

June 2020

AnyTone AT-D578UVIIIPRO Triband DMR/FM Transceiver

RigExpert Stick 230 Antenna Analyzer

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Product Review

AnyTone AT-D578UVIIIPRO Triband DMR/FM Transceiver

Reviewed by Pascal Villeneuve, VA2PV
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The AnyTone AT-D578UVIIIPRO is a triband VHF/UHF mobile radio for North America that operates on DMR and analog FM. This transceiver covers 144 – 148, 222 – 225, and 430 – 450 MHz. The wideband receiver has additional coverage from 136 – 174 and 400 – 480 MHz. It can also receive the FM broadcast band between 87.5 and 108 MHz. RF output power is adjustable, with a specified maximum of 50 W on 2 meters, 5 W on 1.25 meters, and 45 W on 70 centimeters.

The AT-D578UVIIIPRO offers many features, including Bluetooth, a Global Positioning System (GPS) receiver, and support for Automatic Packet Reporting System (APRS) operation. The transceiver operates in full duplex, supports DMR roaming, and supports cross-mode operation with one VFO in analog and the other in DMR when the cross-band repeat function is activated.

Overview

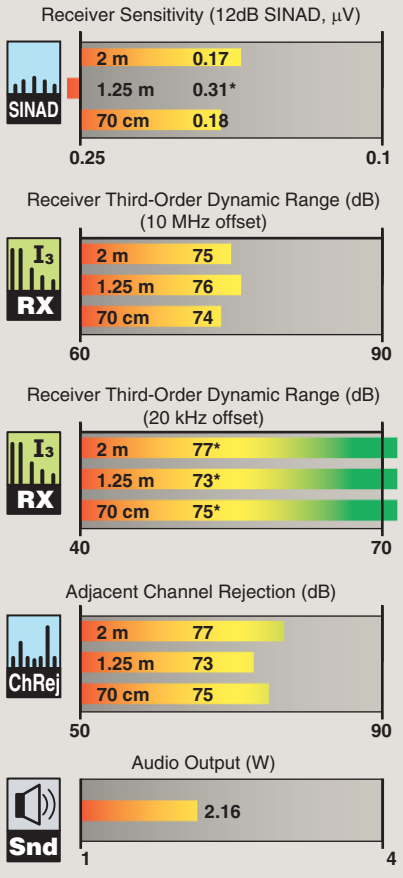
Included in the box with the AT-D578UVIIIPRO radio is a built-in Bluetooth module, an external Bluetooth

Bottom Line

The AnyTone AT-D578UVIIIPRO offers a wide range of features in a triband DMR/FM transceiver.



AnyTone AT-D578UVIIIPRO Key Measurements Summary



Notes: QS2006-PR145
Measurements shown for FM mode.
See Table 1 and expanded test results at **www.arrl.org/qst_in_depth** for additional measurements.
*Bars off the graph indicate values off scale.

Table 1
AnyTone AT-D578UVIIIPRO, serial number 1535193220002

Additional ARRL Lab measurements are available at **www.arrl.org/qst_in_depth**.

Manufacturer's Specifications	Measured in ARRL Lab
Frequency coverage: Receive and transmit, 144 – 148, 222 – 225, 420 – 450 MHz.	Receive: 136 – 174, 220 – 225, 400 – 480 MHz. Transmit: as specified.
Modes: FM, digital voice (DMR), data, WFM (receive only).	As specified.
Power requirements: 15 A at 13.8 V dc.	At 13.8 V dc: Receive, no signal, max. audio and backlights, 536 mA; min. backlights, 524 mA; standby, 296 mA. Transmit (turbo/high/medium/low): 146 MHz, 7.75/5.0/3.3/1.52 A 223 MHz, 4.22/4.22/4.22/2.83 A 440 MHz, 8.75/6.05/4.09/1.59 A Power off, 6 mA.
Receiver	**Receiver Dynamic Testing**
Sensitivity: FM (12 dB SINAD), ≤0.25 µV.	FM (12 dB SINAD): 146 MHz, 0.17 µV; 223 MHz, 0.31 µV; 440 MHz, 0.18 µV. WFM 0.7 µV (100 MHz).
Adjacent-channel rejection: Not specified.	20 kHz offset: 146 MHz, 77 dB; 223 MHz, 73 dB; 440 MHz, 75 dB.
Squelch sensitivity: Not specified.	At threshold: 146 and 440 MHz, 0.31 to 0.77 µV; 223 MHz, 0.36 to 0.37 µV.
S-meter sensitivity: Not specified.	For full-scale signal (4 bars): 146 MHz, 46.2 µV; 223 MHz, 70.7 µV; 440 MHz, 74.1 µV.
Audio output power: 2 W into 8 Ω.	2.16 W into 8 Ω at 8% THD. THD at 1 V_{RMS}, 3%.
Transmitter	**Transmitter Dynamic Testing**
Power output (turbo/high/medium/low): 146 MHz, 55/25/10/1 W 223 MHz, 5/5/5/1 W 440 MHz, 40/25/10/1 W at 13.8 V dc.	Turbo/high/med/low at 13.8 V dc: 146 MHz, 50/21.2/9/1 W 223 MHz, 4.5/4.5/4.5/1 W 440 MHz, 35/18.8/8.8/0.9 W
Power output at minimum specified operating voltage: Not specified.	At 11.7 V dc, high power: 146 MHz, 43.4 W; 223 MHz, 4.4 W; 440 MHz, 32.9 W.
Spurious signal and harmonic suppression: ≥57 dB.	146 MHz, 68 dB; 223 MHz, 50 dB;* 440 MHz, >70 dB. Meets FCC requirements.

Size (height, width, depth): 1.5 × 5.5 × 7.4 inches (with protrusions); weight 2.35 pounds.

*52 dB required at 4.5 W RF output; considered borderline, but within measurement tolerances.

push-to-talk (PTT) key with an elastic bracelet, a handheld microphone, an external GPS antenna, a mobile bracket with assorted hardware, a fused dc power cable, a USB-to-microUSB programming cable, spare fuses, and a user manual. You can download the programming software (CPS) from AnyTone or from your dealer's website.

The AT-D578UVIIIPRO doesn't have a detachable remote head for mobile installations. However, the radio is very small, and it will probably fit in most vehicles somewhere under the dash.

The front panel with its 1.77-inch color display (see Figure 1) is attractive. The downside of a small package like this is that the screen and controls are small as well, but it's still highly functional. There are six programmable keys next to the display, plus a multifunction button that is also a programmable push-button. There are two separate volume knobs, one for each VFO. Volume levels are adjustable in steps, and I found it hard to adjust for low volume. It switches from nothing to a medium-low volume level, behavior that I have seen on other DMR transceivers.

Many important quick-access buttons are available on the hand



Figure 1 — The AT-D578UVIIIPRO front panel.

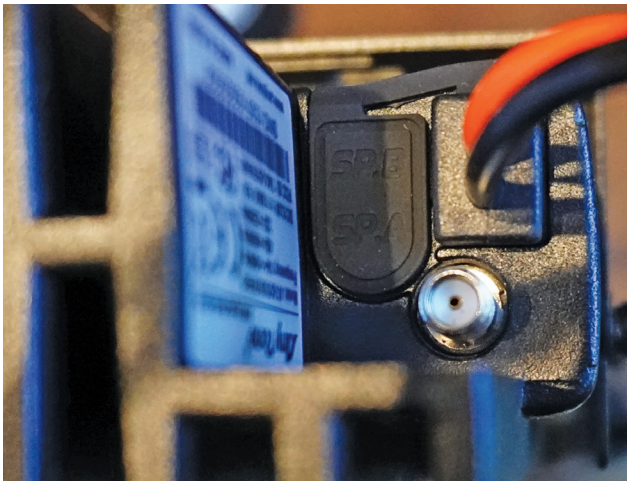
microphone. Functions include toggling between the main and sub VFOs, DTMF tones, and up/down buttons on top for frequency or memory changes. On the mic, there are also dedicated buttons for menu navigation (menu, zone up, zone down, and exit).

The radio supports up to 4,000 memory channels, 10,000 DMR talk groups (TG), 200,000 digital contacts, and up to 250 radio IDs. It is compatible with DMR Tier I and Tier II.

On the rear panel, you will find two antenna ports. One is for the external GPS using an SMA female connector (see Figure 2). The other is a standard UHF female connector (SO-239) with an integrated triplexer for triband operation with a single feed line. Next to the GPS antenna port is a removable rubber cap with two ⅛-inch speaker output jacks that can be configured with separate output for each receiver (VFO A and B). You can also pair the radio with your car stereo for listening to received audio via Bluetooth (if your car has that capability) and still use the external PTT at the same time.

Customizing the Transceiver Using the CPS

The CPS programming software for the AT-D578UVIIIPRO is identical to the software used for AnyTone's DMR handheld radios. With a new DMR radio, there is always a learning curve before you become familiar with its functions. Some features are not available until you check a box or enable a setting in the software. For example, by default, you won't find the setup menu for APRS if you do not



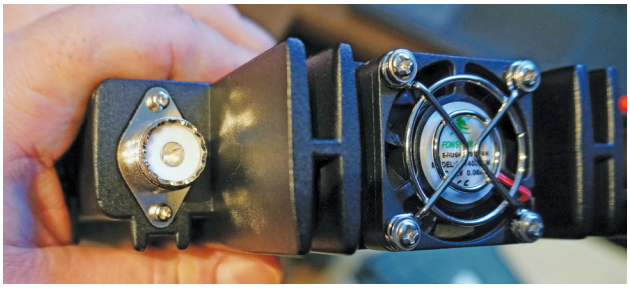


Figure 2 — (Left) On the rear panel, the GPS antenna connects to the SMA connector and two ⅛-inch external speaker jacks are under a rubber cap. (Above) The AT-D578UVIIIPRO uses a single SO-239 antenna jack. The radio has a triplexer built in, and the user will need to supply a suitable multiband antenna.

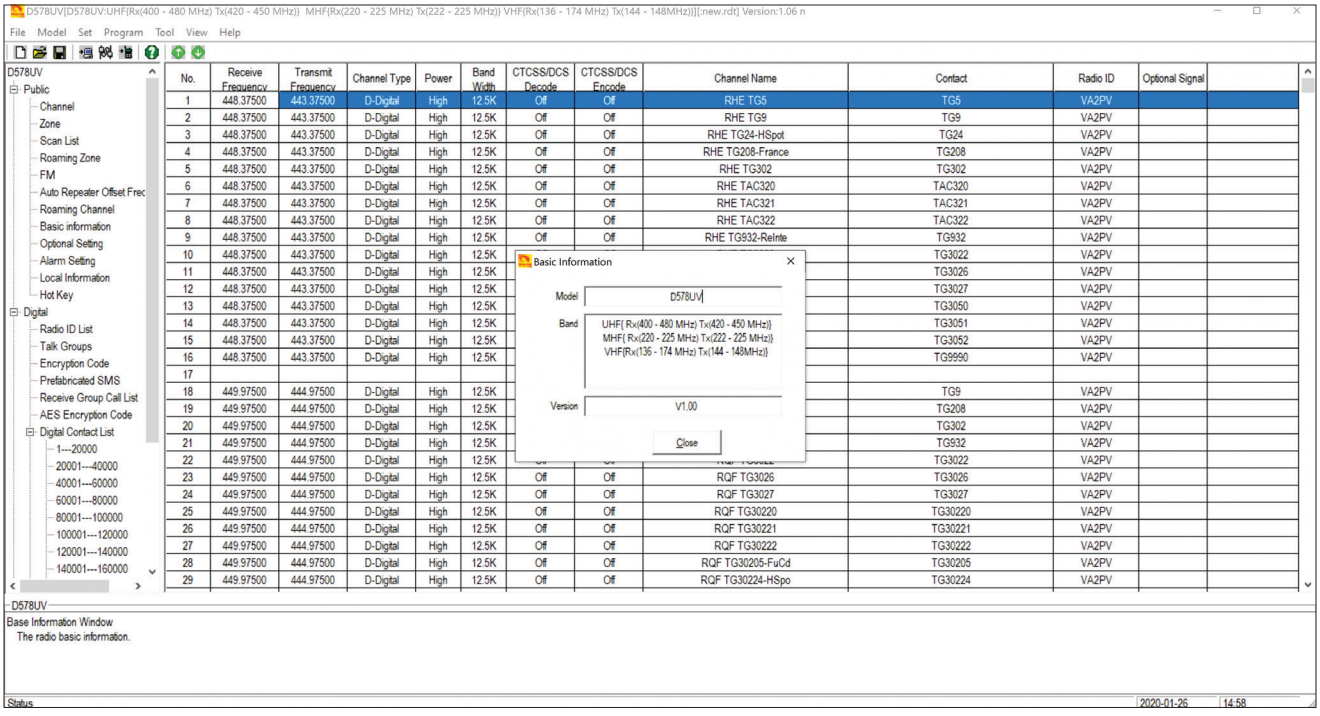


Figure 3 — The CPS software programming screen.

activate the feature first. The same holds for Bluetooth and GPS. To enable these features, go into the CPS **TOOL** tab, and choose the options you want. A typical CPS programming screen is shown in Figure 3.

After I installed the CPS, I wondered if the code plug from my AnyTone AT-D878UV handheld would be compatible. It's not as simple as opening the handheld's code plug into the mobile radio's CPS software, but you won't have to start from scratch. You can import a code plug for the AT-D878UV handheld and edit it for the mobile transceiver. The AT-D578UVIIIPRO can be configured manually from the front panel, and you can build a code plug from the keypad if you are patient. However, I strongly recommend taking the time to build a comprehensive code plug using the CPS software.

Operation on the Air

I tested the radio using analog and digital modes in simplex and on repeaters and received very good feedback about the audio quality. If you're already familiar with the AnyTone AT-D868UV or the AT-D878UV, operating this unit will be easy. All the submenus are the same, but with more features.

This radio has two independent receivers, and it can receive both at the same time. Both VFOs can be set to analog, or one can be set to analog and the other to DMR. When both VFOs are set to DMR, you can only receive one digital signal at a time.

Keep in mind that the analog APRS support is for transmit only. You can send your position manually or as a timed beacon, but you won't be receiving any APRS beacons or displaying them on the screen.

The AnyTone AT-D578UVIIIPRO is a full-duplex transceiver, and it supports the repeater mode (also known as cross-band repeat). You can operate cross-band between the 2-meter and 70-centimeter bands, and you can also operate cross-band between the 1.25-meter and 70-centimeter bands. You cannot operate cross-band between 2 meters and 1.25 meters. (For more information on requirements for cross-band repeat or auxiliary operation in the US, see **www.arrl.org/auxiliary-station-faq**. In Canada, an Advanced-class licence is required.)

I wondered if the radio supports cross-band repeat in DMR as well as analog FM. I started my test in analog (both VFO A and B in FM), and it worked. Then I tried DMR (on both VFOs), and it worked. Then I tried one VFO set for DMR operation and one for analog FM, and I was very surprised to see that it did cross-mode between the two VFOs. Yes, you can use an analog radio to talk to a DMR radio using this feature.

Keep in mind that the DMR color code (analogous to an access tone in analog FM), time slot (TS), and talk group (TG) have to be set correctly if you want to do this. I tried it with my DMR hotspot, and it worked fine. When using a DMR handheld to communicate cross-mode to analog FM, the mobile radio needs to have the same DMR configuration as the handheld for the audio to be decoded.

When operating cross-band repeat with both VFOs set to DMR, I noticed that it will work with any incoming signals on either time slot (TS1 or TS2). For the test, my first handheld was set to TS1 using TG9 on 2 meters, and the second handheld was set to TS2 using TG9 on 70 centimeters, and they were able to communicate.

For the test, I made sure that neither radio was in dual-TS monitor mode. It was a bit confusing, but if the handheld configuration didn't match the mobile radio's TG or the color code, I couldn't hear anything. If you're considering this unit specifically for its cross-mode capabilities, you should confirm with your local dealer that it will work specifically for the intended application.

When you transmit, the fans start as soon as you push the PTT button. I thought the fans were a bit loud, particularly in my quiet home station. That may or may not be the case in a mobile installation, depending on the normal road and wind noise in your vehicle. I guess this is a compromise with a high-power transmitter in a small form factor. I recommend keeping both VFOs set to low power if you operate using the cross-band repeat function, as it gets pretty hot. Keep in mind that in cross-band repeat mode, the radio will transmit as soon as it receives a signal or the squelch opens.

Conclusion

This triband radio adds the 1.25-meter band and offers quite a few features that hams expect in a VHF/UHF transceiver. AnyTone has announced a forthcoming Bluetooth microphone with integrated display that would be a great addition for mobile operation. I also like that you can use any analog handheld to talk to DMR radios via the cross-mode feature. The ARRL Lab did note that receiver sensitivity is lower on 1.25 meters than on the other two bands.

ARRL purchased the review radio from BridgeCom Systems. Their website's Support section has a page with downloadable firmware updates and videos showing how to update the firmware and get started with the CPS software. The purchase price also includes a coupon for free access to BridgeCom University, a series of online lessons on various aspects of installing and using the AT-D578UVIIIPRO.

Additional test data and photos are available from **www.arrl.org/qst_in_depth**.

Manufacturer: Qixiang Electron Science and Technology Co. Ltd., Fujian, China; **www.anytone.net**. Available from several US dealers. Price: $399.99 with GPS, Bluetooth, and programming cable.



Visit https://youtu.be/JIHvvUY26QE to see our review of the AnyTone AT-D578UVIIIPRO Triband DMR/FM Transceiver on YouTube.



RigExpert Stick 230 Antenna and Cable Analyzer

Reviewed by Phil Salas, AD5X
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The lightweight and compact RigExpert Stick 230 antenna and cable vector analyzer is intended for portable applications in the field or on a tower, although it can be used indoors as well. It is less expensive than the RigExpert AA-230 ZOOM, which covers the same 0.1 – 230 MHz frequency range, but there are some significant differences between these two analyzers. It's a good idea to read the AA-230 ZOOM review in the March 2016 issue of *QST* before deciding which to buy.

Overview

The Stick 230 is a single-port vector network analyzer (VNA) that provides signed, complex impedance measurements of RF loads from 100 kHz to 230 MHz with a frequency resolution of 1 kHz. A user manual is not provided with the instrument, but is available for download from the RigExpert website. Supplied accessories include a USB cable, carrying strap, and connector cover.

The measurement port is an SO-239 jack. A USB cable is provided for computer interfacing using *Antscope2* software for Windows or macOS, and for charging the internal 3.7 V, 2,800 mAh type 18650 Li-ion battery. A battery indicator on the main menu shows the battery status. When a computer is connected, power is provided through the USB connection. The Stick 230 has a Bluetooth interface that permits display and control from an Android smart phone using the *AntScope for Android* app from Google Play.

All information is displayed on a 1 × 1 inch (200 × 200 pixel) monochrome screen. You can select single-frequency or a swept-frequency displays. The single-frequency mode displays SWR, return loss, impedance (Z, R, and X), or the equivalent series and parallel representation of an impedance. The swept-frequency mode displays SWR. When using the *Antscope2* software, you can display SWR, phase, impedance, return loss, Smith chart, and TDR (time domain reflectrometer) plots. Table 2 summarizes the Stick 230's specified performance and features.

Stick 230 Testing

I began my tests by checking the Stick 230 output against WWV at 10 MHz. The frequency was within 20 Hz of WWV, and I did not detect any noticeable frequency drift over a 5-minute test period. I also found the fundamental frequency output level to be –8.5 dBm over the full-frequency range.

Table 2
RigExpert Stick 230 Manufacturer's Specifications

Measurement frequency range: 0.1 to 230 MHz, for 25, 50, 75, 100, 150, 200, 300, 450, and 600 Ω systems.
Frequency resolution: 1 kHz.
SWR measurement range: 1 to 100 in numerical modes, 1 to 10 in graphical modes.
Impedance ranges: R = 0 to 10,000 Ω, X = –10,000 to 10,000.
RF output: Square wave, 0.1 to 230 MHz, at –10 dBm (into 50 Ω resistive).
Operating temperature: 32 – 104 °F.
Dimensions: 7.3 × 1.6 × 1.3 inches. Weight: 6.5 ounces with battery.

Bottom Line

The Stick 230 antenna and cable analyzer is compact, lightweight, and rugged. It's a useful tool for antenna system measurements in the field or at home.

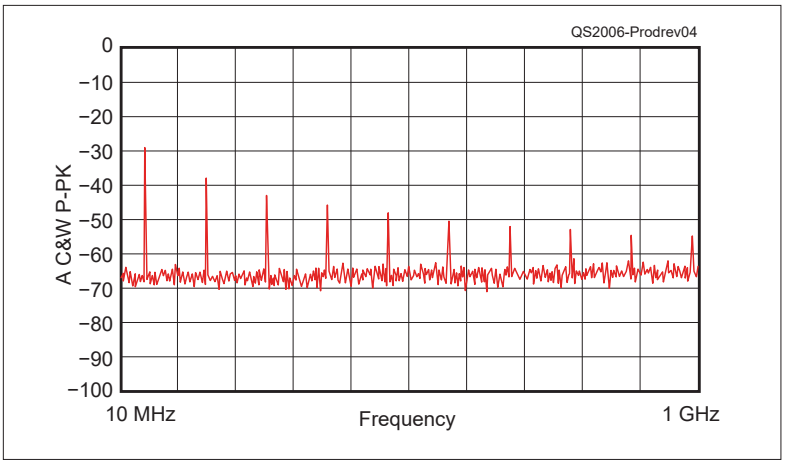


Figure 4 — The output of the Stick 230 viewed on a spectrum analyzer. The fundamental frequency is 50 MHz, and odd harmonics are visible every 100 MHz.

When used as a signal source, keep in mind that the output waveform is almost a perfect square wave, as you can see in the 50 MHz (fundamental) spectrum output of Figure 4. This relative spectrum is constant over the full frequency range of the instrument. The odd harmonic amplitudes almost exactly follow $A = 2/(\pi N)$, the equation for the amplitude of odd harmonics of a perfect square wave.

Next, I recorded the open-circuit output impedance as measured by the Stick 230. This gives an indication of the impedance magnitude you can accurately measure as a function of frequency. The results, tabulated in Table 3, indicate that accuracy will drop off as you go higher in frequency, especially for higher-impedance loads.

For the all-important SWR testing, I checked the Stick 230 against a precision 50 Ω load, and then shorted microwave attenuators of 5 dB (1.92:1 SWR), 3 dB (3.01:1 SWR), 2 dB (4.42:1 SWR), and 1 dB (8.7:1 SWR). Because the pads are not perfect, I also measured them on my Array Solutions VNAuhf for comparison, as shown in Table 4. As you can see, the Stick 230 SWR readings compare quite favorably to the VNAuhf readings.

For my final tests, I used complex loads with an SWR of approximately 2:1 at 50, 146, and 222 MHz. Table 5 displays the Stick 230 versus the VNAuhf measurements. As you can see, the Stick 230 provides almost identical SWR measurements to the VNAuhf. The series R and C measurements compared favorably to the VNAuhf as well.

Table 3
Stick 230 Measured Open Circuit Impedance

Frequency (Ω)	Output (Z) (MHz)
1.8	~4,200
3.5	~3,200
7	~2,100
14	~1,200
28	~700
50	~400
146	~150
222	~90

Using the Stick 230

I found it interesting that the Stick 230 screen is not blank when off. It displays **ANTENNA ANALYZER 230 MHZ**, the serial number, and the firmware version. Prior to using the Stick 230, check the RigExpert website for firmware updates. If a newer version of firmware is available, the RigExpert firmware update tool will download and install the new firmware for you with minimal effort.

I found that the Stick 230 operation is not as intuitive as other RigExpert analyzers because few keys are available. After using it for a while, it does become easier to use. However, if you use the Stick 230 infrequently, you'll probably need to keep the manual on hand for quick reference.

A quick press of the lower right key powers on the unit (press and hold this same key to turn off the unit). Figure 5 shows the Main Menu displayed on power up. A tap of the lower left key brings up screens with descriptions of the four measurement options, and it also provides access to user-adjustable settings. At this time, there is no capability for open/short/load calibration on the Stick 230 menus.

When you select the **SINGLE** mode, you can then sequentially display fixed frequency values of SWR and return loss (screen 1); [Z], R and X (screen 2); Ls and Cs (screen 3); Rp and Xp (screen 4); and Lp and Cp (screen 5). I used this mode to record the data shown in Tables 3, 4, and 5.

Table 4
Stick 230 Resistive Load Measurements

Stick 230 compared to Array Solutions VNAuhf (see text)

Load (SWR)	*1.0:1*	*1.9:1*	*3:1*	*4.4:1*	*8.7:1*
Frequency (MHz)	*Stick*	*Measurement with NanoVNA/VNAuhf* ---------- *Stick/uhf*	*Stick/uhf*	*Stick/uhf*	*Stick/uhf*
1.8	1.02	1.95/2.00	3.1/3.17	4.5/4.45	10/10.93
3.5	1.02	1.95/2.00	3.1/3.17	4.4/4.43	10/10.87
7	1.02	1.95/2.00	3.1/3.17	4.4/4.41	10/10.85
14	1.02	1.95/1.99	3.1/3.17	4.4/4.38	10/10.80
28	1.02	1.94/1.98	3.1/3.16	4.4/4.33	10/10.49
50	1.02	1.94/1.98	3.1/3.16	4.4/4.30	10/10.52
146	1.0	1.92/1.96	3.1/3.17	4.5/4.51	10/10.35
222	1.01	1.92/1.93	3.1/3.18	4.6/4.66	9.9/10.10

Table 5
Stick 230 Complex Load Measurements

Stick 230 compared to Array Solutions VNAuhf measurements of SWR and series resistance/capacitance (see text)

Frequency (MHz)	**------- Stick 230 -------** **SWR**	**Rs + Cs**	**-------- VNAuhf --------** **SWR**	**Rs + Cs**
50	1.97	47 Ω + 98 pF	1.97	48 Ω + 95 pF
146	1.80	44 Ω + 43 pF	1.83	46 Ω + 37 pF
222	1.70	41 Ω + 36 pF	1.77	43 Ω + 28 pF



Figure 5 — The Stick 230 power-up screen and controls.

The **Multé** mode scans the amateur bands in the 100 kHz – 230 MHz frequency range and displays all frequencies where the SWR is less than 3:1. You step through the found frequencies using the left and right arrow keys.

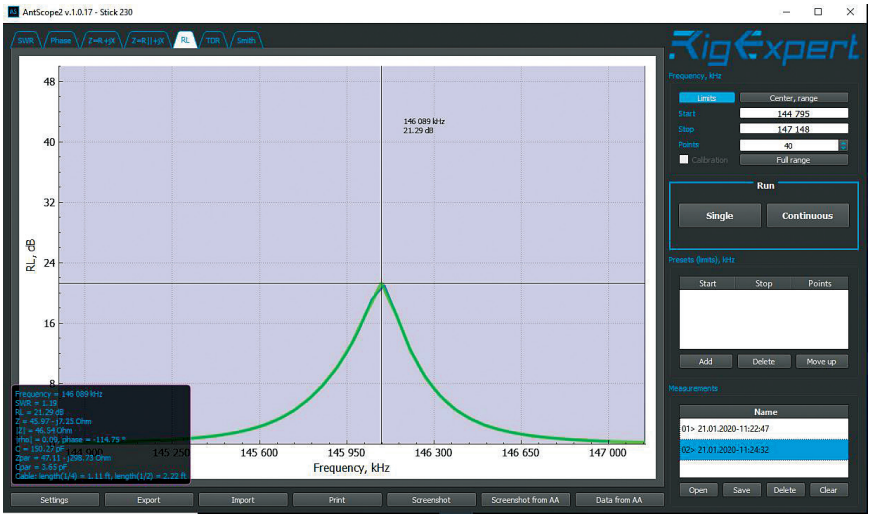
The **HAM** mode graphically displays SWR on all ham bands. You step through the ham bands (plus 11 meters) with the left and right arrow keys. Once a band is selected, you can adjust the swept bandwidth with the – and + keys and change the center frequency with the left and right arrow keys. Figure 6 is an SWR scan of a 2-meter band-pass filter.

The **FREE** mode lets you set up a user-defined swept frequency range. This is useful for looking at multiple resonances as you might find in a multiband antenna.

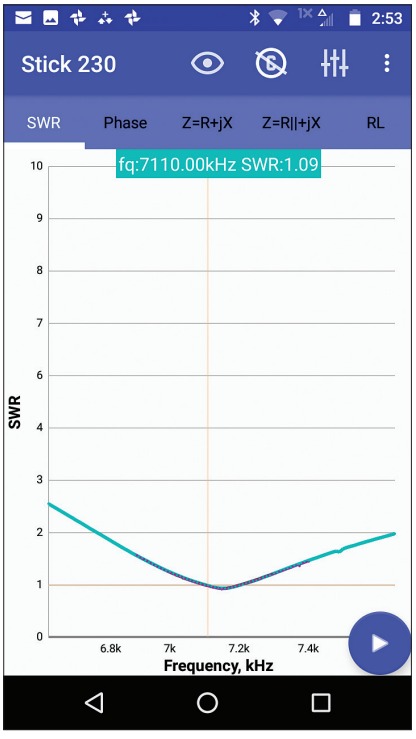
In all cases, you can change frequency in two ways. First, tapping the left or right arrow key will decrement or increment the frequency in small steps. Pressing and holding one of these keys will change frequency in an accelerating manner. The second way to change frequency is to press the lower left key for 2 seconds. This will bring up a screen where you can change the individual frequency digits using the – and + keys.



Figure 6 — SWR scan of 2-meter band-pass filter on the Stick 230 screen.



▲**Figure 7** — Return loss sweep of the 2-meter band-pass filter viewed in *AntScope2* software.



▶**Figure 8** — SWR scan of a 40-meter antenna viewed with the *AntScope for Android* app on a smartphone.

Computer Interface

The *AntScope2* software, available for download from RigExpert's website provides real-time control of the instrument. Upon installation, *AntScope2* creates a desktop icon. Figure 7 shows the *AntScope2* return loss display of the 2-meter band-pass filter tested in Figure 6. It is interesting that the return loss is displayed inverted from what I've typically seen in other VNA software.

AntScope for Android

As mentioned earlier, the Stick 230 has a built-in Bluetooth interface that allows you to control the device from a paired smartphone or tablet using the *AntScope for Android* app. I downloaded the app to my Google Pixel phone and the app instantly recognized the Stick 230. I did not find operating *AntScope* from my phone to be very intuitive, but with a little playing around, I figured it out. Figure 8 is an SWR scan of a 40-meter inverted-V dipole viewed on a smartphone.

It is interesting that *AntScope for Android* shows an open/short/load (OSL) calibration routine, but this feature did not appear to be enabled yet. When I started the OSL function from my phone, the first calibration process seemed to continue far too long. I terminated it after waiting 10 minutes.

Finally, I did have two cases where the Stick 230 completely froze up on me. The only way I could resolve this was to remove the lithium battery (this required removing two screws) and then re-inserting it. RigExpert indicates that this has been fixed in firmware version 1.4 and the Stick 230 no longer freezes.

Conclusion

The Stick 230 is another option for those who want an antenna analyzer, particularly for field applications. It is more compact and less expensive than the RigExpert AA-230 ZOOM analyzer, making it more convenient for carrying around in a toolbox or simply putting it in your pocket. The monochrome E ink display offers excellent visibility, even in direct sunlight. You can investigate the Stick 230 further by viewing the manual on the RigExpert website.

Additional illustrations showing the Stick 230 in operation are available from **www.arrl.org/qst_in_depth**.

Manufacturer: Rig Expert Ukraine Ltd., Kyiv, Ukraine; **www.rigexpert.com**. Available from several US dealers. Price: $290.

Elecraft AX1 Dual-Band Whip Antenna and Accessories

Reviewed by Bob Allison, WB1GCM
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In my youth, portable operation typically happened only at ARRL Field Day, using gasoline-powered generators, temporary antennas, and heavy home-station equipment. Today, we can choose from a selection of HF transceivers that are very small, lightweight, and powered by internal batteries. These are ideal for operating from a remote mountain summit or a local park.

Portable HF transceivers still require an antenna, though. A half-wave dipole antenna cut for the operating frequency is efficient, but may be too large to easily move or put up. A compromise between antenna efficiency and portability must be made.

The Elecraft KX2 and KX3 transceivers are very popular with portable operators, and Elecraft recently

Bottom Line

The Elecraft AX1 and accessories make a highly portable antenna system that integrates well with an Elecraft KX2 or KX3 transceiver. While a short, base-loaded whip antenna is by definition a compromise, the combination works well enough to be heard, even at the very bottom of the solar cycle.



introduced the companion AX1 Multi-Band Whip Antenna. We ordered an AX1 and accessories for use with my Elecraft KX2.

Overview

The AX1 is designed for use on the 20-, 17-, and 15-meter bands. It's resonant on 20 meters and works on 17 and 15 meters, with help from the transceiver's automatic antenna tuner (ATU). There's a switch to select 20-meter or 17/15-meter operation. The Elecraft AXE1 Extender permits operation on 40 and 30 meters with the ATU. Maximum power rating is 30 W, which is more than enough to handle the RF power output of the KX2 or KX3 transceivers. The ARRL Laboratory performed an RF safety evaluation for the AX1 at various frequencies at 10 W and 30 W in controlled and uncontrolled environments. For the most part, the operator and others nearby should be safe using this antenna with the KX2 or KX3. The operator may need to pay attention if the antenna is used with other transmitters operating at the 30 W power limit of the antenna. See **www.arrl.org/files/file/Technology/RFsafetyCommittee/RF%20safety%20sidebar.pdf** for the full report.

The AX1 Whip Antenna consists of two pieces: a 6-inch-long loading coil base with BNC male connection, and a 45-inch-long, 10-section telescopic whip (collapsed length is 6 inches). There are two loading coils mounted one above the other, wound around a pair of slender circuit boards that provide electrical connections and mechanical support. A transparent Lexan cylinder covers the coils and has a small opening above the BNC connector for access to the band switch (20 or 17/15 meters).

The manual recommends the use of at least one radial wire, attached to chassis ground. Elecraft offers a 13-foot radial wire accessory to use with the AX1 for 20-, 17-, and 15-meter operation. A 33-foot radial wire is available from Elecraft for 40/30 meters with the AXE1 Extender. We used the radials for on-air operating for this review.

My measurements showed that the review antenna is resonant at approximately 15.350 MHz in the 20-meter position and 19.280 MHz in the 17/15-meter position, with the 13-foot radial wire connected. With the AX1/AXE1 combination for 40/30 meters and the 33-foot radial wire, the antenna was resonant at about 7.440 MHz. The internal antenna tuner in my KX2 had no difficulty finding a match of 2:1 or less across 20 and 17 meters, and across 40 meters with the AXE1 Extender. I achieved reasonable SWR on 30 meters with the AX1/AXE1 using the 17-meter switch position and 33-foot radial. In the 17-meter position, I was able to find a match on 12 meters as well as 15. Overall operation is smooth using the KX2/AX1 combination, as the transceiver's ATU memorizes tuning settings for previously used operating frequencies.

Although the AX1 uses a sturdy, collapsible whip element, it can be damaged if you accidentally step or sit on it. Give it the same level of care as your transceiver, and it should hold up well. The antenna coil assembly is not submersible or water resistant, though I give it a fair mark on its ability to handle moisture. The coil assembly can be disassembled and dried after use in moist environments. Placing a small piece of tape over the band switch access hole can also help keep out moisture.

The AXE1 40-Meter Extender coil and solder connections are sealed in a thick, transparent cover. As shipped, the AXE1 did not fit the top of the AX1 coil assembly. I removed ¼ inch of the plastic covering from the bottom of the AXE1 body, and then the two pieces fit properly.



Figure 9 — The AX1 mounted on a KX2 transceiver with the optional AXB1 Whip Bipod.



Figure 10 — The AXT1 Tripod Adapter is handy for mounting the antenna on a tripod, away from the operator, but it required a tripod without an integrated head.

Accessories

The AXB1 Whip Bipod consists of two metal supports, hinged in the middle (see Figure 9). The hinge point has a small plastic clamp that fits over the shell of the AX1 male BNC connector. A small, knurled plastic knob adjusts the friction of the bipod, permitting firm placement of the bipod and antenna on a variety of level and irregular surfaces (such as a boulder on a mountaintop).

The AX1 can also be mounted on a camera tripod, away from the transceiver (and operator), using the Elecraft AXT1 Tripod Adapter. The AXT1 is designed to work with any camera tripod that uses a standard ¼-20 threaded mount. Make sure the tripod head is small enough to allow access to the antenna connection. Some tripods have an integrated tilt/pan head with a flat camera platform that's too large to use with the adapter (see Figure 10). The AXT1 bracket has several holes that can be used to guy the tripod and/or attach one or more counterpoise wires.

On the Air with the AX1

The antenna can be connected directly to the BNC antenna jack on the side of a KX2/KX3 transceiver, with the radio held like a small VHF transceiver. For tabletop use, Elecraft includes a right-angle BNC adapter. With an overall antenna length of 51½ inches (add 6 inches if using the AXE1), the antenna tends to flop around a bit, but can be easily braced to remain in a vertical position by using the Elecraft AXB1 Whip Bipod.

I've operated HF using QRP (low power, 5 W or less) and compromised antennas, and had reasonable expectations for what I could do with this short base-loaded whip antenna. To get the most out of your outdoor operating excursions, study radio propagation carefully. Know the times when signal levels are likely to peak from a given location on a given frequency. This will increase your likelihood of making contacts.

While on a hilltop in central Connecticut, I set up the KX2/AX1 combination on the hood of my truck. I didn't expect much, because the bands were reported to be dead, but the weather was sunny and mild for mid-February. Yes, 20 meters was dead, but not completely. There were enough weak signals to try the AX1 with and without the radial wire attached. As expected, the radial wire drastically improved signal strengths, up to about 30 dB by my observation.

On 40 meters, I added the AXE1 extender coil and 33-foot radial wire, leaving the loading coil switch set to 20 meters. That just took a couple minutes. I managed to snag a quick CW contact, with a 459 report from Virginia; otherwise, my CQ calls went unanswered.

On another sunny afternoon in March, I participated in the ARRL International DX Phone Contest. Propagation conditions were fair, but I managed to contact 12 stations, mostly located in Europe, with half the contacts in the clear. As noted in the AX1 manual, "QRP operation with a short whip can be both rewarding and challenging."

I could not resist trying 40-meter operation with the KX2, AX1, and AXE1 extender while walking, with no trailing radial (although the manual recommends using the radial for best results). The KX2 is well suited for this type of pedestrian mobile operating with its built-in microphone and push-to-talk button. For this test, my wife Kathy, KA1RWY, operated from our home station and volunteered reports as I went to various scenic places around our hometown. I comfortably talked over distances up to about 5 miles on SSB on the high end of 40 meters. Transmit audio quality is very good with the KX2 and its built-in microphone. Once sunspots increase, there will be a lot more opportunities to enjoy using the AX1 on 17, 15, and 12 meters.

Manufacturer: Elecraft, 125 Westridge Dr., Watsonville, CA 95076; tel. 831-763-4211, **www.elecraft.com**. Price: AX1 Multi-Band Whip Antenna, $99.95; AXE1 40-Meter Extender, $49.99; AXB1 Whip Bipod Support, $31.95; AXT1 Tripod Adapter, $24.95; AXW1 Replacement Whip, $9.95; E770091 33-Foot Ground Radial, $8.95; E770064 13-Foot Ground Radial, $6.95.