Comet CAA-500MarkII Antenna Analyzer

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Comet recently introduced their next-generation antenna analyzer — the CAA-500MarkII. Like the original CAA-500, reviewed in the March 2012 issue of *QST*, the CAA-500 MarkII has a large analog cross-needle meter for displaying SWR and impedance magnitude.[1] The MarkII, however, adds a 1.4 ×1.15 inch full-color TFT LCD (see Figure 1) that displays the operating frequency, fixed frequency SWR and impedance data, and swept frequency SWR data.

Overview

The CAA-500MarkII is a fairly large instrument — almost as big as a classic Bird 43 wattmeter. Connectors are an SO-239 for 1.8 – 300 MHz, and a Type N for 300 – 500 MHz. Power requirements are six AA-size alkaline or NiMH cells (not included) or external 8 – 16 V dc, 250 mA power source (dc cable included). The CAA-500MarkII also includes an internal trickle charger for NiMH batteries, an upgrade from the original CAA-500. Typical charging time is 15 hours, and typical battery operating time is up to 9 hours (there is a battery indicator on the LCD). An auto-power-off timer helps conserve battery life. It's adjustable from 1 to 9 minutes (default is 5 minutes) and can be turned off.

The CAA-500MarkII provides a single frequency measurement mode and two swept-frequency modes. The single frequency mode displays SWR and impedance (Z) on the cross-needle meter, and digital and bar graph SWR readings across the full frequency range. Digital readings of resistance (R) and reactance (X, unsigned) are displayed below 190 MHz, while only a bar graph display of Z is available above 190 MHz.

The two swept frequency modes display SWR in graphical form. AUTO SWEEP graphs SWR using preset amateur band frequency ranges. MANUAL SWEEP permits selection of the center frequency and sweep bandwidth.

Table 2 summarizes the specifications and performance of the CAA-500MarkII.

Test Results

The CAA-500MarkII output level is quite constant over the full frequency range as shown in Table 3. The frequency can be set to within 1 kHz, but this is a tricky adjustment especially at the higher frequencies. Additionally, the signal is noisy and "warbly." Further, initial frequency drift takes about 15 minutes to stabilize when the CAA-500MarkII is powered from an external dc supply but continues after that period when used with the internal batteries. Also, just touching the case or dc power cable caused some frequency change. For these reasons, the CAA-500MarkII would probably not be the best tool for precise receiver measurements.

Next I checked SWR accuracy, starting with a precision 50 Ω load. Then I tested the CAA-500MarkII with shorted microwave attenuators of 5 dB (1.92:1 SWR), 3 dB (3.01:1 SWR) and 2 dB (4.42:1 SWR). I also used loads made from Caddock thick-film resistors — a 7.5 Ω load (theoretically 6.67:1 SWR), a 200 Ω load (theoretically 4:1 SWR), and a 400 Ω load (theoretically 8:1 SWR). As Caddock resistors are specified for high frequency applications, I used these tests to not only compare the CAA-500MarkII against a high quality Array Solutions AIMuhf vector impedance analyzer, but also to see how good the Caddock resistors really are.[2] As you can see in Table 4, the CAA-500MarkII SWR readings compare favorably to the AIMuhf readings, especially for the lower impedance measurements.

Because the Caddock resistive loads are not perfect, I used 150, 200, and 400 Ω Caddock loads to check impedance measurement accuracy at 50, 146, 222, and 440 MHz. As Table 5 shows, the impedance measurement capability of the CAA-500MarkII is better at lower frequencies and lower impedances.

For my final tests, I built lower impedance complex loads with an SWR of approximately 2:1 for 50 MHz, 146 MHz, and 222 MHz. Table 6 displays the CAA-500MarkII resistance (R) and reactance (X) measurements on 6 and 2 meters, and an impedance measurement at 222 MHz compared to the Array Solutions AIMuhf. As you can see, the CAA-500MarkII provides reasonable impedance measurements at 50 MHz, but the accuracy degrades as you go higher in frequency. Again, the sign of the reactance is not displayed on the CAA-500MarkII.

Bottom Line

While limited in measuring capability and performance compared to other antenna analyzers in its price range, the CAA-500MarkII covers all amateur bands from 1.8 to 500 MHz, making it a single "all-band" instrument.

Table 2
Comet CAA-500MarkII, serial number AA15E0763-1

Manufacturer's Specification	Measured Performance
Frequency range: 1.8 – 500 MHz (35 range segments).	As specified.
Frequency settability: 1 kHz.	As specified.
Frequency accuracy: Not specified.	Actual frequency is within the 1 kHz display range.
RF output level: 0 dBm HF/VHF, –1 dBm UHF.	See Table 3.
SWR range: Analog meter 6:1; LCD, 9.9:1	As specified.
SWR graphical display: 6:1	As specified.
SWR accuracy: Not specified.	See Table 4.
Impedance range: 12.5 – 300 Ω, 190 – 500 MHz.	See Tables 5 and 6.
Resistance range: 10 – 500 Ω, 1.8 – 190 MHz.	See Tables 5 and 6.
Reactance range: 0 – 500 Ω, 1.8 – 190 MHz.	See Tables 5 and 6.
Size (height, width, depth): 3.5 × 7.75 × 2.65 inches. Weight: 2.1 lbs with batteries.	
Price: $400.	

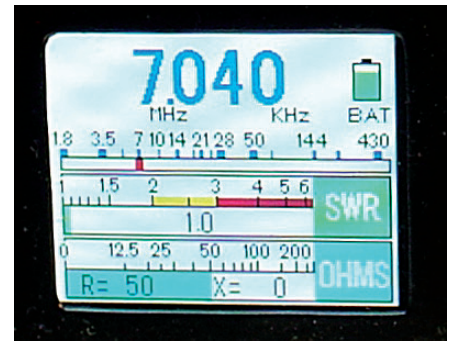

Figure 1 — The color LCD is a new feature on the CAA-500MarkII. It displays battery life, frequency, SWR, and impedance data.

Table 3
Output Power (dBm) vs Frequency

Power measured with a NIST-traceable MiniCircuits PWR-6GHS+ power sensor. Specified power output is 0 dBm at HF and VHF, and –1 dBm at UHF.

Measured Power (dBm) at Frequency (MHz)								
1.8	3.5	7	14	28	50	144	222	440
0	0	0	0	–0.1	–0.3	–0.2	–0.5	0

Figure 2 — Fixed frequency measurement of a 160 meter antenna.

Table 4
SWR Accuracy Measurements

Loads measured with the CAA-500MarkII compared to the AIMuhf. See text.

Freq (MHz)	1:1 SWR CAA	1.9:1 SWR CAA/AIM	3:1 SWR CAA/AIM	4.4:1 SWR CAA/AIM	7.5 Ω Load CAA/AIM	200 Ω Load CAA/AIM	400 Ω Load CAA/AIM
1.8	1.0	2.1/2.01	3.2/3.17	4.6/4.62	6.7/6.76	3.9/3.97	7.9/7.93
3.5	1.0	2.1/2.01	3.2/3.16	4.8/4.61	7.0/6.72	3.9/3.96	7.8/7.93
7	1.0	2.1/2.01	3.2/3.17	4.8/4.61	7.1/6.73	3.9/3.96	7.8/7.93
14	1.0	2.1/2.00	3.2/3.15	4.7/4.59	6.9/6.70	3.9/3.97	7.8/7.95
28	1.0	2.2/2.00	3.3/3.15	5.2/4.59	7.6/6.71	3.9/3.97	7.7/7.93
50	1.0	2.2/2.00	3.2/3.17	5.1/4.60	7.7/6.73	3.8/3.95	7.4/7.92
146	1.0	1.9/1.97	3.2/3.19	5.0/4.75	9.4/7.05	4.0/3.84	7.7/7.59
222	1.1	1.8/1.92	3.2/3.15	5.2/4.76	7.8/7.25	3.8/3.74	7.3/7.18
440	1.0	2.2/2.03	3.1/3.07	6.8/4.81	8.0/8.73	4.2/3.40	>9.9/6.13

Table 5
Resistive Load Measurements

SWR and impedance measurements of 150, 200, and 400 Ω Caddock resistive loads with the CAA-500MarkII compared to the AIMuhf. The CAA-500MarkII reactive readings are unsigned. See text.

Freq (MHz)	150 Ω Load		200 Ω Load		400 Ω Load	
	CAA SWR/R/X/Z	AIM SWR/R/X/Z	CAA SWR/R/X/Z	AIM SWR/R/X/Z	CAA SWR/R/X/Z	AIM SWR/R/X/Z
50	2.9/123/50/–	2.9/134/–39/140	3.8/176/49/–	4.0/186/–45/192	7.4/266/165/–	7.9/317/–156/353
146	3.1/50/61/–	2.9/81/–63/103	4.0/74/85/ –	3.8/127/–86/154	7.7/61/132/–	7.6/129/–175/218
222	3.4/–/–/50	2.8/54/–56/78	3.8/–/–/70	3.7/90/–86/124	6.9/–/–/80	7.2/72/–138/156
440	3.0/–/–/18	3.1/21/–25/33	4.2/–/–/25	3.4/38/–57/68	>9.9/–/–/25	6.1/23/–70/74

– = not measured.

Table 6
Complex Load Measurements

Loads measured with the CAA-500MarkII compared to the AIMuhf. See text.

Frequency (MHz)	CAA-500MarkII SWR	CAA-500MarkII Impedance	CAA-500MarkII |Z|	AIMuhf SWR	AIMuhf Impedance	AIMuhf |Z|
50	2.0	R = 40, X = 30		1.95	47.5 –*j*33	58
146	2.0	R = 31, X = 21		1.80	45 –*j*28	53
222	1.9	R,X not measured	25	1.76	42 –*j*25	49

Figure 3 — Swept response measurement of an 80 meter vertical.

Using the CAA-500MarkII

The CAA-500MarkII is very easy to use in the default single-frequency measurement mode. The BAND switch selects the frequency range of interest, and the FREQ control sets the measurement frequency within this range. SWR and the magnitude of the impedance are indicated on the cross-needle meter, and the LCD provides additional digital and bar graph SWR and impedance information.

Both the AUTO and MANUAL sweep modes display SWR only (6:1 maximum). For the AUTO sweep mode, the BAND switch and FREQ control select the amateur band of interest. Then pressing SWEEP CENTER sweeps the selected full amateur band.

For the MANUAL sweep mode, press GRAPH ON/OFF and set the desired center frequency. Then press the SWEEP/CENTER button, set the band sweep limits, and press A.P. OFF to confirm the settings. Now manually sweep the SWR of the selected band with the FREQ control. In the MANUAL SWEEP mode, you can change the sweep colors and overlay up to five manual sweep results in the different colors. This permits you to see the impact of changes as you adjust your antenna system.

My primary antenna is a 43-foot vertical with a 160/80 meter base matching network.[3] Figure 2 shows the 160 meter fixed frequency cross-needle and digital display at the lowest SWR point. Figure 3 shows the full-band SWR sweep of the matched 43-foot vertical on 80 meters. The displayed frequency of 4.061 MHz is the upper frequency limit of the sweep.

Conclusion

The CAA-500MarkII is a reasonably priced HF/VHF/UHF antenna analyzer. The large cross-needle meter is nice when making antenna system adjustments. And although it is small, the color LCD provides additional SWR and impedance information, as well as band-sweeping capability. A padded nylon soft case with shoulder strap and belt loop is available to protect the instrument during field use. You can investigate the CAA-500MarkII further by viewing the manual on the Comet website.

Manufacturer: NCG Companies, 15036 Sierra Bonita Ln, Chino, CA 91710; tel 800-962-2611, fax 909-393-6136; **www.cometantenna.com**.

Notes

[1]J. Hallas, W1ZR, "A Look at Four Antenna Analyzers," Product Review, *QST*, March 2012, pp 46 – 47.

[2]W. Silver, NØAX, "Array Solutions AIMuhf Vector Impedance Analyzer," Product Review, *QST*, Nov 2012, pp 57 – 60.

[3]P. Salas AD5X, "160 and 80 Meter Matching Network for Your 43 Foot Vertical — Part 2," *QST*, Jan 2010, pp 34 – 35.

See the Digital Edition of *QST* for a video overview of the Comet CAA-500MarkII antenna analyzer.