

RigExpert AA-230 ZOOM

0.1 – 230 MHz Antenna and Cable Analyzer

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RigExpert offers a number of antenna analyzers, with the AA-230/230PRO being one of the more popular versions. The AA-230 ZOOM is the next generation, adding features such as a color display, more convenient powering, easier software updates, and graphical zoom capability.

Overview

The AA-230 ZOOM 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. The measurement port is an N-female connector, but a UHF-to-N adapter is included. A USB A/B cable is provided for computer interfacing, along with a user manual for standalone operation and a separate software manual.

For standalone use, power is provided by four 1.2 – 1.5 V AAA NiMH or alkaline batteries, accessible through a rear battery compartment cover (NiMH batteries must be charged externally). A battery indicator on the main menu shows the battery status. When a computer is connected, power is provided through the USB connection. Frankly, I like the trend toward having an easily accessible battery compartment in that you don't need to remember to charge your analyzer prior to use. Just pop in some fresh alkaline batteries and go.

All information is displayed on a 2 × 1.5-inch TFT color screen. You can select a single frequency display, a swept-frequency display, a Smith Chart display, or a TDR (Time Domain Reflectometer) display. The single frequency modes let you select displays of SWR, impedance (Z, R, and X), or the equivalent series and parallel representation of an impedance. The swept frequency mode displays SWR or return loss, or impedance (R/X). The TDR display can be used for finding coax cable discontinuities. The graphical displays can be expanded with the ZOOM feature for enhanced reading accuracy.

The AA-230 ZOOM can operate as a signal generator. Its output waveform is a



square wave rich in harmonics, however, so this must be considered when making measurements. The AA-230 ZOOM can zero out a transmission line for making accurate remote antenna feed point impedance measurements if calibration standards are available.¹

Finally, the AA-230 ZOOM may be connected to your computer to provide additional data recording and analysis capabilities. Internal memory provides for the storage and recall of measured parameters in a variety of formats.

Bottom Line

The RigExpert AA-230 ZOOM is a flexible and accurate antenna analyzer that will satisfy most antenna and component measurement requirements.

Testing

Table 3 summarizes the general specifications versus measured performance of the AA-230 ZOOM. Table 4 displays its output impedance measured with no termination at the N connector. This gives an indication of the impedance magnitude you can measure accurately as a function of frequency.

When checked against the 10 MHz WWV signal, I did not detect any noticeable frequency drift over a 5-minute test period. Also, the frequency was almost zero-beat with WWV (the frequency readout is adjustable if desired).

The output level is quite constant over the full frequency range, making the AA-230 ZOOM accurate enough for receiver sensitivity testing when used with a good step attenuator. Just keep in mind that the output waveform is not a pure sine wave. Table 5 tabulates the output power level versus frequency measured with my MiniCircuits PWR-6GHS+ power sensor.

Next I measured SWR and impedance measurement accuracy using low-and-high-impedance 2:1 and 3:1 SWR loads, and homebuilt 7.5 Ω (theoretically 6.67:1 SWR) and 400 Ω (theoretically 8:1 SWR) loads.² The AA-230 ZOOM SWR measurements are tabulated in Table 6 as compared to an Array Solutions AIMuhf impedance analyzer.

Finally, Table 7 displays the AA-230 ZOOM measurements of three complex loads, each approximately 50 –j36 Ω at their measured frequencies, compared to the Array Solutions AIMuhf. (See Note 2.) As you can see, the AA-230 ZOOM provides excellent measuring capability. Note that the correct sign of the reactance is displayed.

Using the AA-230 ZOOM

Before using the AA-230 ZOOM for the first time, check that you have the latest firmware. This is a simple process. Go to www.rigexpert.com, select the "AA230 ZOOM" tab, and then run the Firmware Update Tool. This tool finds the AA-230 ZOOM connected to your

Table 3
AA-230 ZOOM, serial number n/a

Manufacturer's Specifications	Measured Performance
Frequency range: 0.1 – 230 MHz.	As specified.
Frequency resolution: 1 kHz.	As specified.
Output power: –10 dBm into 50 Ω.	See Table 5.
Output signal shape: Square wave.	Harmonics: 14 MHz: 2nd –10 dBc, 3rd –13 dBc. 222 MHz: 2nd –23 dBc, 3rd –10 dBc.
Measurement systems: 25, 50, 75 and 100 Ω.	As specified.
SWR range: 100:1 numerical, 10:1 graphical.	SWR of ∞ is indicated into open circuit.
R, X range (numerical): 0 – 10 kΩ, ±10 kΩ.	Less than ±10 kΩ above 28 MHz.
R, X range (graph): 0 – 1000 Ω, ±1000 Ω.	Less than ±1 kΩ at 144 and 222 MHz.
Power: USB interface or four AAA 1.5 V alkaline or 1.2 V NiMH batteries.	
Battery operating time: 4 hours continuous, 2 days standby.	
Dimensions (height, width, depth): 7.2 × 3.2 × 1.3 inches; weight, 8.3 oz.	
Price: \$550.	

Table 4
Output Impedance

Frequency (MHz)	Output Impedance (Ω)
1.8	>10,000
3.5	>10,000
7	>10,000
14	>10,000
28	4500
50	2500
146	750
222	476

computer and determines the current version of your firmware. If a newer version of firmware is available, the update tool downloads and installs it into the analyzer.

The AA-230 ZOOM is very easy to use. The menus and keypad markings are quite self-explanatory, so you will rarely need to refer to the manual. Setting the frequency and frequency range for scans is very easy. The ZOOM capability permits you to scan a wide frequency range, use

Table 5
Output Power (dBm) vs Frequency

Power measured with a NIST-traceable MiniCircuits PWR-6GHS+ power sensor.

Spec Power (dBm)	1.8	3.5	7	14	28	50	144	222
–10 typical	–7.9	–7.9	–7.9	–7.9	–8.0	–8.0	–8.1	–8.2

Table 6
Resistive Load Measurements

Loads measured with the AA-230 ZOOM compared to the AIMuhf.
LoZ = low impedance resistive load. HiZ = high impedance resistive load.

Frequency (MHz)	2:1 SWR LoZ AA230Z/AIM	2:1 SWR HiZ AA230Z/AIM	3:1 SWR LoZ AA230Z/AIM	3:1 SWR HiZ AA230Z/AIM	7.5 Ω Load AA230Z/AIM	400 Ω Load AA234Z/AIM
1.8	1.98/2.02	2.1/2.02	3.1/3.18	3.0/2.99	6.6/6.77	8.1/7.94
3.5	1.97/2.02	2.1/2.02	3.1/3.17	3.0/2.98	6.6/6.78	8.1/7.93
7	1.97/2.01	2.1/2.02	3.1/3.17	3.0/2.99	6.6/6.78	8.1/7.94
14	1.97/2.00	2.1/2.02	3.1/3.16	3.0/2.99	6.6/6.76	8.1/7.96
28	1.96/2.00	2.1/2.02	3.1/3.14	3.0/3.00	6.6/6.73	8.1/7.97
50	1.96/2.00	2.0/2.03	3.1/3.13	3.0/2.99	6.5/6.79	8.0/7.91
146	1.99/1.99	1.97/2.01	3.1/3.13	3.0/2.99	6.5/7.11	7.9/7.62
222	1.98/1.97	1.95/2.01	3.1/3.14	3.0/2.96	6.6/7.28	7.5/7.25

the < and > keys to center the frequency of interest, and then use the ^ and v buttons to zoom in or out in order to get more or less detail.

My main antenna, a Hy-Gain TH-1 rotatable dipole, consists of a 20/15/10 meter trap dipole with a 6 meter fan dipole element. As the 6 meter dipole is close to a ¾ wave dipole on 2 meters, I took advantage of the multiband feature of the AA-230 ZOOM to look at all five bands as shown in Figure 8.

Next I took a 10 – 60 MHz scan of the antenna as shown in Figure 9. You can clearly see the four ham bands covered by this scan. Use the < and > buttons to center the frequency of interest for more detail.

Next I used the ZOOM feature to expand the 20 meter section of the display. As you can see in Figure 10, you may lose some resolution when you zoom in on a small section of a large sweep. Figure 11 shows a direct scan (not using the ZOOM feature) of the same frequency range.

As discussed earlier, single-frequency parameters may also be displayed. A single band, or a section of it, can be displayed to provide detailed impedance information.

There are many other useful features available in the AA-230 ZOOM. These include the ability to measure cable length, cable loss, velocity factor, and characteristic impedance. The TDR function is useful for determining discontinuities in your antenna system. I used the TDR feature to determine the physical length of coax from my operating position to my 43-foot vertical, which I'd estimated to be about 60 feet. The AA-230 ZOOM gave me the exact answer — 53.63 feet — as shown in Figure 12.

Table 7
Complex Load Measurements

Loads measured with the AA-230 ZOOM compared to the AIMuhf.

Frequency (MHz)	AA-230 ZOOM SWR	AA-230 ZOOM Impedance (Ω)	AIMuhf SWR	AIMuhf Impedance (Ω)
50	1.96	45 -j 32	1.94	47 -j 33
144	1.84	39 -j 25	1.80	45 -j 28
222	1.78	34 -j 18	1.76	42 -j 25



Figure 8 — Using the AA-230 ZOOM's multi-band feature to check the author's TH1 antenna on 20, 15, 10, 6, and 2 meters.



Figure 11 — A direct 20 meter scan (not using the ZOOM feature).



Figure 9 — A 10 – 60 MHz scan of the author's TH1 antenna. Note that the frequency of minimum SWR is indicated.



Figure 12 — The AA-230 ZOOM's TDR mode used to find the length of feed line to the author's 43-foot vertical.



Figure 10 — A ZOOMed 20 meter scan.

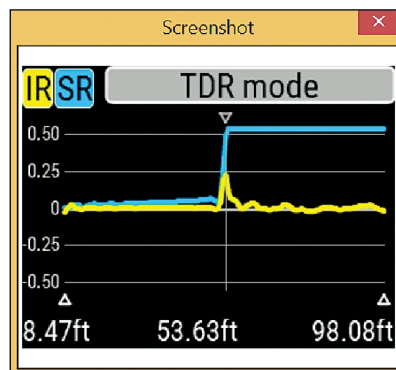


Figure 13 — Using the AntScope software to view the TDR measurement of Figure 12.

Computer Interface

RigExpert provides a powerful, easy-to-use program called *AntScope* that permits importing data from the AA-230 ZOOM memory, as well as providing for real-time control of the analyzer. Figure 13 is the *AntScope* capture of the Figure 12 TDR display.

Conclusion

The AA-230 ZOOM is an accurate antenna and component analyzer that can be an indispensable tool for most hams. You can investigate it further by reviewing the manual on the RigExpert website.

Manufacturer: Rig Expert Ukraine Ltd, Yakira St 17A, 04119 Kyiv, Ukraine; www.rigexpert.com. Available from many US dealers.

Notes

¹P. Salas, AD5X, "MFJ-226 Graphical Antenna Impedance Analyzer," Product Review, *QST*, Dec 2015, pp 39 – 42. See the sidebar on page 41.

²P. Salas, AD5X, "SARK-110 Vector Impedance Antenna Analyzer," Product Review, *QST*, Nov 2015, pp 62 – 64.

Most *QST* Product Review videos published between December 2012 and December 2016 are available on YouTube at www.youtube.com. Please go to the ARRLHQ YouTube channel at <https://www.youtube.com/user/ARRLHQ> and select the video you wish to view.