

IC-2820H

Dual Band FM Mobile Transceiver

QST Product Review

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ICOM®

PRODUCT REVIEW

ICOM IC-2820H Dual Band FM Transceiver



Reviewed by Steve Ford, WB8IMY
QST Editor

The ICOM IC-2820H has to be the most complex FM transceiver I have ever operated — and that isn't a bad thing.

No doubt you are familiar with what I like to call *negative complexity*. This concept is embodied by a radio that is packed to the gills with a mind-numbing array of features, most of which you'll never use. *Positive complexity*, on the other hand, is best described as a transceiver that offers numerous features that are genuinely useful, an embarrassment of riches, if you will. The IC-2820H is a positively complex rig.

The primary features of the IC-2820H are those that you *will* use and will *want* to use. Yes, there is a considerable learning curve that begins when you first power up the radio, but I think that is part of the enjoyment of purchasing a new transceiver. The learning is made easier by the fact that the IC-2820H manual is detailed and well written. There is only one slight gap concerning the optional GPS functionality, which I'll discuss later.

Magnetic Personality

FM transceivers with detachable front panels or *control heads* are not new. What is new in the IC-2820H is the way the control head secures to the radio, and to other objects, for that matter. The IC-2820H's control head features two powerful magnets about the size of large shirt buttons. These magnets hold the control head tightly to the body of the radio, but not so tightly that you can't remove it quickly. There are two rows of recessed pads on the body to receive the magnets. By attaching the magnets to the upper or lower row you have your choice of positioning the control head "high" or "low" on the front of the body.

Of course, the main attraction (pardon the pun) of magnetic mounting is that you can, at least in theory, slap the control head

onto any metal surface inside your car. The problem I encountered is that my car doesn't have metal surfaces. The IC-2820H comes with a metal plate that you can affix to your dashboard or other location. I was reluctant to put screws into my otherwise pristine interior, so I used an adhesive hook-and-loop fastener strip instead.

The IC-2820H control head is sizeable with a big, bright liquid crystal display (LCD). I had no difficulty reading the display in any light. Of course, brightness, color and contrast are adjustable. There are separate VOLUME and SQUELCH controls for each band positioned on opposite sides of the display. The SQUELCH control is unique in the IC-2820H. As you rotate the knob from about 7 to 10 o'clock, it functions as a normal squelch, completely cutting off the audio until a sufficiently strong signal appears on the frequency. When you rotate beyond the 10 o'clock position the squelch begins functioning as an RF attenuator (up to 10 dB).

Magnets and Microphones

One issue with magnetic mounting is that you have to strike a compromise between magnets that are powerful enough to hold the control head firmly, but not so powerful that you need a crowbar to remove it. In the case of the IC-2820H, this compromise means that you must avoid attaching anything to the control head that is likely to tug it off the mount — namely the microphone cable. With the IC-2820H you can mount the control head anywhere (the radio comes with a 10 foot separation cable), but the microphone must plug into the body of the radio — *period*. This can be a hassle when you want to install the body out of sight and out of reach. ICOM's solution is to offer a long (16 foot) microphone extension cable as optional equipment. At \$85 the OPC-440 extension is a pricey solution, though. If you're willing to do a bit of shopping, there is a frugal alternative. You could

purchase a \$5 inline CAT5 cable coupler, a 15 foot long CAT5 network cable for another \$5 and assemble your own microphone extension in about 30 seconds. I did exactly that with parts from my junkbox. It worked perfectly.

The supplied microphone puts the most important functions of the radio in the palm of your hand. The buttons are also illuminated for easy viewing at night. The microphone audio level can be set to either HIGH or LOW. I've been told that I have a loud voice, yet I found that I needed to use the HIGH setting. Also, I noticed a lack of low frequency response in my transmit audio. According to on-air reports, the audio was crisp and clear, but rather flat — all midrange and little else.

Speaking of remote installations, it's worth noting that you can plug in one or two external speakers — one for each band — if you wish. The internal speaker is plenty powerful, however, with excellent audio. Despite stuffing the IC-2820H body under the driver's seat, I still had more than enough audio to hear the radio clearly.

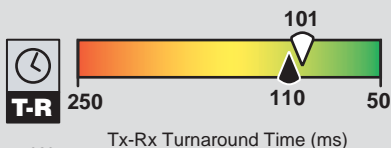
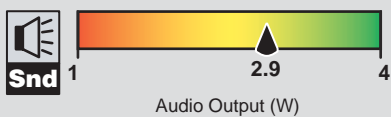
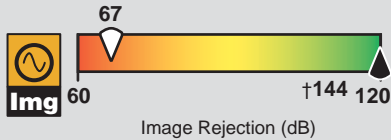
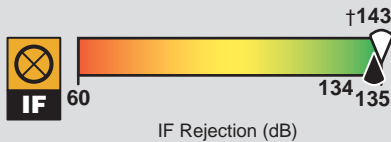
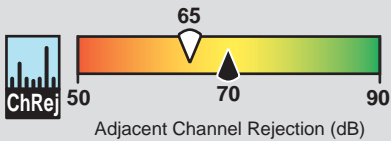
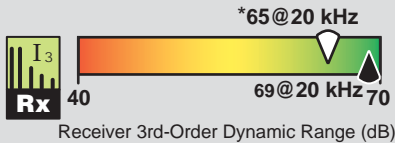
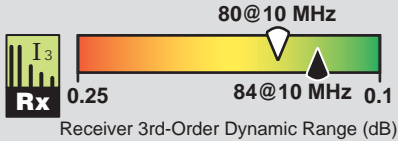
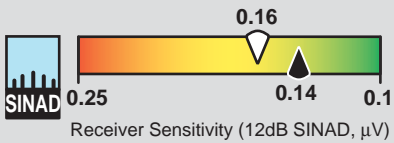
Split Personality

The IC-2820H offers two separate receivers, which makes for some interesting possibilities. Either band can be selected as the "Main Band" by simply pressing either the left or right tuning controls, but it is more appropriate to speak of the bands as "left" or "right," which is how the manual approaches the subject.

The left band offers receive coverage from 118 to 550 MHz in AM, Narrow AM, FM, Narrow FM or DV (D-STAR digital voice, assuming you've installed the optional UT-123 module). The right band takes the coverage all the way to 999.99 MHz, with the usual cellular-telephone gaps.

There are two SO-239 antenna ports on the IC-2820H's rear panel. ANT1 is for transmission and reception, but ANT2 is receive only. If you have two separate antennas, you can connect them both to the IC-2820H and take advantage of its *diversity reception* feature. I had some experience with diversity reception during my review of the ICOM IC-R2500 receiver (January 2007 *QST*) and it functions the same way in the IC-2820H. When you're listening in diversity mode, the radio compares the strengths of the signal at both antennas and "chooses" the strongest signal. This is a useful feature when you're monitoring a mobile station directly (not through a repeater). As the mobile's signal fluctuates, you will always hear the best result possible as the radio switches between one antenna and the other.

Key Measurements Summary



pr023

Key:

* Noise limited at value shown.

† Off Scale

70 cm

2 M

Bottom Line

The IC-2820H is complex and somewhat pricey, but this dual-band radio does it all. With the optional module, D-STAR and GPS features integrate seamlessly. It's got a full set of analog FM features and a sensitive wideband receiver, too.

Table 2

ICOM IC-2820H, serial number 0501881

Manufacturer's Specifications

Frequency coverage: Receive, 118-550, 810-1000 MHz (cell blocked); transmit, 144-148, 430-450 MHz.

Power requirement: Receive, 1.8 A (max audio); transmit, 13 A (high power).

Modes of operation: FM, AM (receive only).

Receiver

AM sensitivity, 10 dB S/N: 118-160 MHz, 1.0 μV ; 220-225, 350-360, 375-400 MHz, 1.8 μV ; 225-350, 360-375 MHz, 18 μV .

FM sensitivity, 12 dB SINAD: left band, 118-160, 400-500 MHz, 0.32 μV ; 160-180, 220-225, 350-360, 375-400, 500-550 MHz, 0.56 μV ; 180-220, 225-350, 360-375 MHz, 0.32 μV ; right band, 118-160, 400-500 MHz, 0.32 μV ; 160-174 MHz, 375-400, 500-550 MHz, 0.56 μV ; 810-880 MHz, 1.4 μV ; 880-1000 MHz, 3.2 μV .

FM two-tone, third-order IMD dynamic range: Not specified.

FM two-tone, second-order IMD dynamic range: Not specified.

FM adjacent channel rejection: Not specified.

Spurious and image rejection: 60 dB.

S-meter sensitivity: Not specified.

Squelch sensitivity: 0.13 μV .

Receiver audio output: 2.4 W at 10% THD into 8 Ω .

Transmitter

Power output (H/M/L): 50/15/5 W.

Spurious-signal and harmonic suppression: 60 dB.

Transmit-receive turnaround time (PTT release to 50% audio output): Not specified.

Receive-transmit turnaround time (tx delay): Not specified.

Bit-error rate (BER), 9600-baud: Not specified.

Measured in the ARRL Lab

Receive and transmit, as specified.

Receive, 0.85 A; transmit, 11 A.
Tested at 13.8 V.

As specified.

Receiver Dynamic Testing

For 10 dB S+N/N: 120 MHz, 0.58 μV .

For 12 dB SINAD, 144 MHz, 0.14 μV ; 440 MHz, 0.16 μV .

20 kHz offset: 146 MHz, 69 dB; 440 MHz, 65 dB.*

10 MHz offset: 146 MHz, 84 dB; 440 MHz, 80 dB.

74 dB.

20 kHz channel spacing:
146 MHz, 70 dB;
440 MHz, 65 dB.

First IF rejection, 146 MHz, 134 dB; 440 MHz, >143 dB.

Image rejection, 146 MHz, >144 dB; 440 MHz, 67 dB.

Max indication: 146 MHz, 7.6 μV ; 440 MHz, 9.9 μV .

At threshold: 0.1 μV .

2.9 W at 8.5% THD into 8 Ω .
(Closest VOL step to 10% THD.)

Transmitter Dynamic Testing

146 MHz, 49 / 13 / 4.8 W;
440 MHz, 46 / 13 / 4.0 W.

VHF, 62 dB; UHF, 70 dB.
Meets FCC requirements.

S9 signal, 146 MHz, 110 ms;
440 MHz, 101 ms.

146 MHz, 43 ms; 440 MHz, 49 ms.

146 MHz: Receiver BER
at 12-dB SINAD, 2.7×10^{-4} ;
at 16 dB SINAD, $<1.0 \times 10^{-5}$;
at -50 dBm, $<1.0 \times 10^{-5}$.

transmitter BER
at 12-dB SINAD, 4.7×10^{-4} ;
at 12-dB SINAD +30 dB, $<1.0 \times 10^{-5}$.

440 MHz: Receiver BER
at 12-dB SINAD, 6.9×10^{-4} ;
at 16 dB SINAD, $<1.0 \times 10^{-5}$;
BER at -50 dBm, $<1.0 \times 10^{-5}$;
transmitter BER
at 12-dB SINAD, 6.2×10^{-4} ;
at 12-dB SINAD +30 dB, $<1.0 \times 10^{-5}$.

Size (height, width, depth): main unit, 1.6 \times 5.9 \times 7.4 inches; weight, 3.3 pounds; remote head, 2.3 \times 5.9 \times 1.3 inches; weight, 7.4 ounces.

Price: IC-2820H transceiver: \$650; UT-123 GPS/D-STAR module: \$300; OPC-1529R serial data cable: \$25; CS-2820 cloning software: \$35; OPC-440 mic extension cable: \$85.

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.

Diversity reception only works in the FM or DV modes, and works best when signals are reasonably strong.

For most of this review, I operated the IC-2820H with a single dual-band antenna connected to the ANT1 jack. Thanks to the radio's twin receiver design, I could listen to separate bands simultaneously, or monitor two signals within the same band at the same time. My favorite mobile pastime was scanning through a set of memory channels (the IC-2820H offers 522 of them) on the left band while monitoring local fire and rescue continuously on the right band. Yes, that can be confusing at times, but the IC-2820H gives you the ability to automatically mute the sub band when a signal appears on the main band (remember that either the right or left bands can be "main" or "sub" — it's up to you).

The IC-2820H provides a band scope that creates a visual representation of all signals within a range you specify. The individual signals appear as spikes in the band scope display. You can turn the dial and sweep a tiny cursor among the spikes, selecting and monitoring various signals.

Of course, you also have all the other features and functionality you've come to expect of transceivers in this price class: continuous tone coded squelch system (CTCSS) tone decode and tone squelch, dual tone multi-frequency (DTMF) encoder and decoder, flexible scanning options (including CTCSS tone scanning), automatic power off, weather channel monitoring and more.

With DTMF remote control enabled, you can use another transceiver to change the IC-2820's frequency through DTMF commands. Remote access is protected by a three digit password that you create.

When it comes to transmit power, you have three choices in the IC-2820H: 5, 15 and 50 W (both bands). You can transmit from either the right or left band, as long as you've designated it as the "main" band.

Software Programming

A complicated transceiver tends to have a complicated menu system and the IC-2820H is no exception. ICOM did its best to simplify menu navigation from within the main display, but it is still a bit of a strain.

My preference was to purchase ICOM's CS-2820 "cloning software" and their OPC-1529R data cable. Although ICOM calls it cloning software, you can use this convenient *Windows* application to set up all the memory channels and many of the most commonly used features from your PC. This is a well-written piece of software and it takes much of

the pain out of programming the IC-2820H. Within minutes I was able to enter all my favorite frequencies, tone options, splits, and so forth — and write everything to the transceiver's memory — all from the comfort of my laptop.

GPS and D-STAR

For this review we installed the optional UT-123 module to add D-STAR and GPS (Global Positioning System) functionality to the IC-2820H. The UT-123 comes with a tiny GPS antenna with a magnetic base attached to a 16 foot cable. The cable plugs into the front of the IC-2820H body.

With the DV mode enabled and GPS function selected, data appears on the radio's display showing your position and direction of travel. A large compass arrow makes this pretty obvious. If you receive a transmission from another GPS equipped D-STAR radio, you can display its location data along with the distance between your stations. There is even an alarm function that sounds when you are within a preset distance of a given location.

Note that I said the IC-2820H will display the location data, *not* locations on a map as you may be accustomed to seeing with APRS. The LCD is big, but it isn't that big. It is possible to connect the IC-2820H to a computer and display the received GPS data, but the output is not in APRS format. Instead, it is in a similar, but incompatible format that ICOM calls *GPS-A*. There is a free application for *Windows* called *D-PRS* that will convert the *GPS-A* data to APRS format for display within *UI-View* or other APRS software. You'll find it on the Web at www.aprs-is.net/.

But even though you may be able to convert the *GPS-A* data and view the results in APRS software, *transmitting* APRS is a different matter. To put it bluntly, you can't transmit APRS with the IC-2820H in the DV mode. D-STAR and APRS are both digital modes, but the similarities end there. To transmit APRS you need to operate in the analog FM mode and use an external packet radio TNC. The IC-2820H TNC port supports 1200 and 9600 baud packet signals.

The good news — and this is the part that isn't well documented in the manual — is that the IC-2820H's DV data port spits out standard NMEA GPS "sentences" that can be parsed by any GPS-compatible TNC and used to create APRS packets. The data stream is there even when you are op-

⁴G. Pearce, "Operating D-STAR," *QST*, Sep 2007, pp 30-33.

erating analog FM, as long as you have GPS DATA enabled. I tried it with a packet radio TNC and it works. In fact, I was also able to feed the GPS data directly to a mapping program and it displayed my position information without difficulty.

But what about D-STAR? This digital protocol, developed by the Japan Amateur Radio League (JARL), allows you to operate digital voice, either directly or through D-STAR repeaters, or exchange low-speed data files at about 1200 bits per second. You can even exchange voice and low-speed data simultaneously. There are not yet any D-STAR repeaters in range of my station, but *QST* contributor Gary Pearce, KN4AQ, is another IC-2820H user who is active on D-STAR.⁴ See the accompanying sidebar.

All This and Satellites Too

During this review I took the IC-2820H along when my family made its annual summer pilgrimage to the Rhode Island shore. With a ground plane antenna on the balcony, I was in radio heaven. I was working FM stations on 2 meters and 70 cm all up and down the shoreline. Eavesdropping on marine radio and aviation traffic was fun, too.

With the IC-2820H's flexible dual-band capability there is another dimension of Amateur Radio enjoyment available — and it is not mentioned in the manual. We have two satellites in low Earth orbit that usually function as FM repeaters: OSCARS 27 and 51. These birds listen on 2 meters and repeat on 70 cm. The frequencies and additional information are available from AMSAT-NA at www.amsat.org. With nothing more than 50 W to my balcony ground plane, I used the IC-2820H to make several contacts through the satellites and received outstanding reports from hundreds of miles away. I transmitted on the left band and received on the right band. It was surprisingly easy.

In conclusion, the ICOM IC-2820H is one of the best dual-band FM rigs to come my way in quite some time. At a selling price of well over \$600, the radio is financially intimidating. Equipping it for GPS and D-STAR will push the price near \$1000. Even so, what you have in the end is a highly versatile transceiver that can do everything short of SSB. It is an investment you are not likely to regret.

Manufacturer: ICOM America, 2380 116th Ave NE, Bellevue, WA 98004; tel 800-872-4266; www.icomamerica.com.

D-STAR Operation with the IC-2820H

Plug in the optional UT-123 module and the world of D-STAR digital voice opens to you — if you have a D-STAR repeater in your area. The IC-2820H is the latest in a series of D-STAR radios from ICOM (so far, the only manufacturer selling D-STAR capable radios in the US).

Digital voice operation on the '2820H is "routine," in that it works the same as ICOM's other D-STAR radios. Dial up a frequency with a digital repeater, enter DV mode from a menu selection, and you're in business. At this point, though, it's hard to call digital voice operation of any kind routine.

The '2820H has the same D-STAR "sound" as the other radios — a slightly mechanical or robotic sound and a somewhat more restricted audio passband than the best sounding analog FM radios. It also has digital's signature lack of noise and mobile flutter, all the way down to the minimum signal threshold. At that point, there can be some garble, but most of the time a signal is either clear, or it's gone. You see the usual information on the display, including the call sign and message of each transmitting station.

One '2820H advantage is in its large display that lets you see multiple options and settings (see Figure 1). There are plenty of options and settings in analog operation, but they multiply with digital operation. An example: You can see all the fields used to route a call through a Gateway to a distant repeater.

Another advantage: The IC-2820H is the first D-STAR mobile capable of monitoring two frequencies at once (ICOM's other dual band D-STAR mobile, the ID-800, is strictly one band at a time). The IC-91AD handheld is also capable of two frequency operation, but only the "B" band supports the digital mode. The '2820 lets you use digital on either side of the radio, with one limitation — you can only monitor one digital channel at a time. If you put a digital frequency on both sides, the sub band will be muted, because the UT-123 module contains only one digital coder/decoder (codec). As with other D-STAR radios, you can mix and match analog and digital channels in memories and scan through them all.

The memory bank system, useful in analog, is especially useful for D-STAR. Many D-STAR operations require programming call signs to route signals from one repeater to another through the network. Call sign routing can be stored

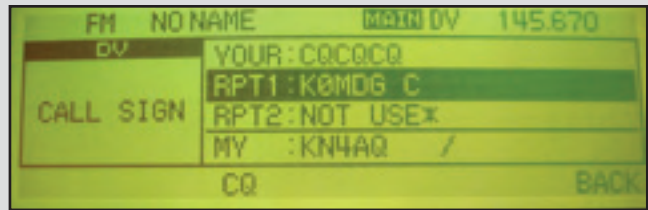


Figure 1 — One of the IC-2820H D-STAR menus. This radio is configured to talk to anyone (CQCQCQ) through the KØMDG 2 meter digital repeater, making a local contact. The frequency (145.67) is being adopted in some areas as the D-STAR simplex channel. (If you use 146.52 for digital simplex, analog users would hear your signal as white noise that they can't "squelch out.")

in memory, and D-STAR "power users" have learned to use memories, and alphanumeric displays, to store frequently used routes for easy recall. The memory banks let you group channels together and scan them any way you want. You don't want to be programming call signs and routing while driving a car.

The UT-123 module includes a built-in GPS. The GPS data can be included in each DV transmission, and with the '2820H you can set an alarm that beeps if another DV/GPS user's transmission is close to your location. The display can show how far, and in what direction, other GPS equipped D-STAR stations are, locally or anywhere in the world.

I only encountered one minor issue operating D-STAR with the IC-2820H. On a few occasions I was transmitting on UHF DV but not being repeated. Several other users mentioned this as well. ICOM has determined that if you put UHF DV on the left side, the '2820H would not always transmit the header information. (UHF on the right side worked perfectly, so you could just remember to always use UHF DV there.) They have fixed this issue (with a resistor change) in current production radios. If you have an older IC-2820H and experience the difficulty, contact ICOM America service.

The digital option makes a fairly expensive radio even more expensive, but you'll enjoy the deluxe digital operation. — Gary Pearce, KN4AQ