

THE UNIVERSITY OF MICHIGAN RADIATION LABORATORY

015972-502-M

MEMO TO: File

DATE: 22 February 1978

FROM: J.E. Ferris

SUBJECT: Backscattering Measurements of Missiles #2 and #3

The backscatter radiation characteristics of missiles #2 and #3 (see Figures 1 and 2 respectively) were measured at two frequencies (12.14 GHz and 12.23 GHz), for two polarizations (vertical and horizontal) and for two conditions (with and without nose cone). Measurements of missile #2 were made for three roll angles ($\phi = 0^\circ, 45^\circ$ and 90°) and missile #3 for two roll angles ($\phi = 0^\circ$ and 45°). All pattern plots were measured in the θ variable plane as shown in Figures 1 and 2. Data for missiles #2 and #3 are shown respectively in Figures 3 through 26 and Figures 27 through 42.

All data is plotted (Figures 3-42) with the nose and tail of the missile located respectively at θ equals 0 and 180 degrees. Further, the left and right side of the missile (as viewed from the tail) are plotted to the left and right of $\theta = 0^\circ$. The backscatter range used to plot this data was located within an anechoic chamber (50 ft. long x 30 ft. wide x 15 ft. high). Spacing between the illuminating horn and model was 40 ft. providing nominally a D^2/λ range for the length of models under test. Typically a D^2/λ range will reduce the broadside return 0.5 dB and cause the near broadside side-lobes to appear as shoulders. All data were calibrated against a 10-inch sphere. A calibration mark is shown on the left side of each plot in the vicinity of 120-150 degrees, and the cross section of the calibration sphere is -12.9 m^2 at both measurement frequencies.

15972-502-M = RL-2287

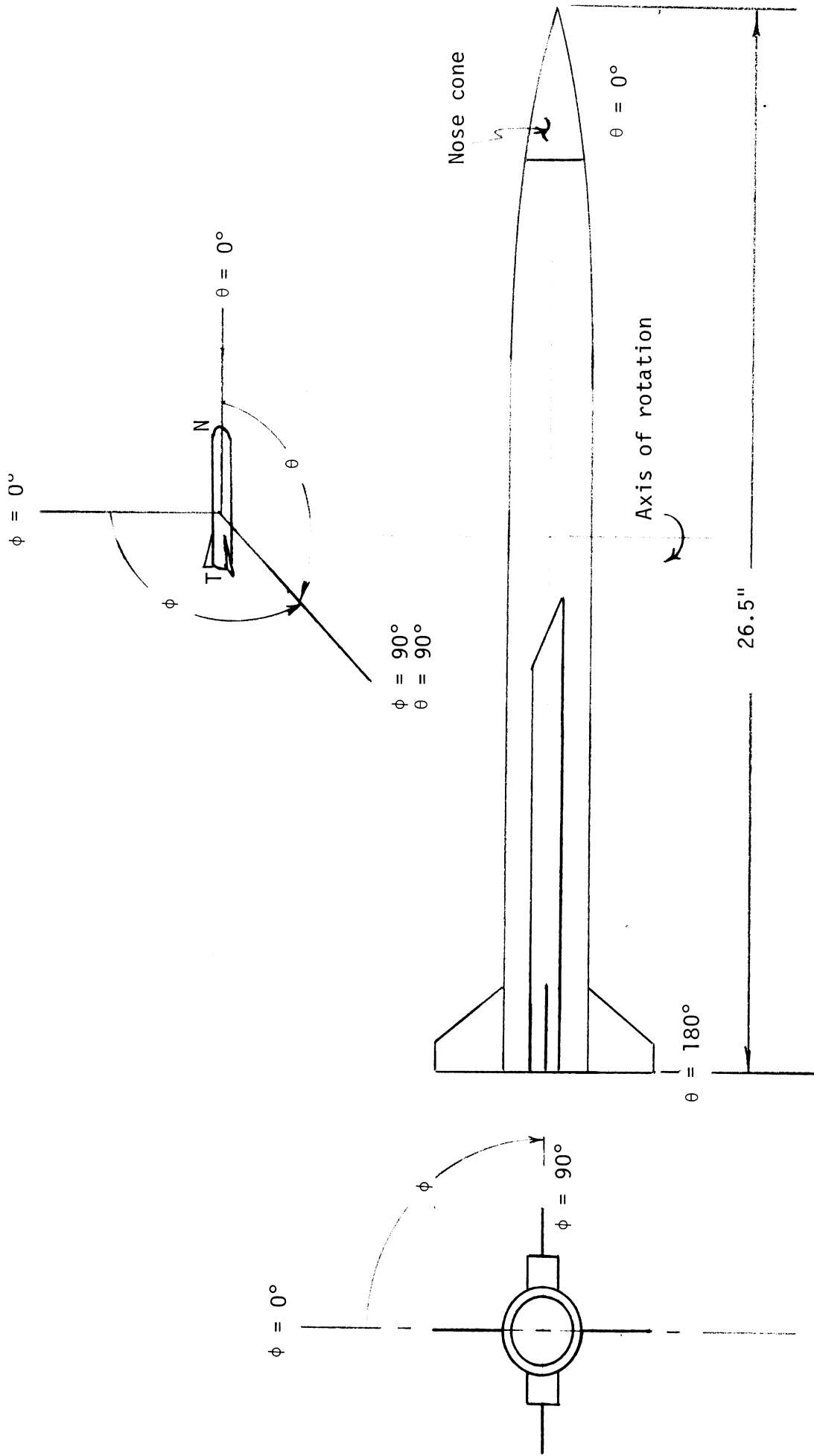


Figure 1: Missile #2 coordinate system.

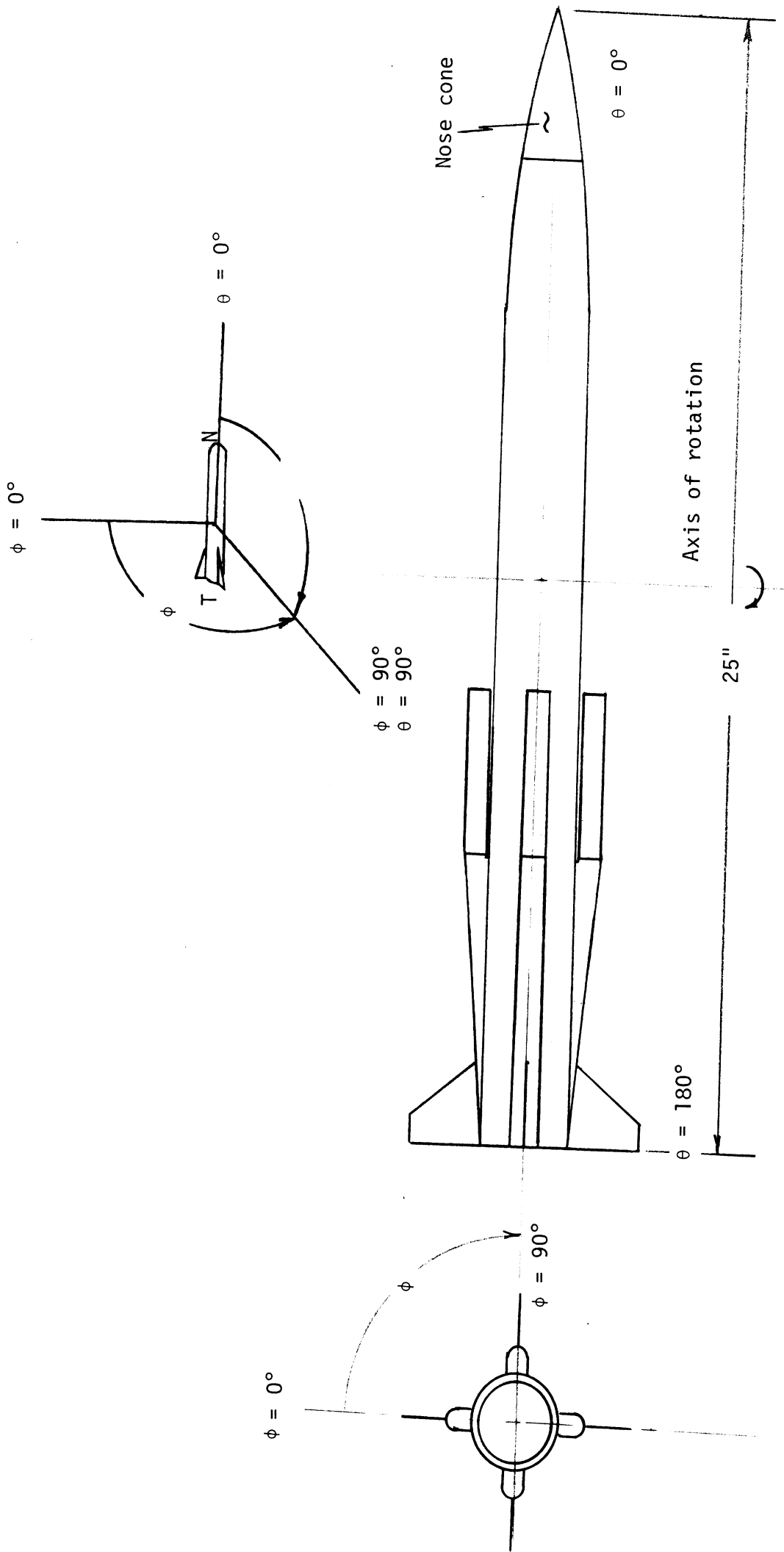


Figure 2: Missile #3 coordinate system.

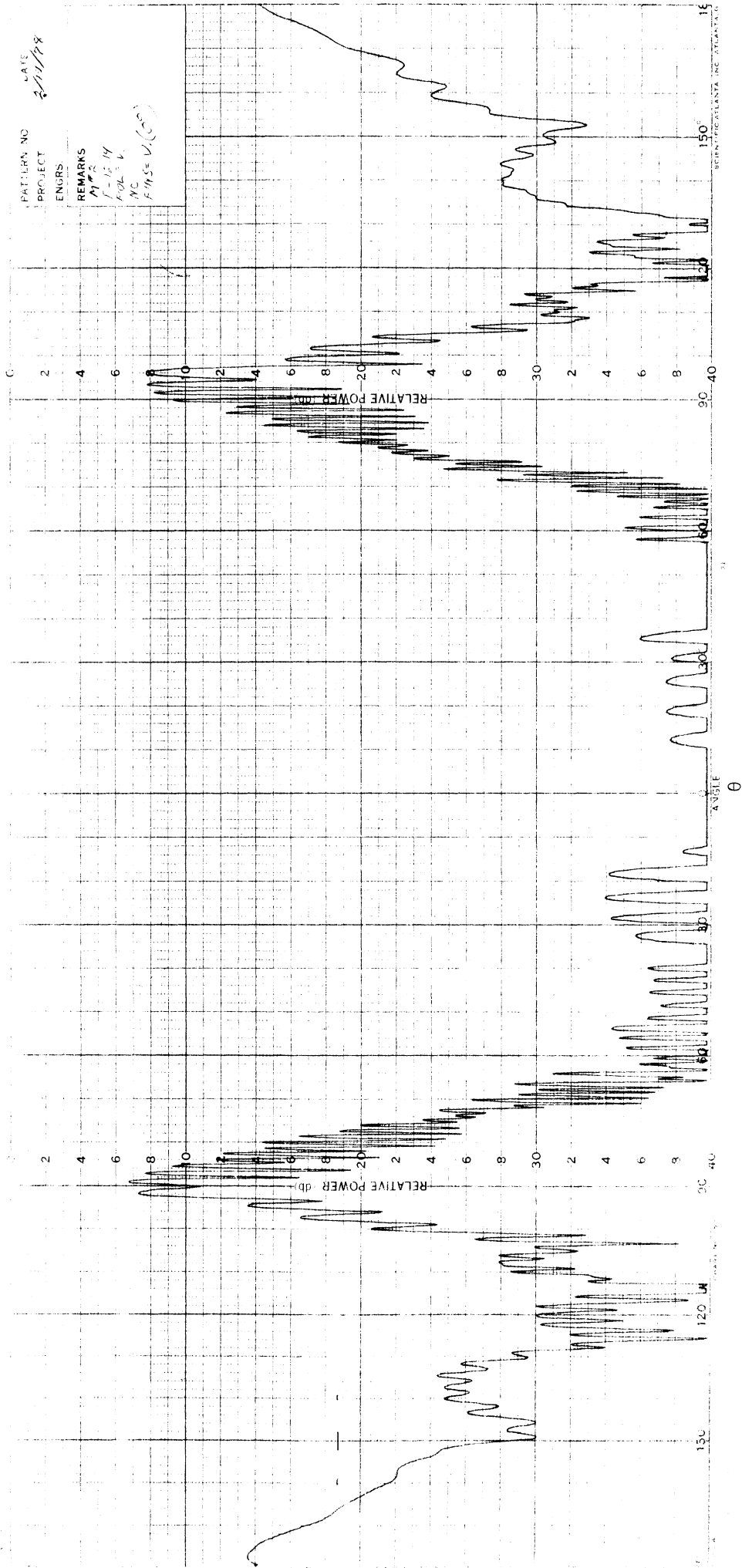


Figure 3: Backscatter characteristics of missile #2; frequency 12.14 GHz, vertical polarization, with nose cone, $\phi = 0^\circ$, 10" calibration sphere.

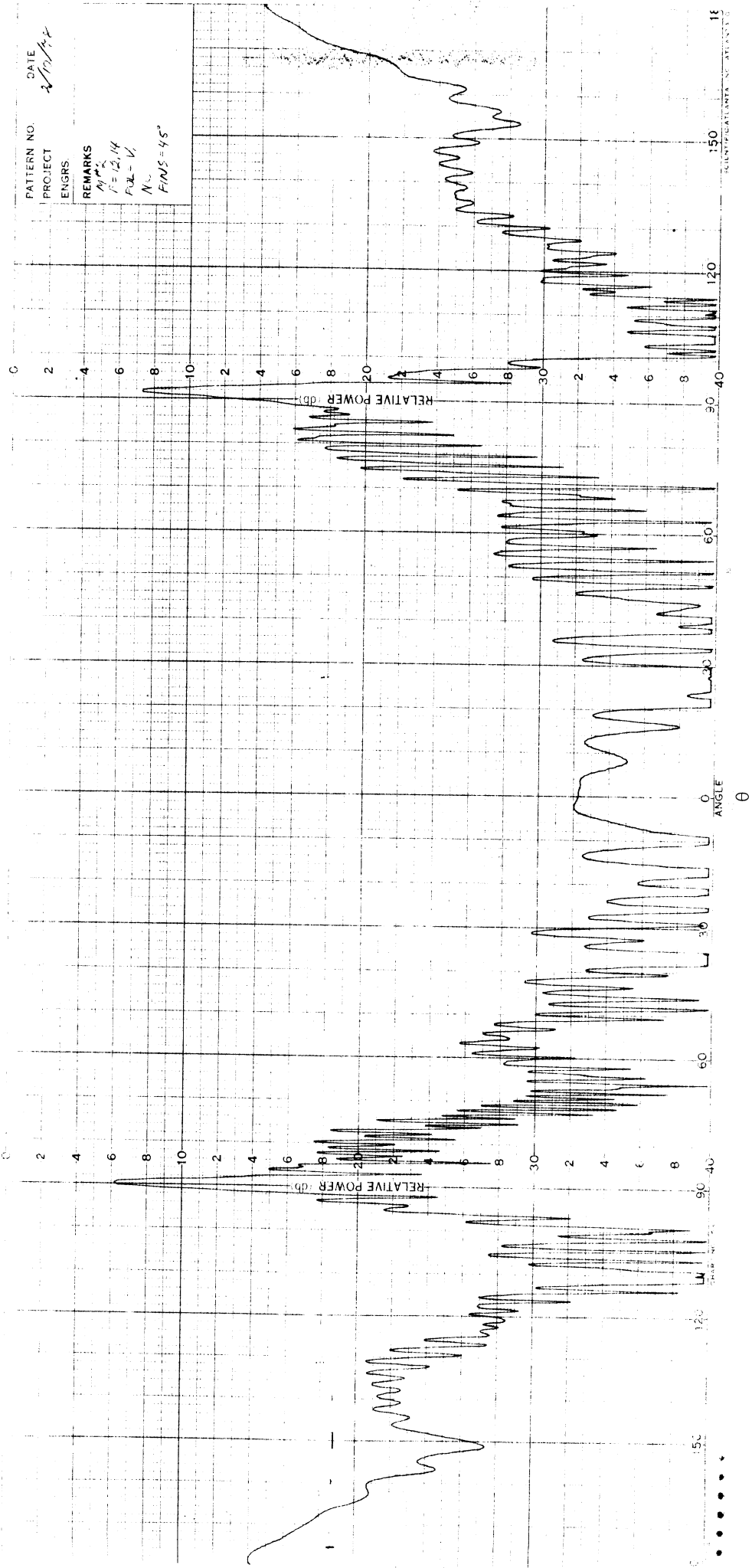


Figure 4: Backscatter characteristics of missile #2; frequency 12.14 GHz, vertical polarization, with nose cone, $\phi = 45^\circ$, 10° calibration sphere.

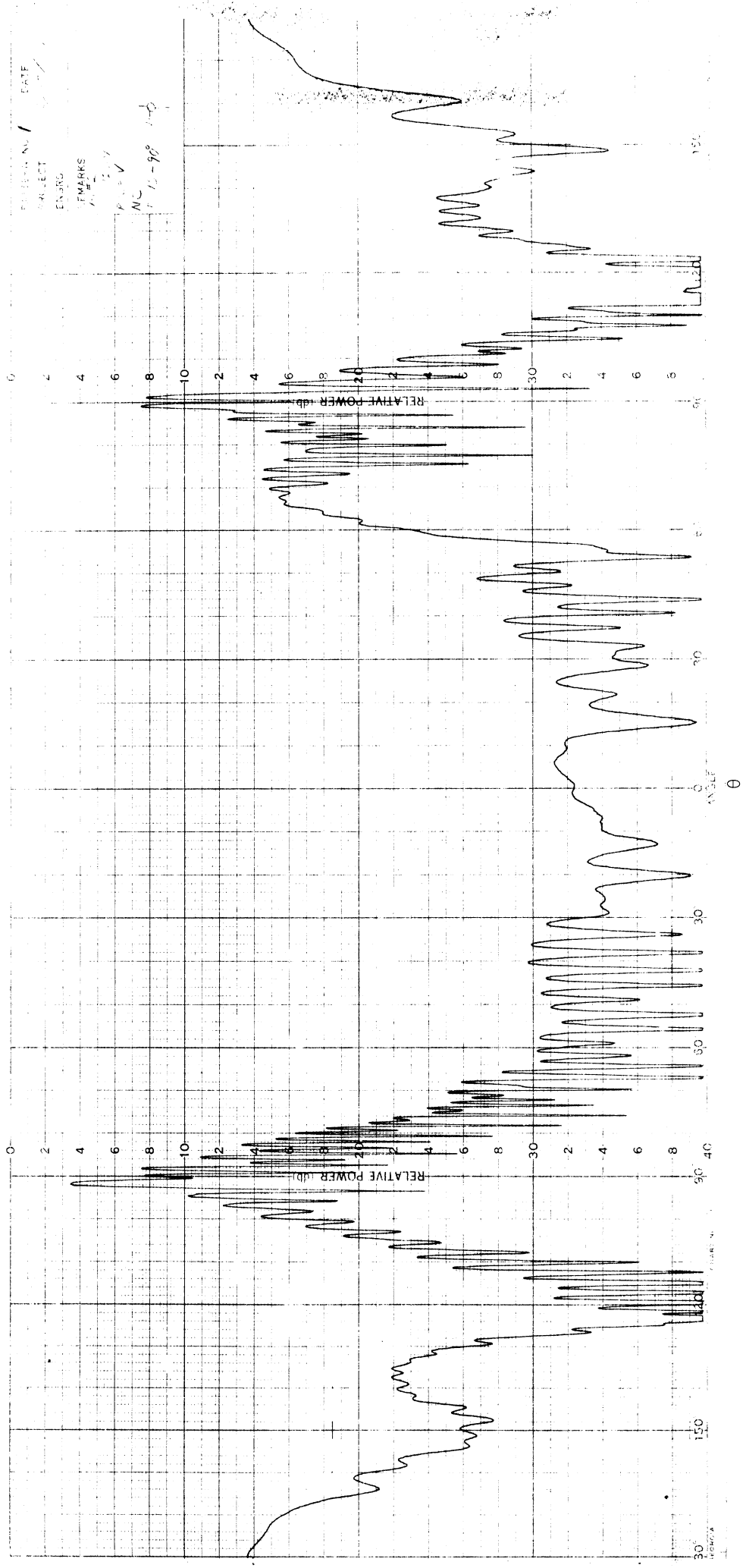


Figure 5: Backscatter characteristics of missile #2; frequency 12.14 GHz, vertical polarization, with nose cone, $\phi = 90^\circ$, 10" calibration sphere.

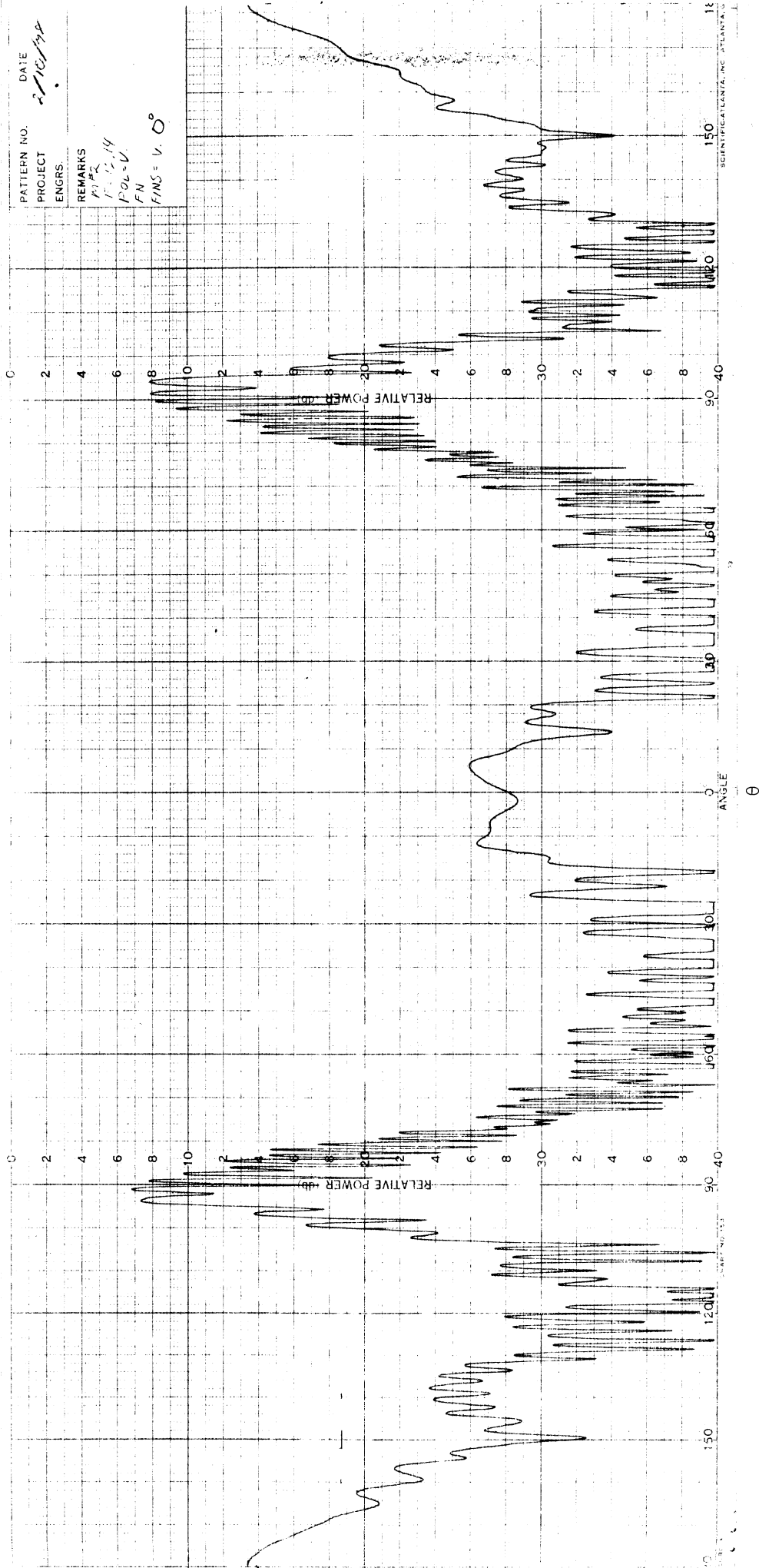


Figure 6: Backscatter characteristics of missile #2; frequency 12.14 GHz, vertical polarization, without nose cone, $\phi = 0^\circ$, 10" calibration sphere.

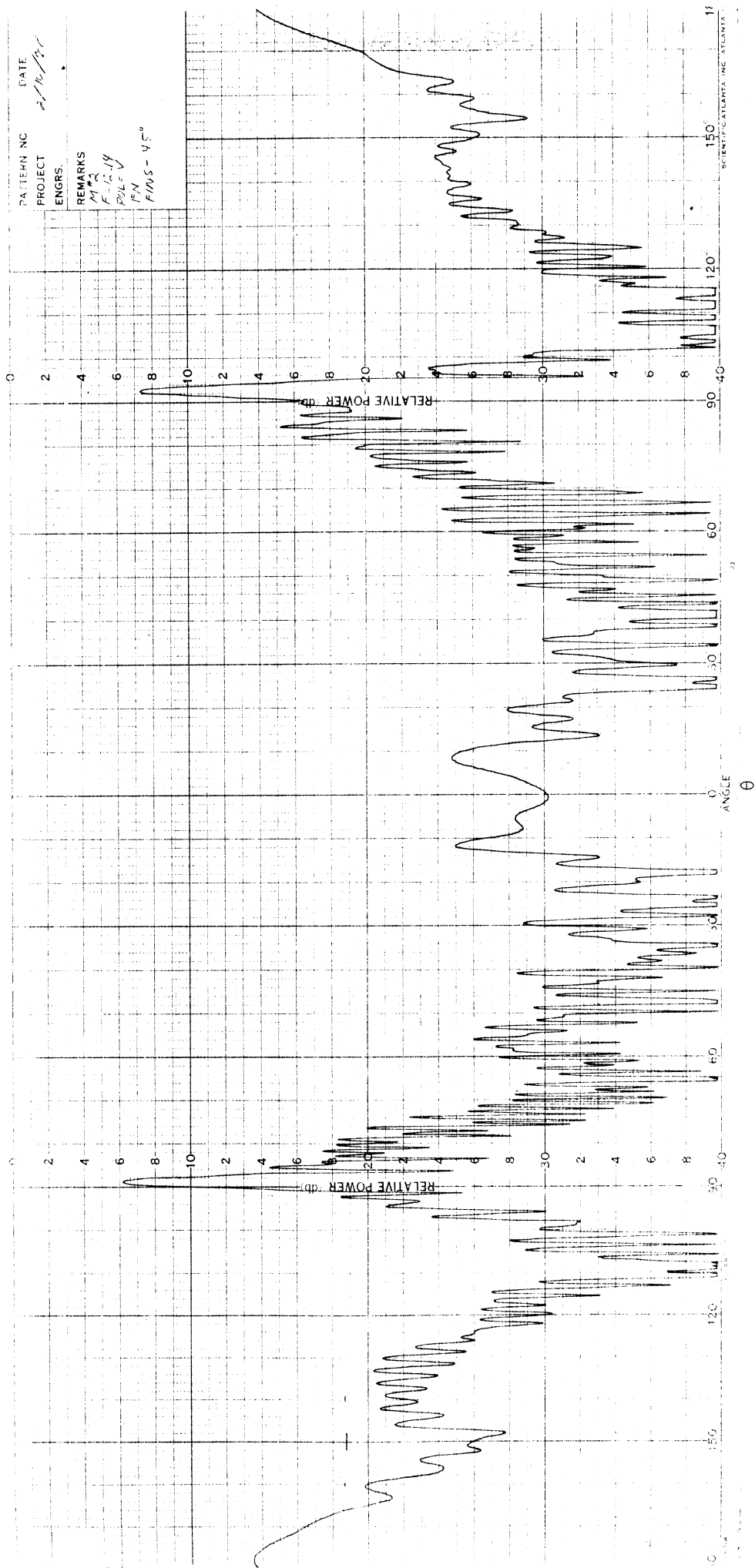


Figure 7: Backscatter characteristics of missile #2; frequency 12.14 GHz, vertical polarization, without nose cone, $\phi = 45^\circ$, 10" calibration sphere.

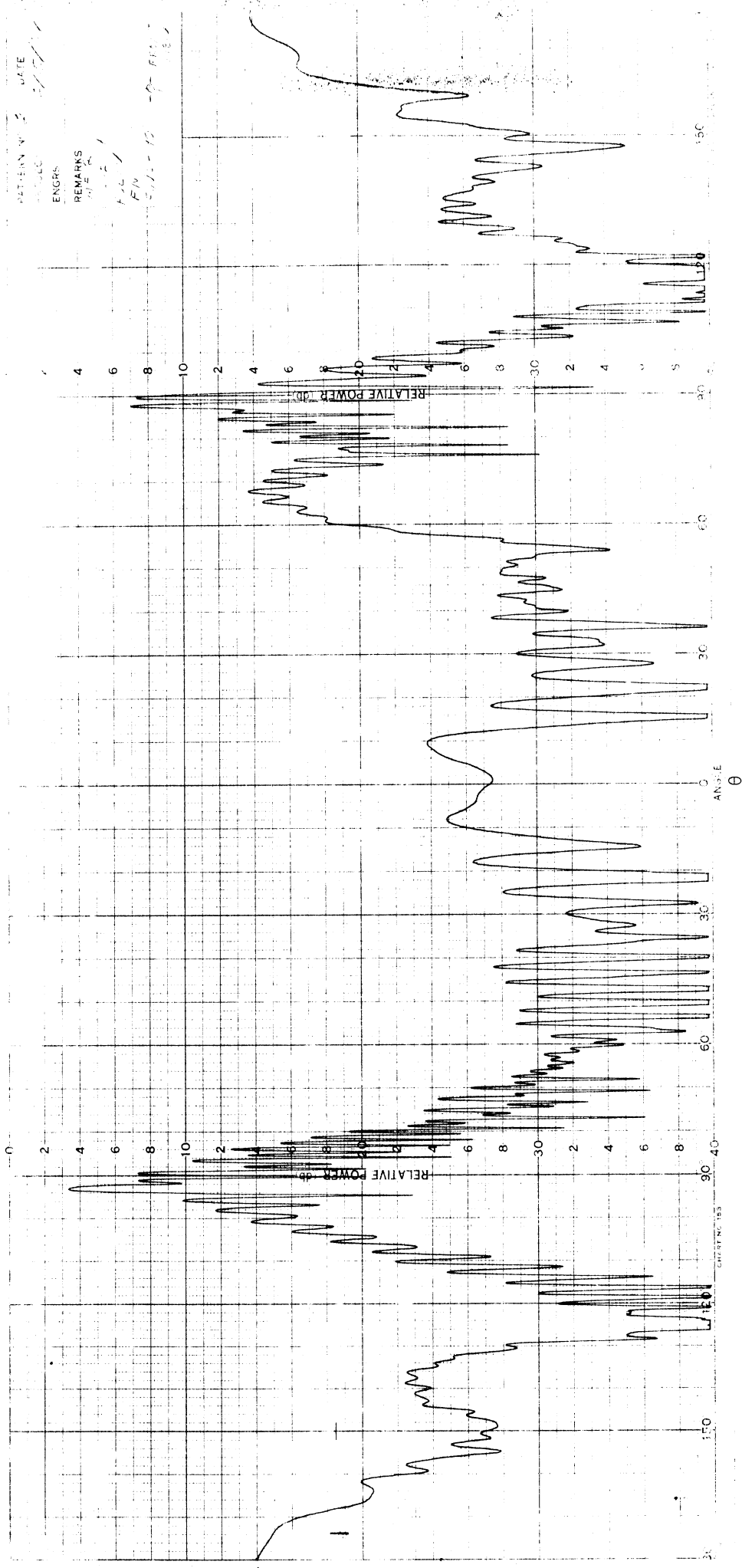


Figure 8: Backscatter characteristics of missile #2; frequency 12.14 GHz, vertical polarization, without nose cone, $\phi = 90^\circ$, 10" calibration sphere.

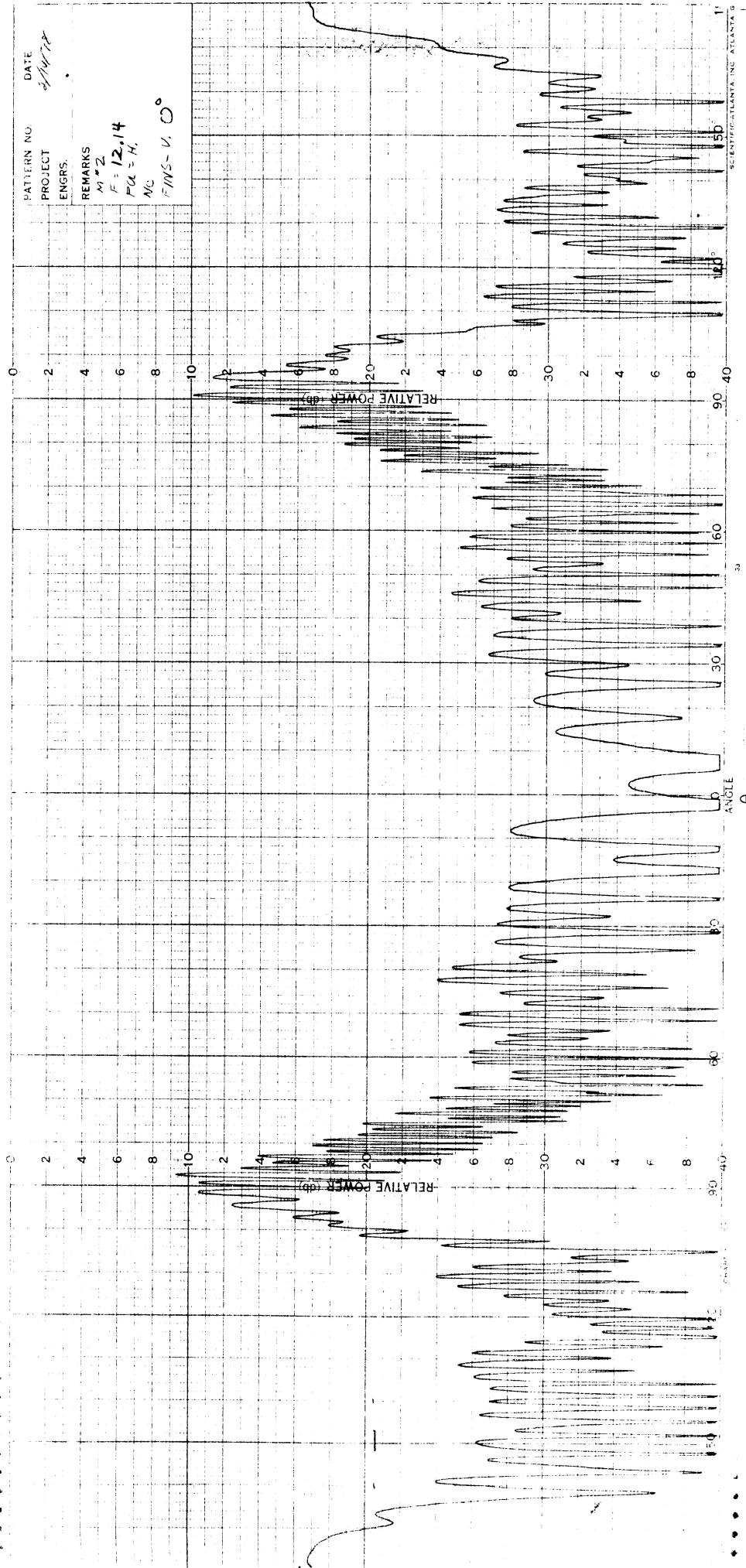
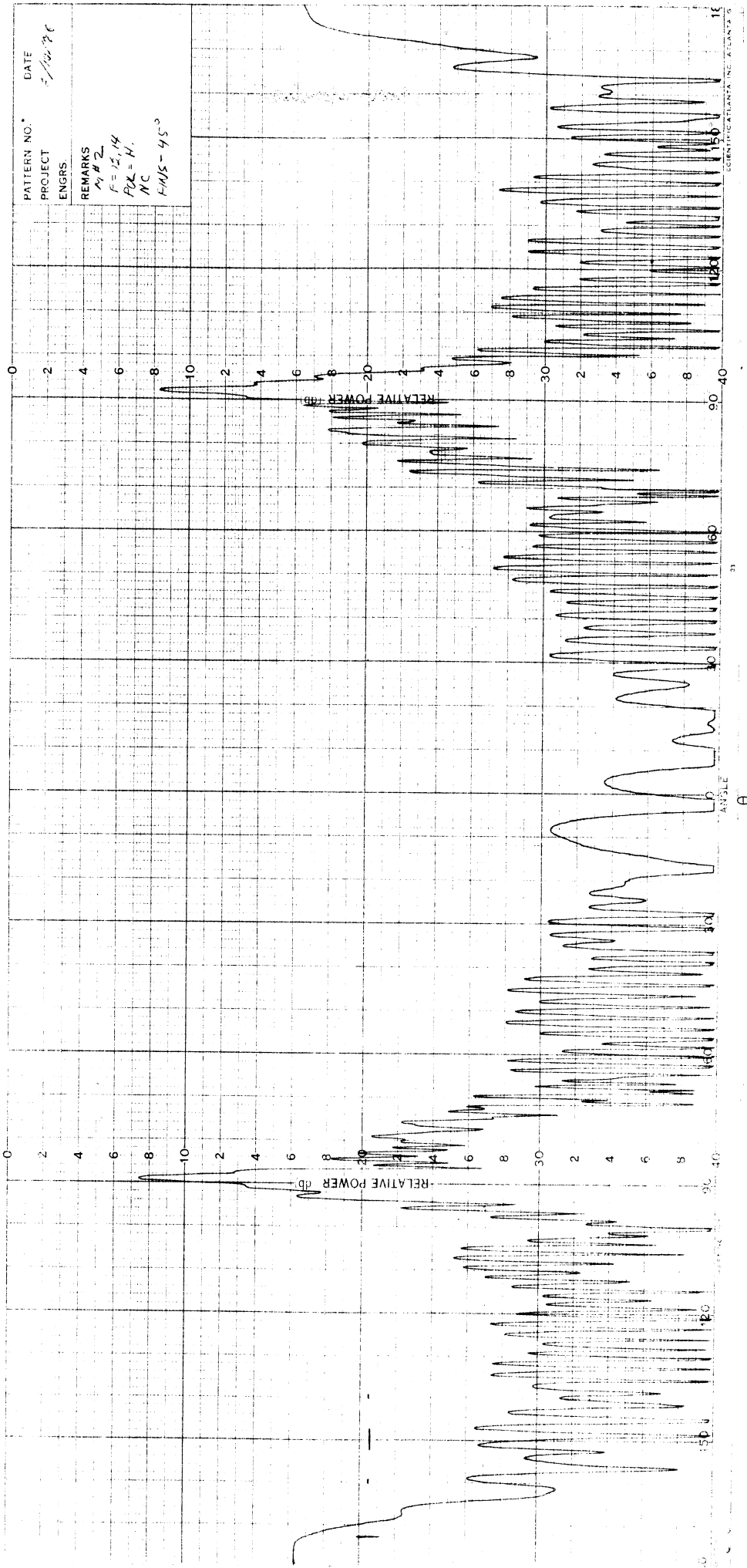


Figure 9: Backscatter characteristics of missile #2; frequency 12.14 GHz, horizontal polarization, with nose cone, $\phi = 0^\circ$, 10" calibration sphere.



PATTERN NO. *
 PROJECT ENGRS.
 REMARKS
 F = 12.14
 POL = H.
 NC
 FMS = 45°

DATE
 2/10/56

Figure 10: Backscatter characteristics of missile #2; frequency 12.14 GHz, horizontal polarization, with nose cone, $\phi = 45^\circ$, 10" calibration sphere.

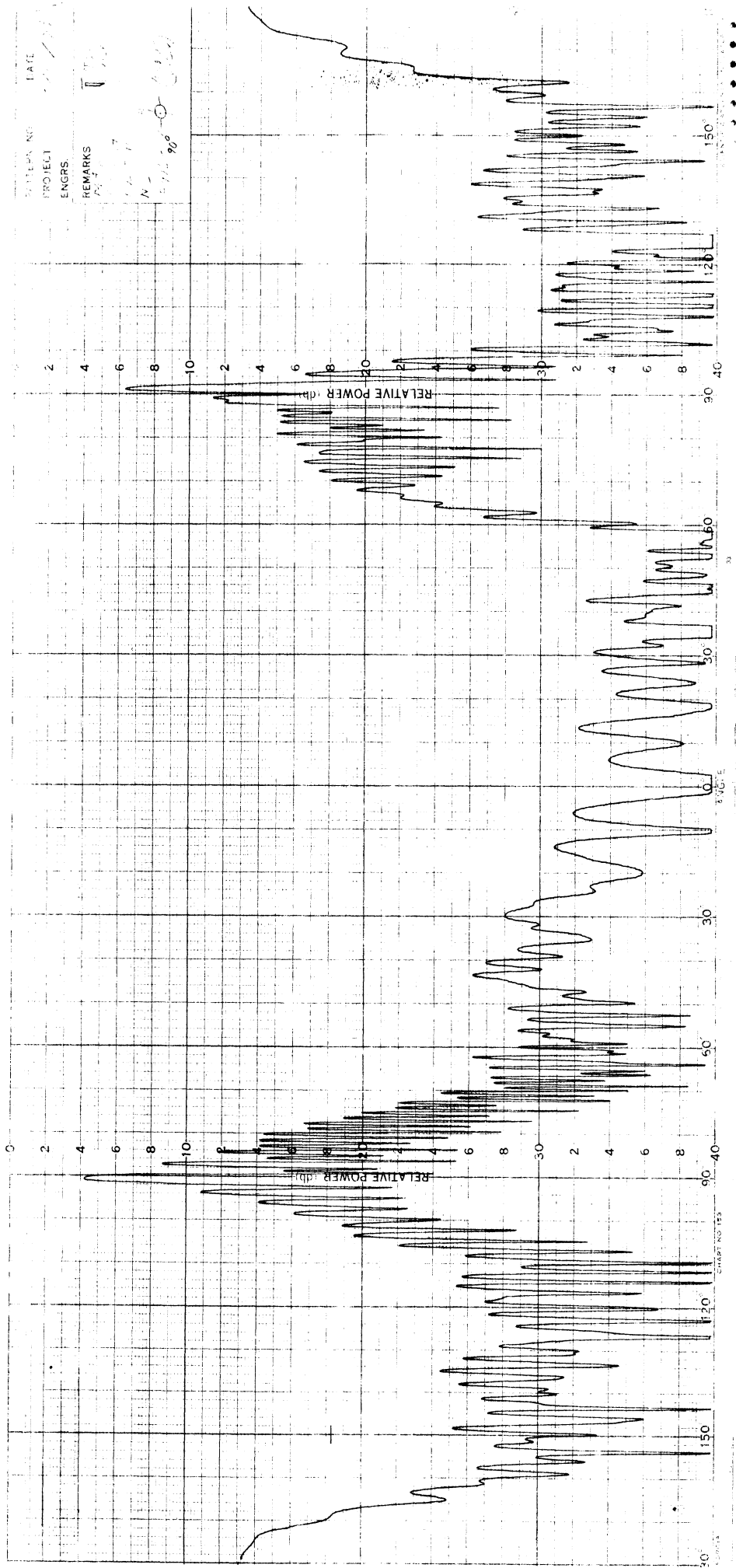


Figure 11: Backscatter characteristics of missile #2; frequency 12.14 GHz, horizontal polarization, with nose cone, $\phi = 90^\circ$, 10" calibration sphere.

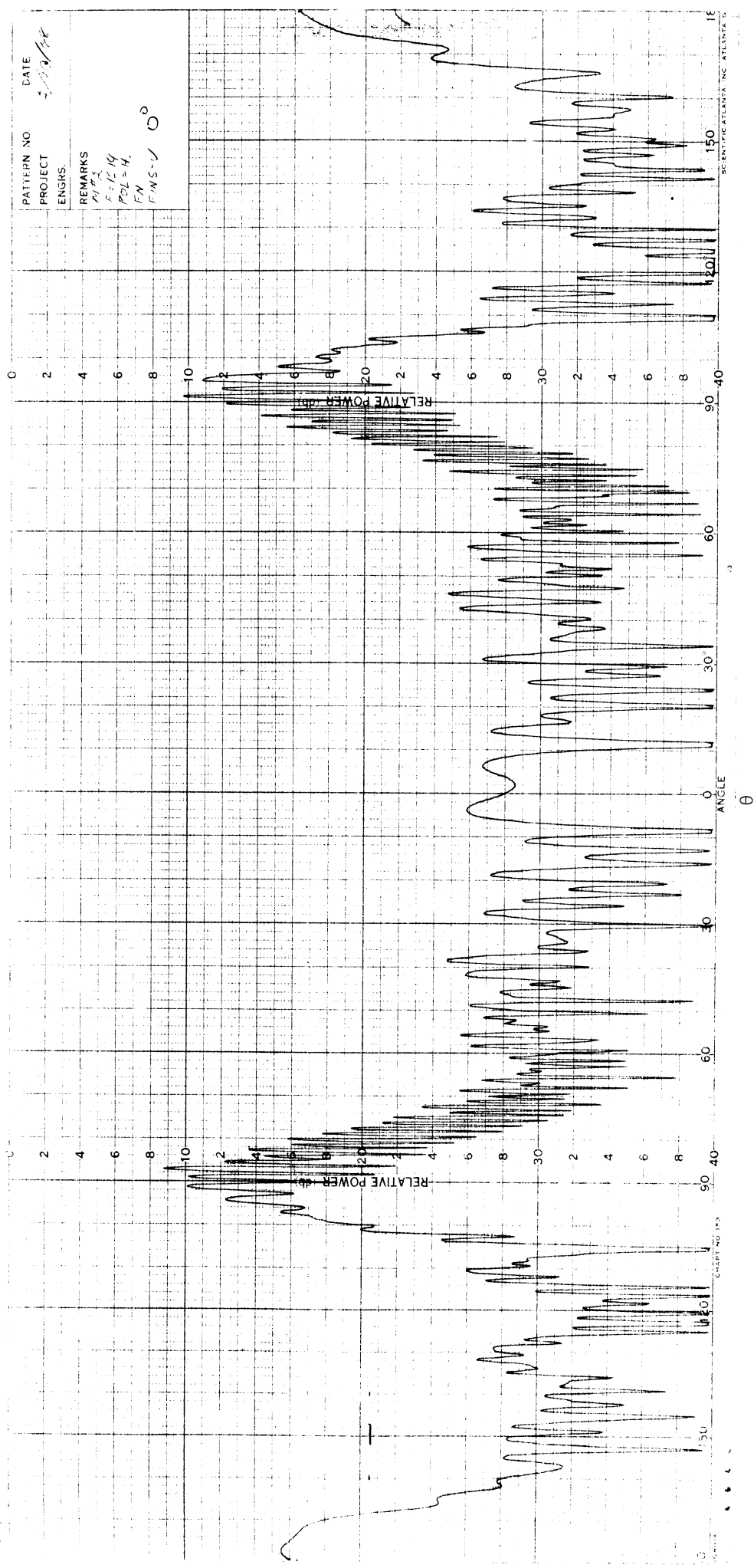


Figure 12: Backscatter characteristics of missile #2; frequency 12.14 GHz, horizontal polarization, without nose cone, $\phi = 0^\circ$, 10° calibration sphere.

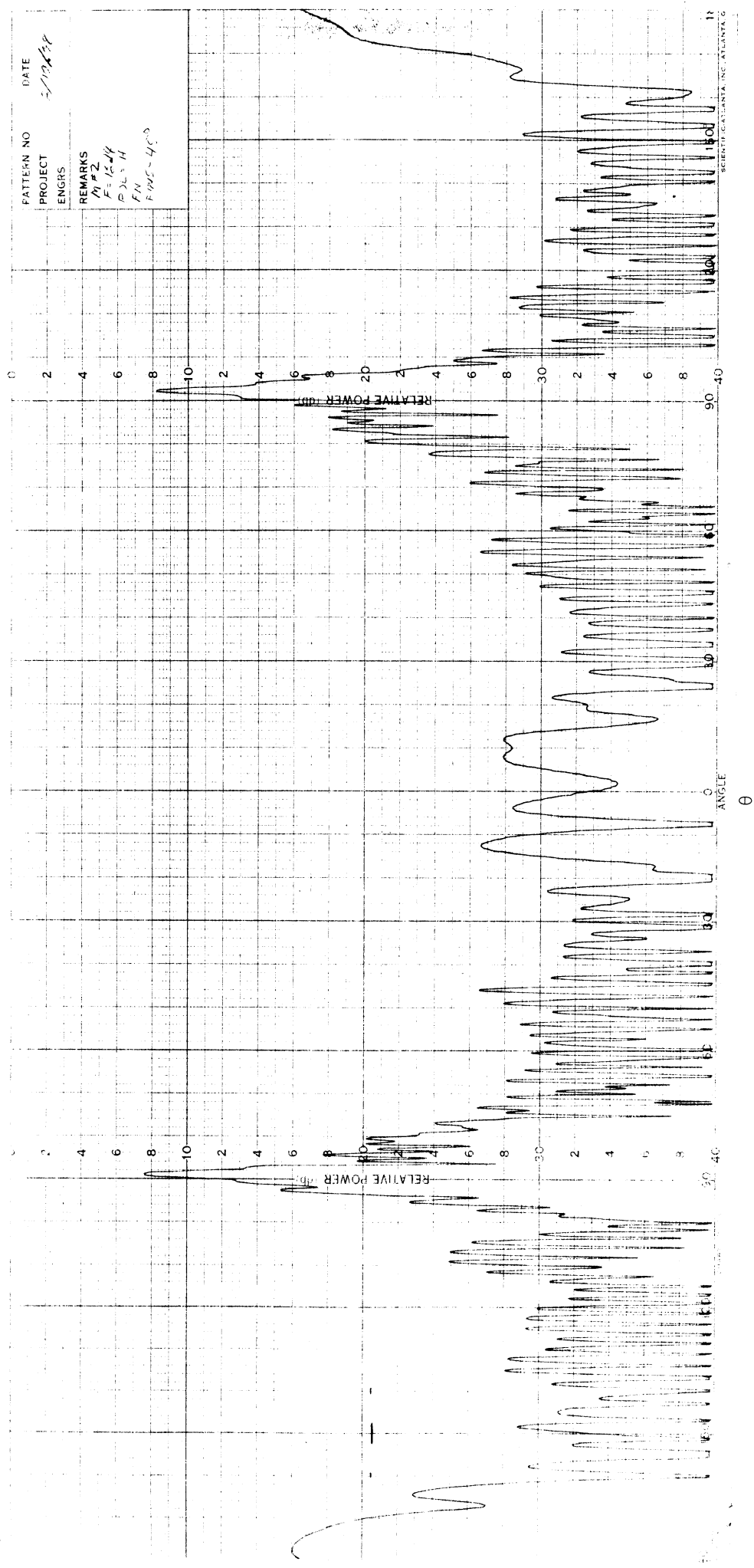


Figure 13: Backscatter characteristics of missile #2; frequency 12.14 GHz, horizontal polarization, without nose cone, $\phi = 45^\circ$, 10" calibration sphere.

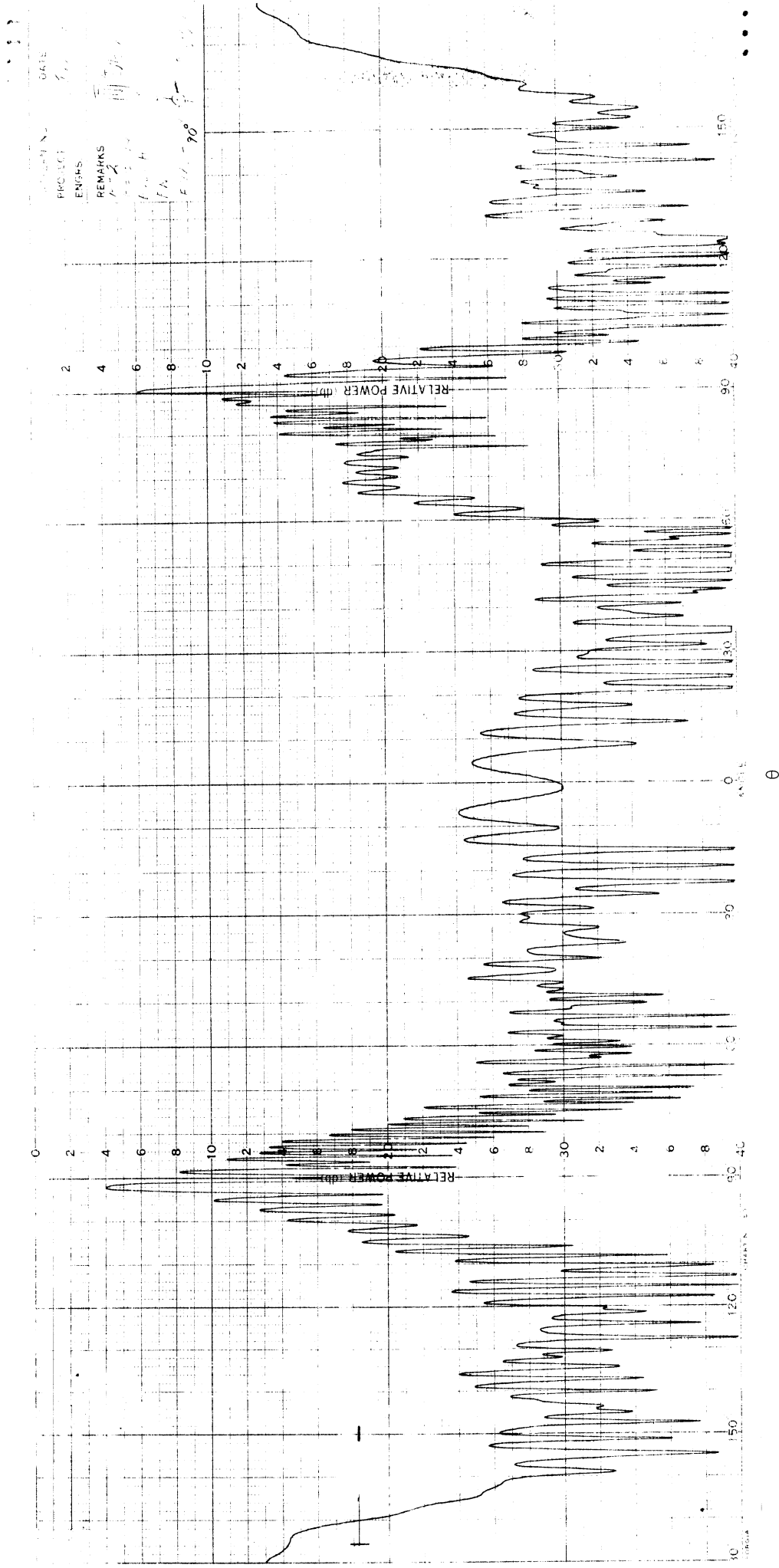


Figure 14: Backscatter characteristics of missile #2; frequency 12.14 GHz, horizontal polarization, without nose cone, $\phi = 90^\circ$, 10° calibration sphere.

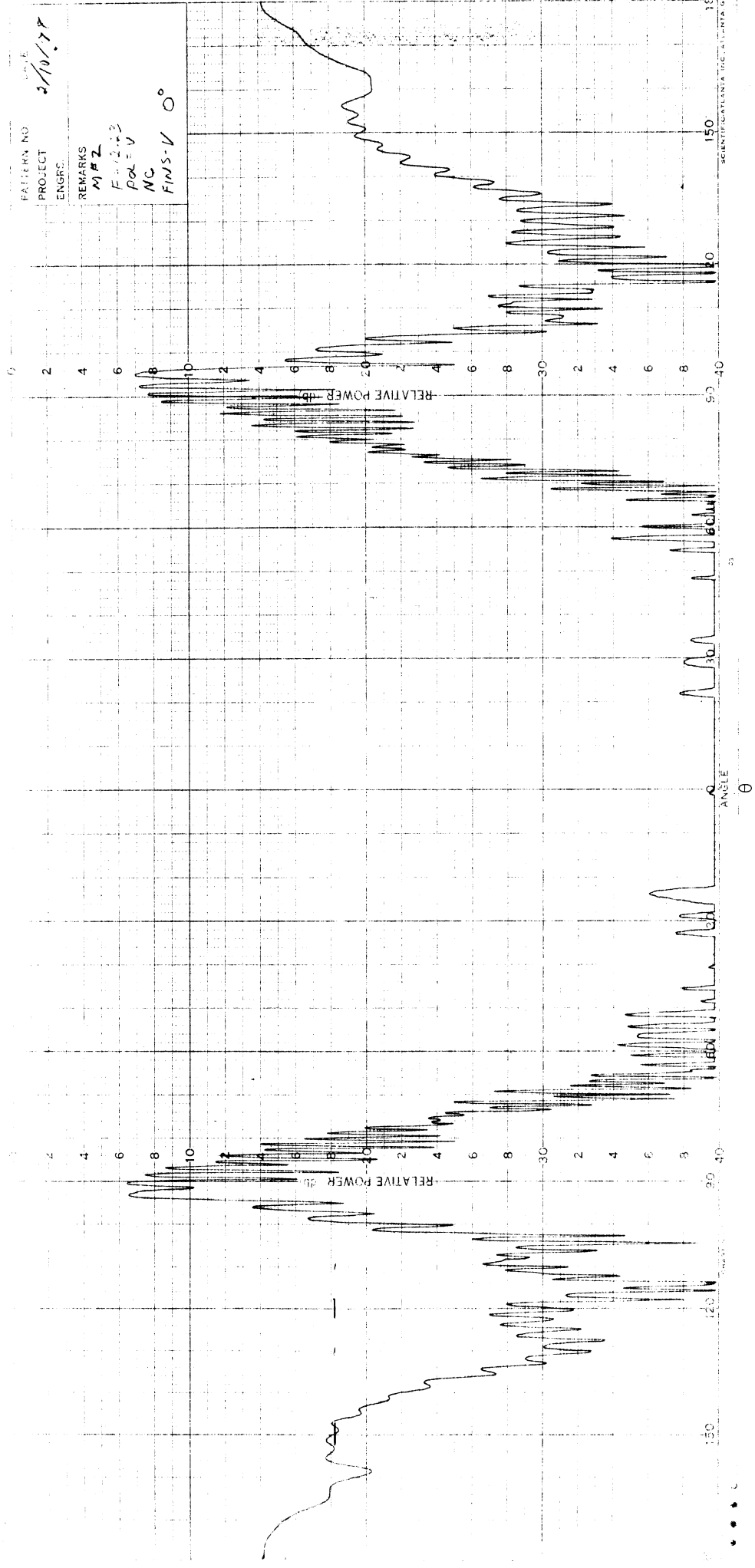


Figure 15: Backscatter characteristics of missile #2; frequency 12.23 GHz, vertical polarization, with nose cone, $\phi = 0^\circ$, 10" calibration sphere.

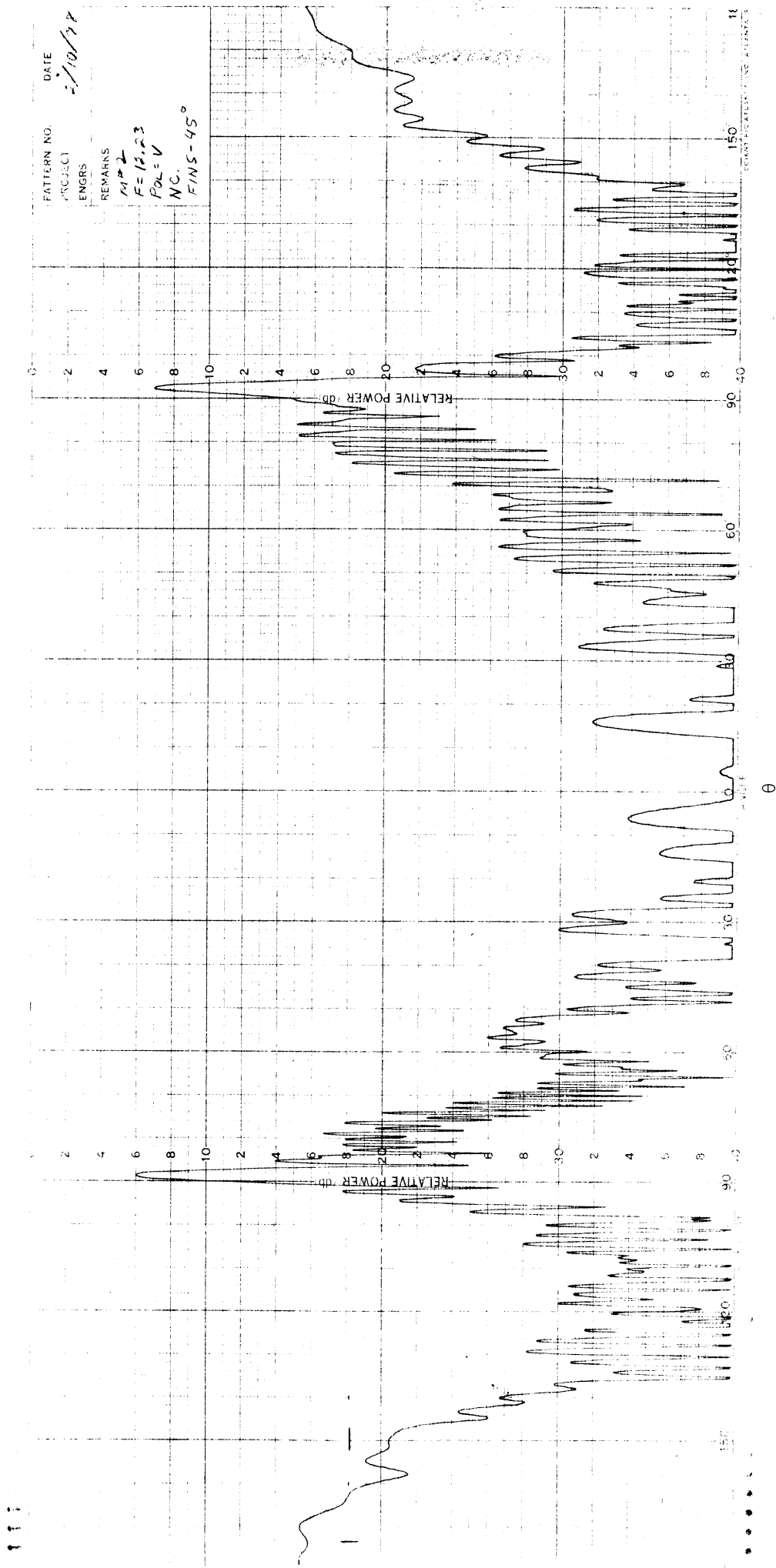


Figure 16: Backscatter characteristics of missile #2; frequency 12.23 GHz, vertical polarization, with nose cone, $\phi = 45^\circ$, 10" calibration sphere.

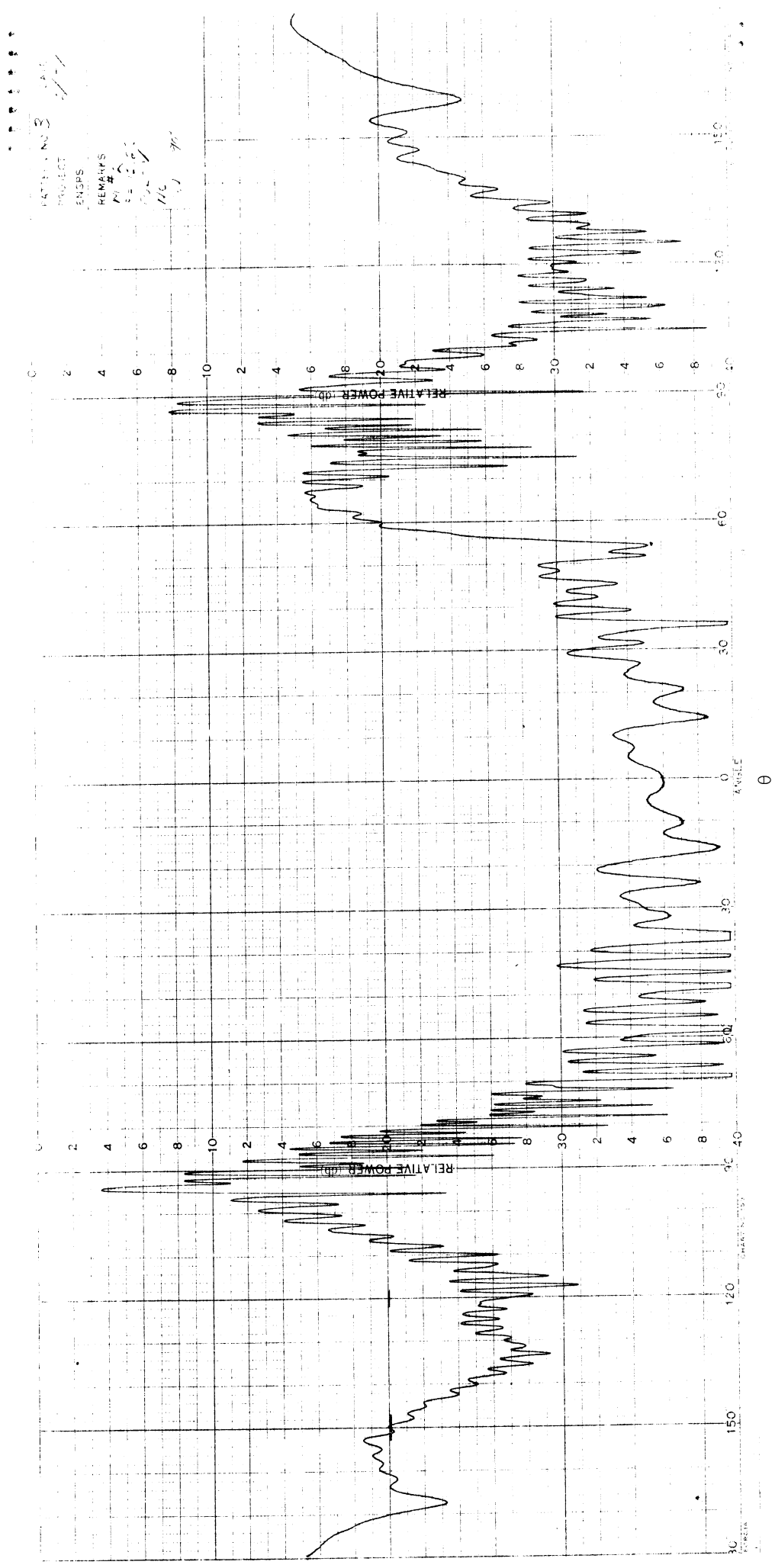


Figure 17: Backscatter characteristics of missile #2; frequency 12.23 GHz, vertical polarization, with nose cone, $\phi = 90^\circ$, 10" calibration sphere.

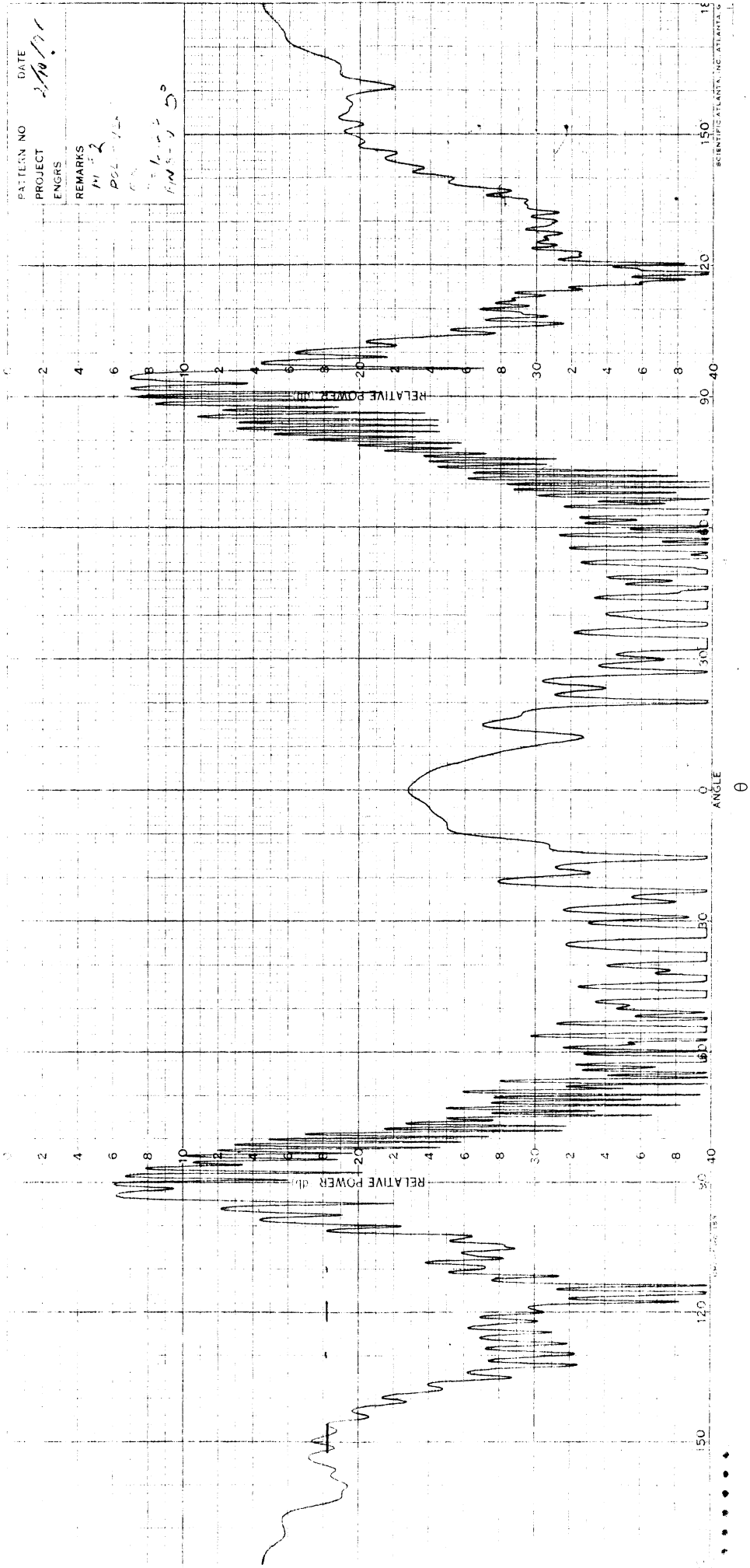


Figure 18: Backscatter characteristics of missile #2; frequency 12.23 GHz, vertical polarization, without nose cone, $\phi = 0^\circ$, 10" calibration sphere.

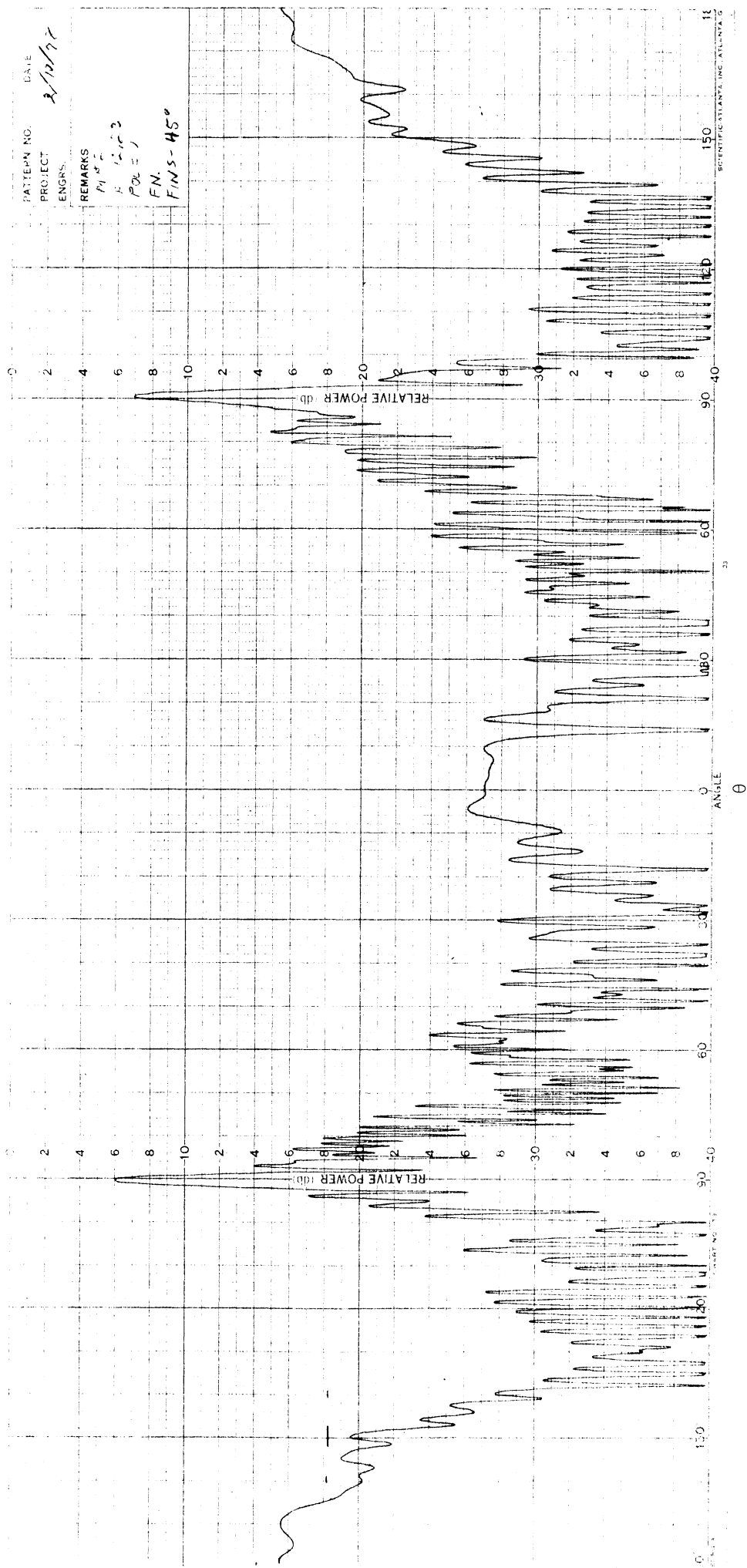


Figure 19: Backscatter characteristics of missile #2; frequency 12.23 GHz, vertical polarization, without nose cone, $\phi = 45^\circ$, 10" calibration sphere.

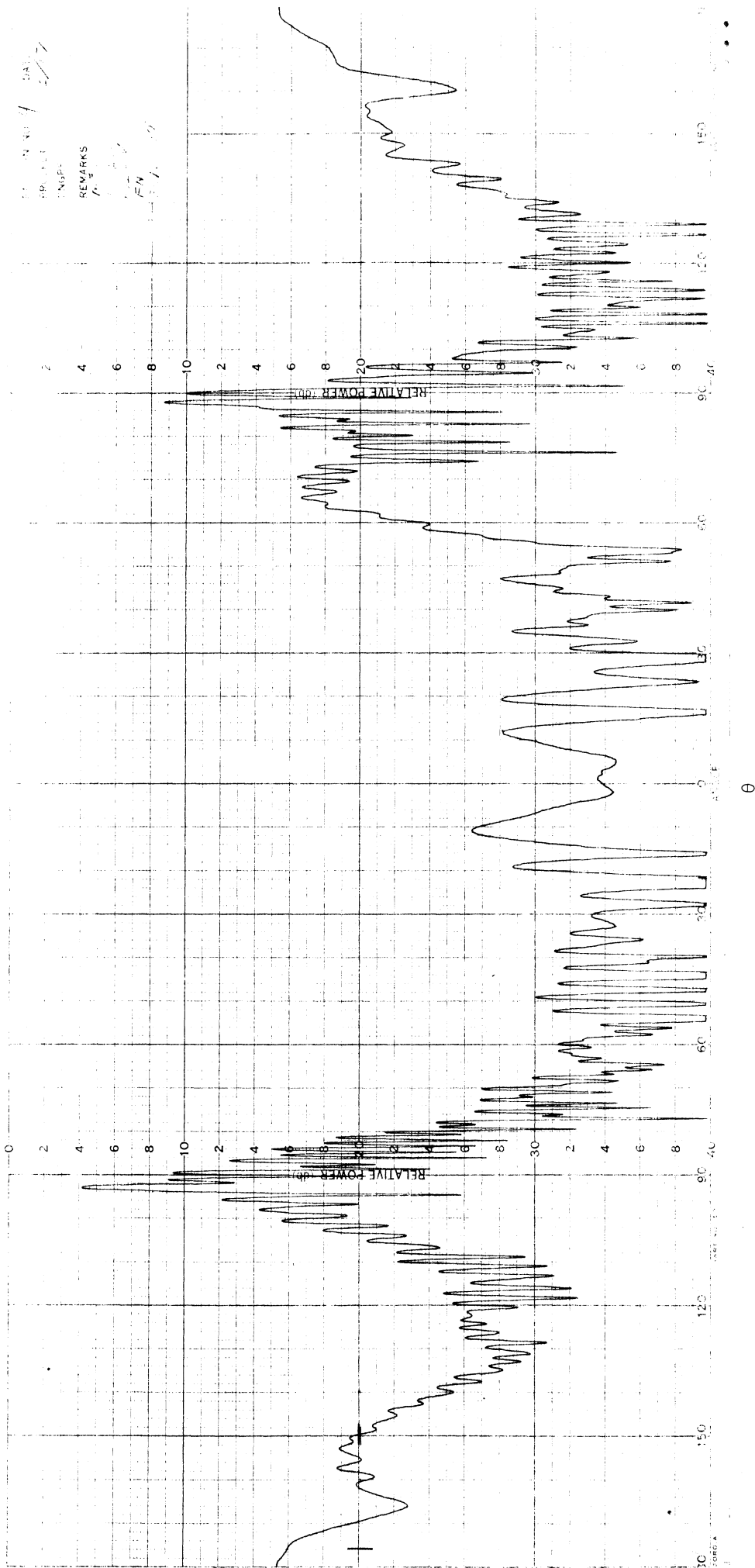


Figure 20: Backscatter characteristics of missile #2; frequency 12.23 Ghz, vertical polarization, without nose cone, $\phi = 90^\circ$, 10" calibration sphere.

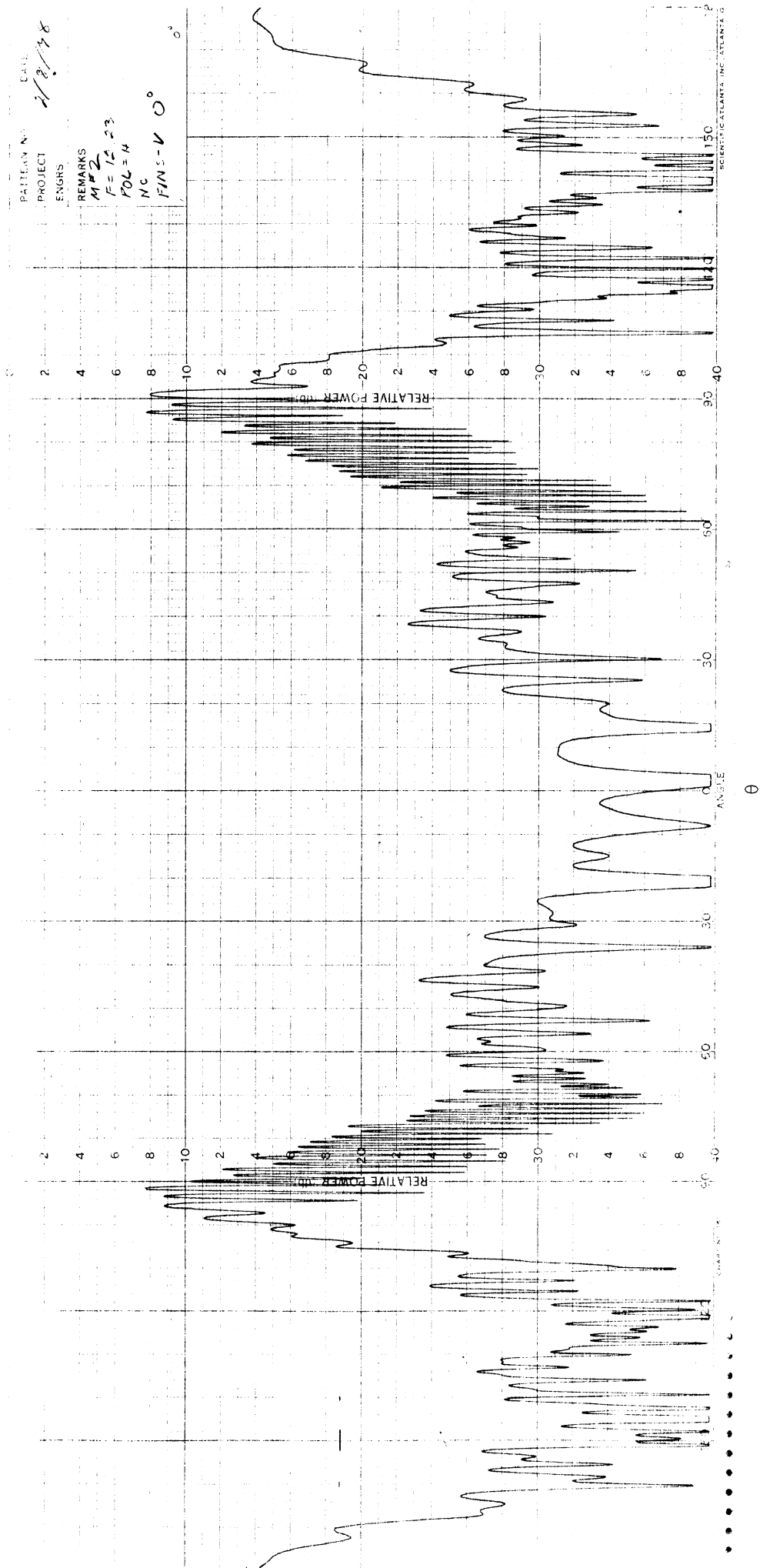


Figure 21: Backscatter characteristics of missile #2; frequency 12.23 GHz, horizontal polarization, with nose cone, $\phi = 0^\circ$, 10" calibration sphere.

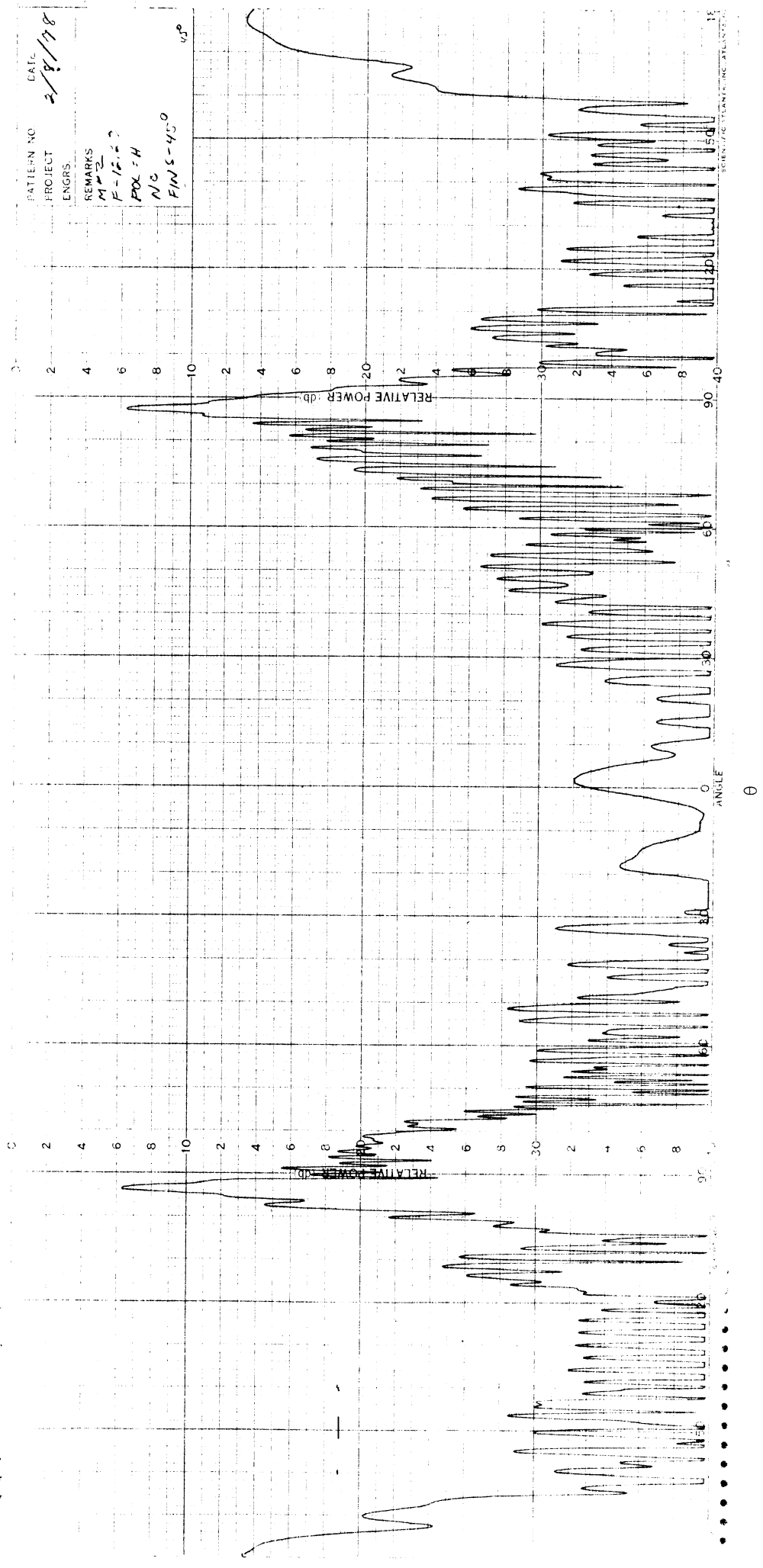


Figure 22: Backscatter characteristics of missile #2; frequency 12.23 GHz, horizontal polarization, with nose cone, $\phi = 45^\circ$, 10" calibration sphere.

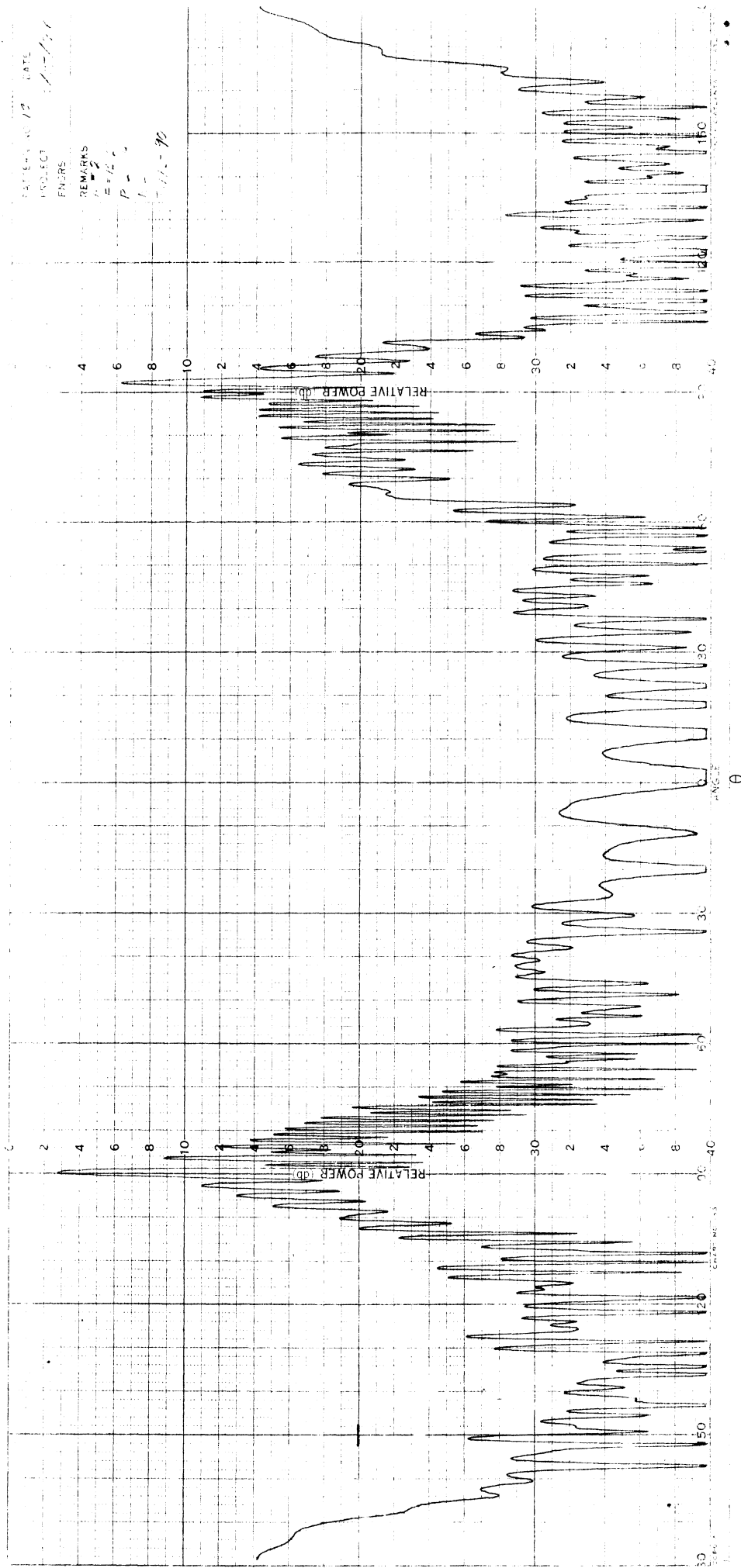


Figure 23: Backscatter characteristics of missile #2; frequency 12.23 GHz, horizontal polarization, with nose cone, $\phi = 90^\circ$, 10" calibration sphere.

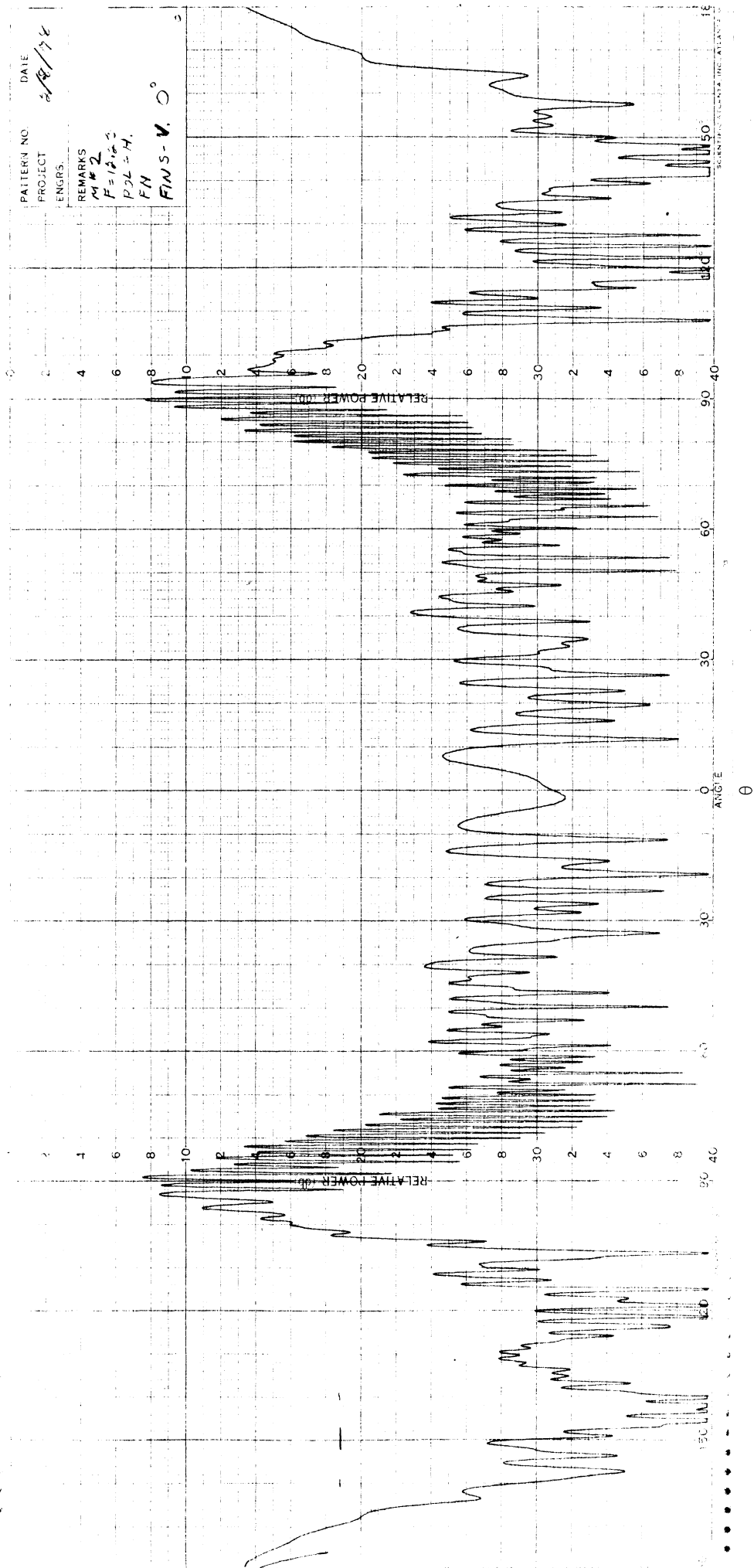


Figure 24: Backscatter characteristics of missile #2; frequency 12.23 GHz, horizontal polarization, without nose cone, $\phi = 0^\circ$, 10" calibration sphere.

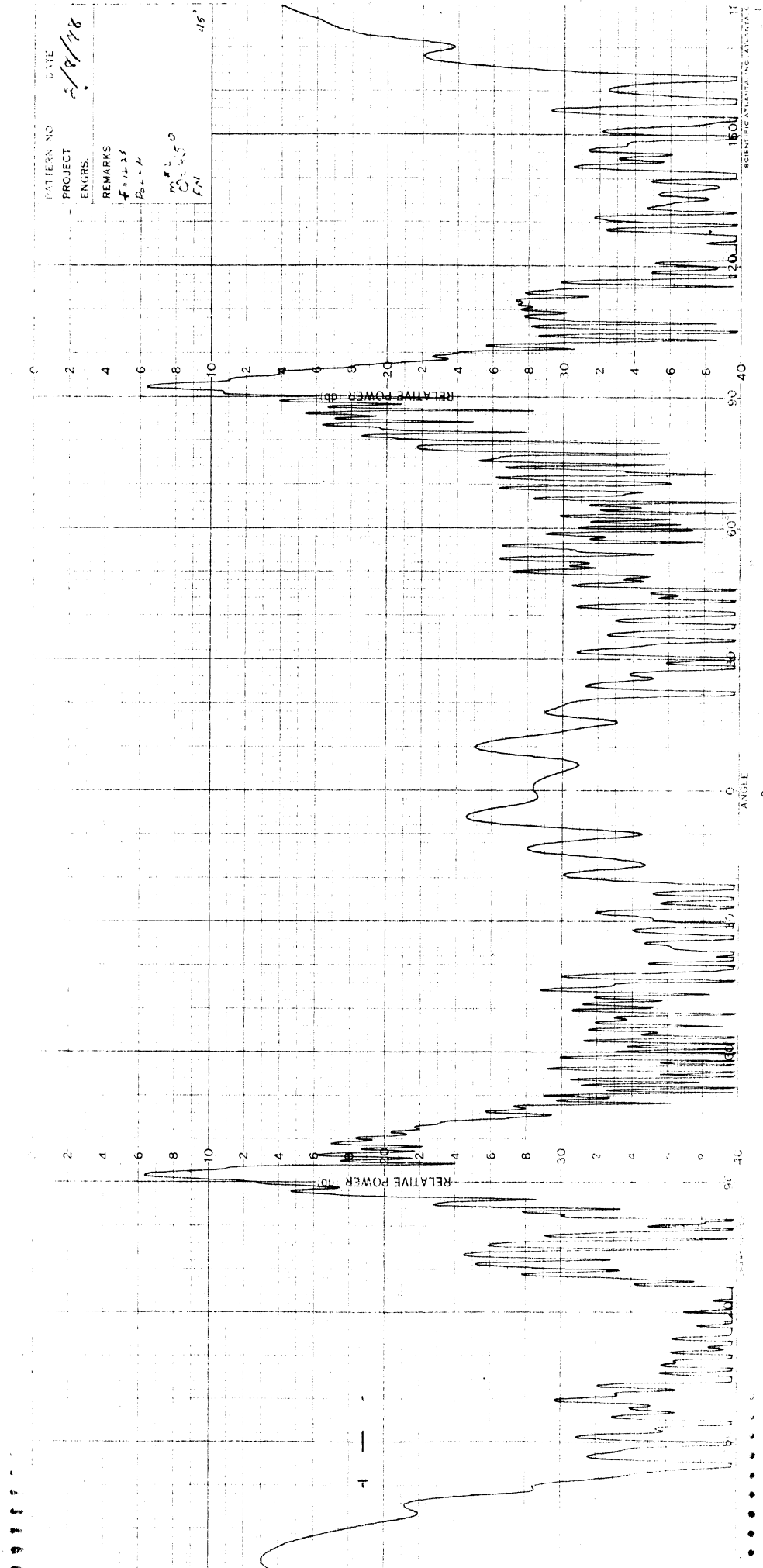


Figure 25: Backscatter characteristics of missile #2; frequency 12.23 GHz, horizontal polarization, without nose cone, $\phi = 45^\circ$, 10" calibration sphere.

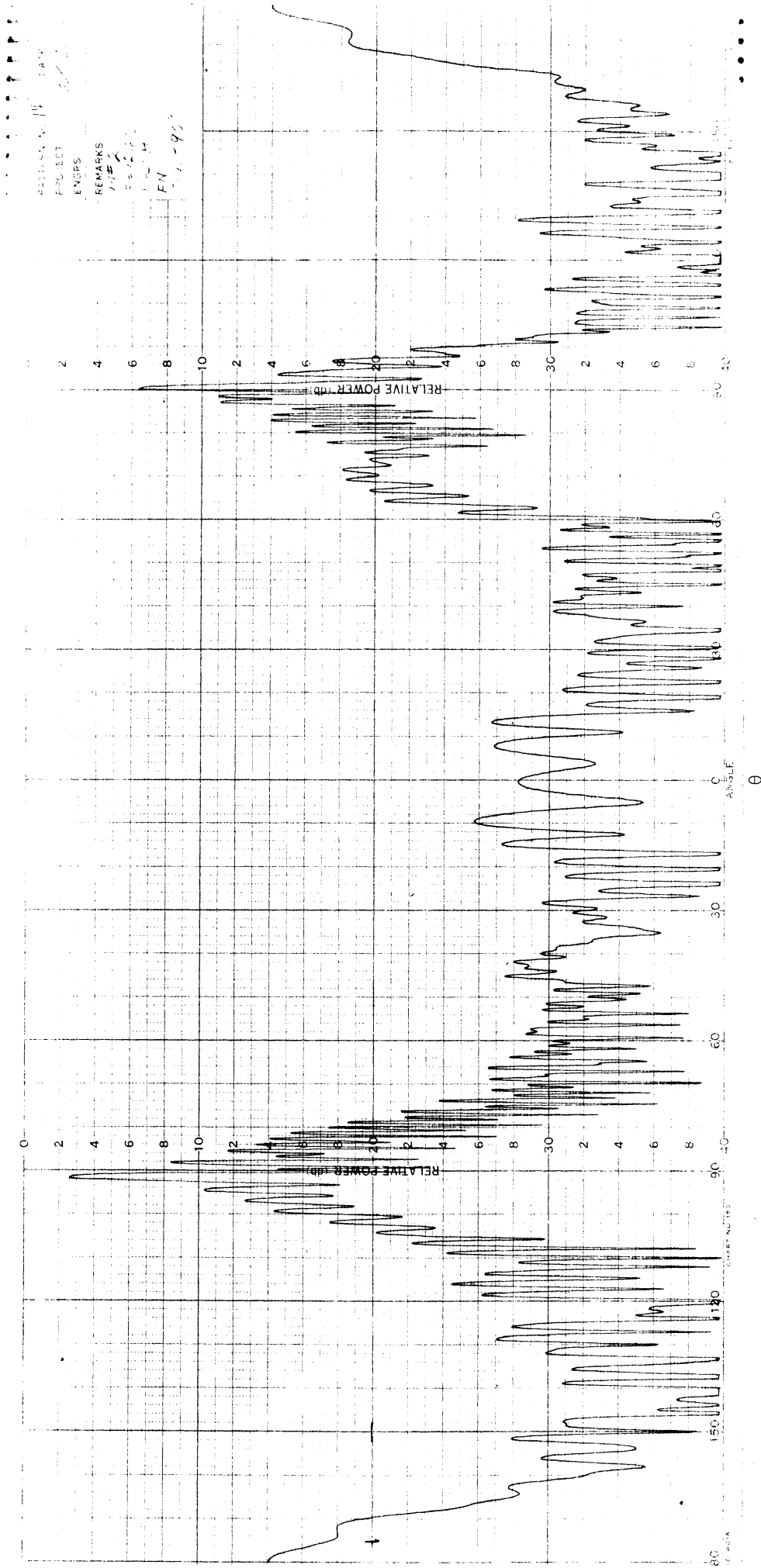


Figure 26: Backscattering characteristics of missile #2; frequency 12.23 GHz, horizontal polarization, without nose cone, $\phi = 90^\circ$, 10" calibration sphere.

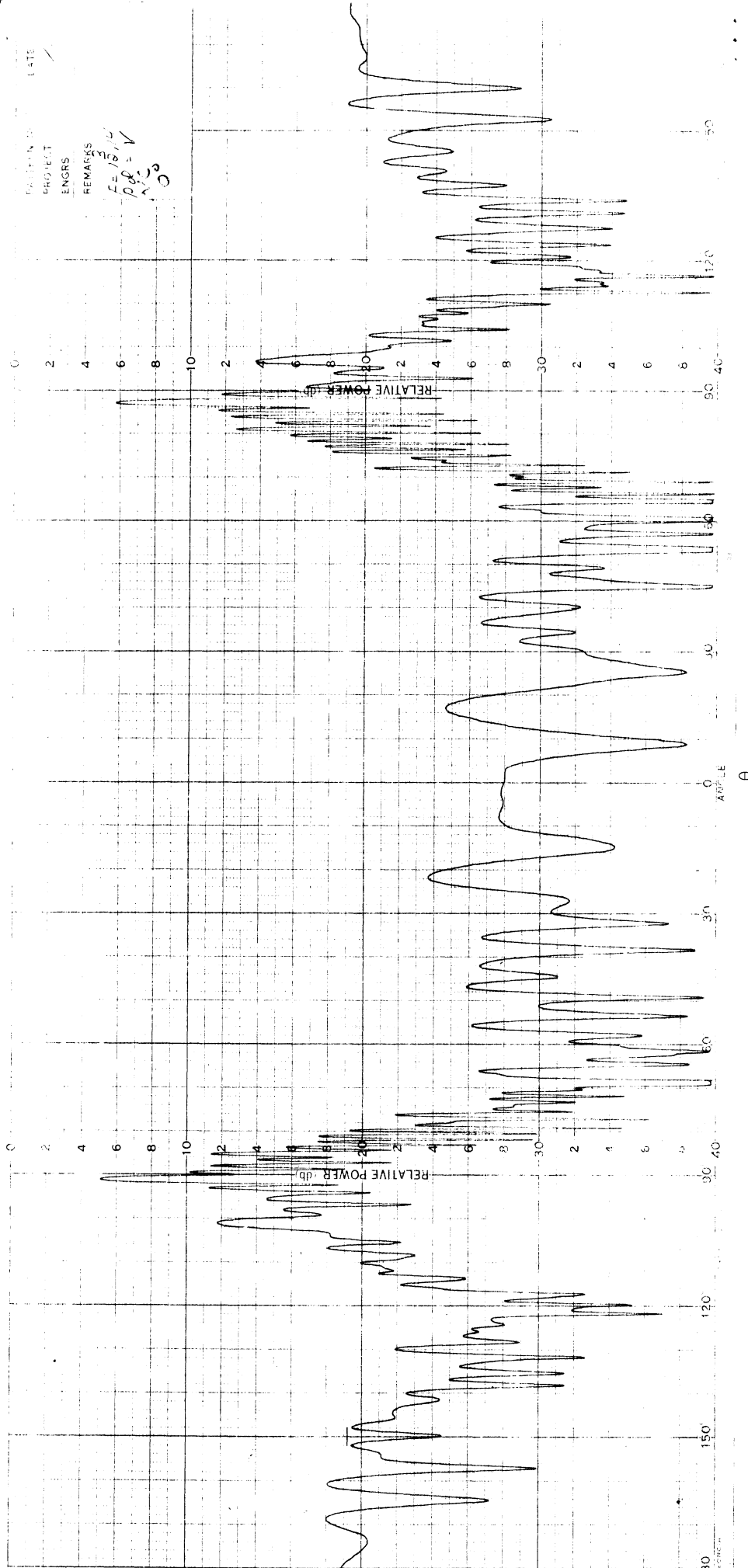


Figure 27: Backscatter characteristics of missile #3; frequency 12.14 GHz, vertical polarization, with nose cone, $\phi = 0^\circ$, 10" calibration sphere.

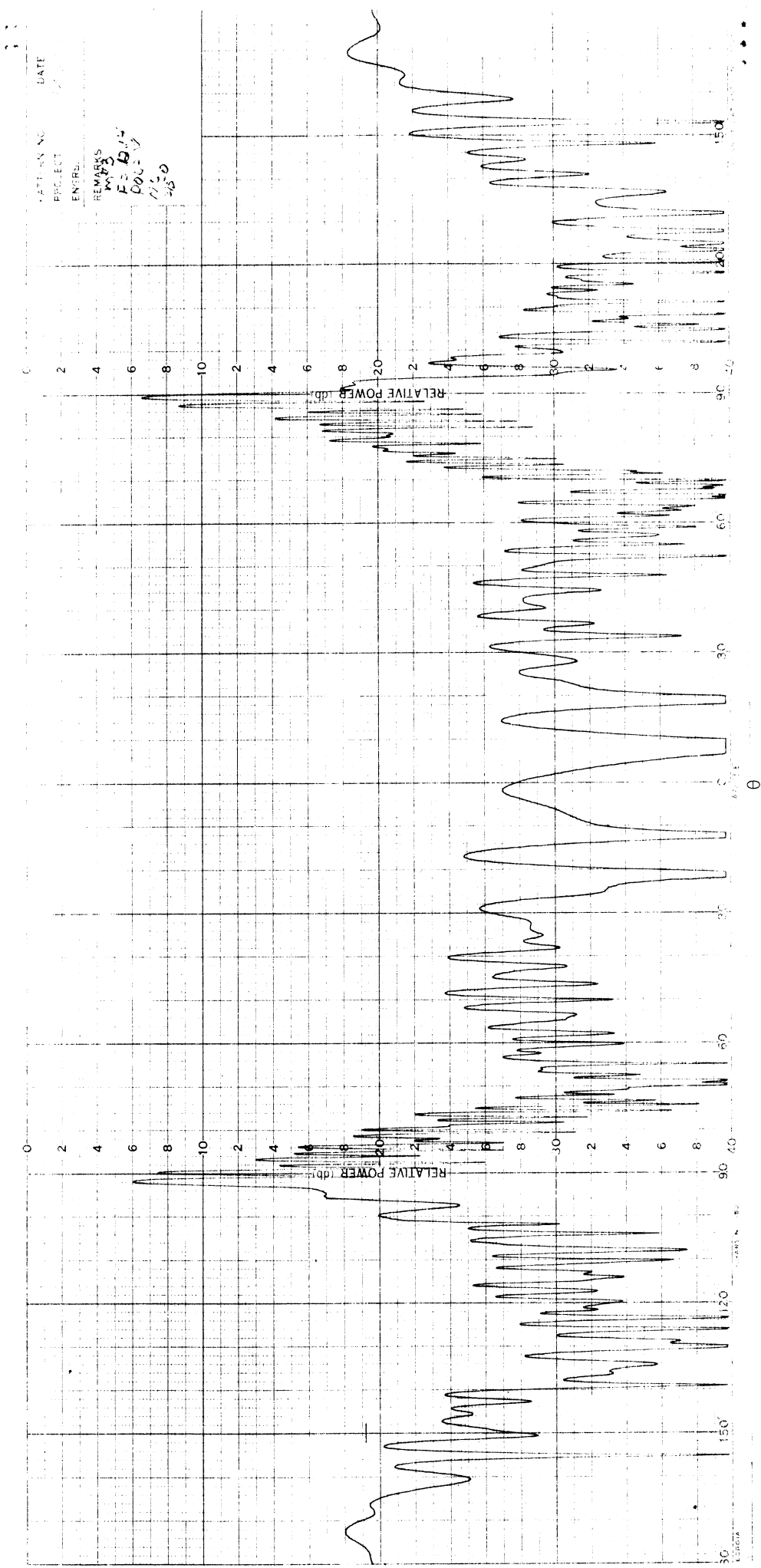


Figure 28: Backscatter characteristics of missile #3; frequency 12.14 GHz, vertical polarization, with nose cone, $\phi = 45^\circ$, 10" calibration sphere.

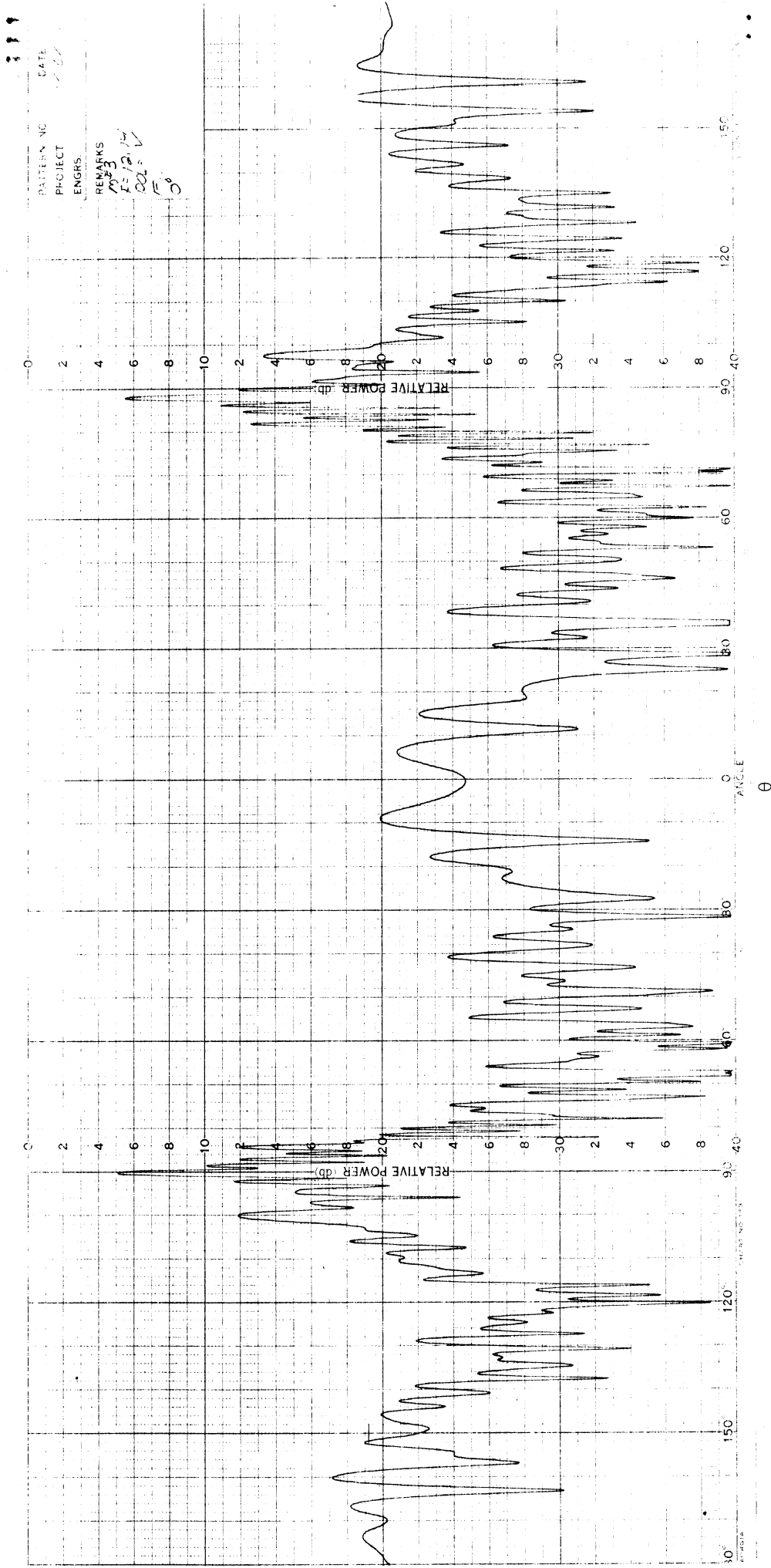


Figure 29: Backscatter characteristics of missile #3; frequency 12.14 GHz, vertical polarization, without nose cone, $\phi = 0^\circ$, 10" calibration sphere.

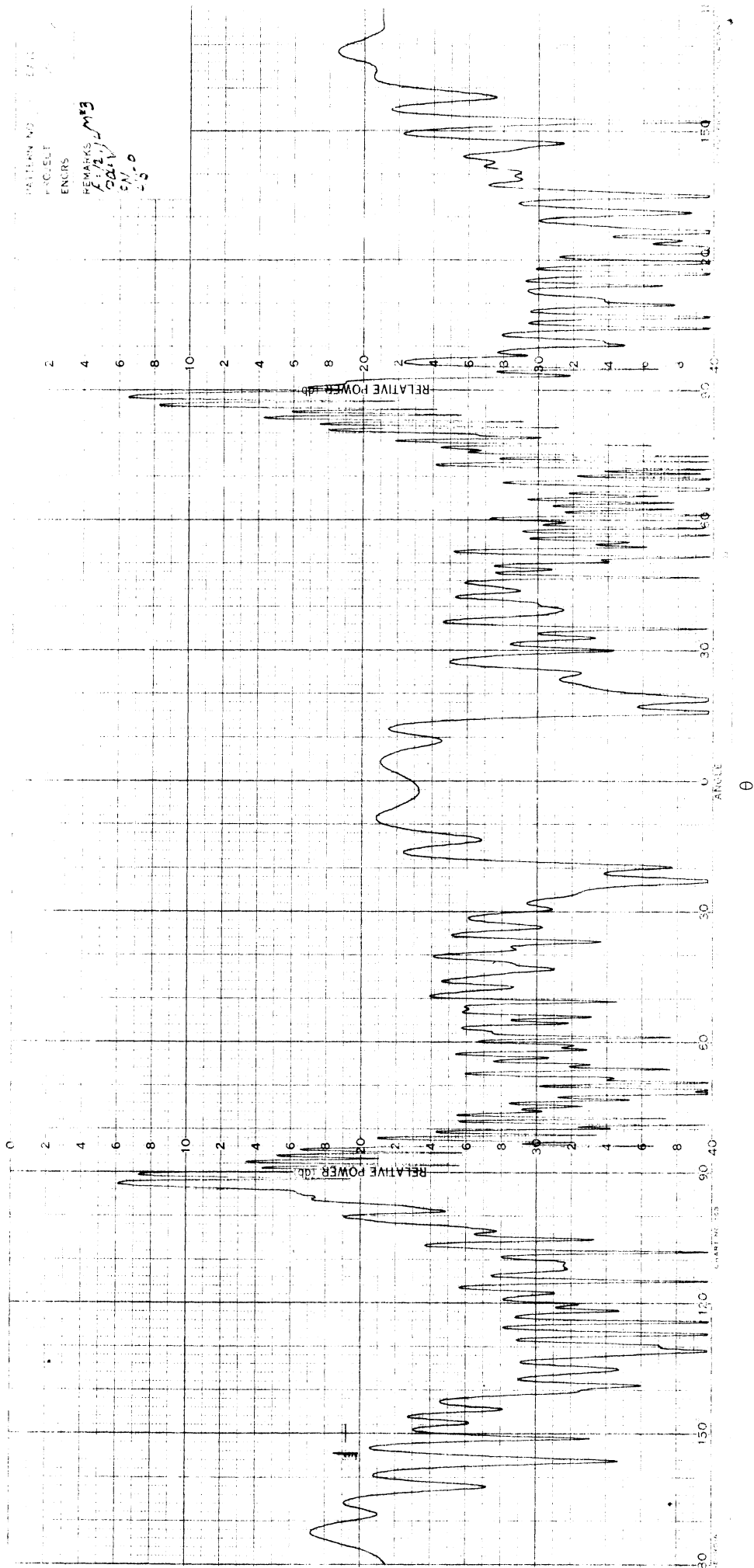


Figure 30: Backscatter characteristics of missile #3; frequency 12.14 GHz, vertical polarization, without nose cone, $\phi = 45^\circ$, 10" calibration sphere.

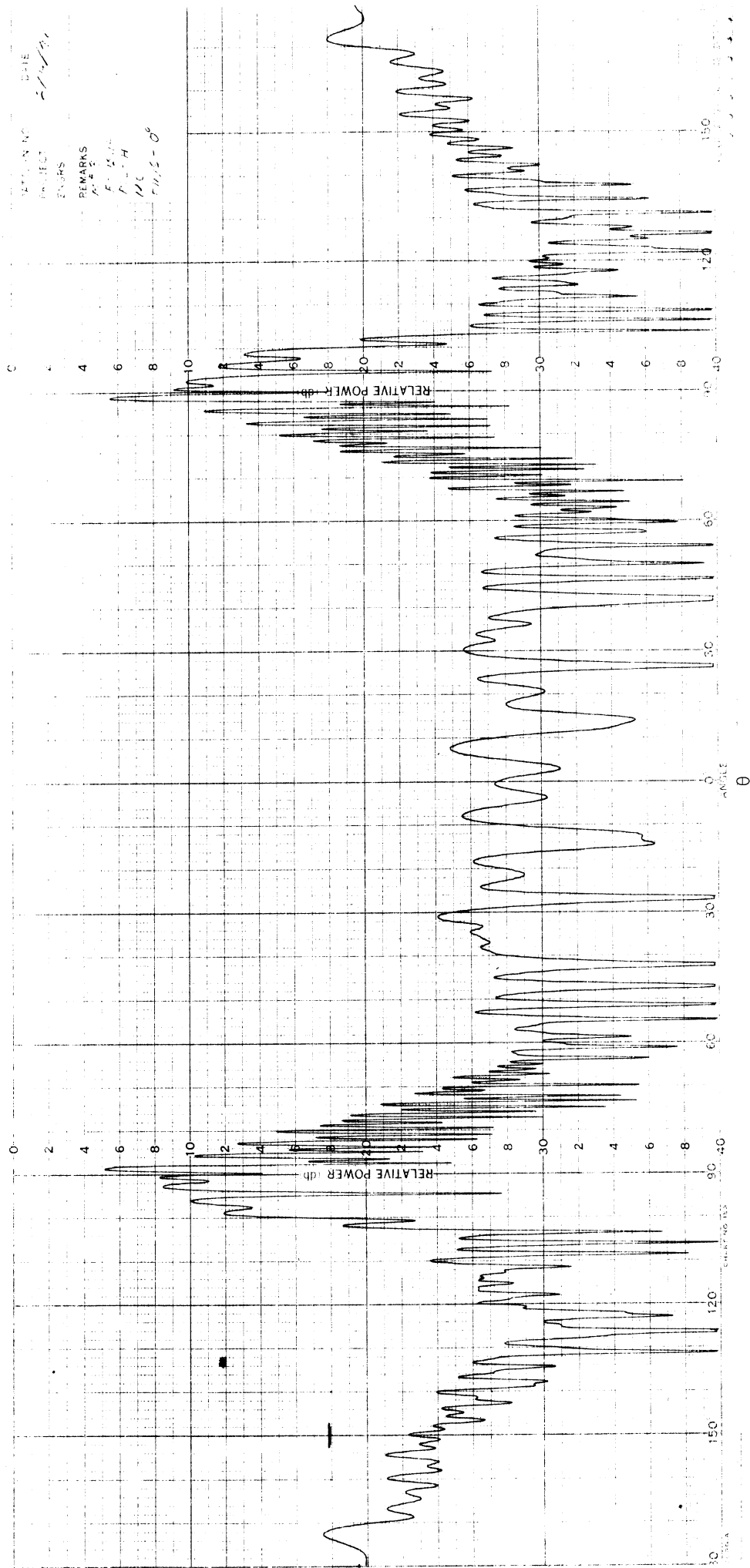


Figure 31: Backscatter characteristics of missile #3; frequency 12.14 GHz, horizontal polarization, with nose cone, $\phi = 0^\circ$, 10" calibration sphere.

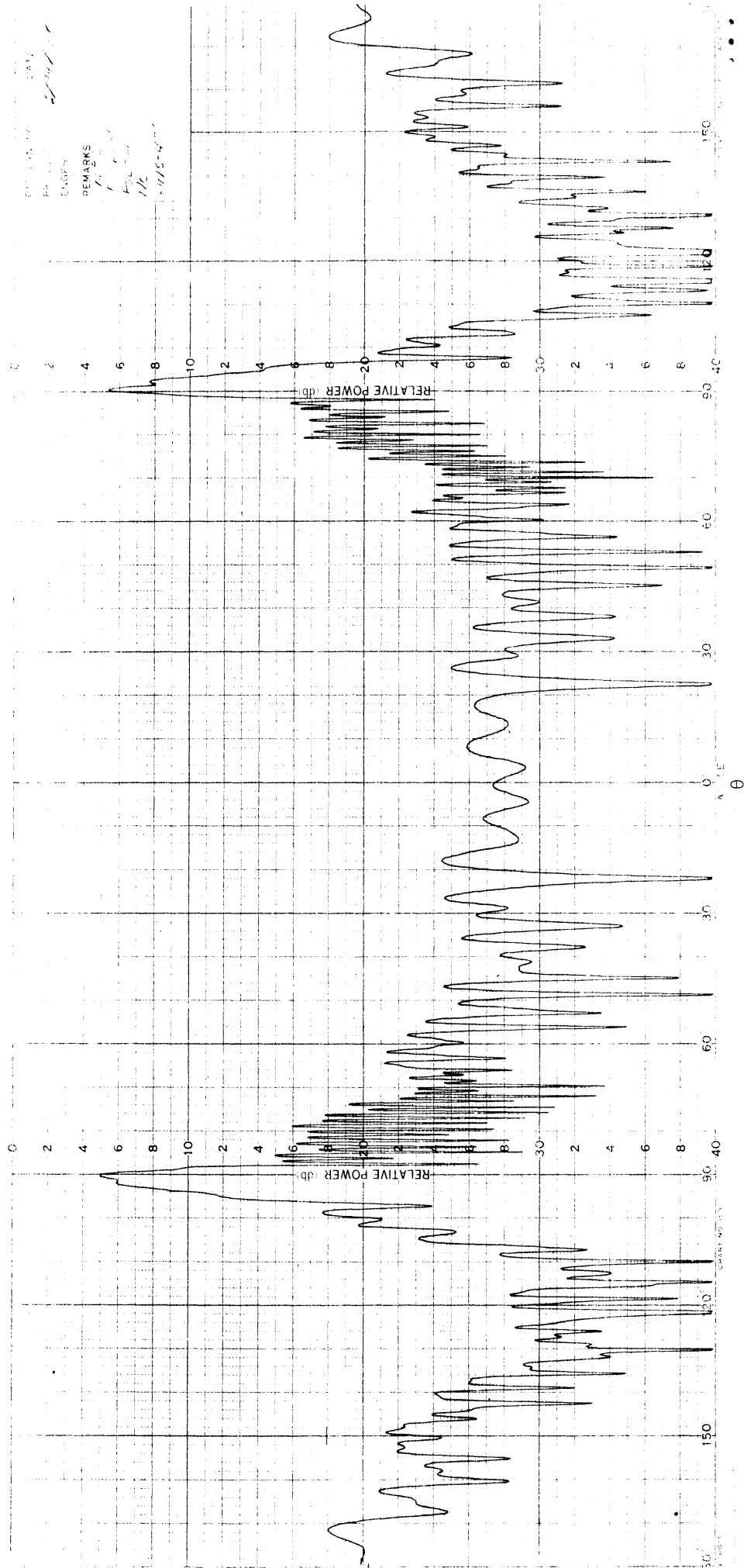


Figure 32: Backscatter characteristics of missile #3; frequency 12.14 GHz, horizontal polarization, with nose cone, $\phi = 45^\circ$, 10" calibration sphere.

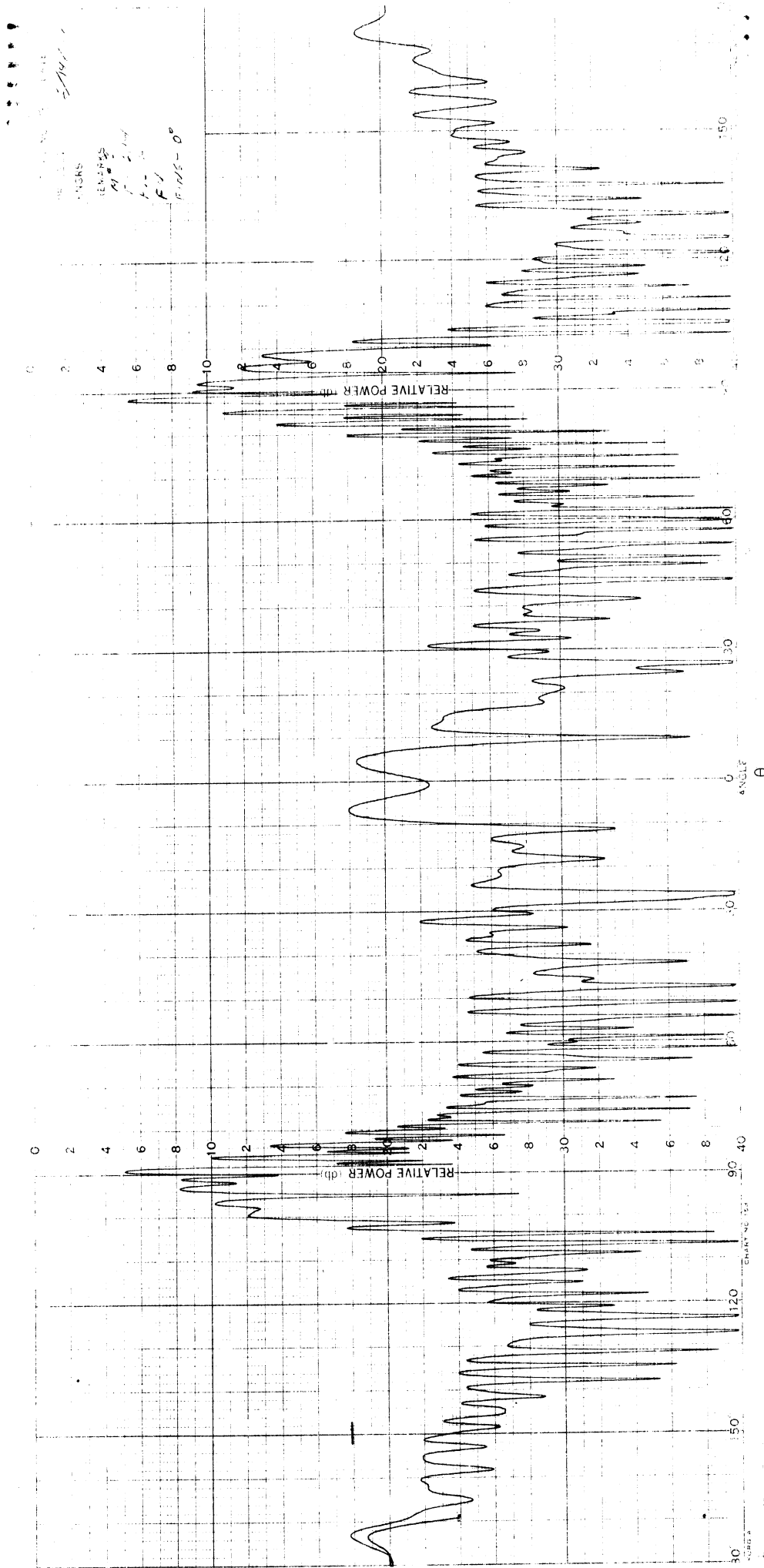


Figure 33: Backscatter characteristics of missile #3; frequency 12.14 GHz, horizontal polarization, without nose cone, $\phi = 0^\circ$, 10" calibration sphere.

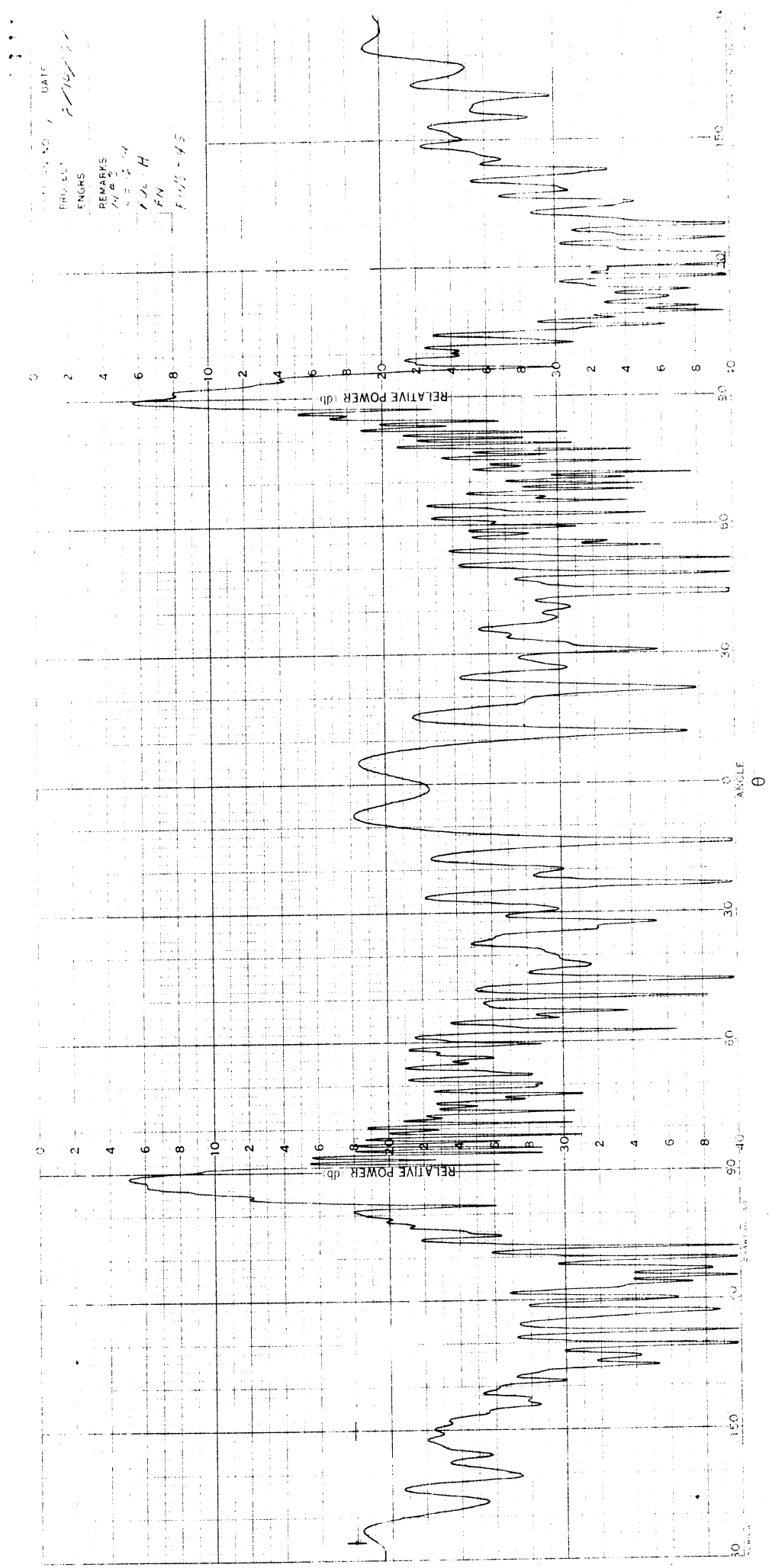


Figure 34: Backscatter characteristics of missile #3; frequency 12.14 GHz, horizontal polarization, without nose cone, $\phi = 45^\circ$, 10" calibration sphere.

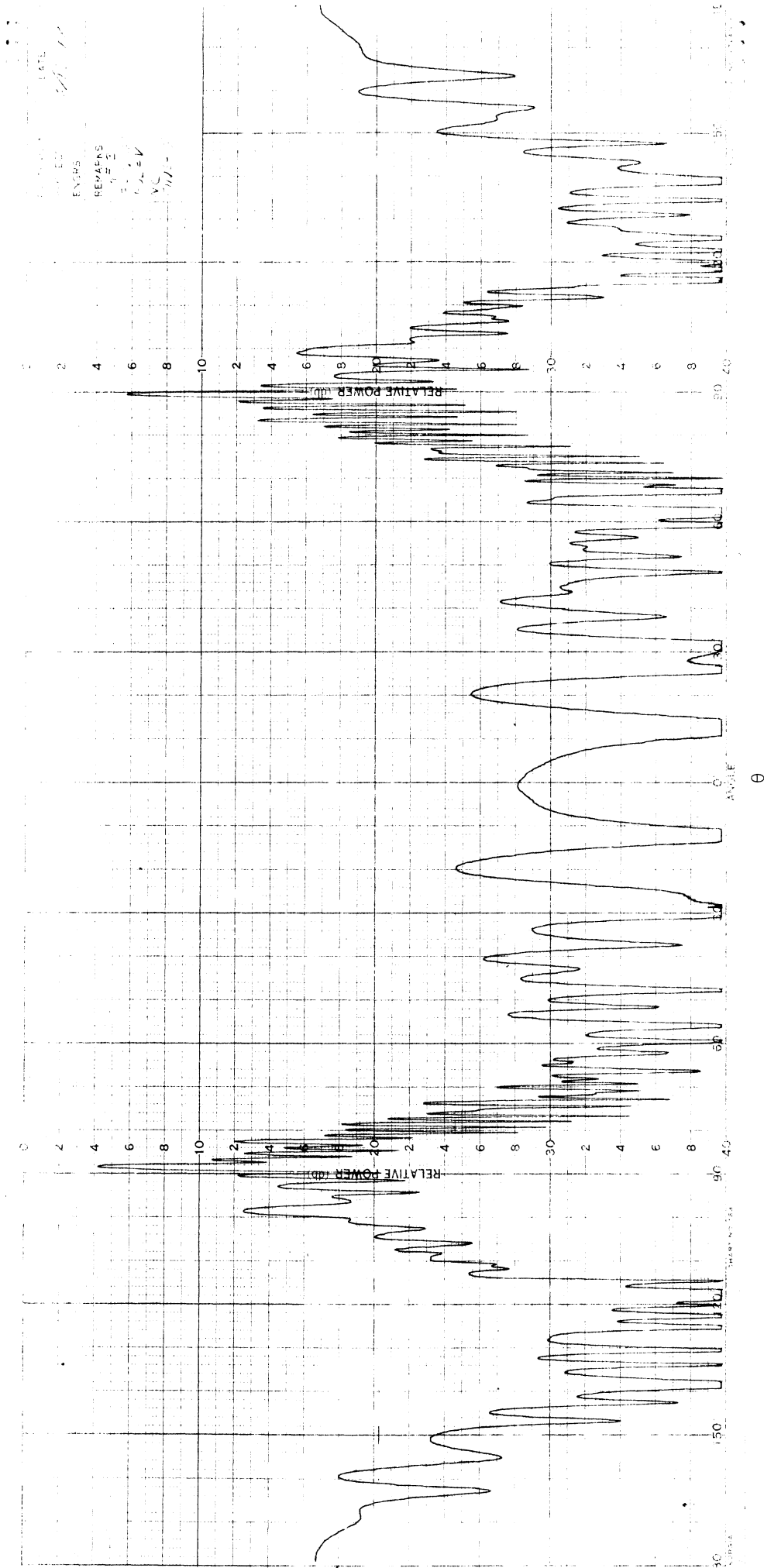


Figure 35: Backscatter characteristics of missile #3; frequency = 12.23 GHz, vertical polarization, with nose cone, $\phi = 0^\circ$, 10" calibration sphere.

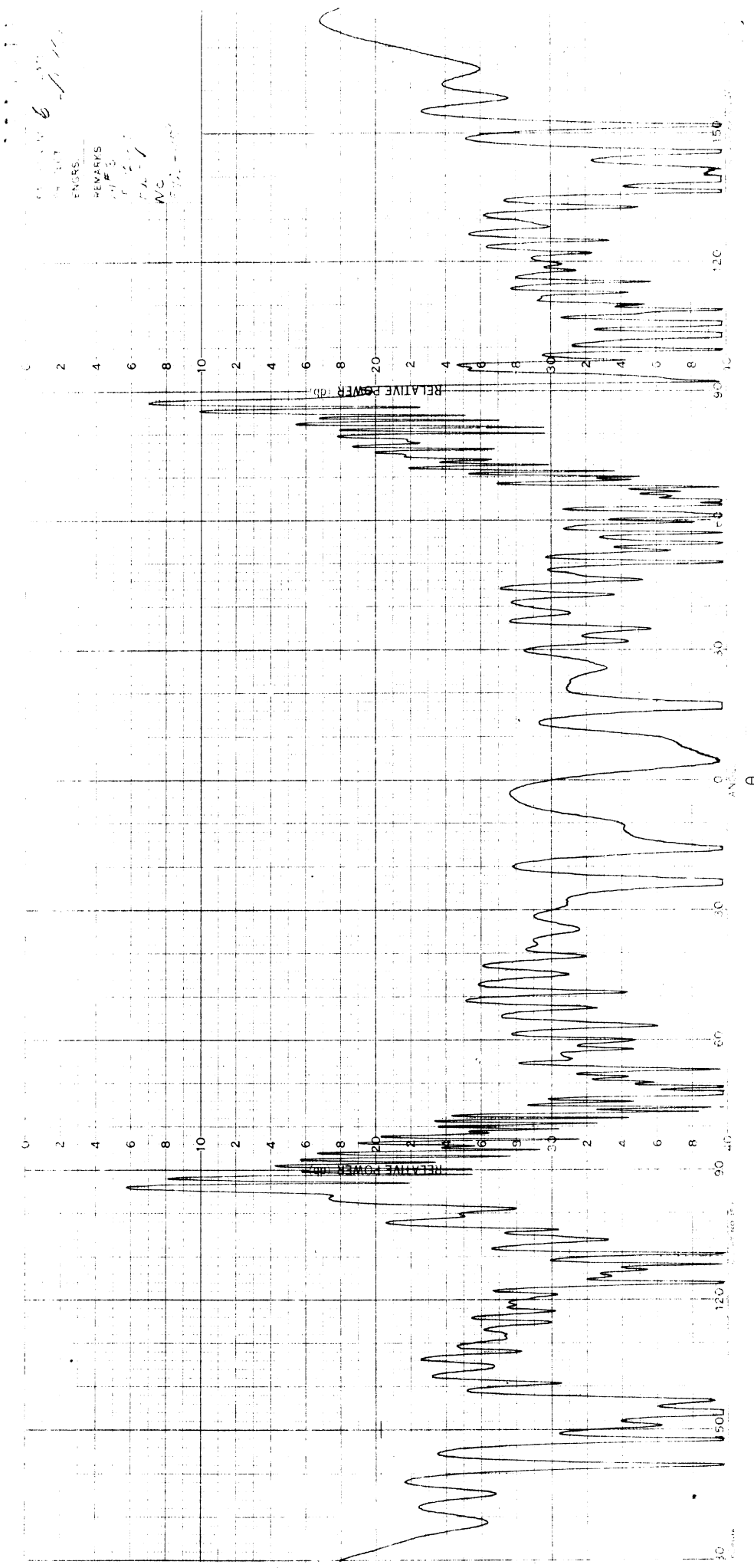


Figure 36: Backscatter characteristics of missile #3; frequency 12.23 GHz, vertical polarization, with nose cone, $\phi = 45^\circ$, 10" calibration sphere.

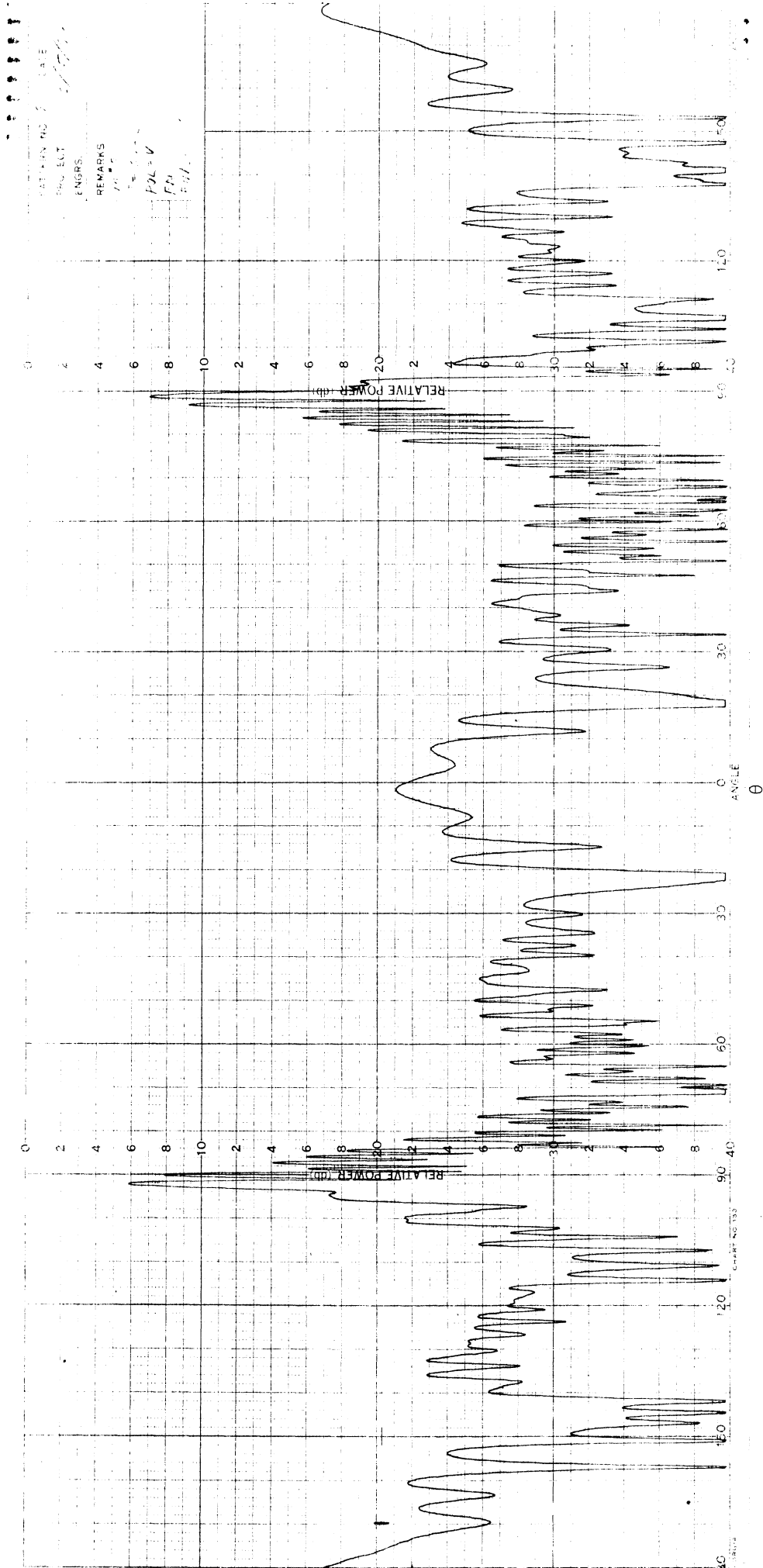


Figure 38: Backscatter characteristics of missile #3; frequency 12.23 GHz, vertical polarization, without nose cone, $\phi = 45^\circ$, 10" calibration sphere.

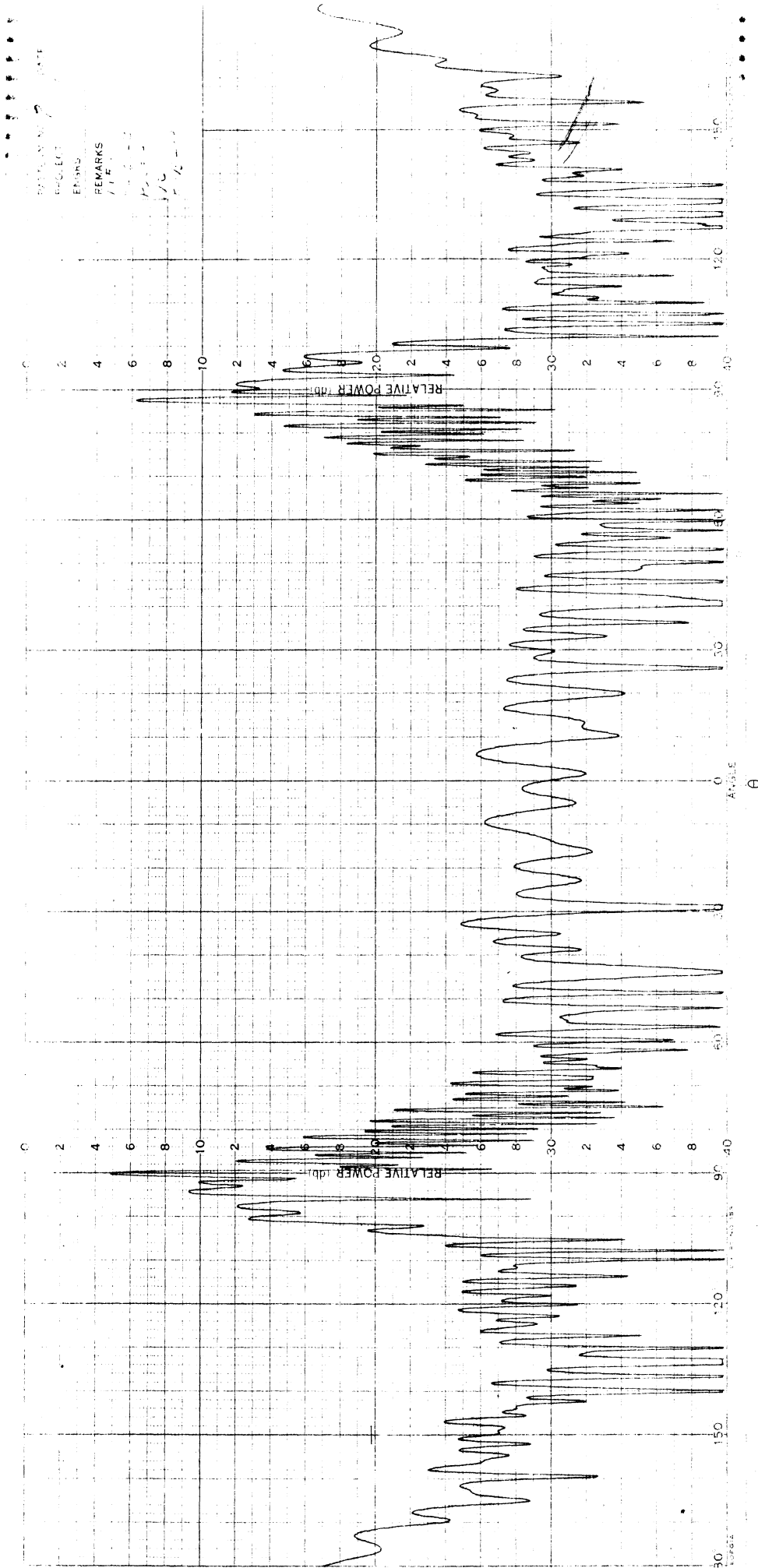


Figure 39: Backscatter characteristics of missile #3; frequency 12.23 GHz, horizontal polarization, with nose cone, $\phi = 0^\circ$, 10" calibration sphere.

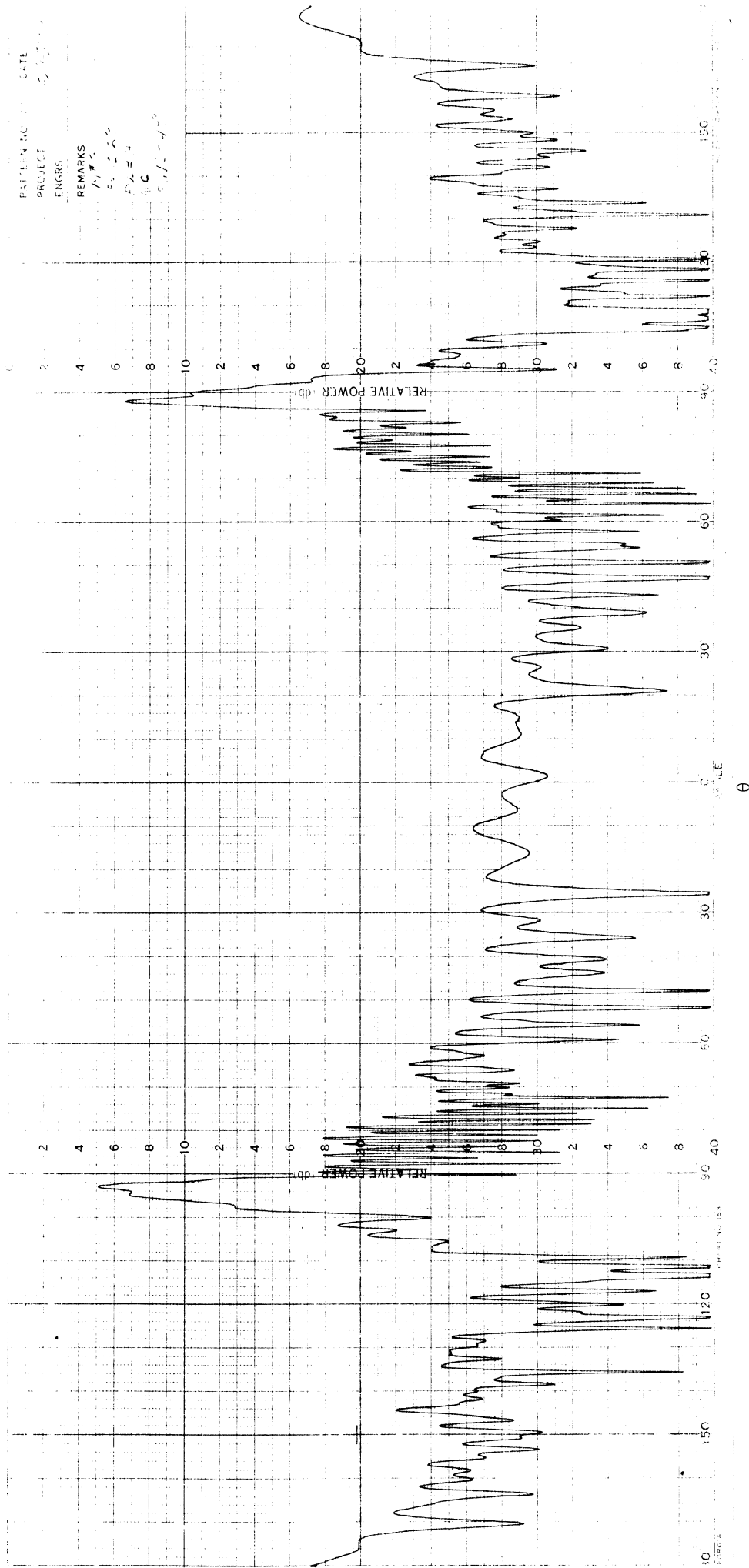


Figure 40: Backscatter characteristics of missile #3; frequency 12.23 GHz, horizontal polarization with nose cone, $\phi = 45^\circ$, 10" calibration sphere.

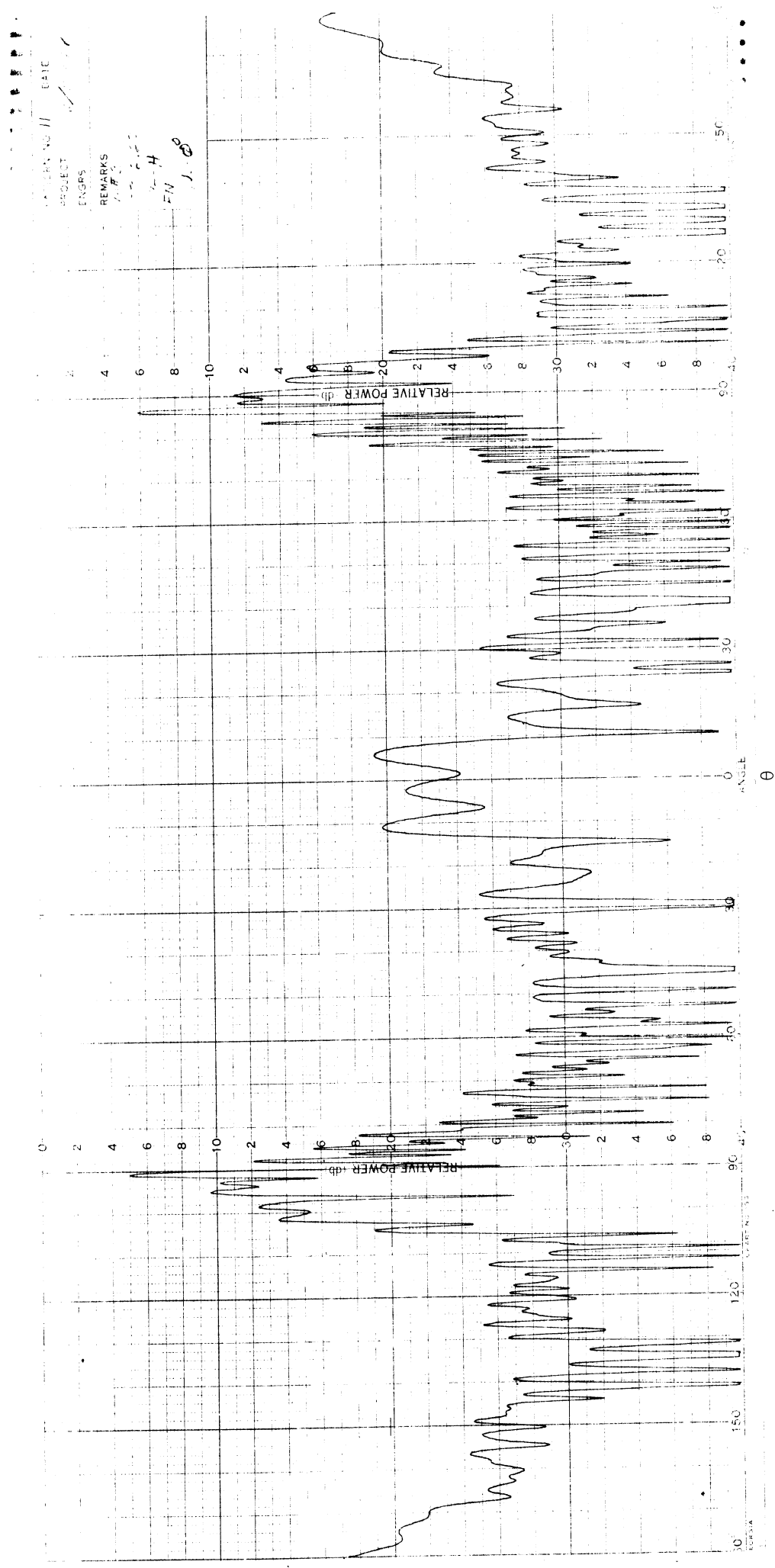


Figure 41: Backscatter characteristics of missile #3; frequency 12.23 GHz, horizontal polarization, without nose cone, $\phi = 0^\circ$, 10° calibration sphere.

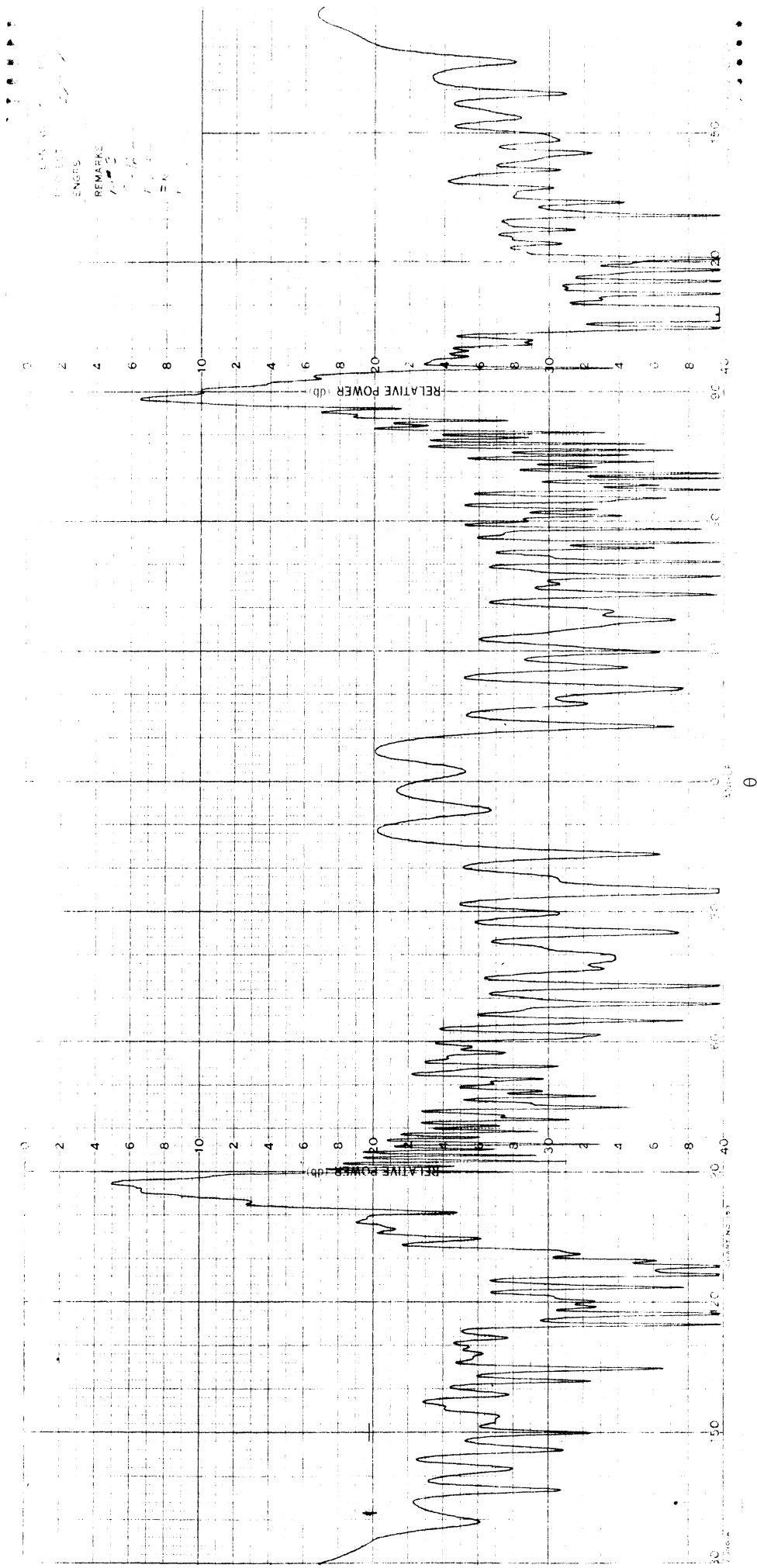


Figure 42: Backscatter characteristics of missile #3; frequency 12.23 GHz, horizontal polarization, without nose cone, $\phi = 45^\circ$, 10" calibration sphere.