating. But wait a minute! When you place the switch in **PACT**, you lose the receive audio from the Sub band—your 70-cm FM downlink. Instead, you get the *Main* band audio—your *uplink* channel. This won't work.

No problem, you think. You'll just flip-flop the Main and Sub bands. You can transmit on 2 meters using the Sub band and receive the 70-cm downlink on the Main band. *Wrong.* You can't transmit from the Sub band, remember?

In other words, you're stuck. You can't use the IC-820H to operate the 9600-bit/s packet satellites—at least not without a modification. G3RUH's solution was to pick off the signal from the Sub band discriminator and make it available at the rear panel. He simply attached a small shielded cable to pin 9 of IC20, the Sub receiver discriminator chip. I tried the same approach and it worked beautifully. ICOM has adopted this modification "officially" for the IC-820H and will provide the necessary details upon request.

With the modification in place, I was able to successfully work OSCARs 23 and 25. Throughput was excellent, even with my less-than-optimum antenna system. Manual tracking for Doppler shift was a bit tricky at times, but manageable.

### Conclusion

ICOM's IC-820H is a serious contender for hams anxious to explore VHF/UHF activities beyond the local repeater. It excels as a terrestrial radio for FM, SSB, CW or packet. Its 9600-bit/s performance is superb. With a simple modification, the 820H is also a good way to try the packet satellites. And it's a fine starter rig for those who want to work OSCAR 13, OSCAR 20 and so on. As G3RUH has stated, though, the ICOM IC-820H won't win the hearts of serious satellite operators.

Manufacturer: ICOM America, 2380 116th Ave, Bellevue, WA 98004, tel 206-454-8155. Manufacturer's suggested retail prices: IC-820H transceiver, $1999; PS-55 power supply, $345; HM-14 hand-held microphone with DTMF keypad, $82; CT-17 level converter, $123; UT-50 CTCSS tone squelch unit, $68; FL-132 500-Hz IF filter, $96.

# Azden AZ-61 6-Meter FM Hand-Held Transceiver

*Reviewed by Steve Ford, WB8IMY*
*Assistant Managing Editor*

Despite the fact that we're wallowing in the depths of a solar minimum, 6-meter activity appears to be on the rise. Codeless Technicians are the engines driving much of this band's new-found popularity. Many have grown weary of the overcrowding on 2 meters and want to explore new territory. The 6-meter band rewards the curious with coverage that's often superior to 2 meters, and occasional *sporadic E* openings that span hundreds of miles or more. If the current crop of 6-meter enthusiasts remains active for a few more years, they'll be astonished at the DX propagation they'll encounter. (Routine contacts into Europe, Africa and so on.)

Two modes enjoy the lion's share of activity on 6 meters: SSB and FM. The SSB operators usually chase exciting band openings on a variety of interesting modes, and many are heavily involved in contesting. FM operators enjoy local and regional contacts through repeaters. You'll also find them on several simplex frequencies, but mainly on 52.525 MHz. Contesting is not as popular on FM, but that's changing.

If you want the best of both worlds, a 6-meter *multimode* transceiver is ideal. It offers CW and SSB in addition to FM. But if SSB doesn't interest you, there is little reason to waste your money on a multimode when a 6-meter FM-only transceiver will do. Single-mode rigs are also easier to use.

### The AZ-61

With the AZ-61, Azden brings the convenience of an H-T to the 6-meter FM world. The AZ-61 is patterned after the AZ-21A 2-meter hand-held and includes many of its features. The design is rugged, and Azden backs up the AZ-61's durability with a two-year warranty (unique in the amateur equipment market).


**The Bottom Line**

The AZ-61 is a dandy H-T for a band that can provide many interesting contacts, both local and—when the band is open—DX.

RF output is switchable from a hefty 5 W to only 500 mW. Considering that 6-meter repeaters are few and far between in many areas of the country, 5-W output is a necessity. Much of the H-T's bulk is comprised of a NiCd battery pack. The battery supplies up to 1.5 A when the AZ-61 is transmitting at the 5-W setting. The AZ-61 provides an automatic power-off (APO) mode to conserve battery power. When the APO is active, the radio will shut down after a preset time (10, 30, 60 or 120 minutes).

Because of the changeable nature of 6-meter propagation, your "local" coverage area can suddenly expand to hundreds of miles! In this situation it's possible for one station to key up several repeaters simultaneously on the same frequency. To reduce the headache potential, many 6-meter repeaters require you to send a subaudible *CTCSS* tone along with your primary signal. A repeater activates only when it receives the correct tone. It ignores all other signals on the input frequency.

The AZ-61 accommodates this arrangement with a flexible CTCSS encoder. You can select the tone frequency from the keyboard, or program it into any of the AZ-61's 40 memory channels. The AZ-61 also includes the ability to *decode* CTCSS

**Table 2**

**Azden AZ-61 6-Meter FM Transceiver, serial no. 021225**

| *Manufacturer's Specifications* | *Measured in ARRL Lab* |
|---|---|
| Frequency coverage: Receive, 46-54 MHz; transmit, 50-54 MHz. | As specified. |
| Power requirements: 6.5-16 V dc; 150 mA max (receive); 1.5 A max (transmit). | At 13.8 V dc: 190 mA max (receive); 940 mA max (transmit). |
| *Receiver* | *Receiver Dynamic Testing* |
| Sensitivity: Better than 0.16 μV for 12 dB SINAD. | 0.15 μV for 12 dB SINAD. |
| Two-tone, third-order IMD dynamic range: Not specified. | 60 dB at 20-kHz spacing. |
| Adjacent-channel rejection: Not specified. | 70 dB at 20-kHz spacing. |
| IF rejection: Not specified. | 1st IF (16.9 MHz): 69 dB; 2nd IF (455 xkHz): >133 dB. |
| Image rejection: Not specified. | >50 dB. |
| Squelch sensitivity: 0.1 μV or less. | 0.06 μV at threshold. |
| Audio output: ≥250 mW into 8 Ω at 10% distortion. | 730 mW at 10% THD into 8 Ω. |
| *Transmitter* | *Transmitter Dynamic Testing* |
| Power output: High, 5 W; low, 0.5 W with external 13.8 V power source. | As specified. |
| Spurious signal and harmonic suppression: Equal to or better than 60 dB. | As specified. The AZ-61 meets FCC requirements for spectral purity for transmitters in its power class and frequency range. |
| Transmit-receive turnaround time (PTT release to 50% of full audio output): Not specified. | Squelch on or off, 240 ms. |

Size (height, width, depth): 7.3×2.8×1.5 inches; weight, 1.2 pounds with BP-11 battery pack.

tones for paging. This is especially useful for emergency-response situations where whole groups of operators must be alerted at once.

A 16-button keypad on the front panel is the entry point for most programming functions. This same keypad is used for DTMF (*touchtone*) dialing when you're using an autopatch to place a telephone call through a repeater. The AZ-61 also decodes DTMF tones for paging and other applications.

### Out of the Box

When I opened the AZ-61's box, I thought someone had made a mistake. The manual was labeled "AZ-21A 144 MHz FM Transceiver." No, it wasn't a mistake. Rather than provide a separate manual for the AZ-61, you're told to use the AZ-21A documentation along with a photocopied addendum sheet. This is unfortunate because it adds another layer of confusion to the task of learning a new rig. It became particularly disconcerting when I tried to use features that were available on the AZ-21A, but *not* on the AZ-61. According to Azden, a new manual was in the works at presstime. The new manual will be sent free of charge to AZ-61 owners of record.

As I removed the radio from the packing material, I was pleased to discover that Azden included a charging stand with the AZ-61. The Azden engineers must have had my clumsiness in mind. Now I could charge an H-T upright without worrying about knocking it over every other minute. When I needed to use the rig, all I'd have to do is lift it from the stand. If you want to power the AZ-61 from a source other than its batteries, a coaxial dc power jack is available on the top of the radio.

At about 1.5 pounds, the AZ-61 felt as solid as a brick. I bounced it up and down in my hands and wondered what would happen if it slipped and headed for my feet. A belt clip is included, although I wouldn't advise attaching it to the waistband of a loose pair of shorts! After connecting the oversized flexible rubber antenna, I was ready to take it on the air.

### On the Air

My first impulse was to switch on the AZ-61 and dial up 52.525 MHz. As I pushed the **VFO** up/down switches, I saw the digital display read 52.520 then 52.530 MHz. Wait a minute! You mean you can't step frequencies in 5-kHz increments? Yes, you can. However, the default setting for the AZ-61 is *10*-kHz steps. I had to enter the program mode and switch it to 5 kHz. Programming the AZ-61 is relatively easy. It's just a matter of stepping through the choices until you find the one you want to modify.

After listening for a hour or so, it became apparent that 52.525 MHz was little used in my area—at least by nearby hams. When I attached an improvised 6-meter outdoor dipole, however, I heard signals from as far as 70 miles away.

The AZ-61 offers extended receive capability down to about 46 MHz. While I was hooked up to the external antenna, I set the H-T to scan from 46 to 50 MHz. After 10 minutes of listening I heard several cordless telephone conversations and a few baby monitors—including our own. I programmed our baby monitor frequency into memory and took a walk with the AZ-61. I was astonished to discover that I could hear the signal from nearly three blocks away. This demonstration renewed my appreciation of how unsecure cordless telephones, baby monitors and similar devices can be. If the AZ-61 can eavesdrop over such a wide area, who else is listening?

According to *The ARRL Repeater Directory*, there was a 6-meter FM repeater not far from my home, and I was eager to give it a try. The input frequency was at 52.050 MHz and the output was at 53.050 MHz (a 1-MHz split). I set the AZ-61 on the output frequency and toggled the transmit offset to minus (–). When I keyed the H-T, I was surprised to see that it was transmitting on 52.550 MHz, only 500 kHz below 53.050 MHz. This was understandable, however, because the most recent ARRL band plan calls for a 500-kHz input/output split for 6-meter repeaters. Obviously, the AZ-61 was set up to conform to the band plan.

For many years, the band plan called for a 1-MHz split, and this arrangement is still in use in many areas. I didn't think this would present a problem. All I had to do was enter the program mode and readjust the offset for 1 MHz. *Wrong!* The 500-kHz split is *fixed* in the AZ-61. You can't change it. The only way I could access the repeater was to program the transmit and receive frequencies into one of the memory channels and select the duplex mode. This is another area where the manual (or lack thereof) falls short. Because of my impatience, I wasted time trying to program the H-T for a 1-MHz split *before* reading the footnote on the addendum sheet ("Offset width control not available.").

Once I had the frequencies programmed into memory, the rest was simple. I was able to access the repeater and eventually received several good signal reports. Finding people to talk to wasn't easy, though. In some areas of the country (southern California, for example), 6-meter FM has a sizable following. In New England, however, 6-meter FM is not terribly popular. I had to hunt for contacts during the morning and afternoon commutes.

Speaking of commuting, I had a number of opportunities to use the AZ-61 mobile. An H-T in an automobile with a rubber-duck antenna is always the worse-case scenario. My experience with the AZ-61 was no exception. I usually received poor reports unless I happened to be on a hilltop. An external $^1/_4$ or $^5/_8$-wavelength mobile antenna would have made a world of difference.

The lighted LCD display was handy

when operating mobile or portable. In addition, there is a push-button **LOCK** control to prevent you from changing frequencies or other settings by accident. A similar push button controls high/low RF output. I enjoyed having RF power control on a push button rather than on the keypad. It beats fumbling for the right keypad button in the dark. An optional speaker/microphone is available for the AZ-61 and I consider it a must for convenient mobile operating. If you plan to do a lot of 6-meter FM operating from your car, consider Azden's PCS-7500H 50-W mobile transceiver.

The AZ-61 really shined when I used it with my outdoor dipole antenna at home. Not only did I make several distant simplex contacts, I also took advantage of a couple of band openings. One Saturday morning I enjoyed several contacts through a repeater 300 miles away. Not bad for 5 W and a dipole!

### Conclusion

The AZ-61 was a pleasure to use, although my initial experience would have been more fun if I'd had the new manual. The radio performed well in all applications: mobile, portable and home. If you're going to explore FM simplex or work distant repeaters from your car, you'll need a power amplifier to boost the AZ-61's output to 50 W or more. An amplifier is also a good idea for home use, although you can realize the same gain by installing a beam antenna.

What surprised me most about 6-meter FM is how much fun it is. Chasing signals with the AZ-61 reminded me of 2-meter FM in the early 70s: low activity, but plenty of fascinating contacts.

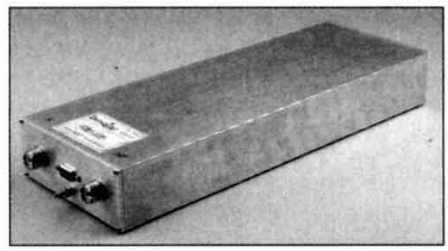
Manufacturer: Azden Corporation, 147 New Hyde Park Rd, Franklin Square, NY 11010, tel 516-328-7501. Manufacturer's suggested retail price: $379.

# Dunestar Model 600 Multiband Bandpass Filter

*Reviewed by R. Dean Straw, N6BV*
*Senior Assistant Technical Editor*

The Dunestar 600 bandpass filter is an in-line filter that operates on both transmit and receive. Its primary application is reducing interference between stations operating in close proximity, at Field Day or a multitransmitter contest site. The Dunestar 600 covers 160 through 10 meters (excluding 30, 17 and 12 meters) and is rated at 200 W. Band switching is accomplished by applying 12 V dc to the appropriate pin on a DB9 connector, or by grounding the appropriate pin. You can select either option (ground-to-switch or 12 V-to-switch) with an internal jumper. An internal relay automatically bypasses the filter if you remove power or do not specifically select a band. This feature allows operation on 30, 17 and 12 meters or listening outside the ham bands without rerouting coaxial cables. The manual shows a number of possible switching configurations.

During the October 1994 CQ World-Wide Phone DX Contest, I used the Dunestar 600 in my single operator, all band, unassisted contest effort. My station consists of two ICOM IC-765 transceivers feeding separate power amplifiers. One radio is used primarily for CQing and the other for tuning for multipliers on other bands. I used a Band Decoder made by Top Ten Devices[1] to switch the filter to the correct band automatically, using data available from a jack on the IC-765's rear panel. Late in the contest, when fatigue sets in, I'm never quite sure which of the two radios I'm listening to—a problem no bandpass filter is going to solve! But not having to switch transmitter filters manually is a good step in the right direction. The highest compliment I can pay the Dunestar 600 and Top Ten Band Decoder is that they never reminded me they were in



the circuit—they just did their jobs quietly and efficiently!

My antenna system consists of eight antennas, all on a single 120-foot-high Rohn 45 tower.[2] I like to think I have one of the more efficient single-tower contesting setups around, with four stacked tribanders on 20 through 10 meters, a five-element 10-meter monoband Yagi, a three-element 40-meter Yagi and a full-sized 80-meter quad—gain on all HF contesting bands!

One drawback to using a single-tower system with two active stations is that the transmitting antenna for one station will always be physically close to the other station's receiving antenna. I eliminate fundamental overload by using simple double-tuned bandpass filters in the receivers' antenna input lines. I manually select these receiver filters, which are part of the switchbox controlling the Beverage receiving antennas. (Someday I'll automate that function too.)

However, modern no-tune solid-state transmitters also generate wideband white noise. Although it is usually suppressed well in excess of 100 dB compared to the desired fundamental signal, this wideband noise is often strong enough to affect nearby receivers, even on different frequency bands. The second receiver is affected only when it is used on a frequency lower than the cutoff frequency of the transmitter output low-pass filter, which is used only to suppress harmonics. For example, when the main transmitter is on 21 MHz, a nearby 14-MHz receiver would hear wideband noise passing through the transmitter's output low-pass filter, typically designed to cut off above 30 MHz.

Efficient external high-power bandpass filtering with a filter such as the Dunestar 600 can save the day. Since the band-pass filter must be able to withstand the full exciter power (up to about 200 W for some transceivers), the loss in the filters must be engineered to be very low, yet the attenuation to spurious energy on adjacent amateur bands should be better than about 30 to 40 dB, to ensure that wideband noise is suppressed adequately.

Band-pass filters like the Dunestar 600 can also help protect the receiver in the main transceiver from fundamental overload whenever a very close transmitter is activated on another HF band. (By the way, I can't help wondering why transceiver manufacturers themselves don't incorporate better band-pass filtering in their radios at the medium-power-level stages, after the low-level gain stages, especially for so-called "contest-grade" radios. *Sigh.*) The second-order IMD problem noted by Ulrich Rohde in a recent series of *QST* articles[3] can also be helped by such extra selectivity before the receiver front end.

One unexpected benefit of using the Dunestar 600 between the transceiver and my AL-1200 linear amplifier was that it "smoothed out" the input SWR of the amplifier on 20 meters enough to allow the transceiver to deliver full power into the amp without having to resort to using the internal antenna tuner, as I had to do previously.

[1]Top Ten Devices, 143 Camp Council Rd, Phoenixville, PA 19460; tel 610-935-2684. Price class: $100.

[2]R. Dean Straw, N6BV/1, and Fred Hoppengarten, K1VR, "Stacking Tribanders: A Super Station—Sorta," *QST*, Feb 1994, pp 38-44.

[3]Ulrich L. Rohde, KA2WEU, "Key Components of Modern Receiver Design," Part 1 in *QST*, May 1994, pp 29-32; Part 2 in *QST*, June 1994, pp 27-31; Part 3 in *QST*, Jul 1994, pp 42-45.