

Product Review

Icom IC-7610 HF and 6-Meter Transceiver

Reviewed by Joel R. Hallas, W1ZR
QST Contributing Editor
w1zr@arrl.org

The IC-7610 is a nominal 100 W SSB, CW, AM, FM, and digital-mode transceiver for 160 through 6 meters. While its ancestry is clearly based on the popular direct-sampling IC-7300, its performance and features may be more closely tied to Icom's top-of-the-line IC-7851.^{1, 2} The key step up from the '7300 is the addition of a completely independent second receiver, with performance equal to the primary receiver and separate audio channels for speakers or headphones. In addition, the dual-frequency readouts and virtual analog multimeters are reminiscent of the larger, heavier, and more expensive IC-7800 and '7851 front panels.

The Display

We were smitten by the display of the IC-7800, first reviewed in 2004 — particularly its digital emulation of traditional analog meters. The IC-7610's display is equally impressive (see Figure 1), with a nice upgrade — display and operational features can be selected by a touch of the screen.

In some cases, such as frequency and band selection, there are other ways to change the settings, but some — notably mode and meter selection, as well as the mode-specific side and bottom buttons — seem to be accessible only via the touchscreen. Unlike the ubiquitous smartphone, the display is not change-able by pinching or spreading of the fingers. This was fine for me, because I always seem to get



in trouble when attempting those maneuvers.

The display offers multiple configurations. The spectrum display can provide a single view of the received spectrum, as in Figure 1. You can change frequency by touching the spectrum display screen, although you can have more precise control by plugging a USB mouse into one of the front panel USB sockets and clicking on a frequency on the spectrum display with that.

I often find it easier to spot weak signals on a waterfall display, and one can be added, as shown in Figure 2. If frequencies are too far apart for signals from both receivers to be shown

on a single display, they can be separated, as shown in Figure 3.

While the virtual meters are fun to look at, they do take up a big chunk of the display, and a more compact bar graph meter allows more room for the spectrum display. All meter choices can be viewed simultaneously, as shown in Figure 4 — handy during setup. An external monitor with a DVI connector can be used for a larger display.

How It Works

As with the IC-7300, this transceiver is based on a direct-digital sampling architecture. That is, there are no conversion steps in front of the analog-to-digital (ADC) conversion — it all happens at signal frequency. This arrangement has multiple advantages. There are no nonlinear mixer or converter stages between input and output, eliminating images and many sources of birdies, as well as places for intermodulation products to hide.

The downside is that if the ADC is overloaded, other problems can arise. The IC-7610 takes pains to reduce the likelihood of this happening by switching in filters, including a

Bottom Line

The IC-7610 direct-sampling transceiver is a full-featured, two-receiver, competition-ready, HF and 6-meter radio that can be an asset to almost any amateur station. It brings together the look and feel of their top-of-the-line transceivers with the benefits of digital sampling at signal frequency, all at a price in the middle of their range.

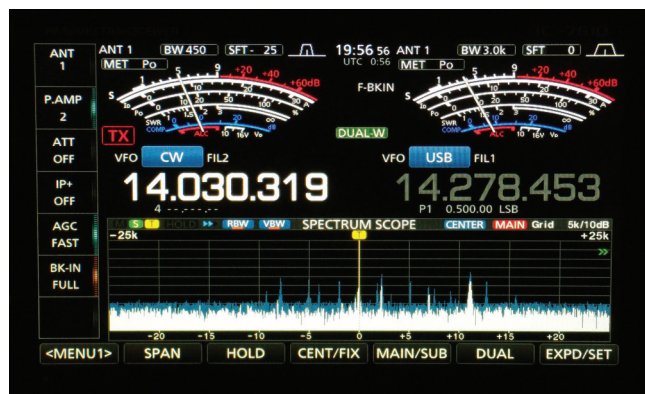


Figure 1 — A close-up of the IC-7610 display showing the virtual analog meters and a single spectrum display.

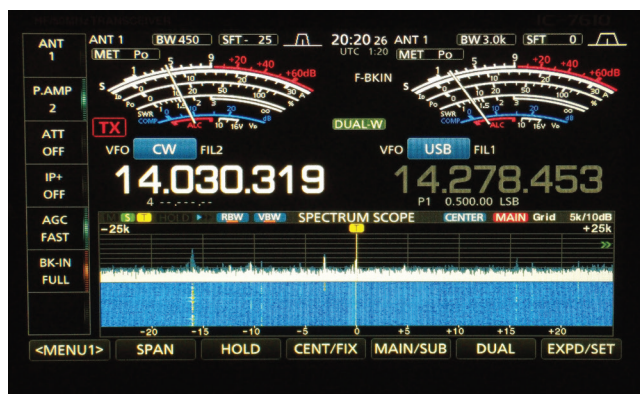


Figure 2 — A waterfall display can be added below the panadapter spectrum display. The waterfall often makes it easier to spot weak signals.

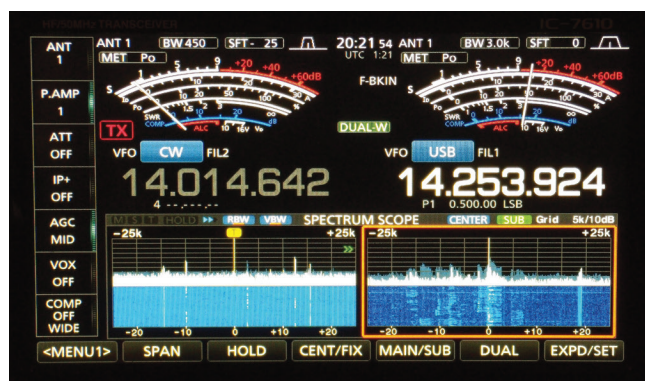


Figure 3 — If the two receiver frequencies are on different bands, or are too far apart to be shown on a single display, the spectrum displays can be separated, as shown here.



Figure 4 — A more compact bar graph of a selected meter at the top of the display allows more room for the spectrum display, or all meter choices can be viewed simultaneously, as shown here.

switchable tracking filter (**DIGI-SEL**) that follows the tuned frequency, as well as attenuators (and amplifiers if needed) ahead of the ADC for gain management.

To help avoid receiver overdrive problems, the display includes an overload indicator (**OVF**) that illuminates if the ADC overflows due to excessively strong signals. The operator can eliminate the problem by turning back the preamp a notch, or adding attenuation. I saw this while participating in a 75-meter net — lots of booming signals, and I had inadvertently left **PREAMP 2** on (rarely is any preamp helpful on 80/75 meters). It was an easy fix, once I recognized my self-inflicted problem.

Computer Connectivity

The IC-7610 includes two USB type-B computer connections on the rear panel. These can make use of typical USB printer cables. The manual indicates that one is dedicated to remote operation and data exchange (such as frequency and mode data for logging software), while the other is for digital data input and output. I found that I could get two data channels as well as RTTY audio in both directions on a single connection to **USB 1**.

Another jack supports Icom's CI-V remote-control protocol, which is used by many logging and station management programs. There is also an RJ-45 ethernet jack for remote control using Icom's optional RS-BA1 remote-control software.

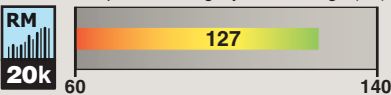
This can work over your in-house LAN or from a distant internet-connected computer. No computer is needed at the radio end.

On the front panel are two USB type-A connectors and an SD card slot. These can be used to back up configuration data to a memory card or flash drive or to upgrade software. A USB mouse and/or keyboard can also be connected to one or both of the USB jacks.

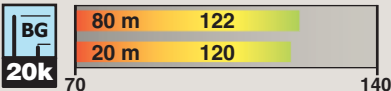
I was successful in getting both the CAT (computer-aided transceiver) data and audio signals routed between the radio and most of my PC logging and digital-mode applications, but it took some fussing with computer settings to route signals through the appropriate ports. The key is to download the drivers and

Icom IC-7610 Key Measurements Summary

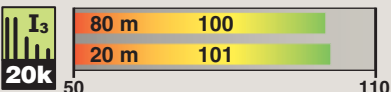
20 kHz Reciprocal Mixing Dynamic Range (dB)



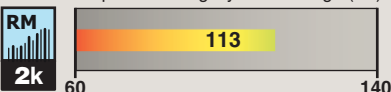
20 kHz Blocking Gain Compression (dB)



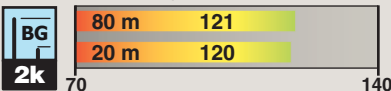
20 kHz Third-Order IMD Dynamic Range (dB)



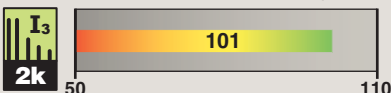
2 kHz Reciprocal Mixing Dynamic Range (dB)



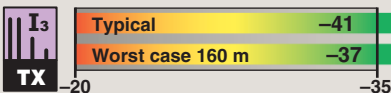
2 kHz Blocking Gain Compression (dB)



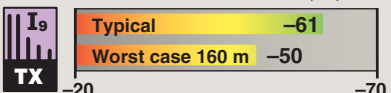
2 kHz Third-Order IMD Dynamic Range (dB)



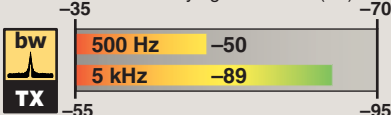
Transmit Third-Order IMD (dB)



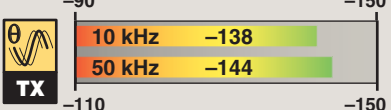
Transmit Ninth-Order IMD (dB)



Transmit Keying Sidebands (dB)



Transmit Phase Noise (dB)



KEY: QS1810-PR130
Measurements with receiver with IP+ function on.

Lab Notes: Icom IC-7610

Bob Allison, WB1GCM, Assistant Laboratory Manager

I found no issues during ARRL Lab testing of the IC-7610. The receiver is considered higher performance because its lowest dynamic range (third-order IMD dynamic range, 3IMD DR) at 2 kHz spacing is 101 dB with the IP+ feature on. The IP+ feature enables a dither signal, which decreases the sensitivity by 3 dB or so, but increases the 3IMD DR by at least 14 dB. If you are not experiencing the effects of intermodulation distortion and desire slightly more sensitivity, turn the IP+ feature off. Note that the sensitivity and dynamic range measurements shown in Table 1 were made with this feature on.

Our dynamic range tests use strong signals that are no more than 40 kHz away from the desired frequency. What about strong out-of-band signals? Receivers with an ADC at the front end can overload from very strong signals outside the current operating band, especially in an environment where the RF spectrum density is high. The IC-7610 has an automatically tuned digital preselector (**DIGI-SEL**) that attenuates the cumulative effects of strong out-of-band signals (about 20 dB for a signal 1 MHz away, for example), while not attenuating the signal that you're listening to. The addition of the digital preselector makes the transceiver a good performer in a multi-transmitter Field Day environment, where stations are operating on multiple bands in close proximity. It's also important to keep receiver gain management in mind, and turn off preamps or use attenuation when unwanted effects are observed or the overload indicator lights.

The best receiver cannot overcome the effects of wide or spurious signals generated by a transceiver with poor transmit performance, and transmitter cleanliness is facing increasing scrutiny these days. The transmit quality of the IC-7610 is quite good overall, with low transmit phase noise and relatively low transmit intermodulation distortion (IMD) on SSB. On CW, the keying waveform, with resulting narrow CW sidebands, makes the IC-7610 a good neighbor to those on adjacent frequencies. The keying sidebands can be made even narrower with no degradation of signal quality by selecting 6 ms rise time (the 4 ms default was used for Lab testing).

High-speed CW ops will appreciate the fact that the receive processing delay time (the time it takes from when a signal arrives at the antenna jack to when it comes out the speaker) is only 12 ms. What comes out of the speaker is clear audio, with total harmonic distortion of only 0.5% at normal listening levels. The S-meter scale is 3 dB per S-unit. With the preamp off, S-9 is at -73 dBm, and the + scale is very accurate — S-9+10 dB is -63 dBm, S-9+20 dB is -53 dBm, and so on. As seen in Table 1, the S-meter reads higher with the preamps on. Power-off current consumption is 25 mA, a consideration for those using battery power only.

the *USB Driver Installation Guide* from Icom's support website.

The *Installation Guide* provides step-by-step instructions for installing the drivers for Windows 7, 8.1, and 10 systems. No other operating systems are mentioned. After the drivers are installed and the radio is connected, two USB-to-UART bridges appear in the **PORTS** section of *Windows Device Manager*, which identify the virtual com port numbers and allow setting of parameters to match those of the software.

As with most current transceivers, firmware is updated regularly to add features and fix bugs. Our radio arrived with firmware version 1.04, which we used for initial evaluation. Updates to V1.05 and V1.06 add subtle improvements in many areas, including SSB sideband suppression, AM receiver filtering, transmitting and receiving signal quality, various interface improvements, and bug fixes.

To update the firmware, download the appropriate ZIP file from Icom's support website and extract the

compressed files to a folder named **IC-7610** on an SD card or USB thumb drive. The uncompressed V1.06 upgrade files took less than 14 MB of space on my USB drive.

After the firmware file was on my USB drive, it took about 2 minutes for the upgrade of four areas (**MAIN CPU**, **SUB CPU**, **FRONT CPU**, and **FPGA CPU**). The manuals strongly warn that if power is interrupted, or anything else stops the process, the radio may need to go back to an Icom distributor for firmware reinstallation. An uninterruptible power supply (UPS) or battery could be used to prevent power loss during the firmware update. After the firmware upgrade, the radio came right back up and all is well.

ARRL Lab test results are shown in Table 1, Figures 5, 6, and 7, and the “Lab Notes” sidebar.

On the Air with the IC-7610

I enjoyed using the IC-7610 as my main station rig and had an opportunity to test it in most modes. While getting started was simple, as with most full-featured radios, expect to spend some time with the manuals to be able to fully appreciate and learn to operate all the advanced features. You can almost assume that any feature or function you’ve encountered is supported on this radio.

Some basic features stand out on the IC-7610. Tuning with the weighted knob is smooth and easily adjustable for drag. The tuning rate speeds up whenever you tune quickly and can be adjusted to different speeds by touching the kilohertz portion of the frequency display. By touching the display for a second, you can set the fast rate on a mode-by-mode basis.

The **DUAL WATCH** feature on the '7610 is not the same as with many other Icom transceivers, in which the radio receives on two frequencies in the same band and combines the audio into a single channel. On the '7610, it is really two completely independent,

Table 1
Icom IC-7610, serial number 1201580, Main CPU V1.06 FPGA V1.05

Manufacturer's Specifications		Measured in the ARRL Lab			
Frequency coverage: Receive, 0.03 – 60 MHz; transmit, not specified.		Receive, 0.03 – 60 MHz. Transmit, 160 – 6 meter amateur bands, including 5.255 – 5.405 MHz.			
Power requirement: Transmit, 23 A (maximum). Receive, 3.5 A (maximum audio) at 13.8 V dc (±15%).		At 13.8 V dc: Transmit, 20 A (maximum), 18.5 A (typical) at maximum RF power output; 6.0 A at minimum RF output. Receive, 2.43 A (maximum audio and backlight), 2.24 A (minimum backlight). Power off, 25 mA.			
Modes of operation: SSB, CW, AM, FM, PSK, RTTY.		As specified.			
Receiver		Receiver Dynamic Testing			
SSB/CW sensitivity: At 10 dB S/N, 0.16 μV typical at 1.8 – 30 MHz (preamp 1 on); 0.13 μV typical at 50 MHz (preamp 2 on), filter soft.		Noise floor (MDS), 500 Hz bandwidth, IP+ on: <div><div>Preamp</div><div>Off</div><div>1</div><div>2</div></div> <div>0.137 MHz–116–127–133 dBm</div> <div>0.475 MHz–130–137–141 dBm</div> <div>1.0 MHz–131–140–142 dBm</div> <div>3.5 MHz–132–140–142 dBm</div> <div>14 MHz–130–138–142 dBm</div> <div>50 MHz–130–138–141 dBm</div>			
Noise figure: Not specified.		Preamp off/1/2, 14 MHz: 17/9/5 dB; 50 MHz, 17/9/6 dB.			
AM sensitivity: At 10 dB S/N, 6.3 μV typical at 0.1 – 1.8 MHz and 2.0 μV typical at 1.8 – 30 MHz (preamp 1 on); 1.0 μV typical at 50 MHz (preamp 2 on), filter soft.		10 dB (S+N)/N, 1 kHz tone, 30% modulation, 6 kHz BW: <div><div>Preamp</div><div>Off</div><div>1</div><div>2</div></div> <div>1.0 MHz2.281.200.90 μV</div> <div>3.88 MHz2.211.070.98 μV</div> <div>29.0 MHz2.341.050.78 μV</div> <div>50.4 MHz3.461.401.0 μV</div>			
FM sensitivity: At 12 dB SINAD, 0.5 μV typical at 28 – 29.7 MHz (preamp 1 on); 0.32 μV typical at 50 MHz (preamp 2 on), filter soft.		For 12 dB SINAD, 3 kHz deviation, 15 kHz BW: <div><div>Preamp</div><div>Off</div><div>1</div><div>2</div></div> <div>29 MHz0.810.300.23 μV</div> <div>52 MHz0.590.260.20 μV</div>			
Spectral sensitivity: Not specified.		Panadapter display, preamp off/1/2: 14 MHz, –109/–120/–128 dBm 50 MHz, –107/–118/–126 dBm Waterfall display, preamp off/1/2: 14 MHz, –106/–117/–125 dBm 50 MHz, –104/–115/–123 dBm			
ADC overload level: Not specified.		With single in-passband signal, >+10 dBm.			
Blocking gain compression dynamic range: Not specified.		Blocking gain compression dynamic range, 500 Hz BW: <div><div>20 kHz offset</div><div>5/2 kHz offset</div><div>Preamp off/1/2</div><div>Preamp off</div></div> <div>3.5 MHz122/119/113121/121 dB</div> <div>14 MHz120/117/113120/120 dB</div> <div>50 MHz122/119/113122/122 dB</div>			
Reciprocal mixing dynamic range: Not specified.		14 MHz, 20/5/2 kHz offset: 127/116/113 dB.			
ARRL Lab Two-Tone IMD Testing (500 Hz bandwidth, IP+ on on):					
Band/Preamp	Spacing	Measured IMD Level	Measured Input Level	IMD DR	
3.5 MHz/off	20 kHz	–132 dBm –97 dBm	–32 dBm –16 dBm	100 dB	
14 MHz/off	20 kHz	–130 dBm –97 dBm	–29 dBm –16 dBm	101 dB	
14 MHz/1	20 kHz	–138 dBm –97 dBm	–38 dBm –26 dBm*	100 dB	
14 MHz/2	20 kHz	–142 dBm –97 dBm	–44 dBm –34 dBm*	98 dB	
14 MHz/off	5 kHz	–130 dBm –97 dBm	–29 dBm –17 dBm	101 dB	
14 MHz/off	2 kHz	–130 dBm –97 dBm	–29 dBm –17 dBm	101 dB	

Manufacturer's Specifications

Measured in the ARRL Lab

ARRL Lab Two-Tone IMD Testing (500 Hz bandwidth, IP+ on) continued:

Band/Preamp	Spacing	Measured IMD Level	Measured Input Level	IMD DR
50 MHz/off	20 kHz	-130 dBm -97 dBm	-31 dBm -15 dBm	99 dB
50 MHz/2	20 kHz	-141 dBm -97 dBm	-43 dBm -32 dBm	98 dB

Second-order intercept point:
Not specified.

DSP noise reduction: Not specified.

FM adjacent channel rejection:
Not specified.

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

Squelch sensitivity: SSB, <3.2 μ V;
FM, <0.32 μ V.

S-meter sensitivity: Not specified.

Notch filter depth: Not specified.

IF/audio response: Not specified.

Receive processing delay time: Not specified

Audio output power: >2 W (8 Ω load,
1 kHz tone, 10% THD).

Preamp off/1/2:

14 MHz, +73/+69/+63 dBm

21 MHz, +77/+55/+39 dBm

50 MHz, +71/+71/+71 dBm.

15 dB.

Preamp 2 on: 29 MHz, 82 dB;

52 MHz, 86 dB.

20 kHz offset, preamp 2 on:

29 MHz, 82 dB**; 52 MHz, 86 dB.**

10 MHz spacing, preamp 2 on:

29 MHz, 88 dB; 52 MHz, 92 dB.

FM, preamp 2 on: 29 MHz, 0.1 μ V to

112 mV; 52 MHz, 0.13 μ V to 112 mV.

SSB, preamp off: 14 MHz, 4.31 μ V to

91.1 mV.

S-9 signal, preamp off/1/2:

14 MHz, 51.8/23.7/23.2 μ V

50 MHz, 72.4/34.6/35.4 μ V.

Scaling: 3 dB per S-unit.

Auto-notch, 52 dB; attack time,

200 ms (single tone).†

Range at -6 dB points:‡

CW (500 Hz BW): 344 – 859 Hz;

Equivalent Rectangular BW: 516 Hz;

USB (2.4 kHz BW): 234 – 2,750 Hz;

LSB (2.4 kHz BW): 234 – 2,750 Hz;

AM (6 kHz BW): 30 – 3,188 Hz.

12 ms.

2.17 W at 10% THD.

THD at 1 V_{RMS}: 0.5%

Transmitter

Transmitter Dynamic Testing

Power output: 1 – 100 W (SSB, CW, RTTY,
PSK, FM), 1 – 25 W (AM).

RF power output at minimum specified
operating voltage: Not specified.

Spurious-signal and harmonic suppression:
>50 dB (HF); >60 dB (50 MHz).

Third-order intermodulation distortion (IMD)
products: Not specified.

CW keyer speed range: Not specified.

CW keying characteristics: Not specified.

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

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

Transmit phase noise: Not specified.

Amplifier key line closure RF output:

Selectable, 0 to 30 ms.

Size (height, width, depth, incl. protrusions): 4.8 x 13.7 x 12.7 inches; weight, 18.7 pounds.

Second-order intercept points were determined using S-5 reference.

*At threshold of ADC overload.

**Measurement is phase noise limited to the value indicated.

†Auto notch reduces two tones \geq 38 dB, if two offending tones are 500 Hz or more apart.

‡Default values; bandwidth is adjustable via DSP.

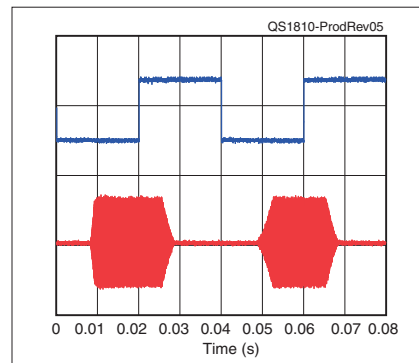


Figure 5 — CW keying waveform for the Icom IC-7610 showing the first two dits in full break-in (QSK) mode using external keying and the default 4 ms rise time setting. Equivalent keying speed is 60 WPM. The upper trace is the actual key closure; the lower trace is the RF envelope. (Note that the first key closure starts at the left edge of the figure.) Horizontal divisions are 10 ms. The transceiver was being operated at 100 W output on the 14 MHz band.

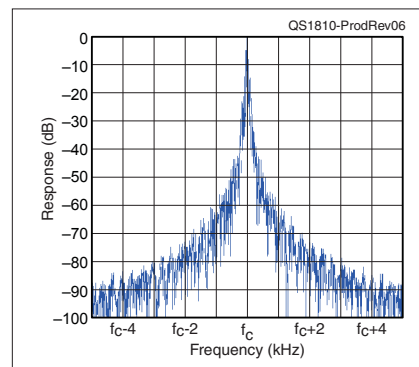


Figure 6 — Spectral display of the Icom IC-7610 transmitter during keying sideband testing. Equivalent keying speed is 60 WPM using external keying and the default 4 ms rise time setting. Spectrum analyzer resolution bandwidth is 10 Hz, and the sweep time is 30 seconds. The transmitter was being operated at 100 W PEP output on the 14 MHz band, and this plot shows the transmitter output \pm 5 kHz from the carrier. The reference level is 0 dBc, and the vertical scale is in decibels.

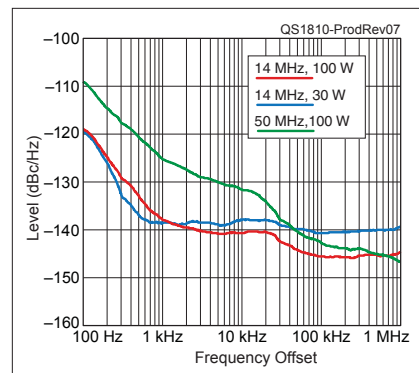


Figure 7 — Spectral display of the Icom IC-7610 transmitter output during phase noise testing. Power output is 100 W on the 14 MHz band (red trace), 30 W on the 14 MHz band (blue trace), and 100 W on the 50 MHz band (green trace). The carrier, off the left edge of the plot, is not shown. This plot shows composite transmitted noise 100 Hz to 1 MHz from the carrier. The reference level is -100 dBc/Hz, and the vertical scale is 10 dB per division.

identical receivers that can operate on different bands and modes if you wish. Each receiver drives its own speaker or one side of stereo headphones, so you can keep track of what's happening on each frequency. Push the **SPLIT** button and the transceiver transmits on the sub-receiver frequency, just as I like.

Unlike some radios with dual receivers, the IC-7610 is equipped with a

single tuning knob that can be switched between receivers. After a bit, I realized that this was not a limitation for me. My use of **SPLIT** is generally for working DX stations that are listening on an offset frequency. You first tune them in on the main receiver, then leave that alone while you switch to tuning the sub-receiver to find a good frequency to transmit on. If this arrangement doesn't work for you, Icom offers an optional

RC-28 encoder that connects to the front panel through a USB cable. It provides a tuning knob that can be used to tune either receiver and also offers other control functions.

The IC-7610's digital noise reduction (NR) and noise blanker (NB) were impressive in both their functionality and lack of digital artifacts. The DSP selectivity system also works well. The **FILTER** button cycles through

A Contester's Impressions of the IC-7610

Scott Wright, KØMD
National Contest Journal Editor

My first impressions of the IC-7610 were amazement at the quietness and sensitivity of its receiver, and the beauty of its panadapter. It is significantly quieter than my Icom IC-7800 and nearly identical to my IC-7851. It is able to pull out weak signals, even amid interference on a crowded band.

I evaluated the IC-7610 in the CQ World Wide WPX CW and IARU HF Championship contests. It has two independent receivers, which can function on separate bands if two antennas are attached. I operated mainly in the SO2V (single-operator, two-VFO) mode, where I used **ANTENNA 1** for both receivers. That said, I have a stack of Force 12 C49XR tribanders, so I was able to operate on any two of the 10-, 15-, and 20-meter bands simultaneously.

Most often, I used the IC-7610's second receiver to work SSB stations when I was running on CW, or to pick up multipliers within the same band segment while running either CW or SSB. When running full break-in (QSK) CW, you can almost believe the rig is running SO2R (single-operator, two-radio) mode, as the second receiver is minimally inhibited during transmissions on the main VFO. When operating on separate bands, it is essentially like SO2R operation. My automatic amplifier could change bands without missing a beat.

Panadapter

The panadapter and waterfall displays on the IC-7610 are simply beautiful. They are colorful, sensitive, and adjustable. Contesters will find the situational awareness they create to be invaluable. I found several empty frequencies to establish a run by simply looking at the panadapter during the busy contests. I could also find adjacent interference more easily and filter it out.

APF

The audio-peak filter (APF) is one of the IC-7610's secret weapons. It is adjustable in gain, center, and peak frequency. It peaks CW signals amid noise without distorting the desired signal. I found it incredibly useful during the weak band conditions of the IARU contest.

Filtering and Noise Management

One of the great strengths of the IC-7610 is noise management. The summertime IARU contest had a lot of static from storms in North America. I found myself using 20 – 24 dB of attenuation on 40 through 160 meters, and the signals seemed to pop out of the noise as I added more attenuation. The AGC with the IC-7610 is a CW operator's dream. It handles weak and powerful signals equally, and does not require riding the RF gain control to avoid hearing damage.

RC-28

I recognized an apparent weakness in the IC-7610's small footprint — lack of a second VFO knob for con-

trol of the second, independent receiver. Icom answered with the RC-28, a remote control that plugs into the IC-7610's USB port and allows dual-VFO control of the radio. I set it up on my rig to control **RECEIVER B** only, giving each of the IC-7610's receivers a separate VFO knob.

The RC-28 is a peripheral option that I deem essential for contesting or DXing. It is extremely helpful with using **RECEIVER B** to search the bands for multipliers and other SO2V operation tasks when running stations on **RECEIVER A** with the main VFO. It is a smooth dial, similar to but smaller than the main VFO knob. It is a plug-and-play accessory and requires no setup, except to download the latest firmware to the RC-28.

USB Computer Interface

I was surprised at how easy it was to use the USB computer interface with *N1MM+ Logger* contest software. No external interface, such as a WinKeyer for CW, is required. The transceiver keys smoothly, even above 40 WPM, without any delay. Icom has designed this radio to work perfectly with PC control. From start to finish, setup with *N1MM+ Logger* was under 5 minutes.

I found the IC-7610 to be easy to use, with performance, functionality, and features like my IC-7851. I bought the IC-7610 for contesting overseas, but if I were limited to one radio in my current station, it would be the one I choose to keep.

three mode-specific bandwidths, each of which can be changed easily. For example, on CW the defaults are 250, 500, and 1,200 Hz. Each filter can be adjusted in 50 Hz steps to customize your choices, and each filter can have either sharp or soft corners. I set the review radio for 150, 350, and 1,000 Hz, for example.

The receiver features a **TWIN-PBT** (passband tuning) function that allows either edge of the passband to be moved in or out to eliminate close-in interference.

There are 99 frequency memories available, each also storing the mode and selectivity choice. Each press of a band-select button cycles through the last three frequencies and modes used on the band. There is also quick-access memo pad (**MPAD**) memory that stores five frequencies, along with modes and filter settings — handy for going back to a station that was busy when you last listened.

The spectrum scope is quite useful. It can be set to cover a particular portion of a band, or to be centered on your receive frequency. The spectrum of your transmit signal is also shown. By switching to **AUDIO** on the main menu, the receive audio signal is shown, both in the frequency and time domain on separate screens, and it also switches to show your transmit signal on each display.

The internal antenna tuner quickly tunes an antenna system with up to a 3:1 SWR to near 1:1, and it remembers the tuner settings and antenna selection for that frequency. By selecting **EMERGENCY** operation, the tuner will do the best it can with a system with an SWR of greater than 3:1, but power output is limited to 50 W.

Voice Operation

Voice modes all worked well with good audio reports received on SSB and AM. For 10- or 6-meter FM operation, the transceiver provides easy split-frequency offsets, as well as

CTCSS tone encoding for repeater access, and decoding to avoid unwanted reception.

The transceiver is supplied with a handheld HM-219 electret microphone that plugs into the round eight-pin front-panel jack. The jack can supply electret bias voltage in the **MIC** line, or it can be set to **OFF** by a menu item to use dynamic microphones or electrets that require bias on a separate pin — also provided on the connector. In addition to the HM-219 and a professional quality dynamic, I tried an amateur desktop electret mic and received good reports on all.

On SSB, the transmit voice bandwidth can be set to **WIDE** (100 – 2,900 Hz), **MID** (300 – 2,700 Hz), or **NAR** (500 – 2,500 Hz). This option is not available for AM or FM voice, presumably set on **MID** range. Each voice mode has its own tone control settings, allowing a boost or cut in the **BASS** or **TREBLE** ranges of up to ± 5 dB in 1 dB steps. While this is likely fine for most microphone and voice characteristics, the folks on the Antique Wireless Association 75-meter AM net, who tend to appreciate booming broadcast-quality sounding modulation, thought it “sounded a bit thin, but of good communications quality.”³ Voice-operated transmit control (VOX) worked flawlessly, as did the anti-VOX function. The VOX didn’t trigger from loud received stations, even with the mic pointed at the speaker.

The receiver was excellent and easy to use. The receiver default SSB selectivity choices are 1.8, 2.3, and 2.9 kHz, just about right, in my opinion, but each setting is easily adjusted in 50 Hz steps. The twin-passband filter allows sliding either edge in to remove interference on either side of the passband and the automatic or manual notch can be used to eliminate a tuner-upper or heterodyne. The audio sounded good through the internal speakers, and even better on a larger external pair, pointed at the operator. If desired, a high-pass and low-pass audio filter can be engaged, or the bass and treble can be boosted or cut by up to 5 dB, with separate settings for each voice mode to compensate for speaker limitations, room acoustics, or personal preference.

CW Operation

The designers of the IC-7610 did a good job of including many useful features for the CW operator. Full break-in (QSK) or adjustable-delay semi-break-in operation is supported, and the transmit-receive switchover is silent even with my ear on the cabinet top. A ¼-inch stereo jack on the front panel accepts connections from a keyer paddle, while a ¼-inch mono jack in the rear can be used for a straight key or connections to an external keyer. The built-in iambic electronic keyer can be adjusted from 6 to 48 words per minute. Multiple CW transmit memories are provided, including the capability to



Figure 8 — The IC-7610 decoding the W1AW RTTY propagation bulletin. Note the two-tone tuning indicator and the open panel for use as a type-ahead buffer.

automatically increment contest serial numbers.

Also provided is a very sharp audio-peaking filter (**APF**). The manual notch filter (**NOTCH**) is also very sharp and can completely eliminate a strong signal in the passband. Unlike some other radios we have recently tested, the IC-7610 won't allow engaging the automatic notch on CW (or RTTY), which would automatically notch out the signal you are trying to hear.

Data Modes

The IC-7610 has many options for data-mode operation. Of particular note is that the '7610 can operate on RTTY or PSK modes without a computer. The radio can decode received data and display six lines of text on the bottom part of the display, in place of the spectrum plots. Tuning indicators appropriate for RTTY (see Figure 8) and PSK are both provided. Due to poor band conditions, I was having trouble finding signals to display, but the W1AW bulletins came to my rescue. There's nothing like having a 1 kW transmitter on 80 meters less than 60 miles away. For transmit in either mode, a USB-connected keyboard can be plugged into one of the front-panel USB jacks, and you're good to go.

There are multiple other ways to do any of the popular computer-based digital modes. For RTTY, an accessory jack (**ACC1**) provides connectivity to support traditional FSK RTTY operation, as well as AFSK RTTY or the many "sound card" digital modes, such as FT8. As noted previously, the rear USB connectors can support audio and control signals, saving some wiring in the process. The front-panel **MIC** connector can also be used with any of the popular input switching and interface devices. It is handy because the receive audio is also available on that connector.

As with other modes, all the selectivity and audio-filtering options are available in data modes, as well as a RTTY-specific twin band-pass filter that can provide optimum selectivity for two-tone frequency-shift signals.

Documentation

Our IC-7610 came with a comprehensive 80-page *Basic Manual* that includes a description of every control, along with a set of connection diagrams. That is only the beginning. A supplied CD-ROM includes a PDF copy of the *Basic Manual*, along with a multi-language version of the same, a 91-page *Advanced Manual*, and a 31-page book of schematic diagrams.

Unfortunately, the indices of the two manuals do not list some key functions, and you must go from manual to manual to find out how to perform some key tasks. I think the manuals could use a bit more structure to help users find their way through this radio. The searchable PDF versions are a help. The '7610 can do a lot, and do it very well, but more complete indices would help owners take full advantage of all its capabilities.

Wrapping Up

The IC-7610 is a very effective, full-featured transceiver that would work

well in most stations. While compact enough to fit into most spaces, its front panel is large enough to include plenty of useful controls and a fantastic touchscreen display. It performs well enough to hold its head high among the best of transceivers, yet is priced near the middle of the range. It is packed with many more features than we can cover here. While it takes some time to become familiar with all it can do, the effort is more than worthwhile.

Manufacturer: Icom America, 12421 Willows Rd. NE, Kirkland, WA 98034; **www.icomamerica.com**. **Price:** IC-7610, \$3,400; RC-28 remote USB encoder with tuning knob, \$259; RS-BA1 remote-control software, \$95.

¹S. Ford, WB8IMY, "Icom IC-7300 HF and 6-Meter Transceiver," Product Review, *QST*, Aug. 2016, pp. 41 – 47.

²J. Hallas, W1ZR, "Icom IC-7851 HF and 6-Meter Transceiver," Product Review, *QST*, Jul. 2016, pp. 43 – 46.

³The Antique Wireless Association AM net meets on 3837 kHz on Sundays at 7 PM Eastern during Daylight Saving Time and at 4 PM Eastern during standard time. Coverage is usually very good throughout the Great Lakes, New England, and mid-Atlantic regions. AWA membership is not required for participation, and while many classic radios are heard, those with modern gear are more than welcome.



Visit <https://youtu.be/8mgl3VxkYSg>
to see our review of the Icom IC-7610
HF and 6-Meter Transceiver on YouTube.

SteppIR SDA 2000 OptimizIR Controller

Reviewed by Martin Ewing, AA6E
aa6e@arrl.net

SteppIR Communications Systems offers a unique line of HF antennas, based on beryllium-copper tapes that are extended and retracted by stepping motors to assure a perfectly tuned antenna at every operating frequency.⁴ Beginning in 2001 with the original three-element Yagi, which tuned from 14 to 54 MHz, many other models have been introduced, all based on the same adjustable-tape technology.

Nearly all these products have been operated through a basic control box that you install at your station desk. It uses buttons to set the operating band and frequency, and to choose normal, reverse, or bidirectional antenna patterns. Through menu selections, you can adjust your antenna element lengths, but they are normally set automatically according to frequency and desired beam pattern. You can connect your transceiver or computer through the serial I/O port for automatic frequency tracking. While the basic controller serves well for normal operation, some functions are awkward to access through the menu system, and the text display is minimal. Customizing and troubleshooting your antenna is possible, but not very convenient.

The new SDA 2000 “OptimizIR” is a decidedly more modern and user-friendly controller. It offers an attractive, informative display that shows the current operating frequency and the nominal antenna performance. Buttons allow you to select the desired pattern and operating band. Two selector knobs give you ready access to all menu options. The



menu system is well designed, making some of the more advanced options, such as **CREATE /MODIFY**, much easier to use for special antenna adjustments. Antenna parameters can be saved internally, or exported or imported through a micro-SD card.

SDA 2000 Operation

It is important to note that the SDA 2000 is a controller that works from a pre-stored matrix of antenna parameters. It does not actually compute or optimize your antenna pattern on the fly. Rather, it lets you change your antenna configurations (element lengths) with new antenna models. The default screen (see Figure 9) shows front-to-back ratio, gain, and beamwidth data, including a bidirec-

tional “thermometer” that indicates the relative forward and reverse antenna response.

There are three basic patterns (normal, 180 degrees, and bidirectional) selected by push buttons (**NORM**, **180**, **BI**). The 180-degree pattern reverses the antenna to fire backward, while the bidirectional pattern produces both a forward and reverse beam. Within the normal pattern, you can select a wide or a maximum front-to-back variant using the **K1** knob. In the bidirectional pattern, you can choose variants that weigh one direction over the other in several steps.

Note that the gain, F/B, and beamwidth on the display are values that apply to a standard installation, but they may not represent your actual situation. For example, your antenna might be interacting with the ground or nearby objects, or you might even have an element failure; neither would be visible on the display. The controller can, however, detect some electrical problems, such as open motor connections.

The factory-installed data will let you operate any current or older model SteppIR antenna, but if you have

Bottom Line

The SteppIR SDA 2000 offers a flexible and attractive user interface for SteppIR antennas that integrates a number of previously optional features, such as lightning protection or tuning relay features. It works with a wide variety of SteppIR antennas, new or old.

⁴H. W. Silver, NØAX, “SteppIR 3-element Yagi Antenna,” Product Review, *QST*, May 2003, pp. 67 – 69.

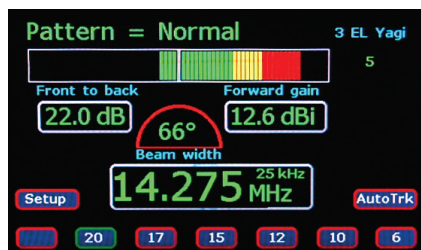


Figure 9 — Default screen.

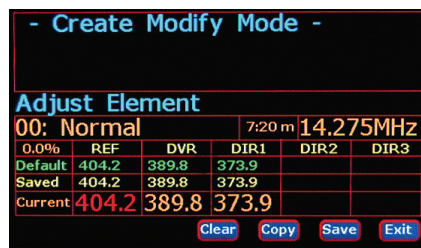


Figure 10 — CREATE/MODIFY screen for a three-element antenna.

special needs, you may want to calculate new parameters and upload them to the SDA 2000. The data is stored on the SD card in a CSV spreadsheet format. There is third-party support, such as *AutoEZ*, to help you generate antenna models for the SDA 2000 (see www.ac6la.com).

The **CREATE/MODIFY** menu option (see Figure 10) shows you the antenna settings currently in effect for your operating frequency and pattern, along with default and saved element lengths. You can edit your antenna data in real time, adjusting element lengths any way you like. If you have high SWR due to an interaction with a local obstacle, you can try to tune it out by adjusting the driven element. You can also apply a percentage change to all elements in common, letting you easily adjust for effects such as wet or ice-covered elements.

The SDA 2000 has several standard features that are add-ons for the earlier SDA 100, including lightning protection (relays that protect motor driver chips) and a tuning relay that

will disable your amplifier when the elements are in motion.

The unit will support an optional remote motor controller board that can be placed near your tower, in case your cables exceed the allowed 500-foot length. The remote driver can be up to 2,000 feet from the SDA 2000.

Alas, there is no block diagram, schematic, or other design information provided, which may disappoint the techies among us. But it appears that the SD 2000 is built around an ATxmega128A1 processor. A USB port is provided to allow software updates from your PC. You can't operate the SDA 2000 through the USB with current firmware, however. Basic control (frequency, pattern, and other functions) is provided through the serial I/O ports.

Operating Experience

I put the new controller to good use by connecting to my 2004-vintage three-element SteppIR beam. It proved to be very compatible without any wiring changes, including the serial I/O connection to my FlexRadio FLEX-6500 transceiver. Choosing the right configuration for this particular beam was straightforward.

Sadly, after carefully checking operation on different bands, I found an unusually high SWR on 6 meters, while the lower bands showed a normal match. Using the **CREATE/MODIFY** display, I quickly found a problem with my reflector element, following the checks suggested in the SteppIR troubleshooting guides.

The pattern variants for maximum gain or F/B ratio are nice options, but the differences are subtle. I could not test this, but we ought to be able to use higher F/B to reject strong interference by carefully aiming away from the offending station. (On 20 meters, with my three-element antenna, the controller claims 22.0 dB F/B for the normal pattern, and 35.0 dB for the

maximum F/B pattern. Take these numbers with a grain of salt.) One variant I would like to have is a super wide beamwidth option — basically allowing a multi-element beam to work as a dipole. That would be helpful for nets or other operations where directivity is not desired.

As a software-oriented device, the SDA 2000 can be kept up to date with downloads from the SteppIR website. During the review period, we received two new bug fix updates. That provided the opportunity to try out the firmware update process. First, you load the *Avr-Osp II* program on your PC. That's a general-purpose programmer. It has many options that you should ignore, but SteppIR's instructions aren't clear about this. Computer-savvy folks can figure it out, as I did, after some head scratching. A **VERIFY** feature gives you confidence that things worked properly.

Suggestions

The SDA 2000 is a major improvement over the earlier controllers for its usability and appearance. It is highly compatible with the older models. The supplied user manual is good for normal operation, but I found a few things lacking. There is no description of the connector pinouts, which will be necessary for anyone setting up new connections for the antenna motors or the transceiver interface. There is some information about diagnostic tests, but there could be more about normal waveforms, voltages, resistances, and so on. Much of this can be found in other SteppIR documents, but it would be handy to have it in the controller manual.

If you want to create your own antenna designs and software, you will need the details of antenna configurations and formats, but you will need to consult the factory, because there is no programmers guide. Support from the online forum (groups.io/g/steppir) has been very responsive.

Conclusion

The SDA 2000 gives you a friendly and attractive user interface for SteppIR antennas, integrating a number of previously optional features. For many new SteppIR installations, it will be a natural choice. Users of

older controllers may wish to upgrade, especially if they need to add the lightning protection or tuning relay features. As an updateable device, we can expect improved functions and bug fixes to be provided over time.

Manufacturer: SteppIR Communication Systems, 13406 SE 32nd St., Bellevue, WA 98005; **www.steppir.com**. Price: \$899.99. Unit tested: serial no. 10727; firmware version 1.13.

IkaScope WS200 Wireless Oscilloscope

Reviewed by Paul Danzer, N1II
n1ii@arrl.net

The object in Figure 11 is not an oscilloscope probe. It is an entire single-channel oscilloscope that relies on a computer, tablet, smartphone, or other device for control and display functions, and it communicates with the control device via a Wi-Fi connection. The IkaScope application software is available online for Windows, Linux, macOS, Android, and iOS operating systems.

Table 2 lists the IkaScope specifications. In summary, the unit is rated at 200 MSPS (mega samples per second) for a 30 MHz bandwidth. It has 4 Kpts (4,000 points) of memory. The input range is 80 V_{p-p}, ac or dc. The manufacturer claims that for 20 measurements per day, the internal rechargeable 420 mAh battery will last for a week.

The IkaScope resembles any modern digital oscilloscope. It has an analog front end, followed by a digital processing stage, and a Wi-Fi

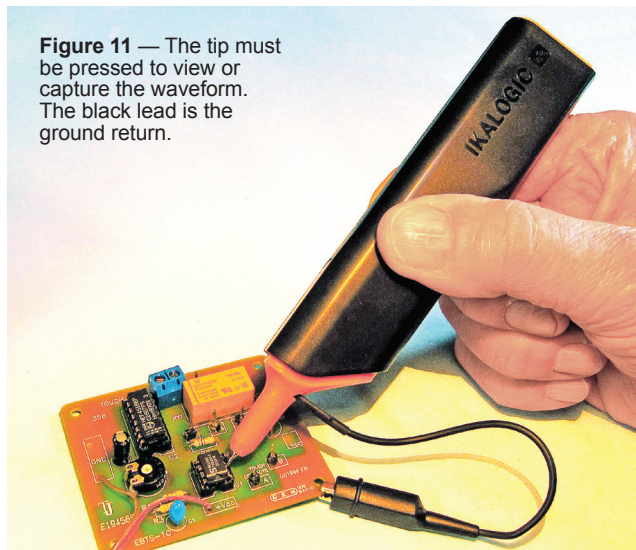


Figure 11 — The tip must be pressed to view or capture the waveform. The black lead is the ground return.

module. Measured signal values are scaled, then followed by analog-to-digital conversion in an eight-bit converter. The result is sent to your host computer/device over the Wi-Fi link.

There are two capabilities that especially interested me. First, it's wireless, so there is no connecting cable that can tangle on the work bench. Second is the flexibility and size of the display. With a smartphone or tablet, it's extremely portable and can be used anywhere. At home, it looks great on a 15-inch laptop or 24-inch desktop PC monitor. You can also use it in a presentation to an audience by sending laptop video to a projector.

Setup

When you open the package, the unit has a protective cover for the front

end, a micro-USB cable, and a small instruction card. While the enclosed instruction card gives basic information, additional information is available on the IkaScope website. Although this instrument is imported from France, all of the paperwork and online information is in well-written English.

To charge the IkaScope's internal battery, plug in the micro-USB cable, and connect the other end to a

Table 2
IkaScope WS200 Specifications

Sampling rate: 200 MSPS.
Rise time: 12 ns.
Sampling memory: 4 Kpoints.
Bandwidth (–3 dB): 10 V/div, 30 MHz to 100 mV/div, 50 MHz.
Timebase accuracy: ±2.5%.
Input impedance: 1 MΩ, 14 pF.
Vertical resolution: 8 bits.
Max. input voltage: 80 V _{p-p} .
DC vertical gain accuracy: ±3% full scale.

Bottom Line

The IkaScope is a flexible and useful 30 MHz oscilloscope that is not much bigger than a typical probe. Coupled via Wi-Fi to its application software running on a desktop PC or mobile device, it can be used in a variety of settings.

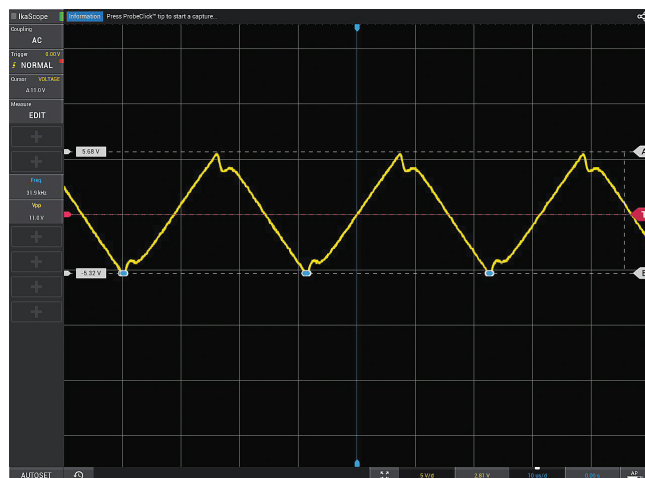


Figure 12 — For these symmetrical triangular waves, the **AUTOSET** function was not used. The cursor was set so you can see the peak-to-peak voltage, shown on the left.

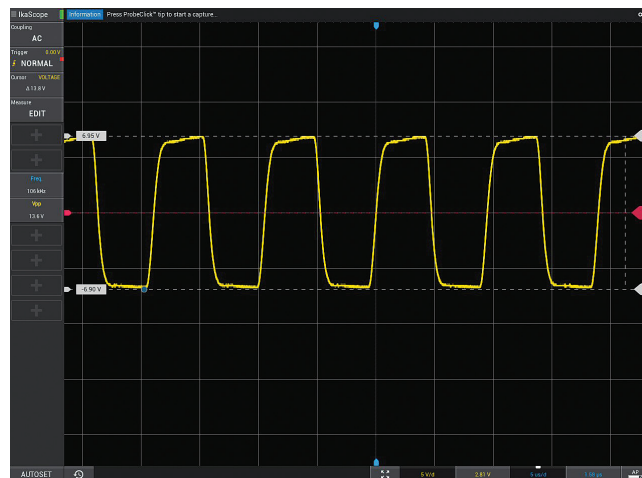


Figure 13 — The **AUTO** trigger was set at 0 V, so this nonsymmetrical square wave shows different positive and negative levels.

computer USB port or a USB charger (not included). An orange LED on the rear of the unit will light and then turn green when the battery is fully charged.

I decided to use the IkaScope with a Windows PC that had a wireless card, but was not connected to my home network. From the IkaScope website, I downloaded the **IKASCOPE_SETUP.EXE** file for Windows. Note that once you have downloaded the setup file, you no longer need internet access. Just follow the instructions to connect your computer to a new local network set up by the oscilloscope.

After charging the IkaScope battery and running the software installation program on my Windows 10 PC, I followed these steps to connect the software and IkaScope:

- 1) Press the IkaScope probe tip against a solid surface (pressing in the tip turns on the device). A white LED on the back of the unit will start blinking.
- 2) On the PC, go to the listing of available Wi-Fi networks. A new one called **IKASCOPE-XXXXXXX** (the device serial number) will appear. Select this network.
- 3) The blinking white LED on the IkaScope will stay on steadily.

- 4) Launch the IkaScope application, and you are ready to run.

Before you start the process, be sure you know how to find the screen on your PC or device that lets you select Wi-Fi networks. If you take too long, the blinking white LED will go off, and you will probably have to start over.

Using the IkaScope

This scope operates differently from most that I have used. The probe end does not have any sort of hook because you must press in the tip to see a waveform. As long as the tip is pressed, the current waveform is shown. When you release it, the scope software stores the last frame.

The small symbol in the upper right corner of the display screen gives the choices for storage. You can copy an image to the host device clipboard or save the image to a file. (That's how I created Figures 12 and 13.) There is a third alternative — save to a CSV file. This option saves the data to a numerical text file that can be examined using *Excel* or a similar spreadsheet program. The CSV file is semicolon delimited (not the usual comma-delimited format) and can be imported into a spreadsheet for further processing. A segment of one such file is shown in Figure 14.

Figure 12 shows a horizontal symmetrical triangle waveform from a signal generator. This signal generator has a dc offset capability, so the image shows the waveform going from +5.68 V to −5.32 V — a small offset.

The menu on the left side of the screen changes parameters by clicking your mouse. If you are trying to observe a changing waveform, you need one hand to hold the probe tip down and the other to move the mouse. Sometimes I felt that I needed three hands. However, because you can change parameters with the mouse after you release the probe and store the last-viewed waveform, it is manageable.

In Figure 12, I set **MEASURE** in the left column to **EDIT** and moved the top cursor to just miss the top of the waveform. I set the bottom to just touch the bottom of the waveform (the little blue circles say that I have just missed the bottom). In the left column, you can see a set of gray + signs under the **EDIT** button. Select one of these, and a menu of choices is brought up on the screen, slightly covering the waveform. In this case, I selected **FREQUENCY** and **Vpp** (voltage peak-to-peak), and the values of 31.9 kHz and 11.0 V are displayed.

The red line is the **TRIGGER** value shown at the left, and it's in the **AUTO** position. In using the IkaScope, I found the automatic trigger function to be very useful and very dependable. The **AUTOSET** function (automatic scaling in both voltage amplitude and horizontal frequency) was also very dependable. I tested it from audio frequencies to slightly less than 30 MHz (for the amateur 10-meter band).

The selections along the bottom of the screen are dropdown menus, giving you a choice of manually set values. Here, it is set at 5 V per division vertically and 10 μ s per division horizontally.

Figure 13 shows a square wave. The cursors are set to measure the peak-to-peak voltage, but the automatic measurement tells us that the manually positioned cursors are off by a bit. The automatic frequency reads 106 kHz.

There is also an automatic storage feature where several previous pictures can be saved and recalled for comparison. While many scopes have a storage capability, they are usually controlled by a **RUN/STOP** button. With the IkaScope, pressing on the probe tip is the equivalent of **RUN**, and releasing the tip is the equivalent of **STOP**. When you release the tip, the picture is saved automatically for editing and processing.

Advantages

As previously mentioned, there is no lead from the probe to the scope body. And you can view the waveform on a desktop computer monitor, thus letting you see details that might not be obvious on a typical 5-inch oscilloscope screen.

After using the scope for a few hours, including troubleshooting an audio amplifier, I found storage features to

	A	B	C
	Time (Seconds)	Voltage (Volts)	
1	-0.00009582	6.187362671	
2	-0.00007482	4.618735313	
3	0.00009843	-3.572985888	
4	-0.00007335	6.013070583	
5	-0.00009078	1.132896423	
6	0.00006735	-0.610022902	
7	0.00006987	-3.398694038	
8	0.00001338	1.307188392	
9	0.00004005	0.784312606	
0	0.00005895	6.884530544	
1	0.00010032	-3.224401951	
2	0.00000498	6.187362671	
3	0.00010284	-0.784314871	
4	-0.00008511	-4.967321396	
5	-0.00004353	6.013070583	

Figure 14 — A segment of a waveform saved using the CSV file option. If the CSV file is just copied into your spreadsheet, all these values will be in the single selected cell. If you follow the procedure to import the information, you get stored values like this, so you can apply any calculations you want to the measurement data.

be quite useful. The ability to reexamine a stored picture and rescale it, both in time and amplitude, let me look for things I did not see on the original screen capture. Then, after I made a small change in the audio amplifier input load resistance, I could see the difference by comparing two stored images on my PC monitor. I could see immediately if I had made a significant change.

As with most modern digital scopes, the IkaScope does a lot and has a learning period. If you're used to conventional knob-and-button scopes, it will probably take you a while to get used to the major controls and capabilities. After the initial familiarization, I found that the logical order of the on-screen controls makes the scope use quite straightforward.

Manufacturer: IkaLogic, 19 Rue Columbia, 87000 Limoges, France; **ikalogic.com**. Available in the US from Saelig Company, **www.saelig.com**. Price: \$300.

New Products

Mastrant's Universal Stainless-Steel Mast Clamp

Mastrant introduces a universal stainless-steel guying mast clamp for a wide range of mast diameters. It is strong, with a 4-millimeter ($\frac{5}{32}$ -inch) thickness and a 40-millimeter ($1\frac{1}{2}$ -inch) height, and it uses $\frac{5}{16}$ -inch M8 screws with 60-millimeter ($2\frac{1}{4}$ -inch) or 100-millimeter ($3\frac{7}{8}$ -inch) length. The clamps are also very durable, using AISI 316 screws, nuts, and washers and AISI 304 steel-plate brackets, which are universal for both three- or four-directional configurations. In the bracket, there is a hole for a security bolt. The holes for 16-millimeter-diameter ($\frac{5}{8}$ -inch-diameter) guys can adopt shackles, chain couplers, or carabiners of 4-millimeter ($\frac{5}{32}$ -inch) sizes and thimbles of 3 to 10 millimeters ($\frac{1}{8}$ to $\frac{3}{8}$ inches).

Pricing

Three-directional,
 $\frac{5}{8}$ – 2 inches (15 – 53 millimeters) \$19

Three-directional,
 $\frac{5}{8}$ – 4 inches (15 – 102 millimeters) \$20

Four-directional,
 $1\frac{1}{4}$ – $3\frac{1}{4}$ inches (32 – 85 millimeters) \$25

Four-directional,
 $1\frac{1}{4}$ – 5 inches (32 – 127 millimeters) \$27

www.mastrant.com

