

COMET CAA 500 MARK II

A Friendly Field Guide to Antenna Analysis

SWR impedance resonance and sweep graphs explained step by step



CAA 500 Mark II front-panel reference view. The photo replaces the earlier simplified drawing so the meter, display, controls, connectors, and case proportions match the actual product.

Purpose

This report turns the CAA 500 Mark II into a practical companion for building, checking, and adjusting antenna systems. Its tiny internal test signal lets you inspect an antenna without transmitting from your radio. Think of it as a stethoscope for the antenna system: it cannot make an antenna healthy, but it makes the symptoms much easier to hear.

Safety first

Disconnect the radio or any transmitter before connecting the analyzer. Never apply transmitter RF to the analyzer. Discharge static from the coax connector to ground before attaching it, use the correct connector for the selected frequency, and keep the instrument dry. If using alkaline cells, keep the internal charge switch OFF.

Scope and source note

Functions and specifications in this guide are based on Comet's English instruction manual, 2015 edition, and product information. The analyzer covers 1.8–500 MHz in 35 segments, with SO 239 used from 1.8–300 MHz and Type N used from 300–500 MHz.

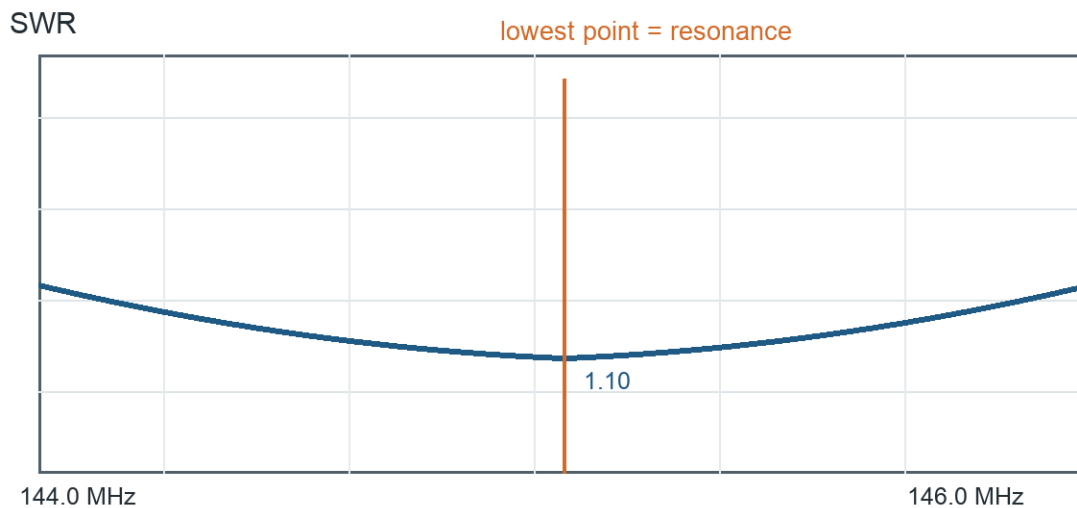
Executive summary

The CAA 500 Mark II has one job: tell you how well the antenna system accepts RF energy at a chosen frequency. It reports that answer as SWR and impedance, helps you locate the lowest SWR point (resonance), and draws the result across a band so you can tune with fewer guess-and-climb trips.

Function	What it tells you	Best everyday use
Normal reading	SWR, impedance and, below 190 MHz, R and X at one frequency.	Check a target channel or verify a repair.
Resonance search	The frequency where the system shows its lowest SWR.	Decide whether an antenna element needs to be longer or shorter.
Automatic sweep	An SWR curve over the selected amateur-band segment in about 25 seconds.	Fast health check for a familiar amateur band.
Manual sweep	A user-chosen center frequency and span; rotate FREQ to plot.	Zoom in on a narrow service band or nonstandard operating range.
Five-color overlays	Up to five manual sweep traces on one graph.	Compare before and after antenna length, height, position, or match changes.
Cross-needle meter and LCD	Analog needle response plus numerical/graphic information.	See a quick trend while retaining detailed values.
Auto power off and power	A saved 0–9 minute inactivity timer; batteries or 8–16 V DC.	Protect batteries during field work.

Reading the numbers in plain English

Term	Plain-English meaning	Useful target
SWR	How different the load looks from the system reference. Lower is generally better.	Near 1:1 is ideal; judge suitability for your radio/system.
Z / impedance	The complete opposition to RF current, combining resistance and reactance.	Often aim near the feedline/radio system impedance, commonly 50 Ω .
R / resistance	The resistive part of impedance—the part that can absorb power.	Near the intended system impedance when tuning.
X / reactance	Stored energy caused by inductive or capacitive behavior. The display is magnitude only.	As close to 0 Ω as practical at the target frequency.



A typical SWR curve. The lowest point is the resonant point for the measured antenna system.

How to read the curve

Read left to right as frequency rises. The curve's lowest point tells you where the system is most nearly resonant; the width of the low area tells you how forgiving the antenna is across nearby frequencies. A curve is more informative than a single number because it shows both location and bandwidth.

See this	Think this
Minimum left of your target	The system is resonant low; length or environment may need adjustment.
Minimum right of your target	The system is resonant high; length or environment may need adjustment.
Low, broad valley	There is useful operating room around the resonant point.

Know the controls before chasing a curve

Control or part	What it does	Why it matters
POWER	Turns the instrument on/off.	Start in Normal mode for a point measurement.
BAND knob	Selects range; higher clockwise. Also sets APO time.	Select the correct band before fine frequency work.
FREQ knob	Moves frequency within the selected range.	Use it to inspect the target frequency or manually plot a curve.
SWEEP CENTER	Starts automatic sweep in Normal; sets graph center in Manual Plot.	The doorway to both graph workflows.
A P OFF BANDWIDTH	Hold to set auto-off; confirms manual span and changes trace color.	One button, three jobs—worth learning.
GRAPH ON OFF	Switches Normal and Manual Plot modes.	Enter/exit the custom-sweep workflow.
SO 239 / N connectors	SO 239: 1.8–300 MHz. N: 300–500 MHz. Automatic switching by band.	Using the wrong jack prevents measurement and can damage it.

Baseline check before a real antenna

A 50 Ω dummy load is the analyzer’s “known good” reference. Do this after a long storage period or when a reading seems suspicious. It tells you that the analyzer is behaving, not that the antenna is.

- 1. Attach a 50 Ω dummy load:** Use the SO 239 jack for this basic check.
- 2. Press POWER:** The instrument starts in Normal mode; watch the battery indicator.
- 3. Select a convenient HF/VHF frequency:** Turn BAND, then FREQ. The exact frequency is less important than a stable valid range.
- 4. Read the result:** The manual says a proper 50 Ω load should show SWR of 1.1 or less. If it does not, stop before blaming the antenna.
- 5. Attach the antenna system:** Ground/discharge the coax first, then use the correct connector and the shortest practical cable.

Function 1 Normal SWR and impedance measurement

Normal mode is the “what is happening right now?” screen. It measures the antenna system at one chosen frequency. The LCD presents frequency, SWR, an impedance bar, and numerical values; the cross-needle meter gives a quick analog view. If the two disagree slightly, the manual gives priority to the mechanical meter.

Step by step

- 1. Make the system safe:** Turn the transmitter off/disconnect it. Discharge static from the coax connector and attach the antenna to the correct analyzer jack.
- 2. Turn on:** Press POWER. Check that the battery icon is healthy; weak batteries can make the LCD unstable.
- 3. Choose the broad range:** Turn BAND to select the relevant frequency segment. The display underlines the current band.
- 4. Choose the exact frequency:** Turn FREQ to your intended operating frequency.
- 5. Read SWR first:** A low SWR indicates a closer match. Treat it as a clue, not a pass/fail grade; context matters.
- 6. Read impedance:** The OHMS bar/numerical Z show the load seen by the analyzer. Below 190 MHz, R and X also appear.
- 7. Record one repeatable setup:** Write down frequency, SWR, Z/R/X, antenna configuration and cable situation before changing anything.

Practical example

You check a 2 m antenna at 146.520 MHz and see SWR 2.4 with a resistance near 35 Ω . That does not instantly identify the culprit; it tells you the system is not presenting a comfortable 50 Ω -ish load at that frequency. Next, use resonance or a sweep to see whether the dip is simply in the wrong place or whether the match/bandwidth needs attention.

A small but important reality check

The analyzer measures the system at its connector. A long or lossy feedline can transform impedance and can make SWR appear kinder than the antenna itself. For antenna-feedpoint work, connect as close as practical to the antenna; for station-system work, measure at the station end intentionally. Both are valid questions—just do not confuse them.

Function 2 Finding resonant frequency

Resonance is the frequency at which the measured system shows its lowest SWR. It is often where reactance is smallest too, but “low SWR” and “perfect resonance” are not magic synonyms. The goal is a useful, repeatable antenna system at the frequencies you care about.

Step by step

- 1. Connect close to the question:** For antenna resonance, use the shortest practical cable and position the analyzer close to the feedpoint if feasible.
- 2. Start in Normal mode:** Press POWER if needed; GRAPH should be off.
- 3. Set a likely band:** Use BAND to get near the intended operating range.
- 4. Slowly turn FREQ:** Watch SWR as frequency changes. When the range ends, change BAND and continue.
- 5. Find the lowest point:** The frequency with the minimum observed SWR is the measured resonant frequency for the system.
- 6. Interpret direction:** If the dip is below your target, a typical resonant element may be electrically too long; if above it, too short. Change one thing at a time and remeasure.
- 7. Verify with a sweep:** Use Auto or Manual sweep to make sure you found the real dip rather than a narrow or misleading local low point.

Reactance without a plus or minus sign

Below 190 MHz the LCD can show X, but it shows absolute magnitude only; it does not label capacitive or inductive. The useful takeaway is simple: values near zero are usually desirable at the intended frequency. If you need the sign, change element length cautiously and observe the response, or use a tool that explicitly reports reactance sign. Do not over-correct based on one number—antennas enjoy turning small changes into plot twists.

Function 3 Automatic band sweep

Auto Sweep gives a whole-band SWR picture with one button press. It uses the currently selected band’s predetermined center and width. It is the fast answer to “where does this antenna behave well across this ham band?”

Step by step

- 1. Prepare in Normal mode:** If a graph is on screen, press GRAPH ON OFF to return to the normal display.
- 2. Select the desired amateur band:** Turn BAND until the wanted segment is selected.
- 3. Press SWEEP CENTER:** The analyzer begins its preset sweep; the red SWR label blinks while it runs.
- 4. Wait for completion:** A sweep typically takes about 25 seconds. Avoid moving the setup during the run.
- 5. Read the curve:** Look for the lowest point, the curve width, and whether your operating frequencies lie in the low-SWR region.
- 6. Repeat if needed:** Press SWEEP CENTER again to re-run after a small antenna adjustment.
- 7. Return to point mode:** Press GRAPH ON OFF; BAND and FREQ are disabled while the Auto Sweep graph is active.

What the shape means

Curve feature	Likely practical meaning	Next move
Dip below target frequency	A resonant element is commonly too long.	Shorten in small, documented steps.
Dip above target frequency	A resonant element is commonly too short.	Lengthen in small, documented steps.
Wide gentle low area	Useful bandwidth; the antenna tolerates frequency movement.	Check the desired endpoints.
No clear dip	A matching, grounding, feedline, installation, or measurement issue may dominate.	Inspect connections and move closer to feedpoint.

Function 4 Manual sweep and precision plotting

Manual Plot mode lets you choose the center frequency and sweep width, then trace SWR by turning the FREQ knob. This is the “zoom lens” mode: ideal for a narrow portion of a band, a non-amateur frequency, or careful work around a target channel. Minimum stated frequency resolution is 1 kHz when sweeping gradually.

Step by step

- 1. Begin in Normal mode:** Connect the antenna safely and set BAND/FREQ near the frequency of interest.
- 2. Enter Manual Plot:** Press GRAPH ON OFF. The SWR legend turns green.
- 3. Set the center:** Use BAND and FREQ to put the desired center frequency on screen.
- 4. Lock the center:** Press SWEEP CENTER. The rounded center appears and the lower sweep limits blink.
- 5. Set the span:** Use FREQ for fine changes; BAND shifts widely. Choose limits that bracket the target range.
- 6. Confirm span:** Press A P OFF BANDWIDTH once.
- 7. Draw the trace:** Rotate FREQ slowly and steadily through the desired range. The analyzer draws the SWR curve as you go.
- 8. Adjust/replot:** Press SWEEP CENTER to change bandwidth, or GRAPH ON OFF to return to Normal mode.

Practical application

For a 146.520 MHz simplex antenna, center the manual sweep at 146.520 MHz and choose a span wide enough to show behavior around the channel. A narrow span reveals tuning detail; a wider span shows whether the antenna remains useful for nearby repeaters. Choose the span to answer a question—not just because the graph looks entertaining.

Function 5 Five color comparison sweeps

Manual Plot mode can overlay traces in red, blue, green, purple, and orange. This is the analyzer’s most practical experimental function: change one variable, run another trace, and see the consequence rather than relying on memory.

Step by step

- 1. Create the first manual trace:** Complete a Manual Plot sweep and note the color and what the setup represents.
- 2. Change only one variable:** Examples: trim 3 mm of element, raise the antenna 0.5 m, move a gamma-match setting, or reposition a radial.
- 3. Keep center and span comparable:** Do not casually change the graph window; comparison requires the same frequency frame.
- 4. Change trace color:** During a manual sweep, press A P OFF BANDWIDTH to cycle red, blue, green, purple, orange.
- 5. Plot the next trace:** Rotate FREQ across the same span. The new color overlays the earlier one.
- 6. Interpret the movement:** A dip moving toward the target frequency is progress. A dip becoming deeper/wider can be useful; check the entire intended operating region.
- 7. Record the winning configuration:** Photograph or transcribe the trace color, settings, physical adjustment, date, and conditions.

Simple experiment design

Trace	One controlled change	What to compare
Red	Baseline length and height.	Where is the SWR minimum?
Blue	Shorten element slightly.	Did the dip move upward in frequency?
Green	Raise antenna / alter surroundings.	Did the curve shift or change depth?
Purple	Adjust matching network.	Did SWR improve without moving resonance oddly?
Orange	Final confirmation.	Does the target operating range now sit in the useful region?

Important limitation

Graph data cannot be preserved if you change graph modes. Take a photo or keep a field notebook before leaving the mode. The analyzer is excellent at showing comparison in the moment; it is not a long-term data logger.

Function 6 Auto power off batteries and external power

The auto-power-off function protects batteries when attention wanders—which is common when an antenna project turns into a ladder project. The timer can be set from 0 to 9 minutes in one-minute steps; 0 disables it. The setting is saved when power turns off.

Set the auto power off timer

- 1. Return to Normal mode:** Press GRAPH ON OFF if a graph is displayed.
- 2. Hold A P OFF BANDWIDTH:** Hold for more than three seconds. The current timer appears; factory default is 5 minutes.
- 3. Choose a delay:** Turn BAND to select 0–9 minutes in one-minute increments.
- 4. Save it:** Press A P OFF BANDWIDTH briefly.
- 5. Understand inactivity:** Frequency changes under 3% count as inactivity for the timer, so do not assume tiny knob movements reset it.

Power and charging choices

Method	Use it when	Critical note
Six AA alkaline cells	You need portable use and do not recharge inside the instrument.	Set internal charge switch OFF. Never charge alkaline cells.
Six AA NiMH cells	You want rechargeable field cells.	Set internal charge switch ON only for NiMH; internal charge is a slow trickle.
External 8–16 V DC	Bench use or powering/charging NiMH.	Center pin positive; source must supply at least 250 mA. Never exceed 16 V or use AC.
12–14 V DC NiMH charge	You have NiMH installed and charge switch ON.	Full trickle charge is about 14–15 hours; disconnect power when away long-term.

Battery indicator habit

For NiMH, the indicator may never show Full; recharge when yellow appears. For alkaline cells, replace all cells when yellow appears. A blinking/unstable LCD is a “stop and sort the batteries” message, not a new antenna mystery.

Field workflow from first check to final tune

Use this repeatable sequence for most projects. It avoids the classic habit of changing three things, getting a different result, and learning nothing except that ladders are tiring.

- 1. Document the starting system:** Antenna type, element length, height, ground/radials, coax type/length, weather, intended frequencies.
- 2. Validate the analyzer:** Use a 50 Ω dummy load when results look questionable or before a major tune-up.
- 3. Measure the target frequency:** Normal mode: note SWR, impedance, and where applicable R/X.
- 4. Find the broad picture:** Auto Sweep the relevant band or Manual Sweep the actual operating range.
- 5. Make one physical change:** Choose one sensible change based on the curve. Keep it small and reversible.
- 6. Compare with overlay:** Use Manual Plot colors for a controlled before/after comparison.
- 7. Verify at endpoints:** A good center-frequency number is not enough; check the lowest and highest frequencies you plan to use.
- 8. Reinstall / recheck:** After routing coax or final mounting, measure again because the system environment can change.

Troubleshooting clues

Symptom	Check before changing antenna metal
Readings jump around	Strong local RF, weak batteries, poor connector contact, or static/grounding concerns.
Dip shifted unexpectedly	Analyzer location/common-mode current, feedline effects, nearby objects, or a quasi-resonance from stray L/C.
50 Ω but SWR is not 1:1	The impedance reading includes reactance; aim for total ~50 Ω with X near zero.
ER1 during sweep	Frequency could not be set or strong RF is interfering. Retry away from RF; if it occurs with no antenna, seek service.
No measurement	Confirm the selected range matches the connector: SO 239 1.8–300 MHz, Type N 300–500 MHz.

Specifications at a glance

Item	Published specification
Frequency range	1.8–500 MHz in 35 range segments
RF output	0 dBm / 1 mW HF/VHF; –1 dBm / 0.8 mW UHF
SWR range	Analog 1.0–6.0; LCD 1.0–9.9
Impedance	12.5–300 Ω; resistance 10–500 Ω; reactance 0–500 Ω absolute, 1.8–190 MHz
Environment	0–40 °C / 32–104 °F; not waterproof or dustproof

Quick reference one page at the bench

I want to...	Do this	Meaning
Check one frequency	Normal mode → BAND → FREQ.	Read SWR and impedance at a point.
Find resonance	Normal mode → scan FREQ slowly.	Lowest SWR frequency is the system resonance.
See an entire ham band	Normal mode → choose BAND → SWEEP CENTER.	Automatic preset-band SWR curve.
Zoom in on a custom range	GRAPH ON OFF → choose center → SWEEP CENTER → set span → A P OFF → turn FREQ.	Manual, user-defined SWR trace.
Compare an adjustment	Manual Plot → A P OFF during sweep to change trace color → replot.	Overlay up to five experiments.
Prevent battery drain	Normal mode → hold A P OFF >3 sec → BAND 0–9 → A P OFF.	0 disables timer; setting persists.

Closing perspective

The CAA 500 Mark II is most useful when you ask it a narrow question: “Where is the dip?”, “Did that trim move it?”, “Does this band still fit?”, or “Is the cable hiding the real problem?” Pair one controlled adjustment with one repeatable graph, and the analyzer turns antenna tuning from guesswork into a calm little experiment.

Sources

Comet CAA 500 Mark II Instruction Manual, English, 1st edition September 2015, pp. 1–8. Comet Antenna CAA 500 Mark II product information. Retrieved 27 September 2026. Product names and specifications remain the property of their respective owners.