[redacted]

5 June 1945

[redacted]

[redacted] COPY NO [redacted]

NAVAL RESEARCH LABORATORY
WASHINGTON 20, D. C.

FR-2553

ANTENNA PATTERN MEASUREMENTS ON USS DADE (APA-99)

Martin Katzin,
Coordinator

Radio Division - Consultant Group

Report No. R-2553; Problem No. S403

5416

[redacted]

Section 1
Approved by: S. G. Lutz, Head, Measurements & Direction Finder Section

Section 2
Approved by: R. C. Guthrie, Head, Search Radar Section

Section 3
Approved by: J. P. Hagen, Head, Centimeter Wave Research Section

Reviewed by: Dr. John M. Miller, Head, Consultant Group

Dr. A. Hoyt Taylor,
Superintendent, Radio Division

A. H. Van Keuren, Rear Admiral, USN (Ret.)
Director, Naval Research Laboratory

[redacted]

Table of Contents

INTRODUCTION

ANTENNA PATTERN MEASUREMENTS ON USS DADE (APA-99)

0-1. CNO Speedletter Serial 0230620 of 17 May 1944 requested that pattern measurements be made on all antennas of AGC class ships. USS DADE was made available for pattern measurements off the Chesapeake Bay Annex of the Naval Research Laboratory on 2-3 December 1944.

0-2. Pattern measurements were made on all communication antennas. The azimuthal coverage pattern of the SG, SC-4, BM, BN and BK antennas were measured and the directive patterns of the SC-4 and BM were taken.

0-3. This report is divided into three sections. Section 1 deals with the pattern measurements of the communication antennas. Section 2 gives the measurements of the SC-4, BM, BN, and BK. Section 3 contains the coverage pattern of the SG antenna.

0-4. Summary of Conclusions:

0-4. 1. The communication antenna patterns are typical of this class of ship.

0-4. 2. The patterns of the BM, BN and BK show good composite coverage, in general, although they are quite ragged because of rough weather which made the measurements difficult. The SC-4 had a bad rotating joint and was erratic in operation.

0-4. 3. The SG gives good all-around coverage.

SECTION I

COMMUNICATION ANTENNA PATTERNS

Encl:
(A) Tables 1 and 2.
(B) Plates 31.

1-1 Tests to determine the radiation patterns of the communication antennas aboard the USS DADE (APA-99) were made on 2-3 December 1944 at CBA. The schedules of the transmitting and receiving tests are shown in enclosure (A), Tables 1 and 2. The patterns obtained are shown in enclosure (B). A discussion of the method of obtaining the patterns is given in the succeeding paragraphs.

1-2 The transmitting antennas were grouped together for test under Schedule 1, Table 1, and all items A to G inclusive of each test were performed simultaneously. All receiving antennas were grouped together under schedule 2, Table 2. In addition, three SCR608 antennas and one transmitting antenna, #4 (TBK), were run during performance of Schedule 2.

1-3. The transmitter antenna numbers used during the tests and in this report are the position numbers of the connected transmitters. No other identifying numbers were found aboard ship. The receiving antennas were identified and the correct receiving antenna numbers are used in this report.

1-4. The tests were conducted in the order shown in Tables 1 and 2. The transmitting antennas were energized by the transmitter and at the frequency shown in the table immediately below each antenna number. The receiving antennas were energized by four portable transmitters, taken aboard for that purpose, at the frequency shown on the left of Table 2. The ship made two complete circles during each test at a position approximately 4.5 miles southeast of CBA. Continuous transmission was maintained on all antennas under test except for momentary interruptions. These interruptions which occured at 30 degree intervals of relative bearing served to mark the graphic recordings ashore with bearing reference marks.

1-5. The reception of the test transmissions was at Building 5, CBA. Five National NC200 receivers and two Hallicrafters 5-27 receivers were used for reception. Each receiver drove a recording milliammeter by means of a d-c amplifier connected to its avc. A signal generator was used to calibrate each receiver-recorder unit and this calibration was used in making the data from the recorder charts to plot the patterns obtained.

1-6 C mmunication was maintained between the ship and CBA during the tests. The relative bearing and time for each mark (interruption of transmi sion) were given over the communication circuit. This informatio was recorded on the charts by personnel manning the receivers. The relative bearings of CBA from the ship were made on a suitable target at CBA. A correction of plus 2 degrees was made to the rel tive bearings as given by the ship to account for the displacement etween Building 5 and the target.

1-8. F eld intensities of the transmissions under test were not made becau e of lack of facilities. The accuracy of the bearings shown is b lieved to be within plus or minus 5 degrees.

Enclosure A)

TABLE 1

USS DADE

Schedule 1 - Test of Transmitting Antenna

		Test 1	Test 2	Test 3
A	Ant.	3	10	-
	Trans	TBM	TCS	TCP
	Freq. (kc)	2800	2600	2240
B	Ant.	1	12	1
	Trans.	TDE	TCS	TDE
	Freq. (kc)	4200	3900	3600
C	Ant.	2	9	2
	Trans.	TDE	TCS	TDE
	Freq. (kc)	6600	6250	5800
D	Ant.	5	13	5
	Trans.	TBL	TCS	TBL
	Freq. (kc)	10,400	9,800	9,200
E	Ant.	-	11	-
	Trans.	-	TCS	-
	Freq. (kc)	-	11,900	-
F	Ant.	FWD	-	AFT
	Trans.	TBS	-	TBS
	Freq. (Mc)	65.74	-	65.74
G	Ant.	STB	Port	Port
	Trans.	TDQ	TDQ	SCR-624
	Freq. (Mc)	121.5	121.5	126

[redacted]

Enclosure (A)

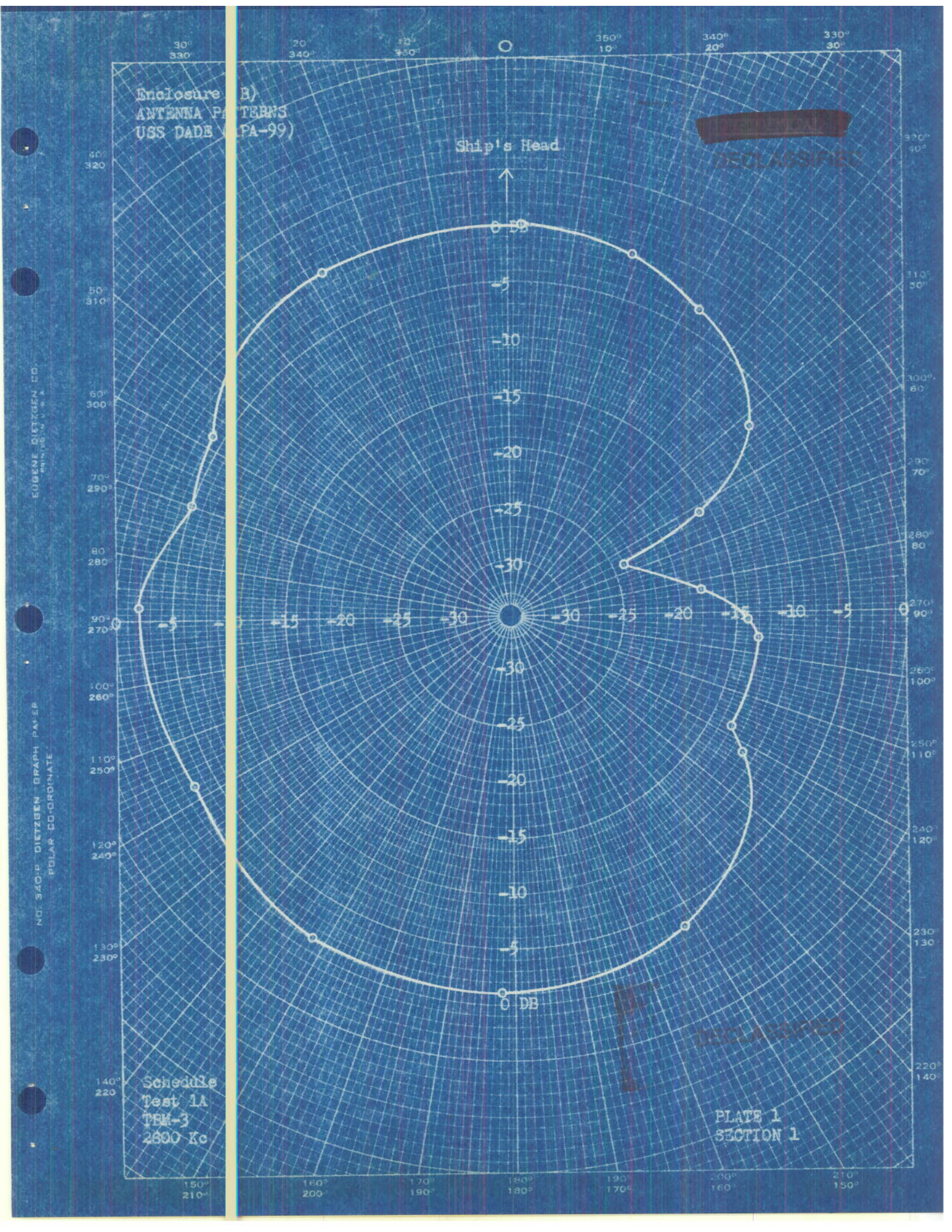
TABLE 2

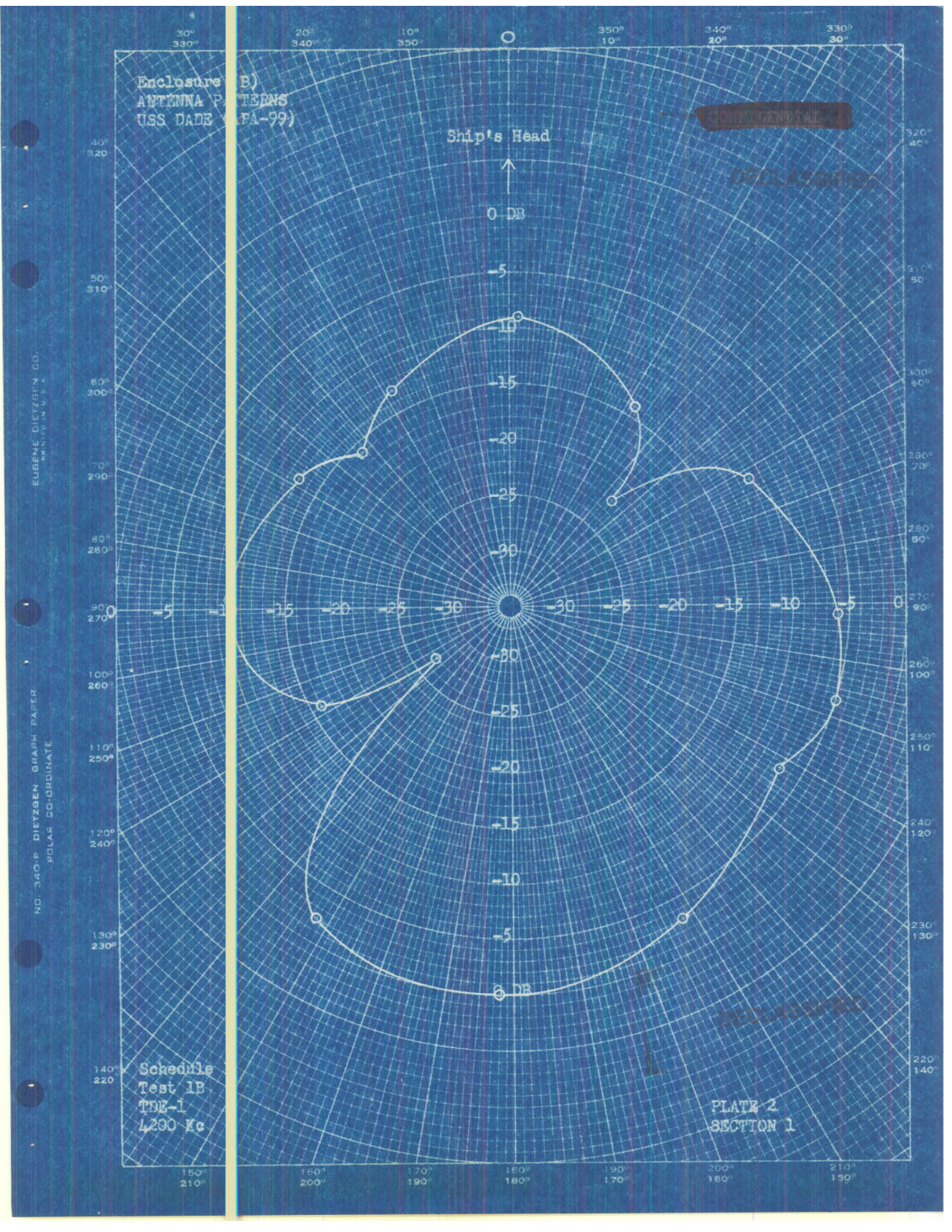
USS DADE

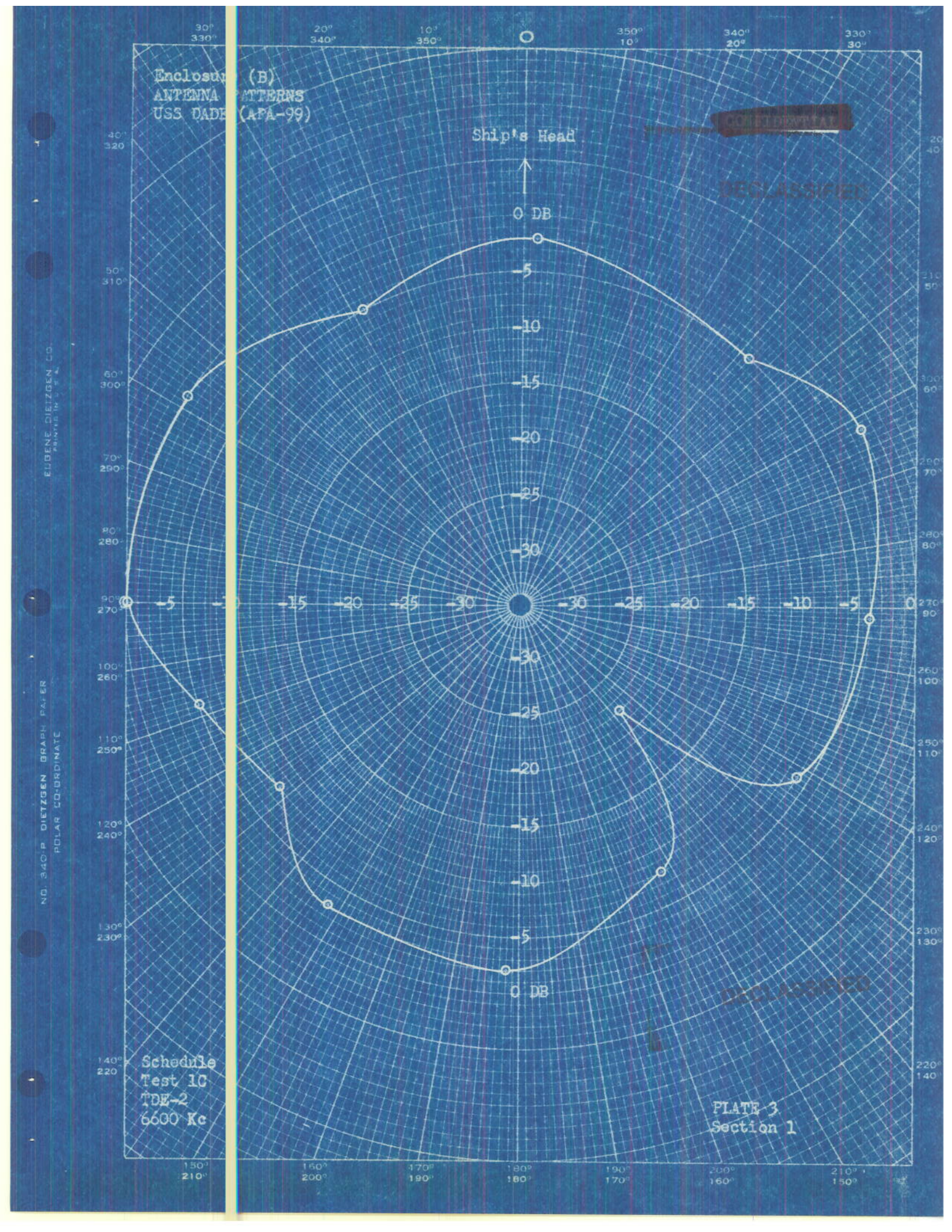
Schedule 2 - Test of Receiving Antennas

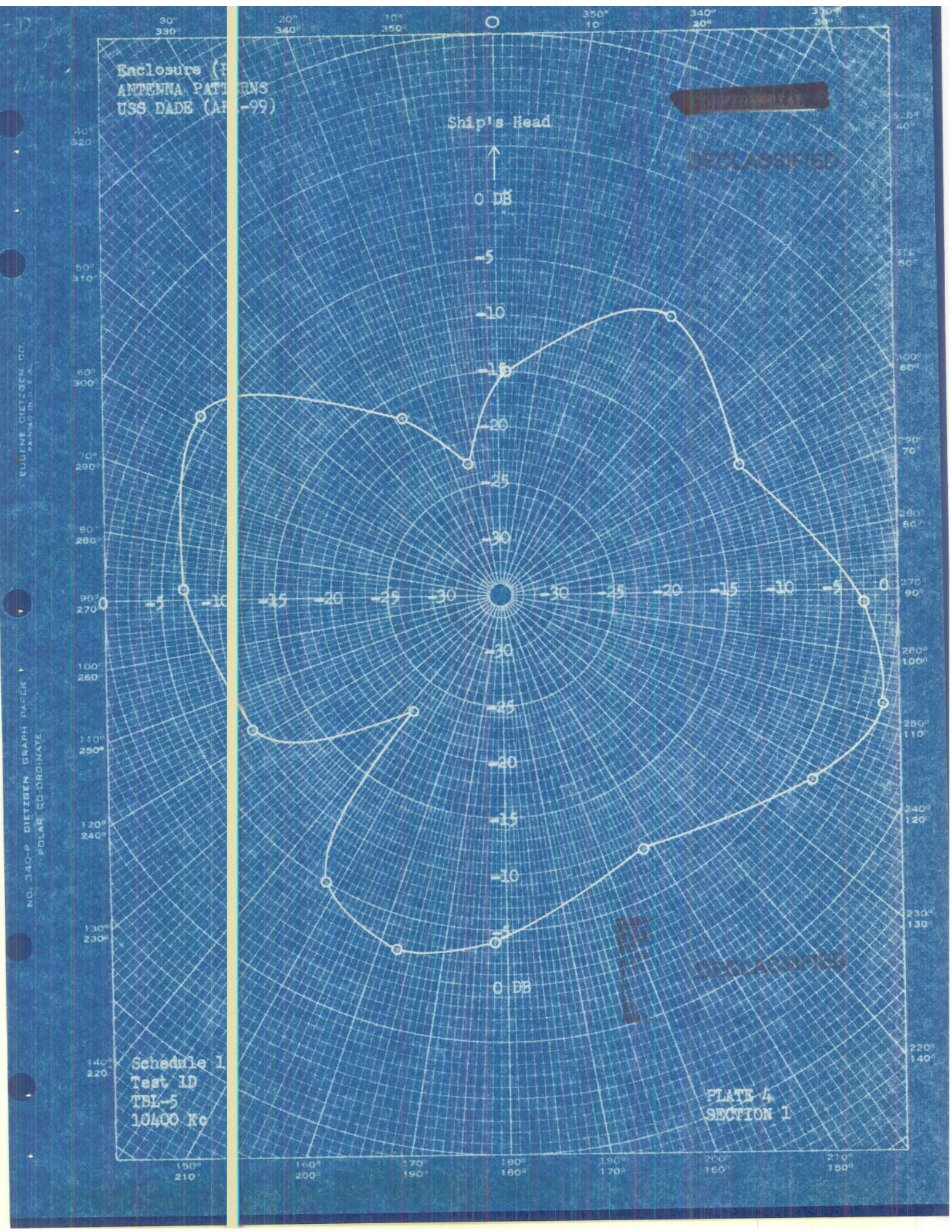
	Freq.	Test 1	Test 2	Test 3	Test 4
A	2545 kc	2	7	SCR-608-3 30.4 Mc	---
B	4430 kc	1	6	- - -	T.A.-4 TBK 9100 kc
C	8450 kc	3	5	8	- -
D	14,100 kc	4	- -	9	- -
G		SCR-608-4 34.9 Mc	- - - -	- - - -	SCR-608 Port 34.9 Mc

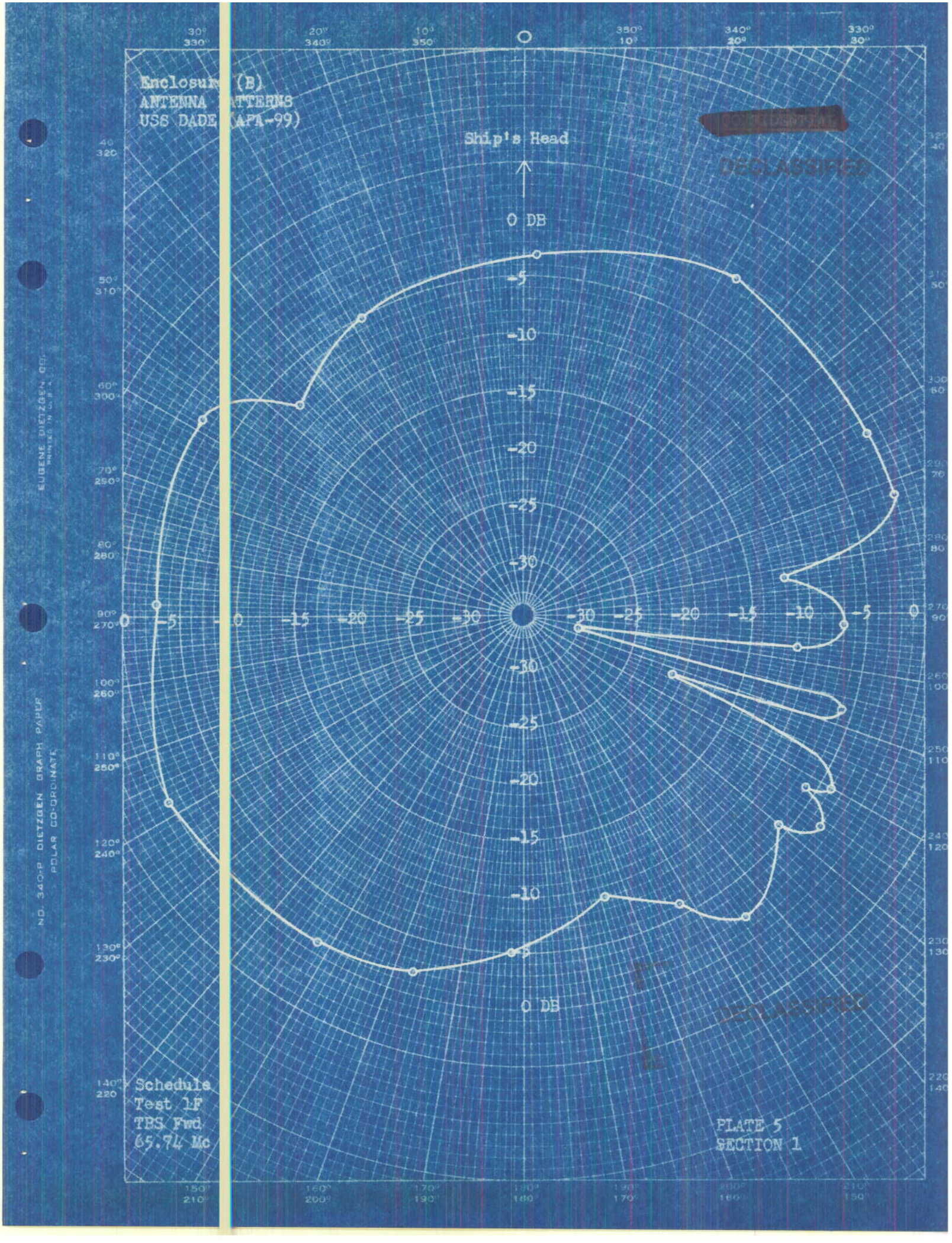
[redacted]

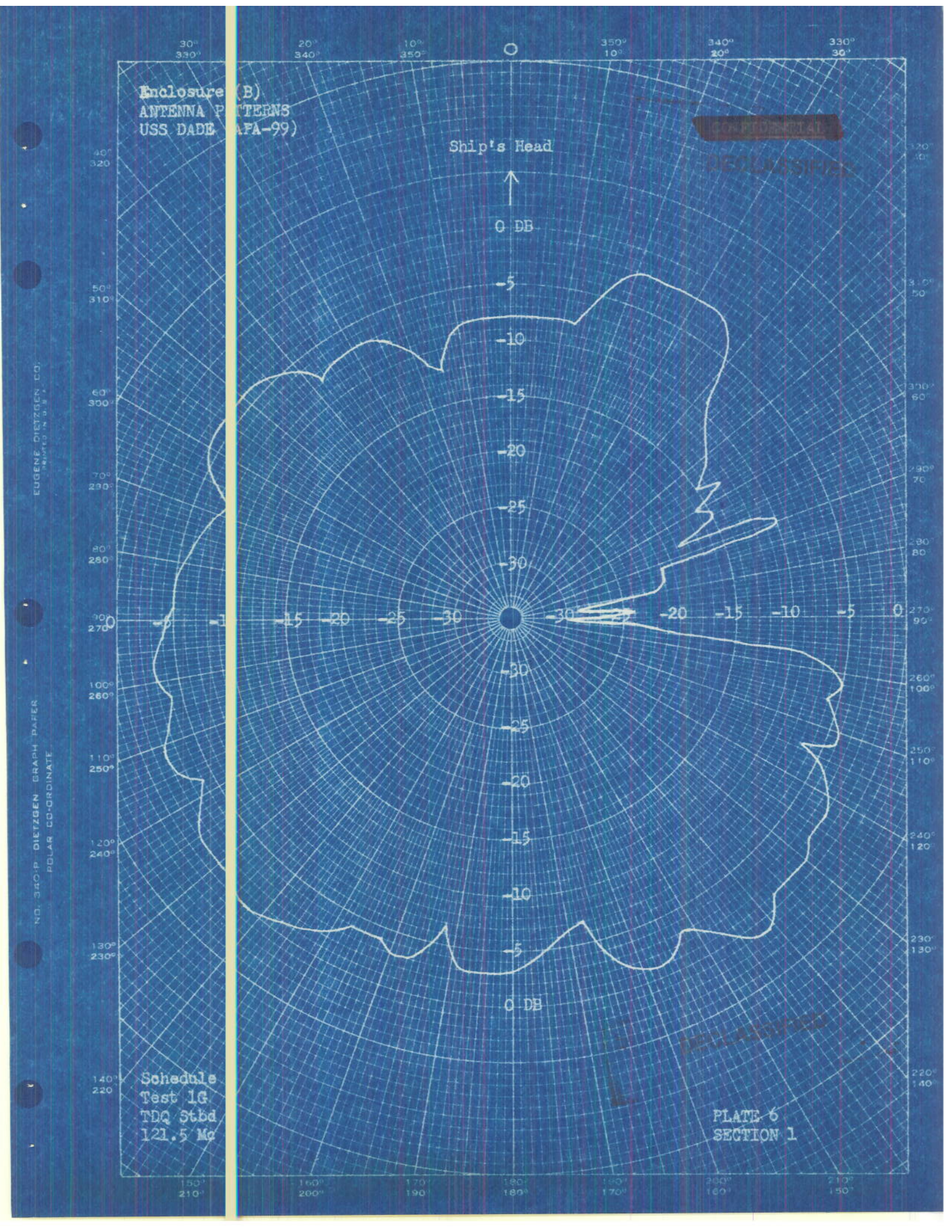

Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
Schedule
Test 1A
TBM-3
2800 Kc
PLATE 1
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

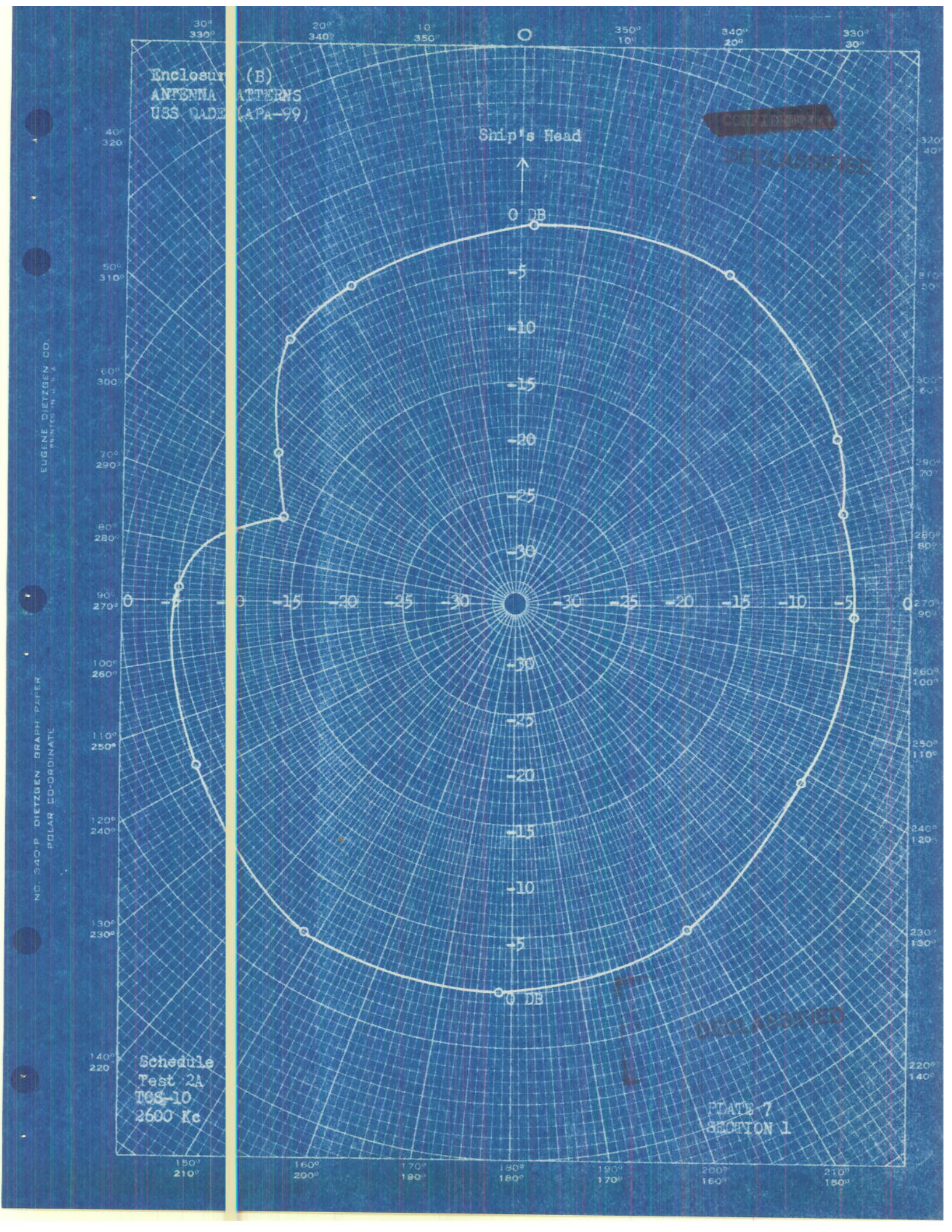

Enclosure (B)
ANTENNA PATTERNS
USS DADE (DFA-99)
CONFIDENTIAL
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule 1
Test 1B
TDE-1
4200 Kc
PLATE 2
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

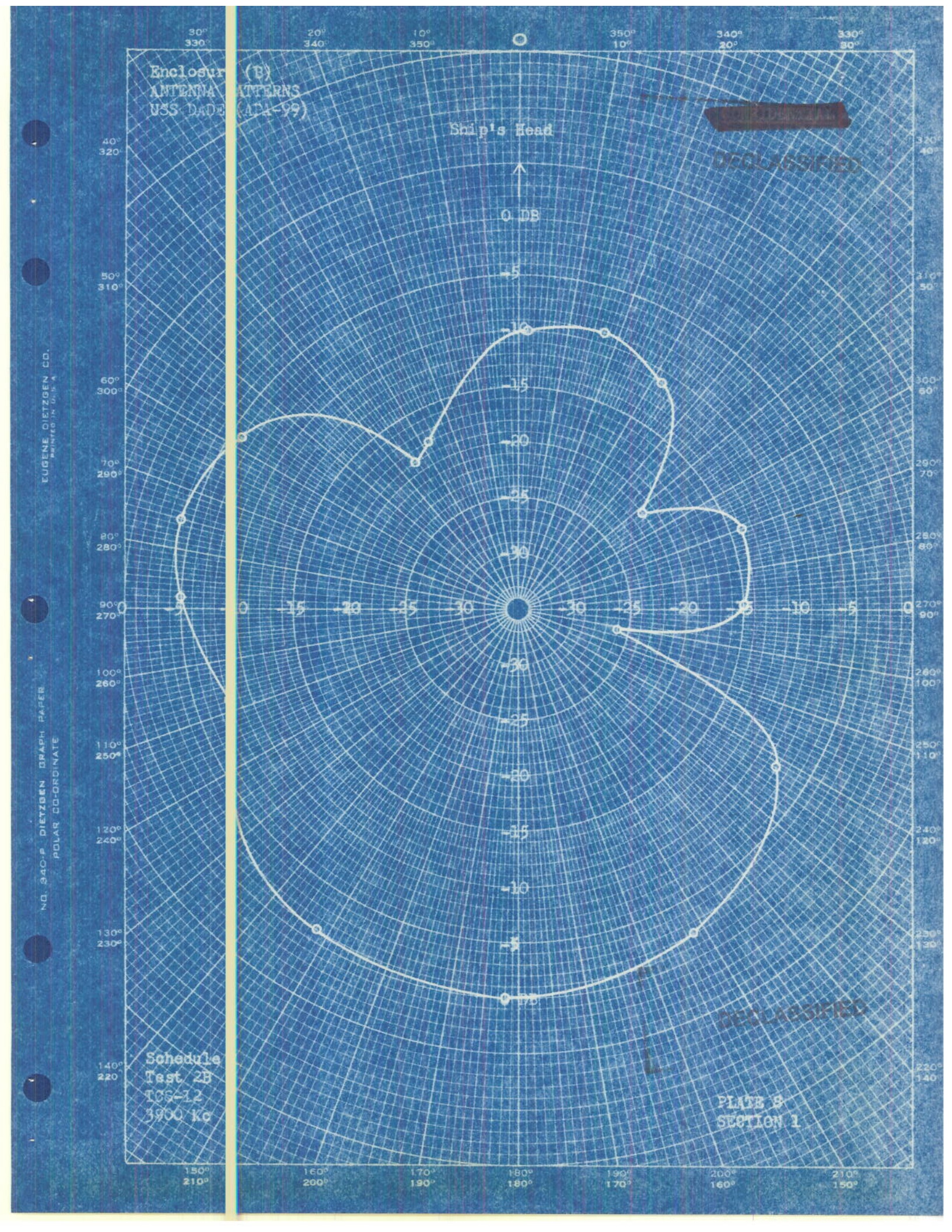

Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
CONFIDENTIAL
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
DECLASSIFIED
DECLASSIFIED
Schedule
Test 1C
TDE-2
6600 Kc
PLATE 3
Section 1
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE
EUGENE DIETZGEN CO.

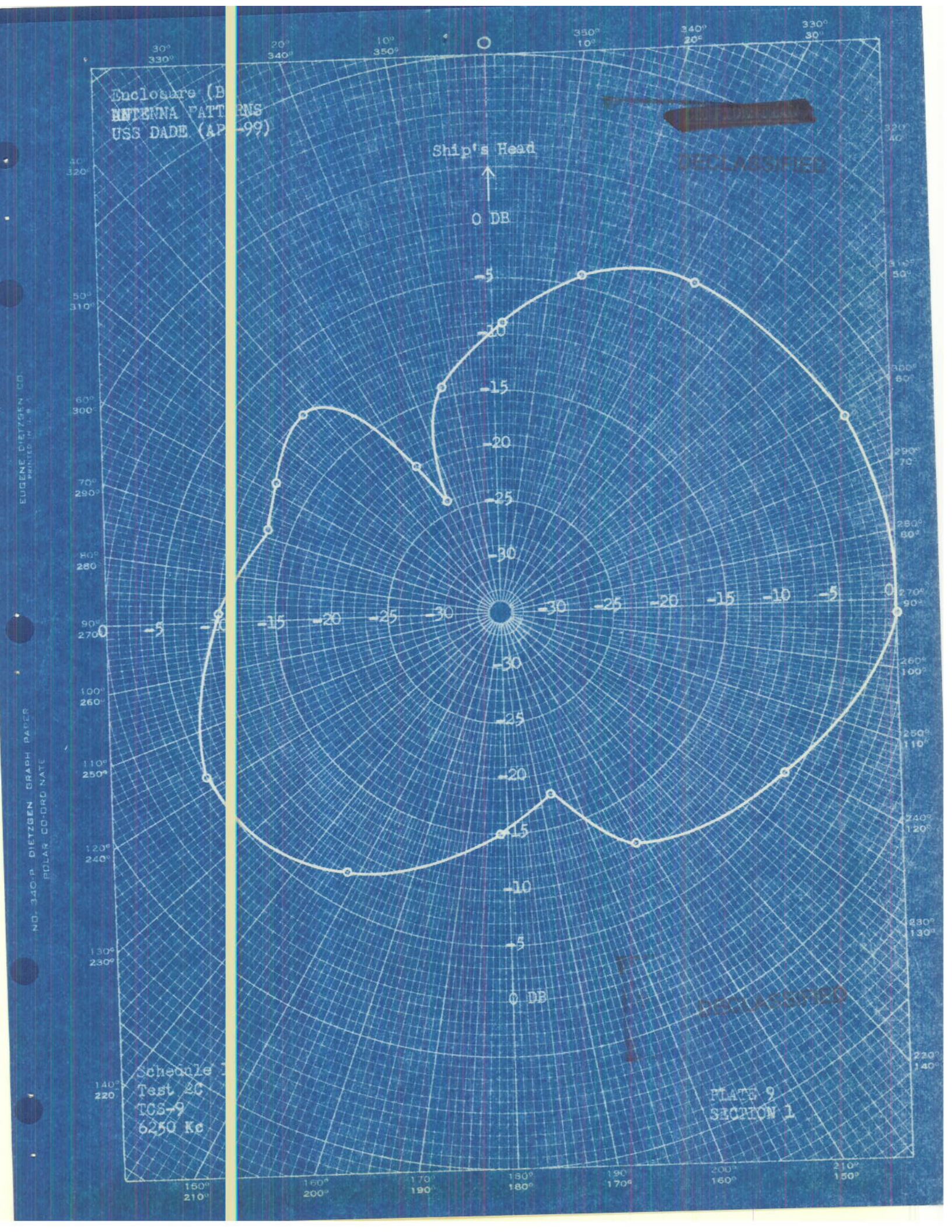

Enclosure (F
ANTENNA PATTERNS
USS DADE (AP -99)
[redacted]
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
DECLASSIFIED
DECLASSIFIED
Schedule 1
Test ID
TBL-5
10400 Kc
PLATE 4
SECTION 1
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

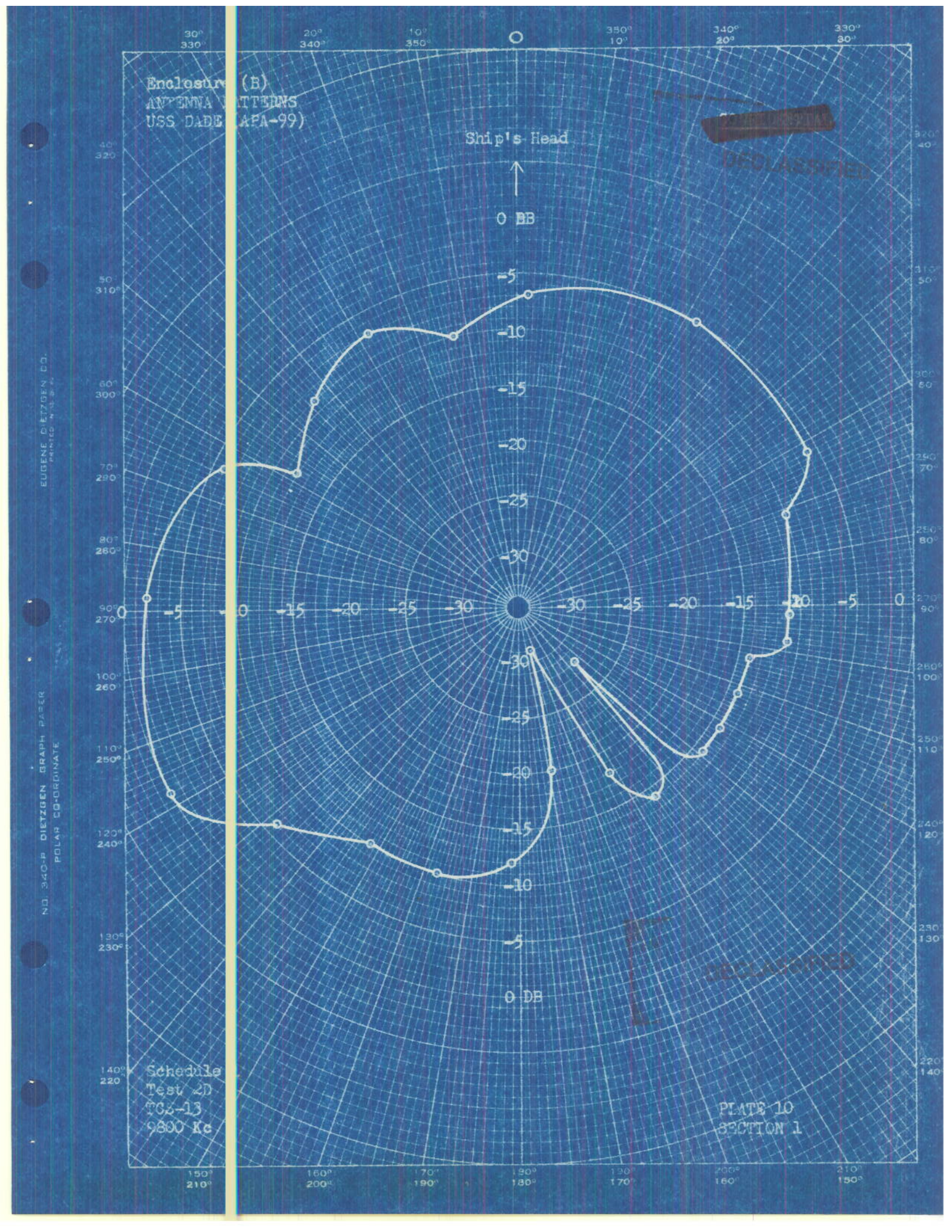

Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 1F
TBS Fwd
65.74 Mc
PLATE 5
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

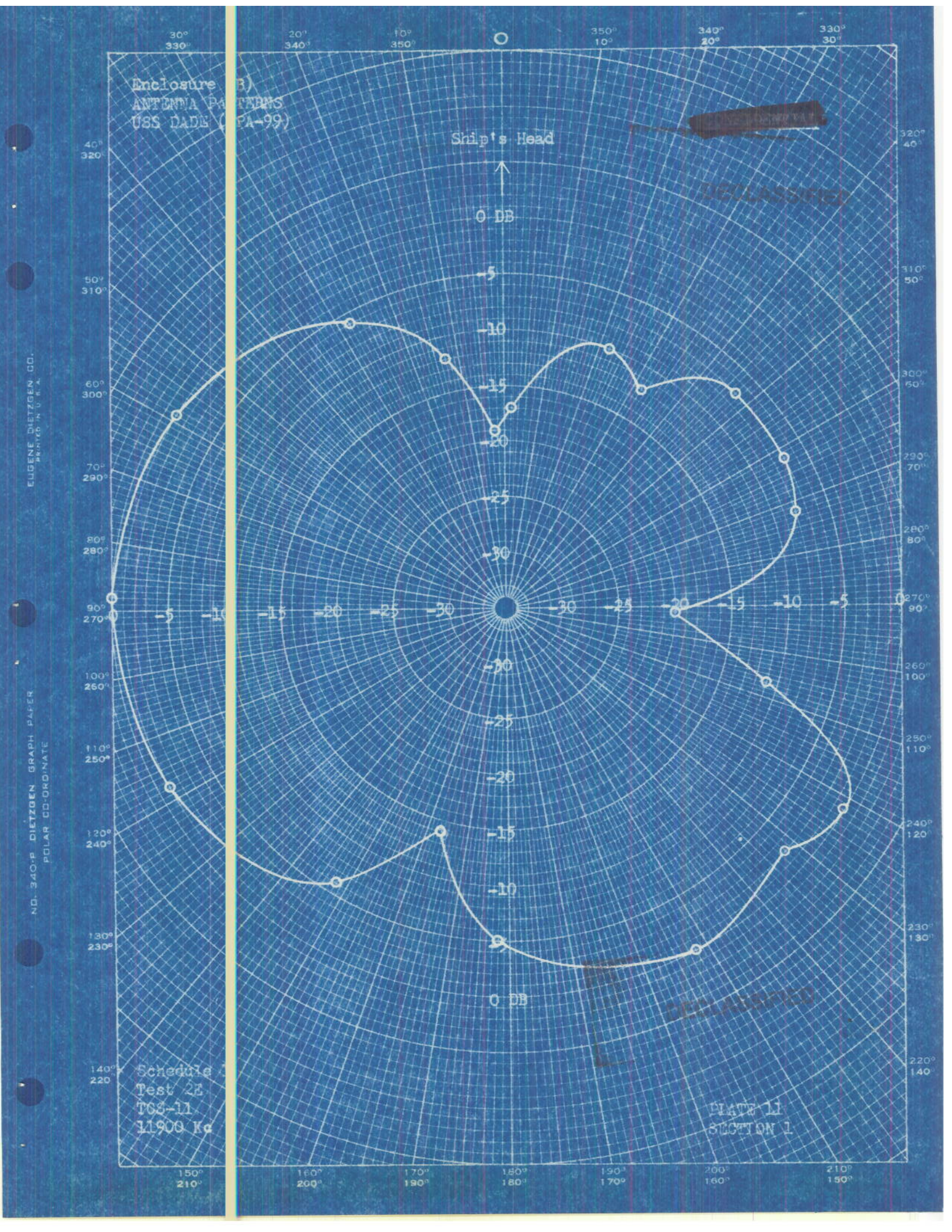

Enclosure (B)
ANTENNA PATTERNS
USS DADE (AFA-99)
CONFIDENTIAL
DECLASSIFIED
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 1G
TDQ Stbd
121.5 Mc
PLATE 6
SECTION 1
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

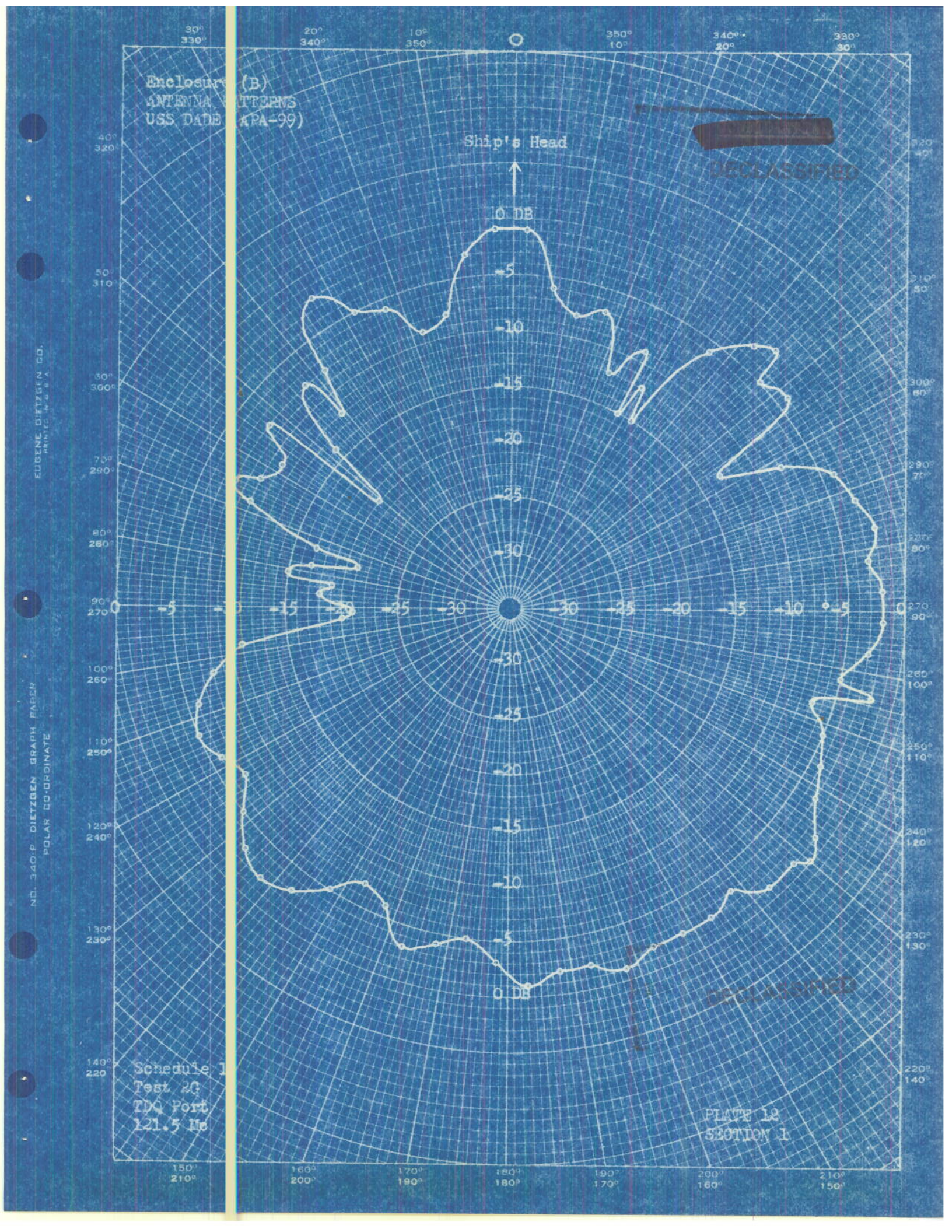

Enclosur (B)
ANTENNA ATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 2A
TCS-10
2600 Kc
PLATE 7
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

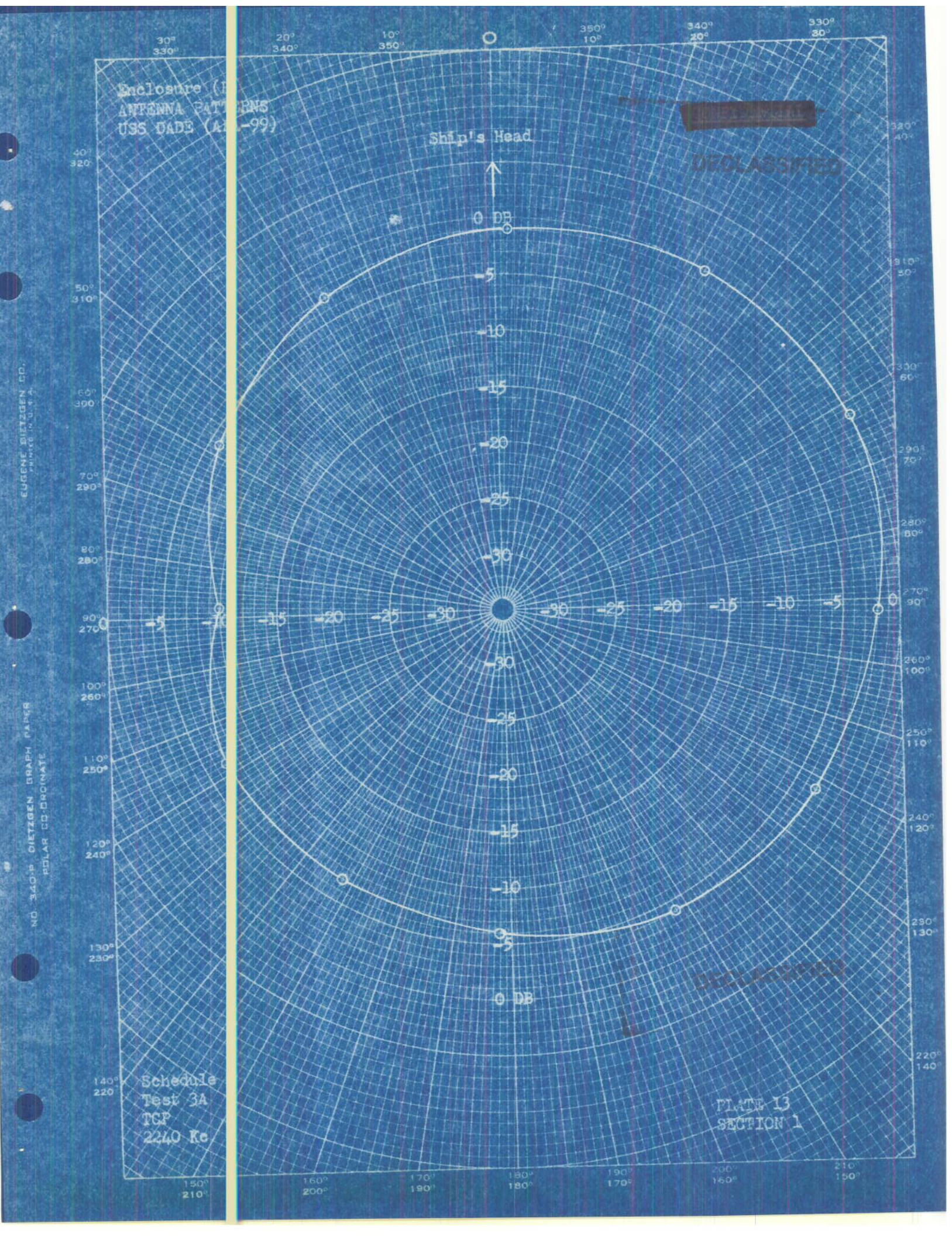

Enclosur (B)
ANTENNA ATTERNS
USS DADE (AP-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
-30
-25
-20
-15
-10
-5
0
Schedule
Test 2B
TCS-12
3900 Kc
PLATE B
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
PRINTED IN U.S.A.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

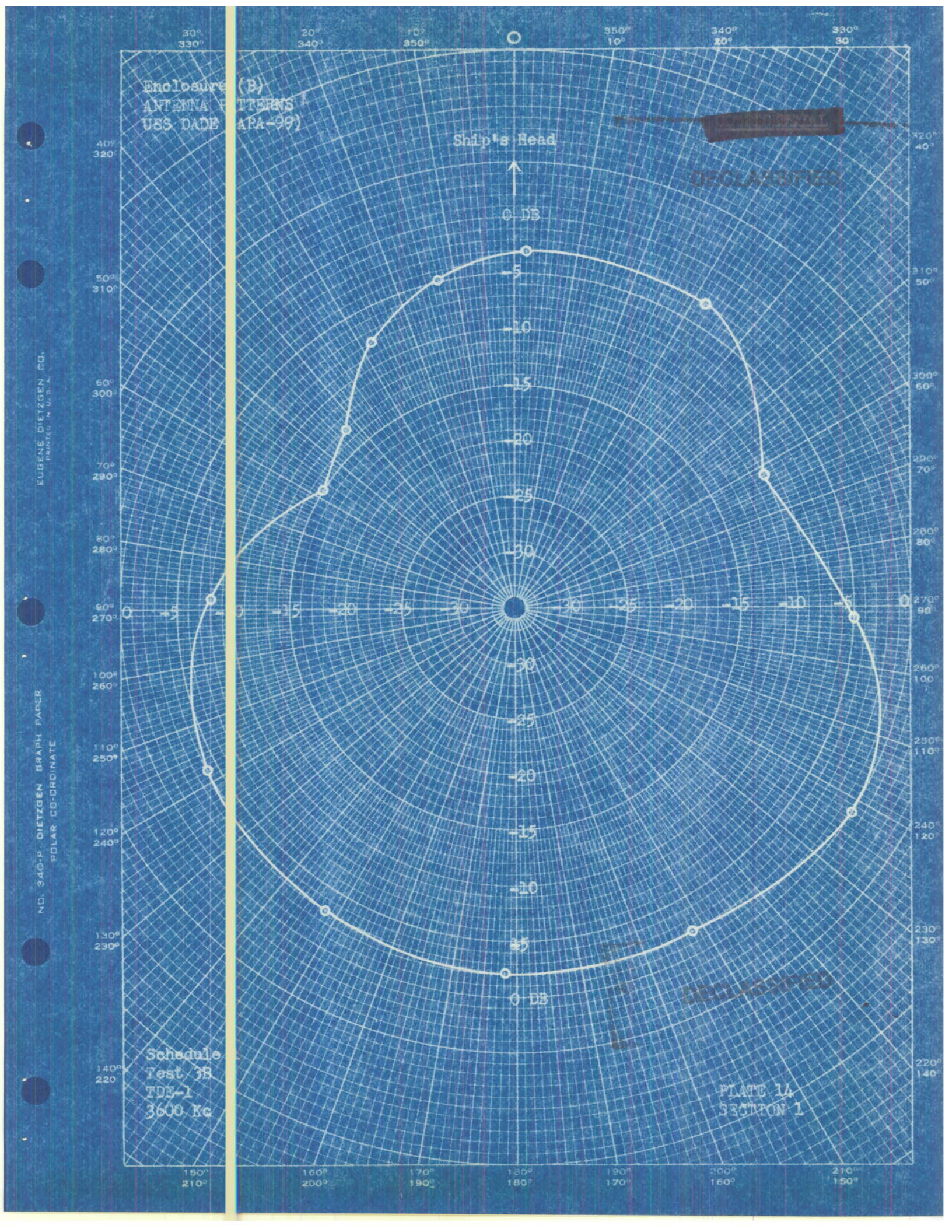

Enclosure (B
ANTENNA PATT RNS
USS DADE (AP -99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 2C
TCS-9
6250 Kc
PLATE 9
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-R DIETZGEN GRAPH PAPER
POLAR CO-ORD NATE

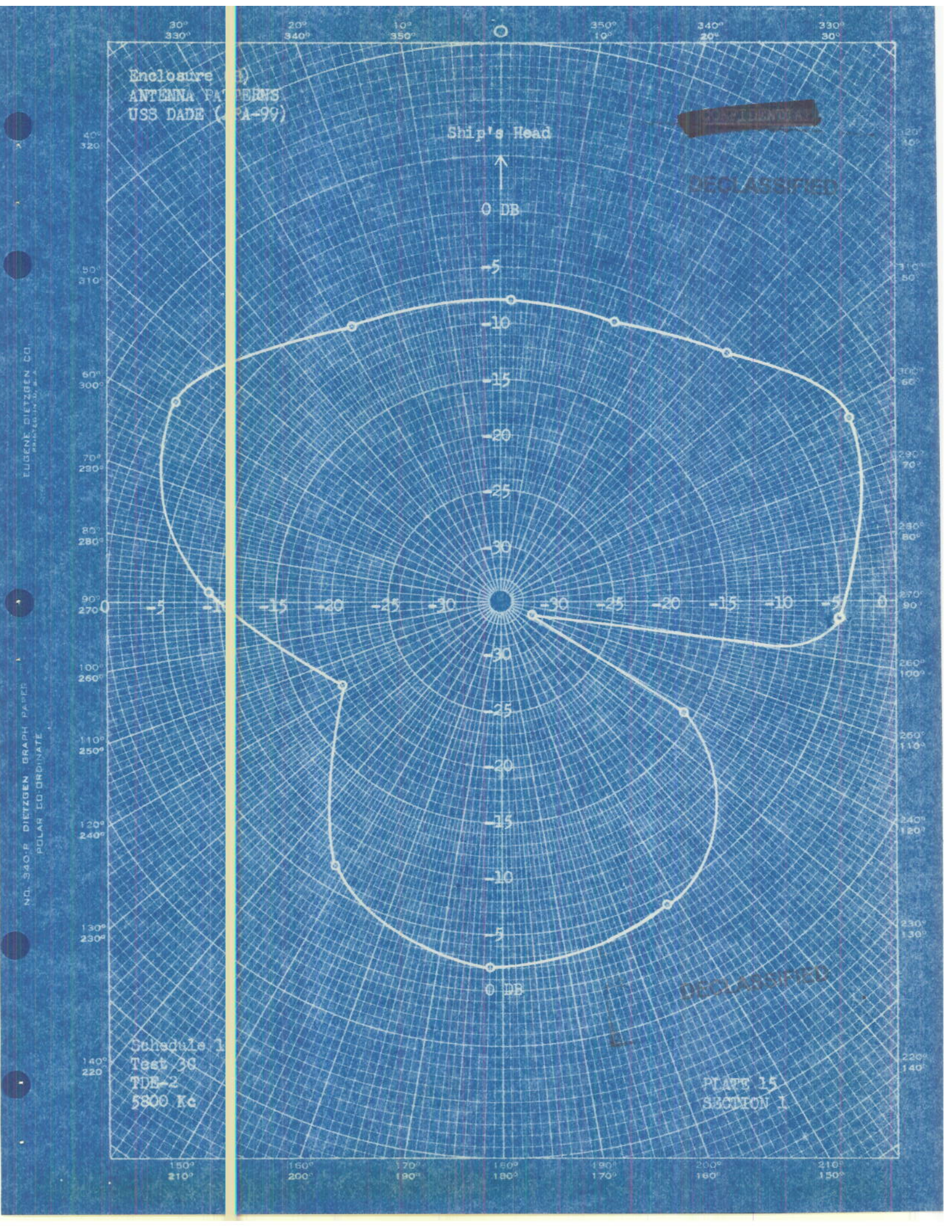

Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 2D
TG-13
9800 Kc
PLATE 10
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

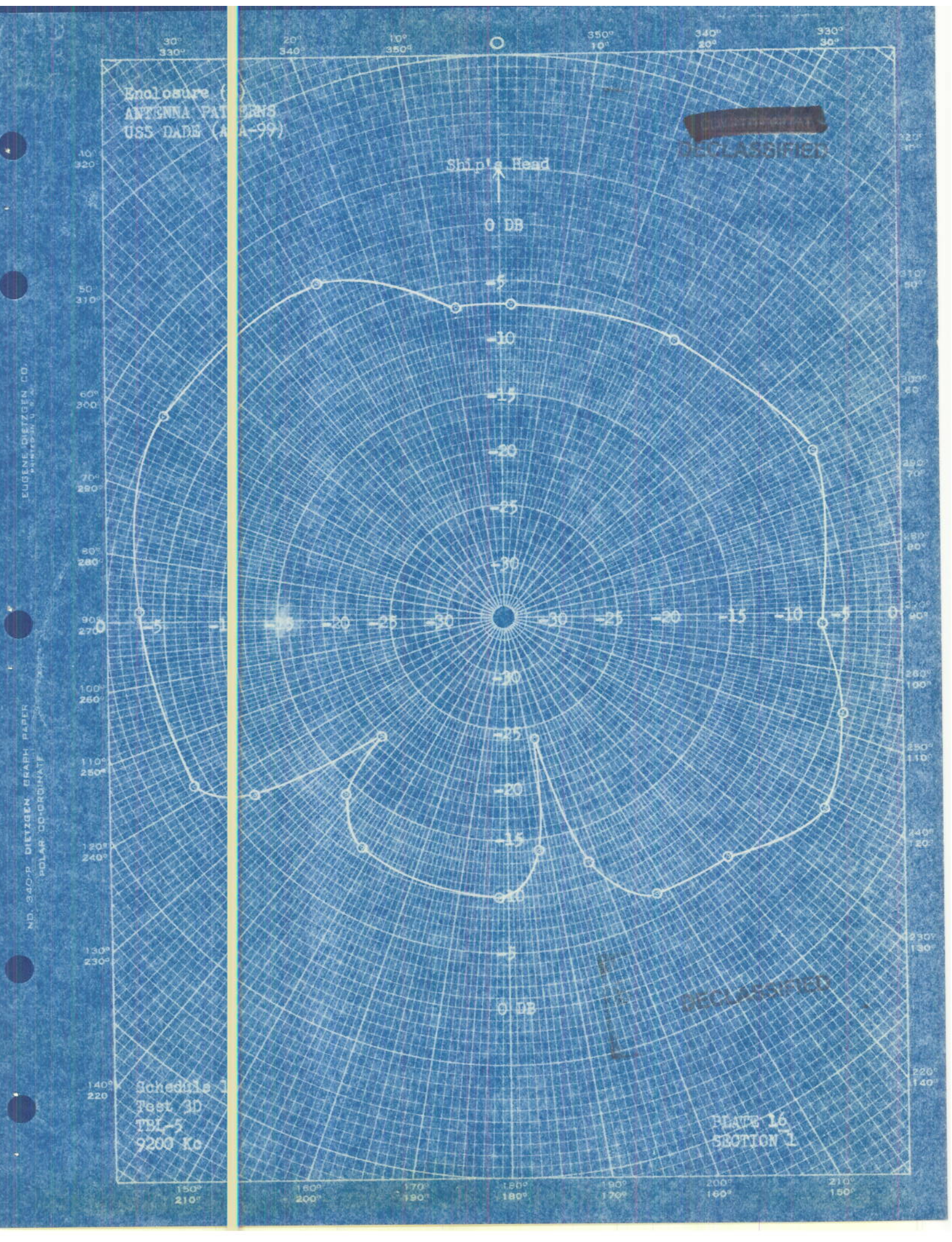

Enclosure (B)
ANTENNA PATTERNS
USS DADE (DFA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 2E
T68-11
11900 Kc
PLATE 11
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
PRINTED IN U.S.A.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

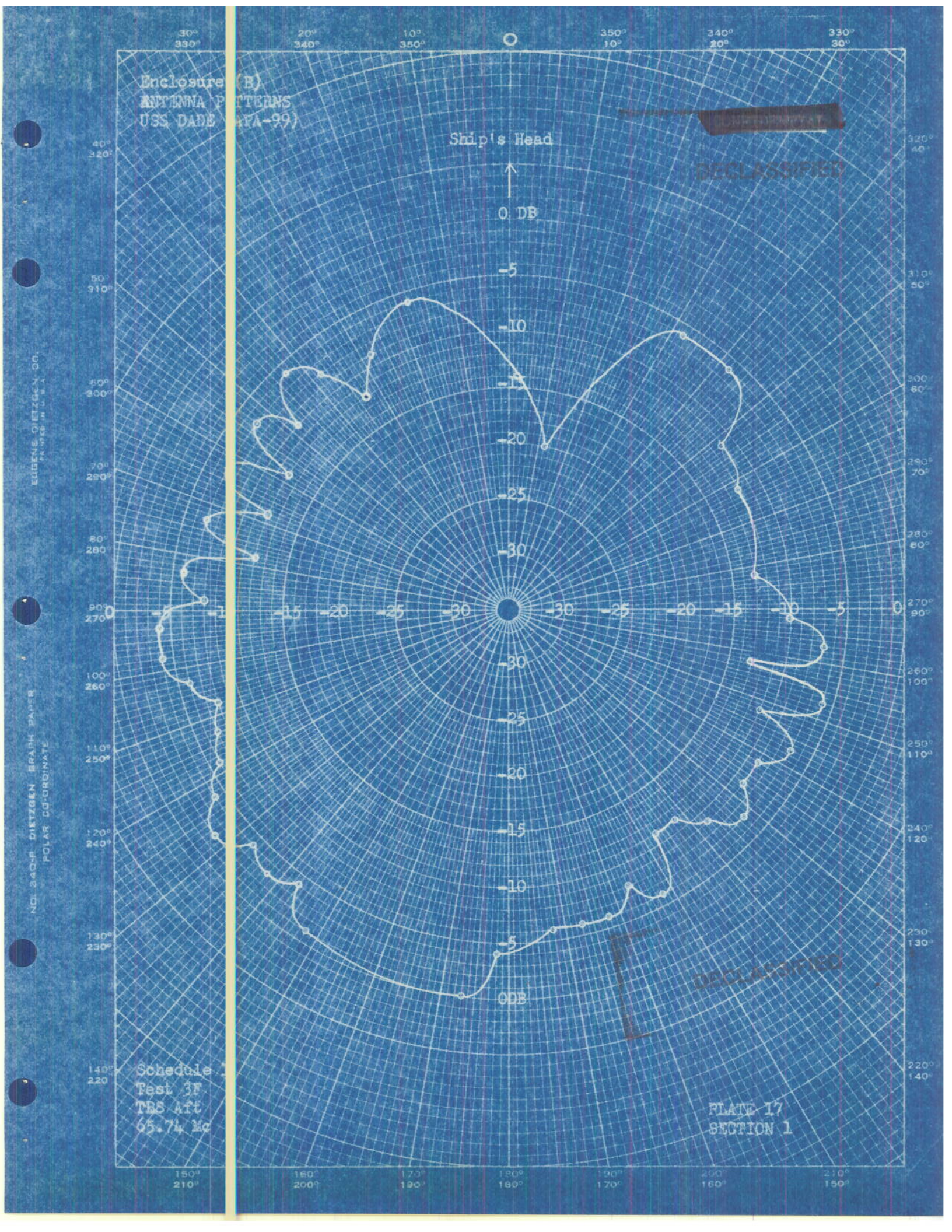

Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule 1
Test 20
TDC Port
121.5 Mc
PLATE 12
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

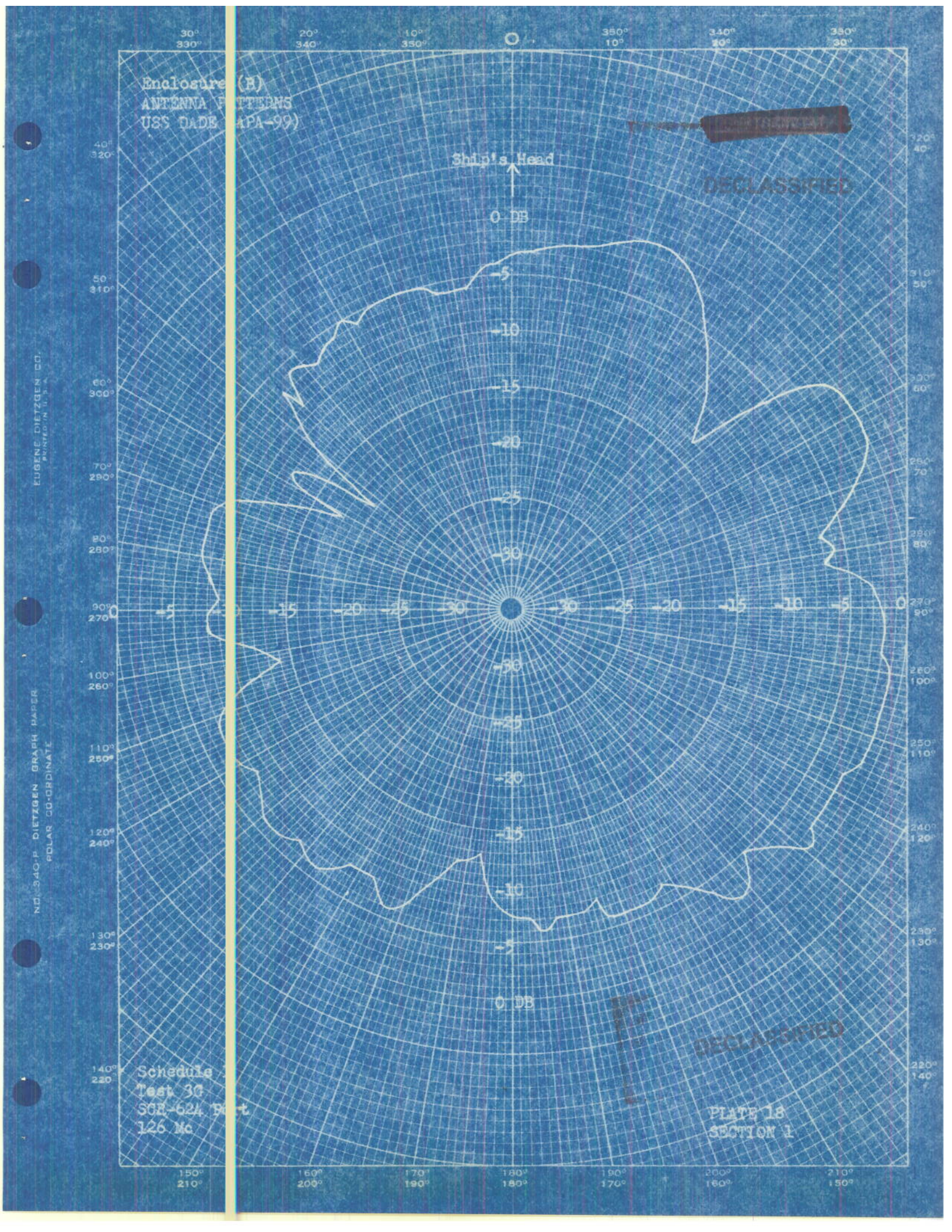

Enclosure (
ANTENNA PAT RNS
USS DADE (A -99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
DECLASSIFIED
DECLASSIFIED
Schedule
Test 3A
TCP
2240 Kc
PLATE 13
SECTION 1
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

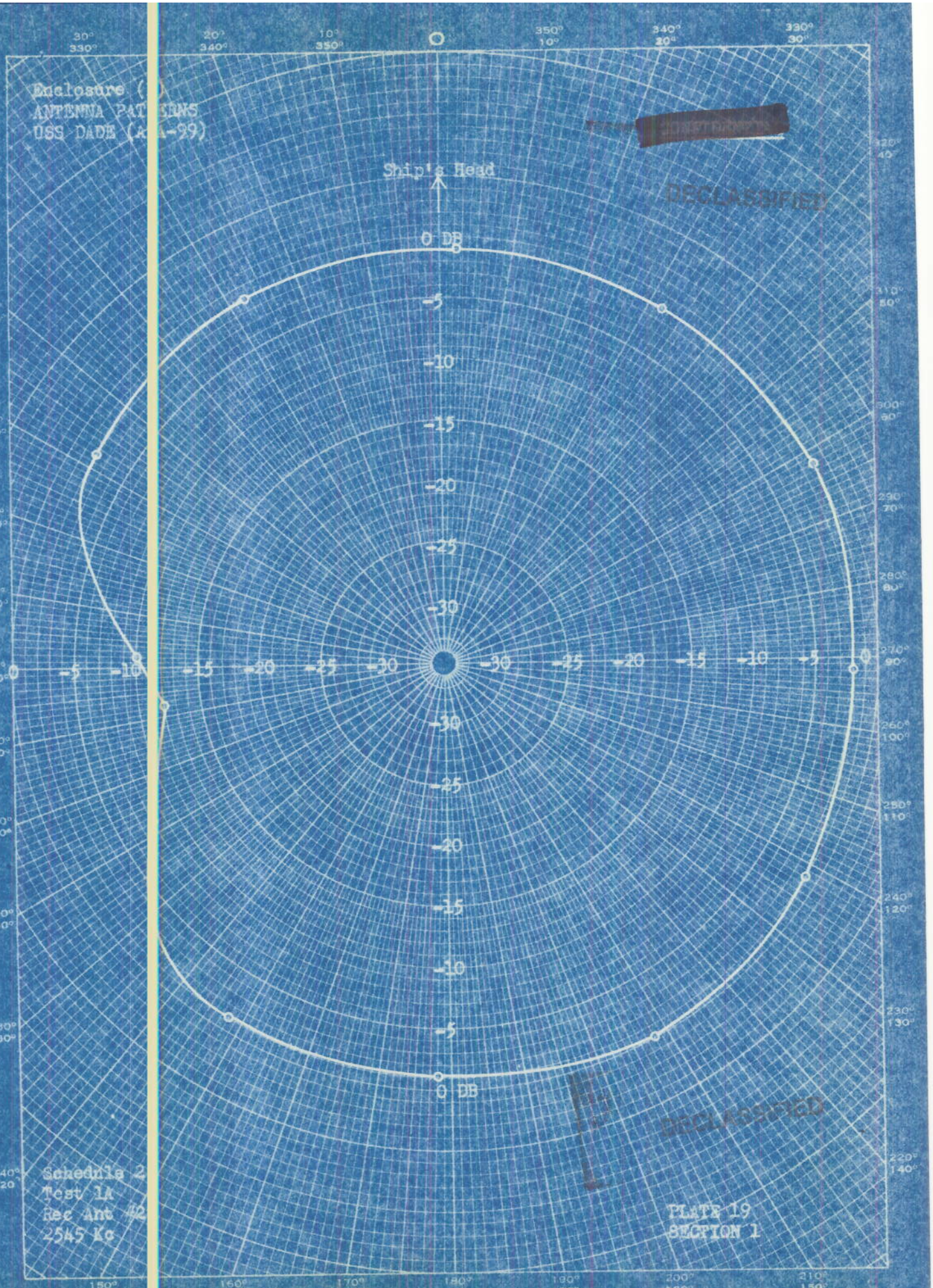

Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 3B
TDE-1
3600 Kc
PLATE 14
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

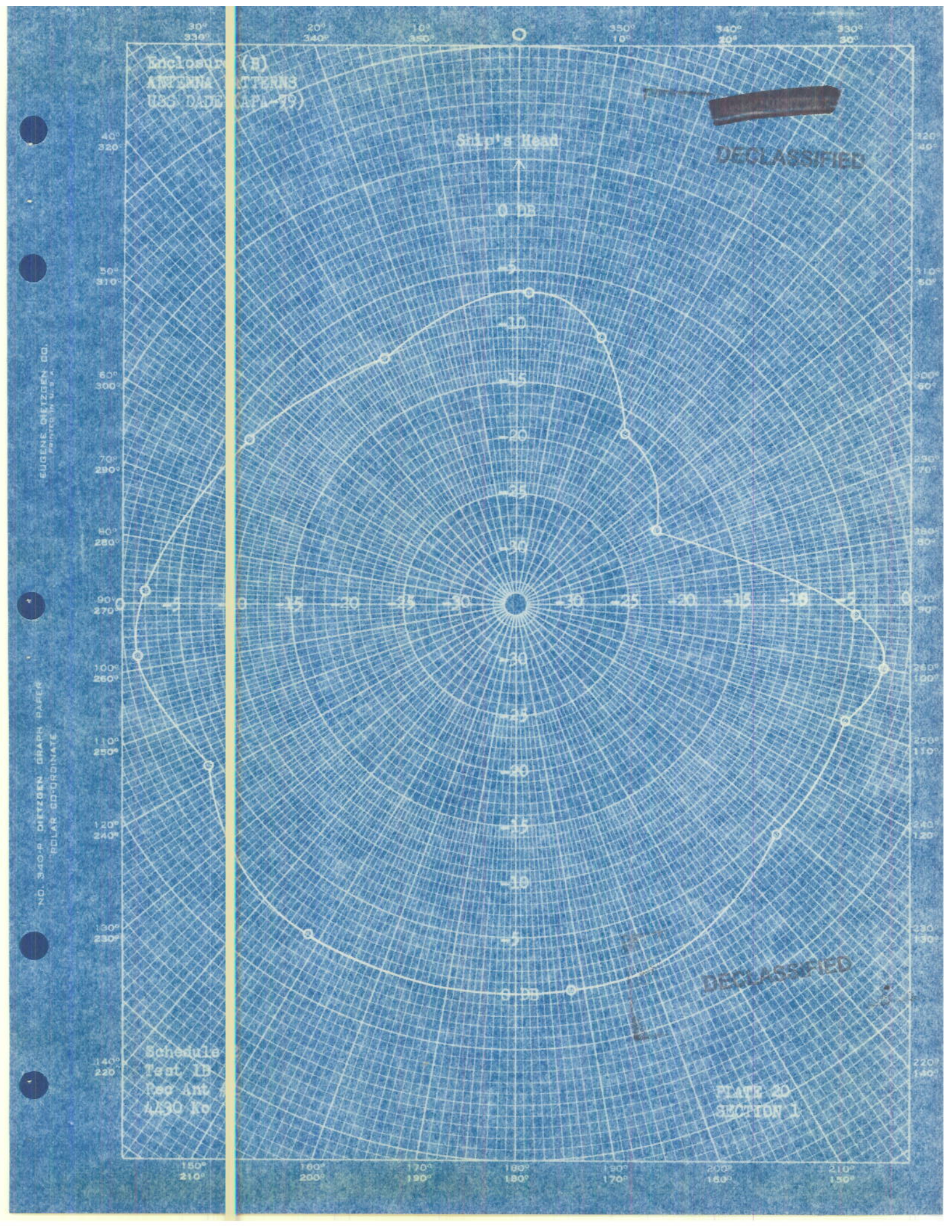

Enclosure (
ANTENNA PA ERNS
USS DADE (A-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule 1
Test 30
TDE-2
5800 Kc
PLATE 15
SECTION I
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

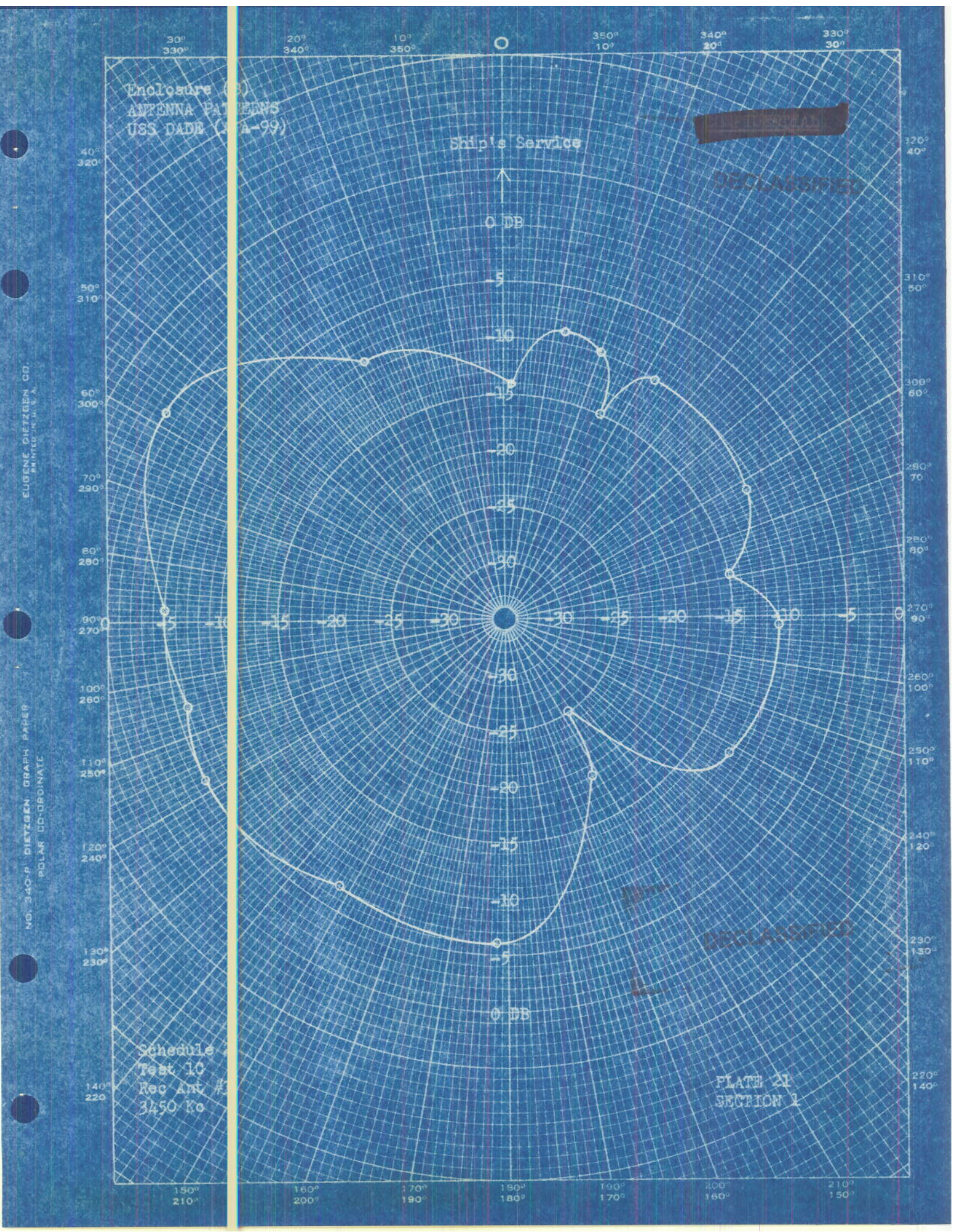

Enclosure ( )
ANTENNA PATTERNS
USS DADE (AVA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule 1
Test 3D
TBL-5
9200 Kc
PLATE 16
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR COORDINATE

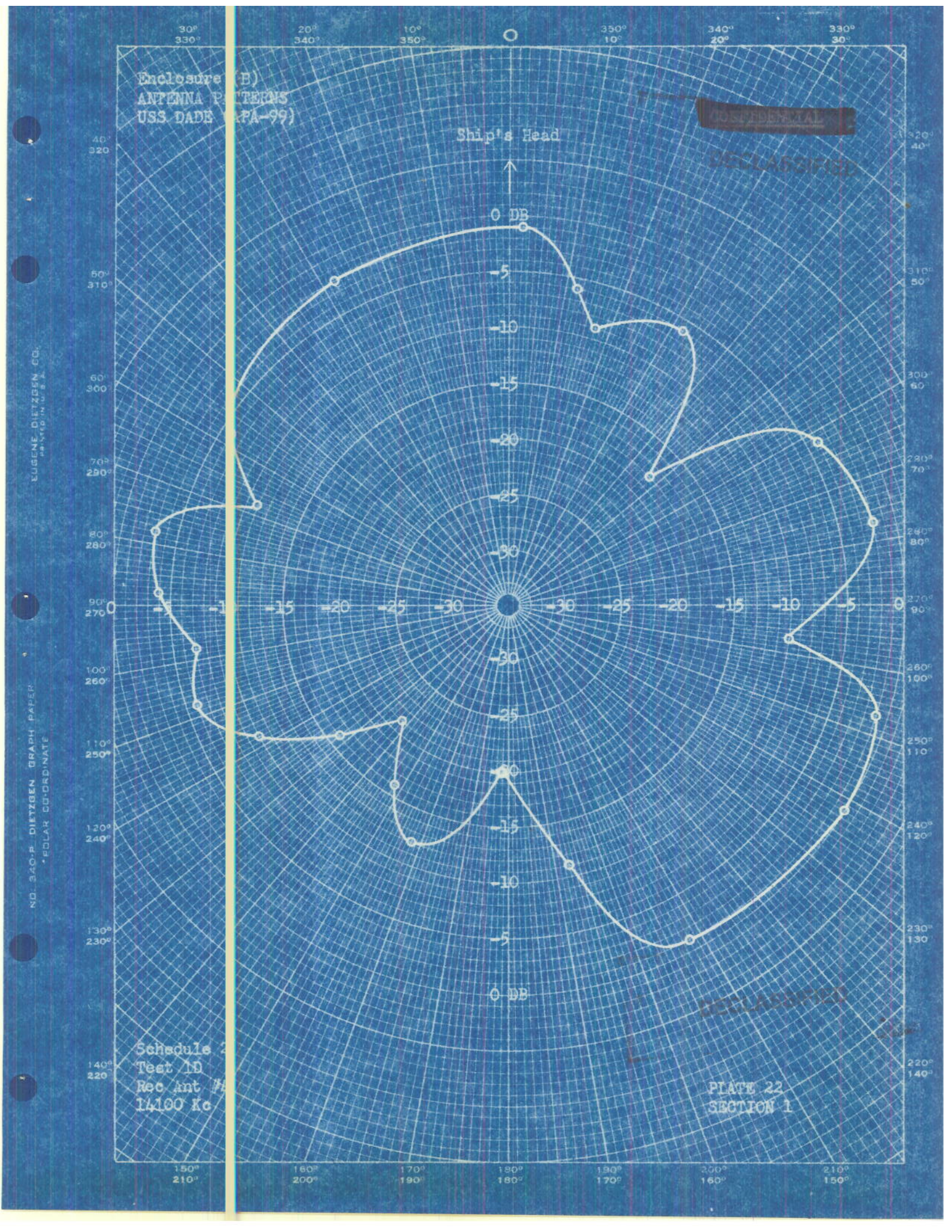

Enclosure (B)
ANTENNA PATTERNS
USS DADE (DFA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
ODB
Schedule 1
Test 3F
TBS Aft
65.74 Mc
PLATE 17
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340R DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

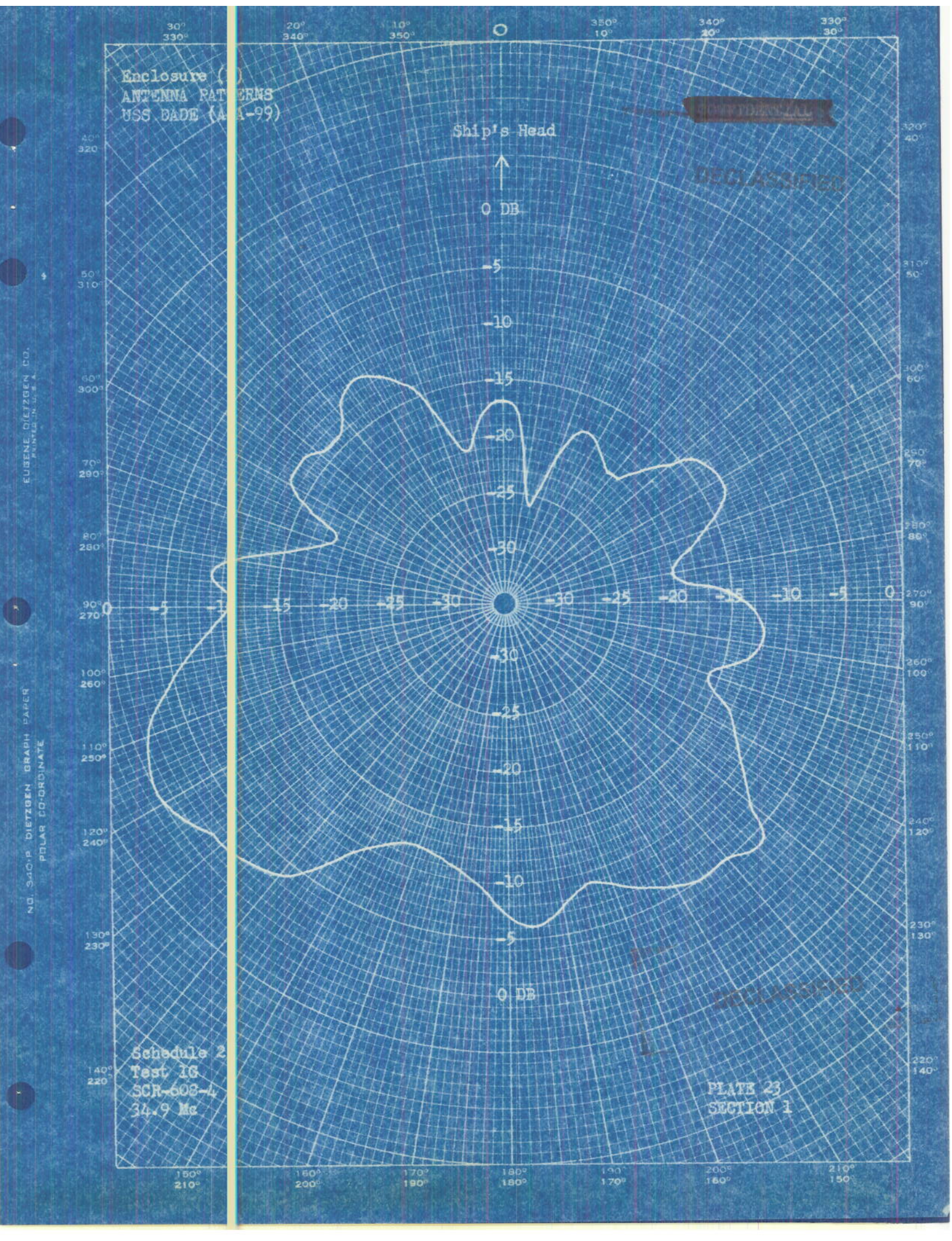

Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 30
SCR-624
126 Mc
PLATE 18
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
PRINTED IN U.S.A.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

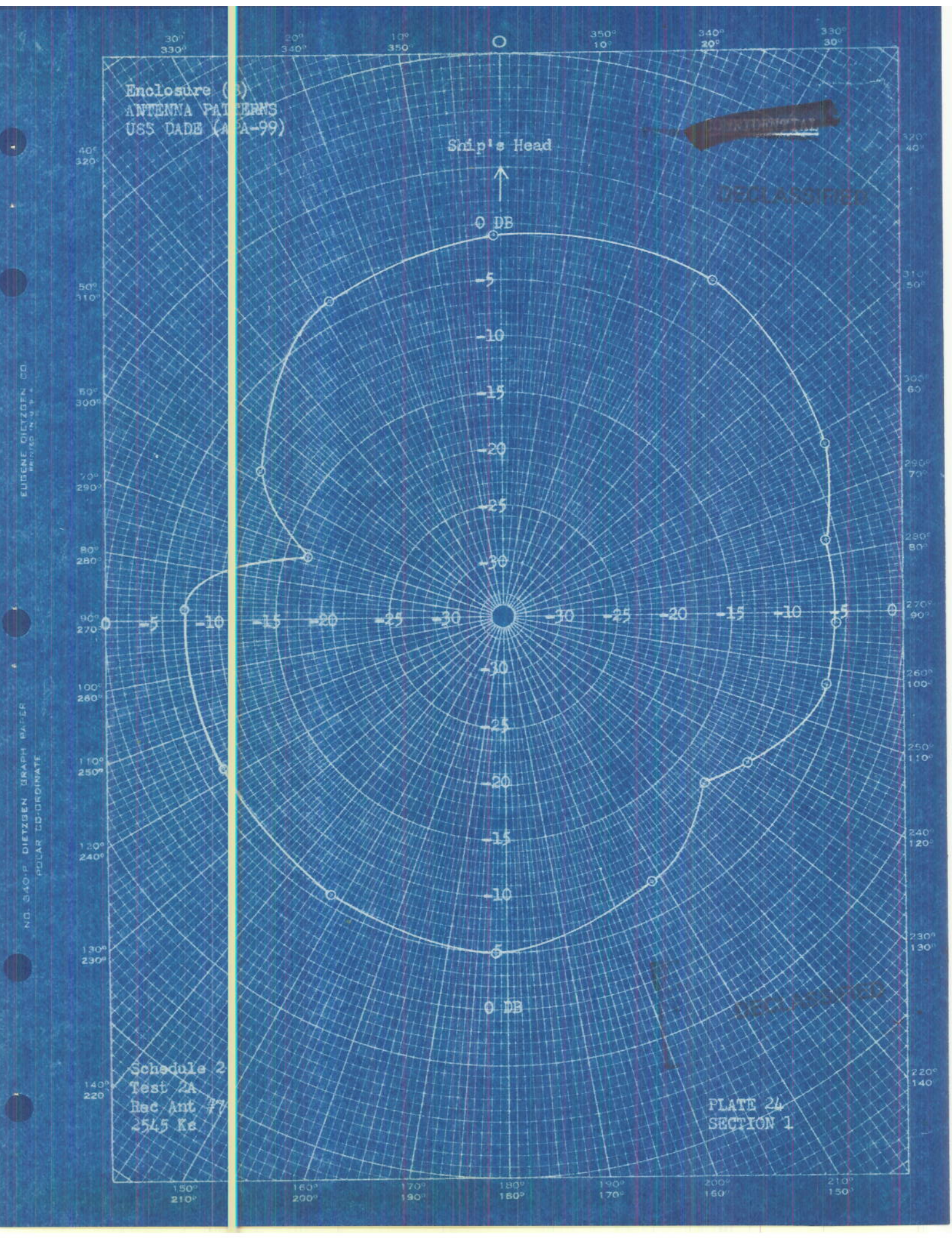

Enclosure ( )
ANTENNA PATTERNS
USS DADE (A -29)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule 2
Test 1A
Rec Ant #2
2545 Kc
PLATE 19
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

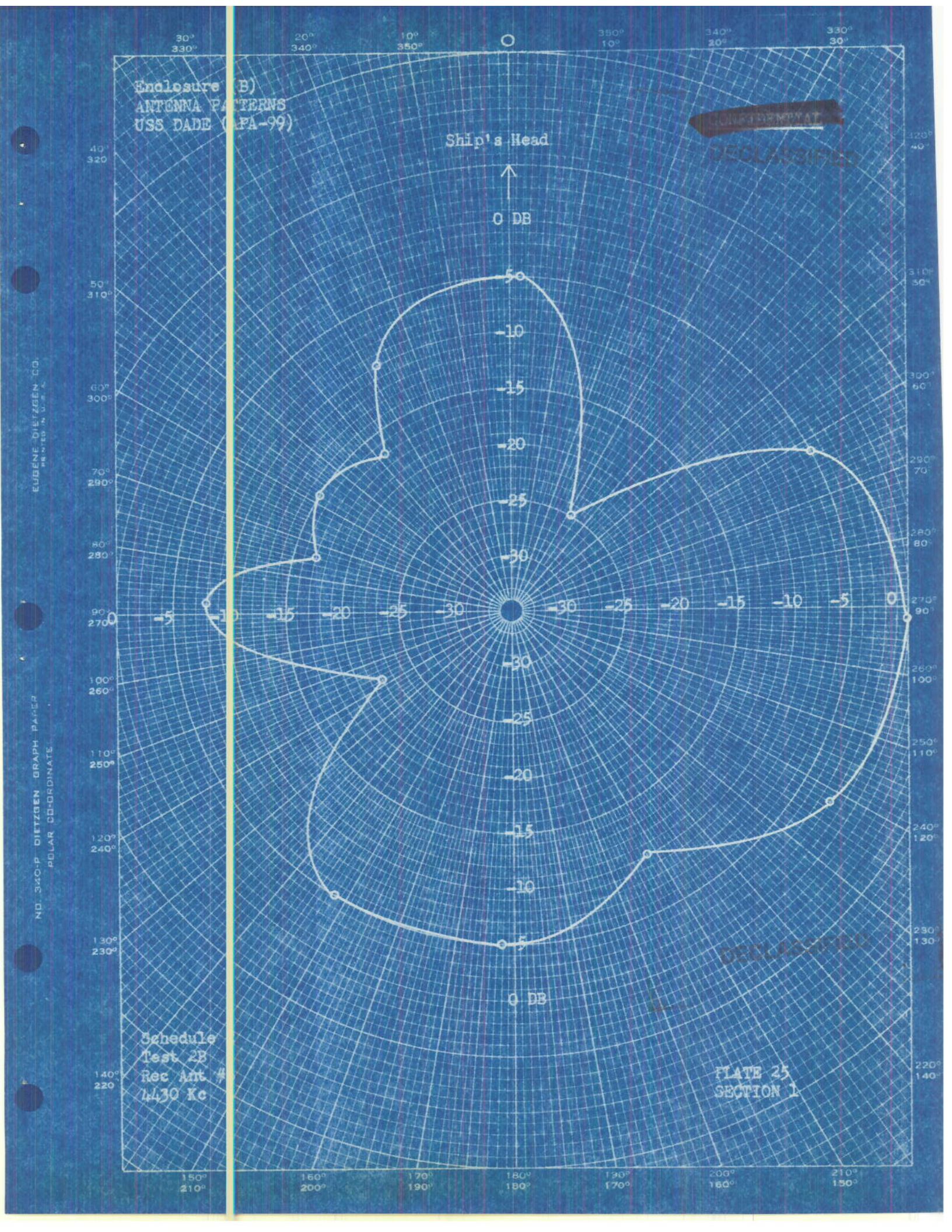

Enclosure (H)
ANTENNA PATTERNS
USS DADE (AFA-79)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
-30
-25
-20
-15
-10
-5
0
0 DB
DECLASSIFIED
DECLASSIFIED
Schedule
Test IB
Rec Ant
AA30 Ko
PLATE 20
SECTION I
EUGENE DIETZGEN CO.
NO. 340-R DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

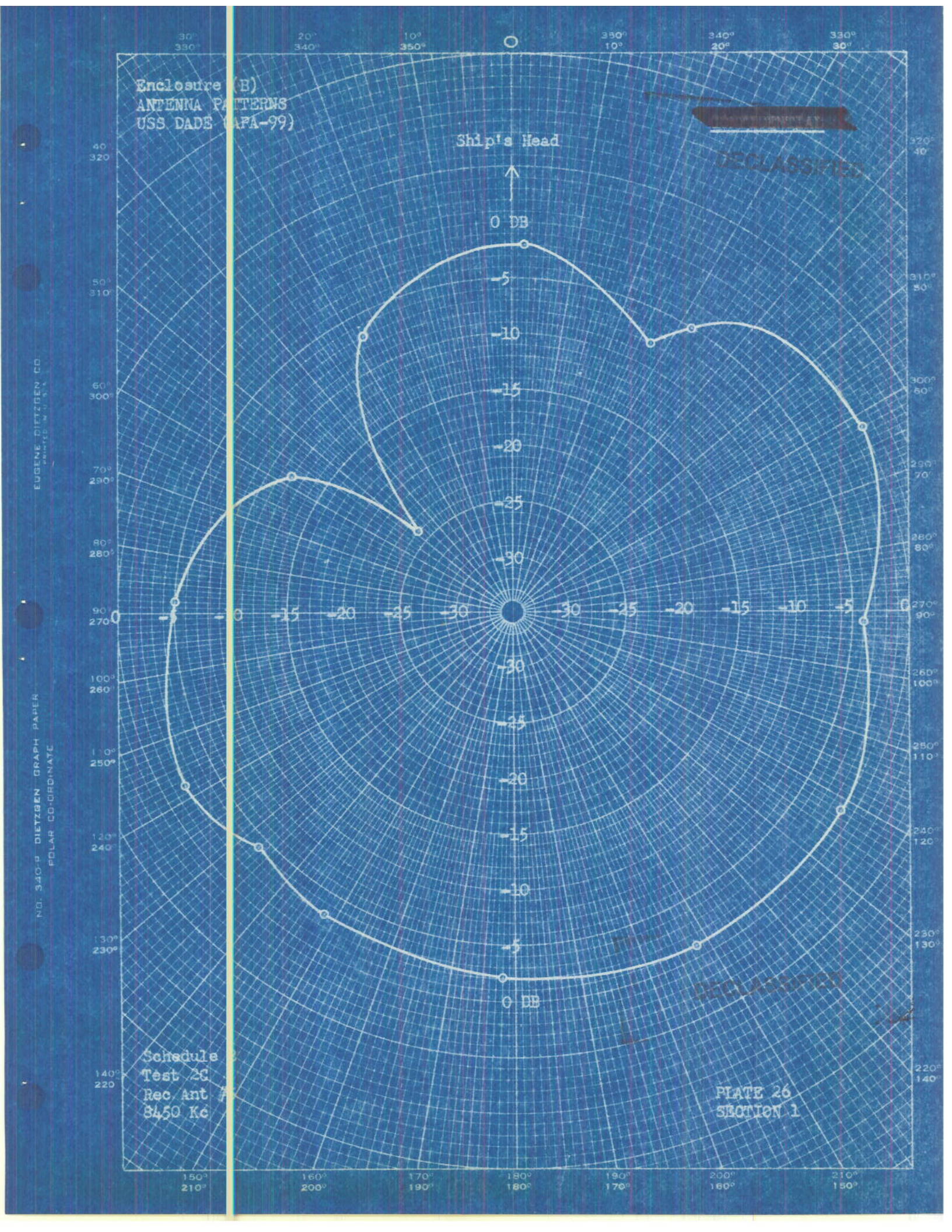

Enclosure (3)
ANTENNA PATTERNS
USS DADE (DLG-99)
Ship's Service
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule A
Test 10
Rec Ant #
3450 Kc
PLATE 21
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
PRINTED IN U.S.A.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

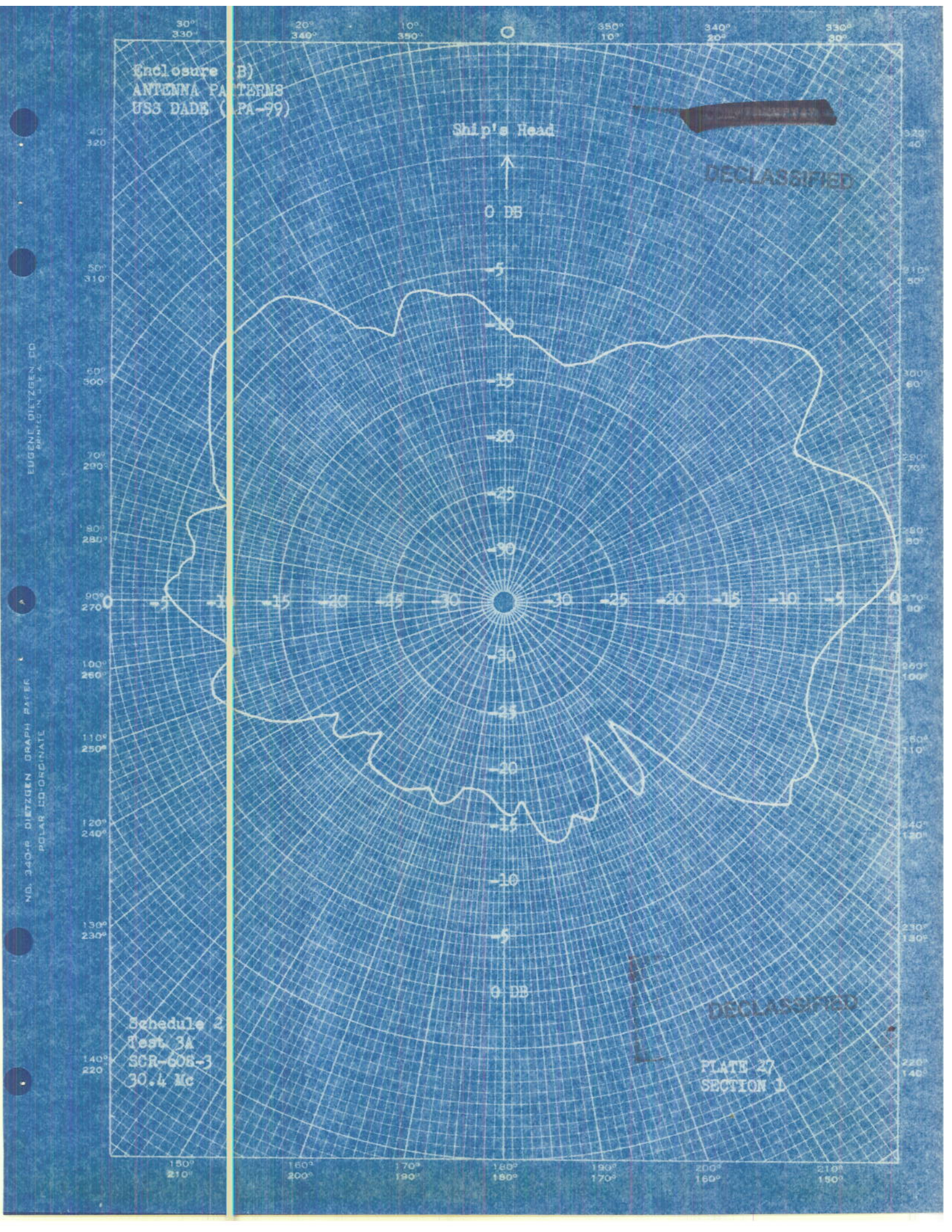

Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
CONFIDENTIAL
DECLASSIFIED
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
Schedule
Test 1D
Rec Ant
14100 Kc
PLATE 22
SECTION 1
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

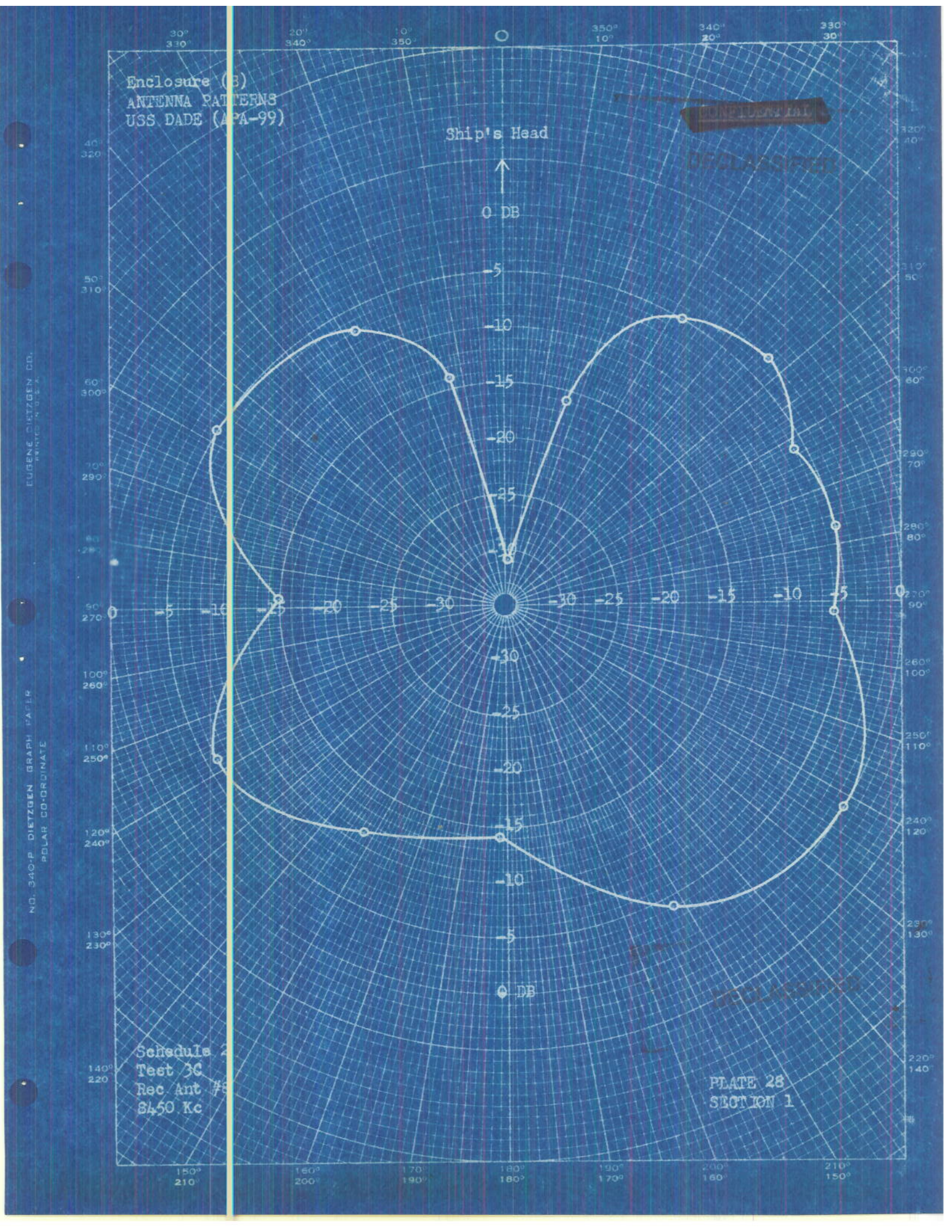

Enclosure ( )
ANTENNA PATTERNS
USS BADE (AKA-99)
CONFIDENTIAL
DECLASSIFIED
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule 2
Test 16
SCR-608-4
34.9 Mc
PLATE 23
SECTION 1
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

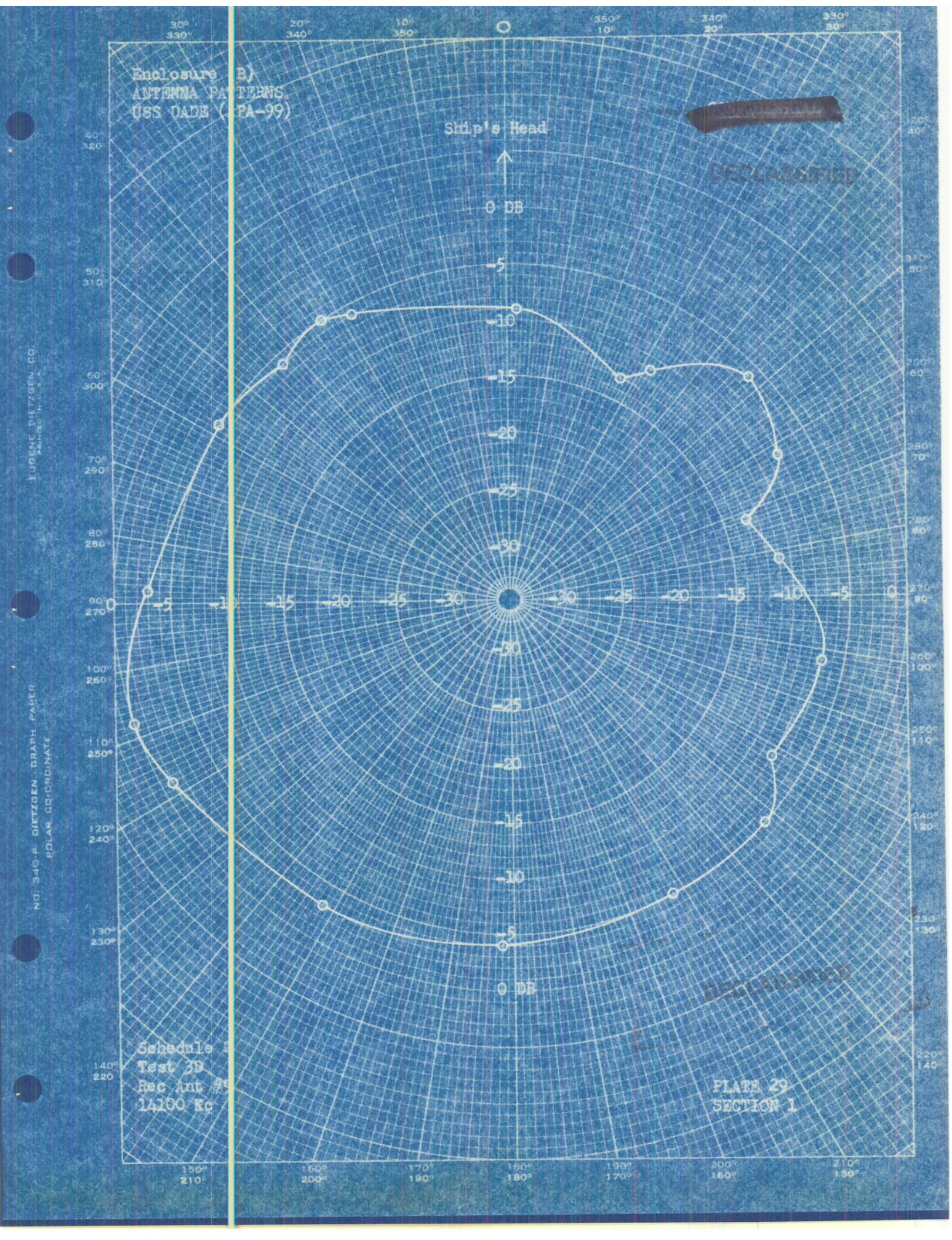

Enclosure (3)
ANTENNA PATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule 2
Test 2A
Rec Ant #7
2545 Kc
PLATE 24
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

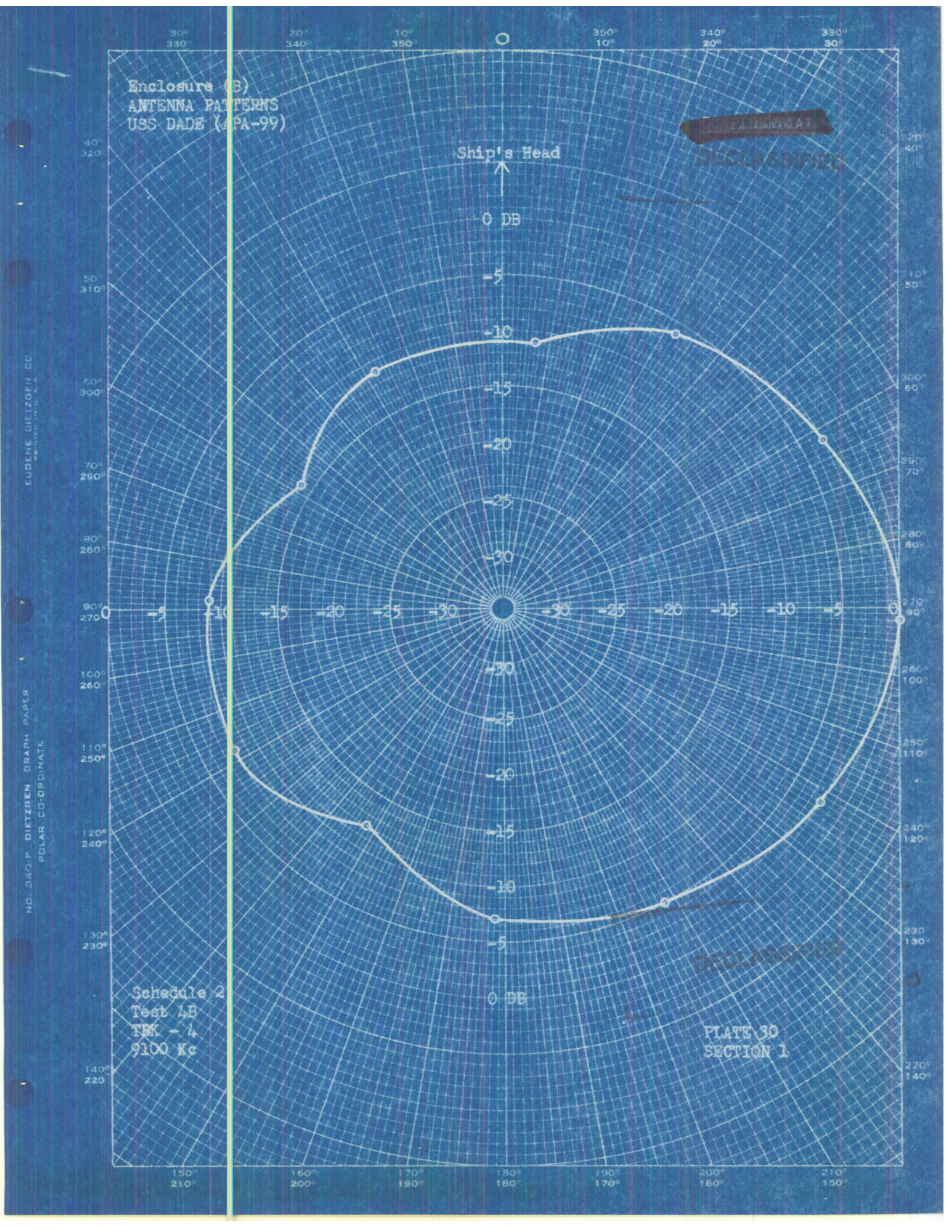

Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
CONFIDENTIAL
DECLASSIFIED
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 2B
Rec Ant #
4430 Kc
PLATE 25
SECTION 1
DECLASSIFIED
EUGENE DIETZGEN CO.
MADE IN U.S.A.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE

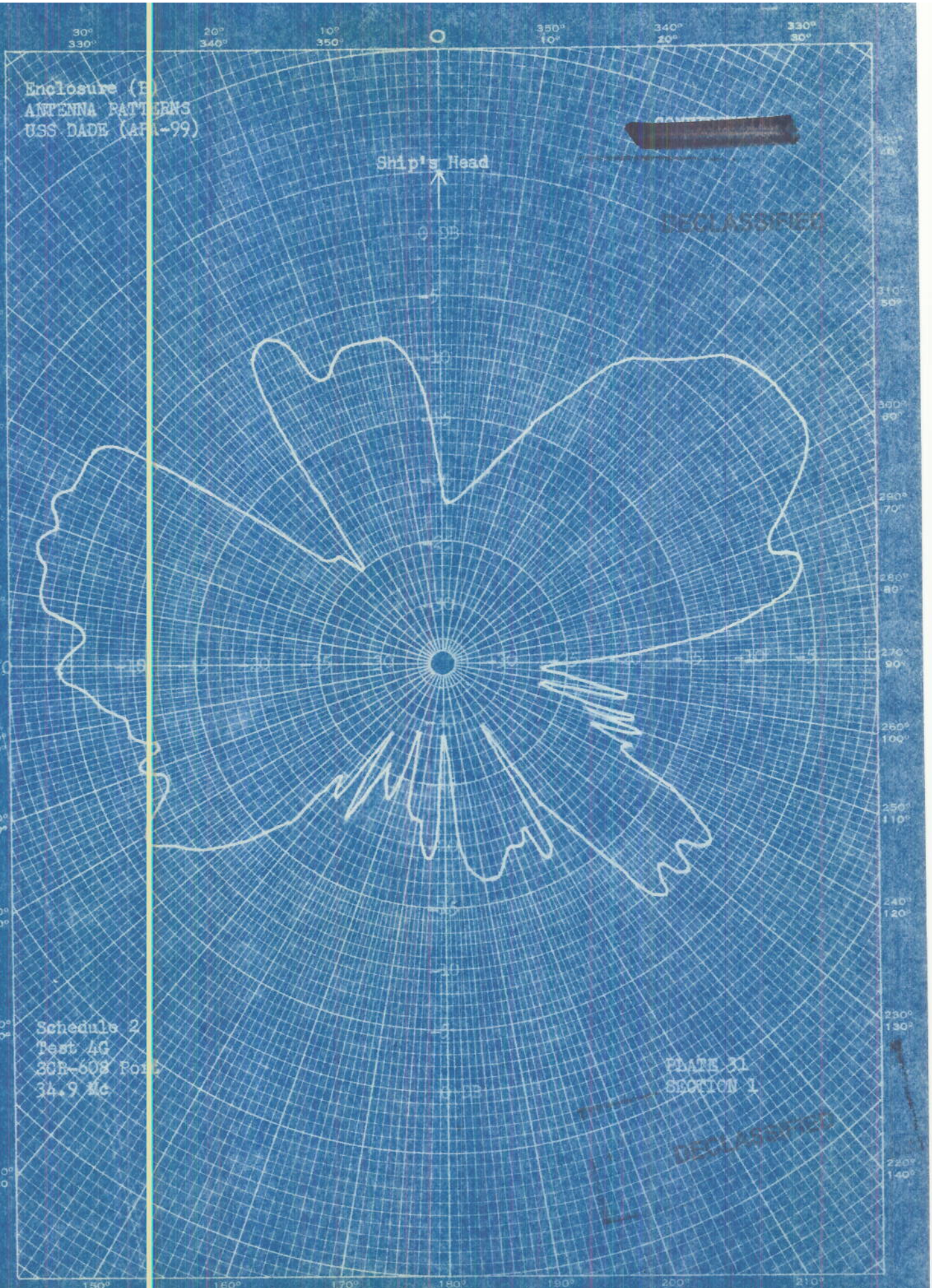

Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 2C
Rec Ant
8450 Kc
PLATE 26
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE


Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule 2
Test 3A
SCR-608-3
30.4 Mc
PLATE 27
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR COORDINATE


Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
CONFIDENTIAL
DECLASSIFIED
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule 2
Test 3C
Rec Ant #8
8450 Kc
PLATE 28
SECTION 1
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE


Enclosure B)
ANTENNA PATTERNS
USS DADE (DPA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule
Test 2D
Rec Ant
14100 Kc
PLATE 29
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE


Enclosure (B)
ANTENNA PATTERNS
USS DADE (APA-99)
Ship's Head
0 DB
-5
-10
-15
-20
-25
-30
0 DB
Schedule 2
Test 4B
TBK - 4
9100 Kc
PLATE 30
SECTION 1
DECLASSIFIED
DECLASSIFIED
EUGENE DIETZGEN CO.
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE


Enclosure (E)
ANTENNA PATTERNS
USS DADE (APA-99)
[redacted]
Ship's Head
0 DB
-10
-20
-30
Schedule 2
Test 4G
30R-60S Form
34.9 Mc
PLATE XI
SECTION 1
DECLASSIFIED
DECLASSIFIED
30° 330°
20° 340°
10° 350°
0
350° 10°
340° 20°
330° 30°
40° 320°
50° 310°
60° 300°
70° 290°
80° 280°
90° 270°
100° 260°
110° 250°
120° 240°
130° 230°
140° 220°
150° 210°
160° 200°
170° 190°
180°
190° 170°
200° 160°
210° 150°
220° 140°
230° 130°
240° 120°
250° 110°
260° 100°
270° 90°
280° 80°
290° 70°
300° 60°
310° 50°
320° 40°
330° 30°
NO. 340-P DIETZGEN GRAPH PAPER
POLAR CO-ORDINATE
EUGENE DIETZGEN CO.
MADE IN U.S.A.

SECTION 2

Coverage Diagrams of Meter-Wave Radar Equipments on USS Dade (APA-99)

Enclosures: Graphs (Plates 1 through 7).

2-1. This section of this report describes tests made on the radar and IFF antennas of the USS Dade (APA-99) while it was anchored near the Chesapeake Bay Annex of NRL on 2 December 1944. Measurements were made of the azimuthal coverage of the SC-4, BM, BN and BK antennas; in addition, directive patterns of the SC-4 and BM were obtained.

2-2. Horizontal patterns of the SC-4 and BM antennas were taken as follows: Two 20 watt c-w oscillators, tunable over these bands, were installed on the YP-564, which lay to at a range of 2000 yards from the Dade at relative bearing 270. One oscillator worked into a vertically polarized "life saver" antenna, the other into a horizontally polarized "turnstile". Aboard the Dade, the BM and SC-4 antenna lines were fed into APR-1 receivers provided with d-c amplifiers and recording milliammeters. The antenna was allowed to rotate at about 1 r.p.m., and the recording meters traced out the patterns.

2-3. In measuring the coverage diagrams of the ship's antennas, the YP-564 circled at a range of 2000 yards. Range and bearing readings of the YP were taken every half minute on the SG-1 and relayed to it as an aid to navigation. Two oscillators were used on the YP as before, one for each polarization. Three receivers were set up on the Dade, so that the coverage of three antennas could be recorded at a time. Thus only two circuits of the YP were necessary. In receiving on the directional SC-4 and BM antennas it was necessary, of course, to keep them trained on the YP.

2-4. Coverage diagrams were prepared from the recording meter chart by reading off the relative field strength corresponding to each bearing measurement and taking account of the variation in range of the test ship by correcting to 2000 yards. The following formulas were used:

For horizontal polarization:

$$F_{2000} = F_d \cdot \frac{d}{2000} \cdot \frac{1}{2 \sin \frac{\delta}{2}} ,$$

and for vertical polarization,

$$F_{2000} = F_d \cdot \frac{d}{2000} \cdot \left[(1 - k)^2 + 4k \cos \frac{\delta - \alpha}{2} \right]^{-\frac{1}{2}} ,$$

where

F_{2000} = field strength at 2000 yards

F_d = field strength at range d yards

d = range in yards

$Ke^{j\alpha}$ = reflection coefficient of sea water

δ = phase lag of reflected ray over direct ray due to greater path length; $\delta = 0.244^{o} f \frac{h_t h_r}{d}$;

where f = frequency in megacycles

h_t = height of transmitting antenna (25 feet), and

h_r = height of receiving antenna in feet.

2-5. The SC-4 and BM patterns, Plates 1 and 2, were somewhat ragged, due to the fact that the YP was tossed considerably by rough water. The beam widths and side lobes were, however, quite similar to those which have been observed on similar ships. Great difficulty was experienced in obtaining a good pattern of the SC-4, as some instability in the system caused the signals in successive maxima to differ as much as 20 db. Inasmuch as it was established that the instability was in neither the oscillator or the receiver, it was strongly suspected that the rotating joint of the SC-4 was defective. Other evidence pointing to this was the excessive grinding noise heard when the antenna turned, as well as the fact that the radar was giving extremely erratic performance in general. The SC-4 coverage diagram, Plate 3, was obtained with difficulty because of this same erratic behavior, and too much confidence should not be placed in it.

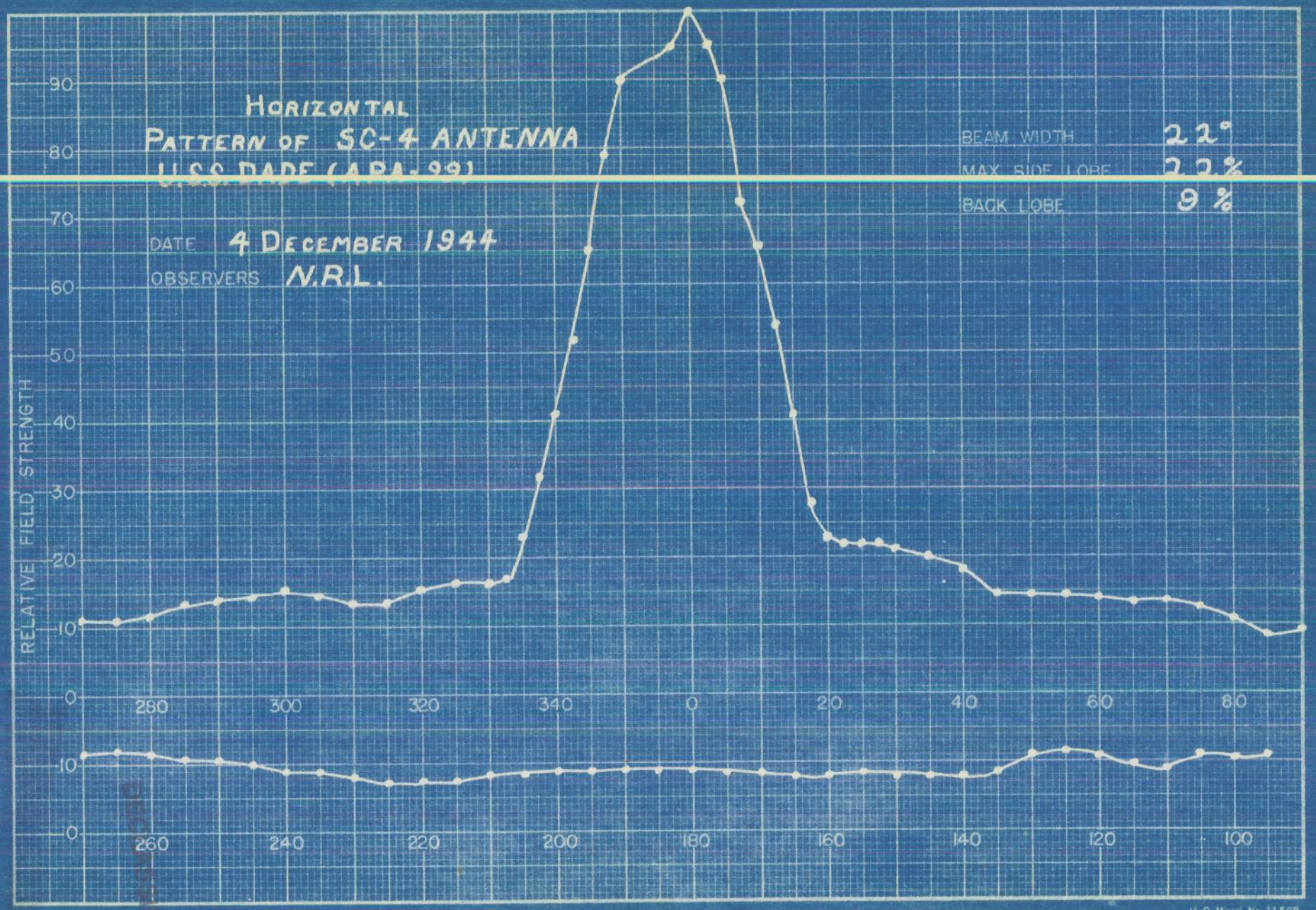
2-6. The BM coverage diagram showed a dip of about 6 db dead astern (Plate 4), as a result of interference by the SG mast. The BN antenna, mounted on the starboard end of the mainmast yardarm was shielded by the SC-4 antenna so that its signal was down about 11 db from the average, in the neighborhood of 275° relative bearing. The antenna for the BK in Flag Plot was located on the port end of the same yardarm and had a 10 db dip at 070°. These diagrams are shown in Plates 5 and 6, respectively. A standby BK in CIC was connected to an antenna mounted from the superstructure deck. As shown in Plate 7, it was shielded fore and aft by the main and mizzen masts, with a reduction in signal of 6 and 7½ db respectively.

2-7. Because of the obstructions mentioned above, the radar and IFF ranges obtainable on aircraft in these directions (and in the maxima of the vertical interference pattern) are reduced in

proportion to the field strength observed. Thus if the normal range of the BM is 100 miles, the range for aircraft dead astern might be 50 miles, while the range of the BN might be about 30% of normal at relative 275°. In the case of surface targets or low-flying aircraft, range is proportional to the square root of field strength. The BM would have 70% of its usual range on ships at 180°, while the BN would be down to 55% of its expected range at 275°.

2-8. The curves obtained from these measurements agree fairly well with results from several other ships of this type which have been tested. One serious defect should be mentioned; namely, the unsteady behavior of the SC-4 antenna. It is thought that the rotating joint may be at fault.

Plate 1



H. O. Miscel. No. 11,508

PLATE 1
SEC. 2

5219

Plate 2

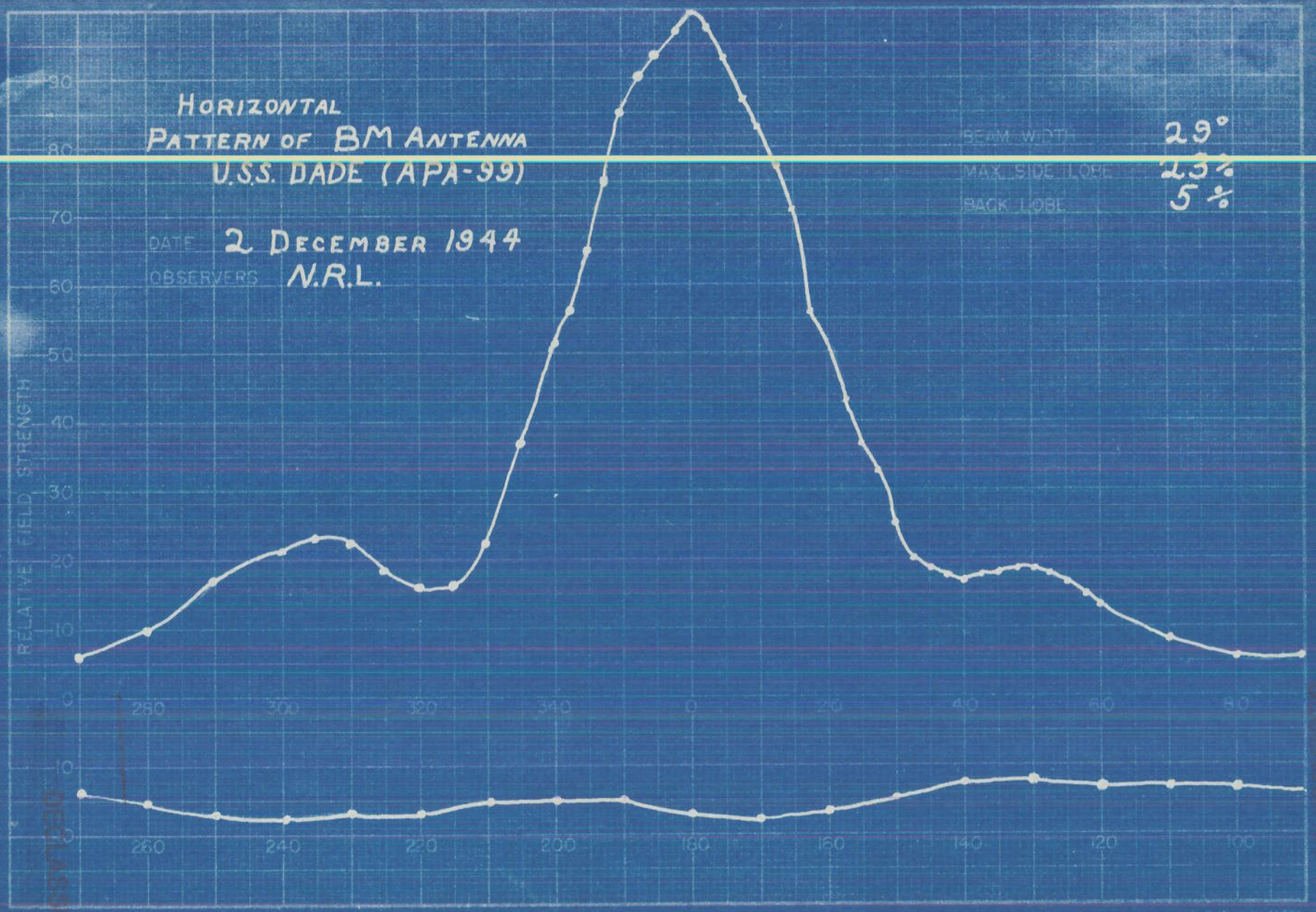


PLATE 2
SEC. 2

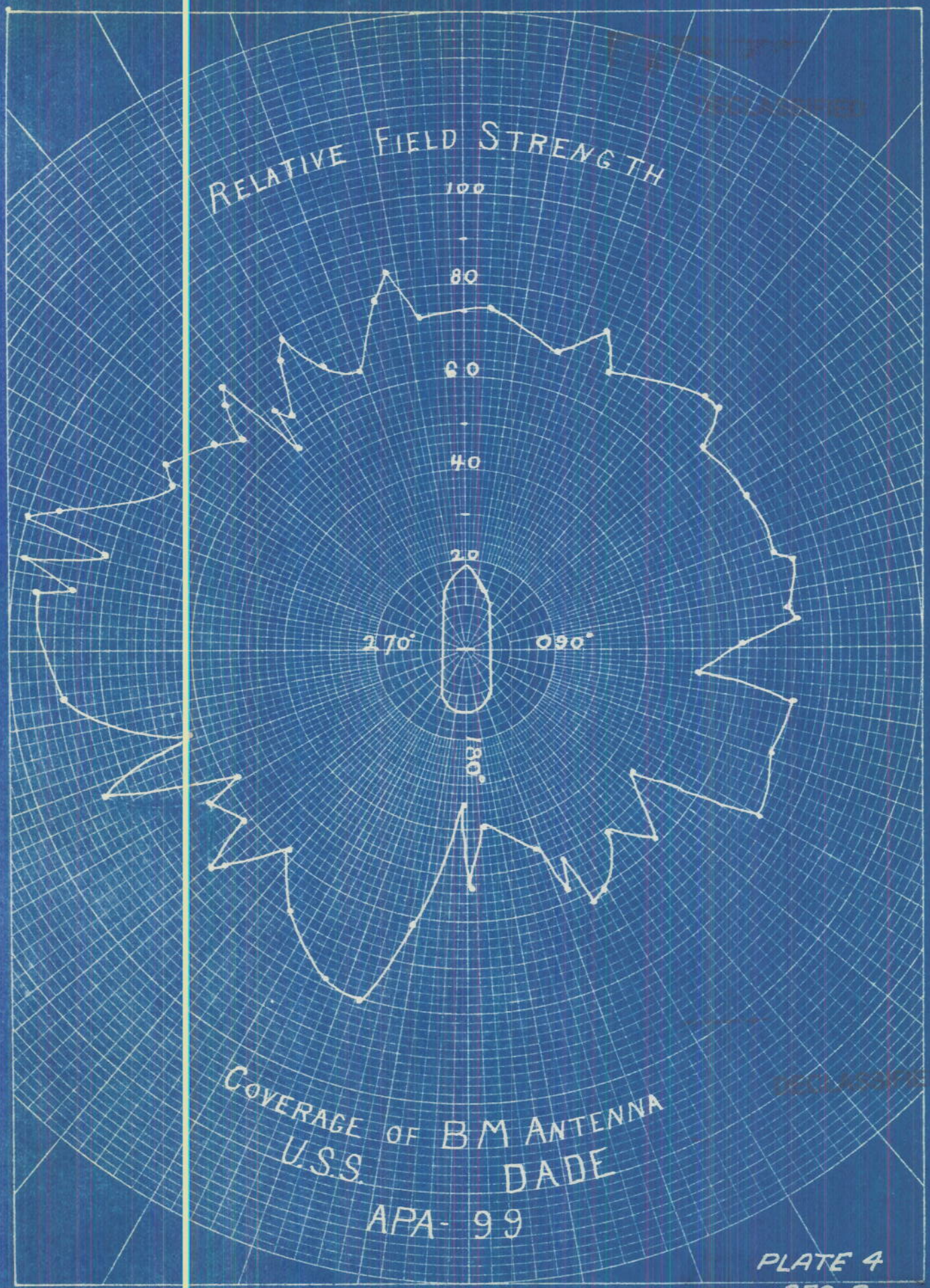


PLATE 4
SEC. 2

KEUFFEL & ESSER CO. N. Y. NO. 343B
POLAR CO-ORDINATE
MADE IN U.S.A.

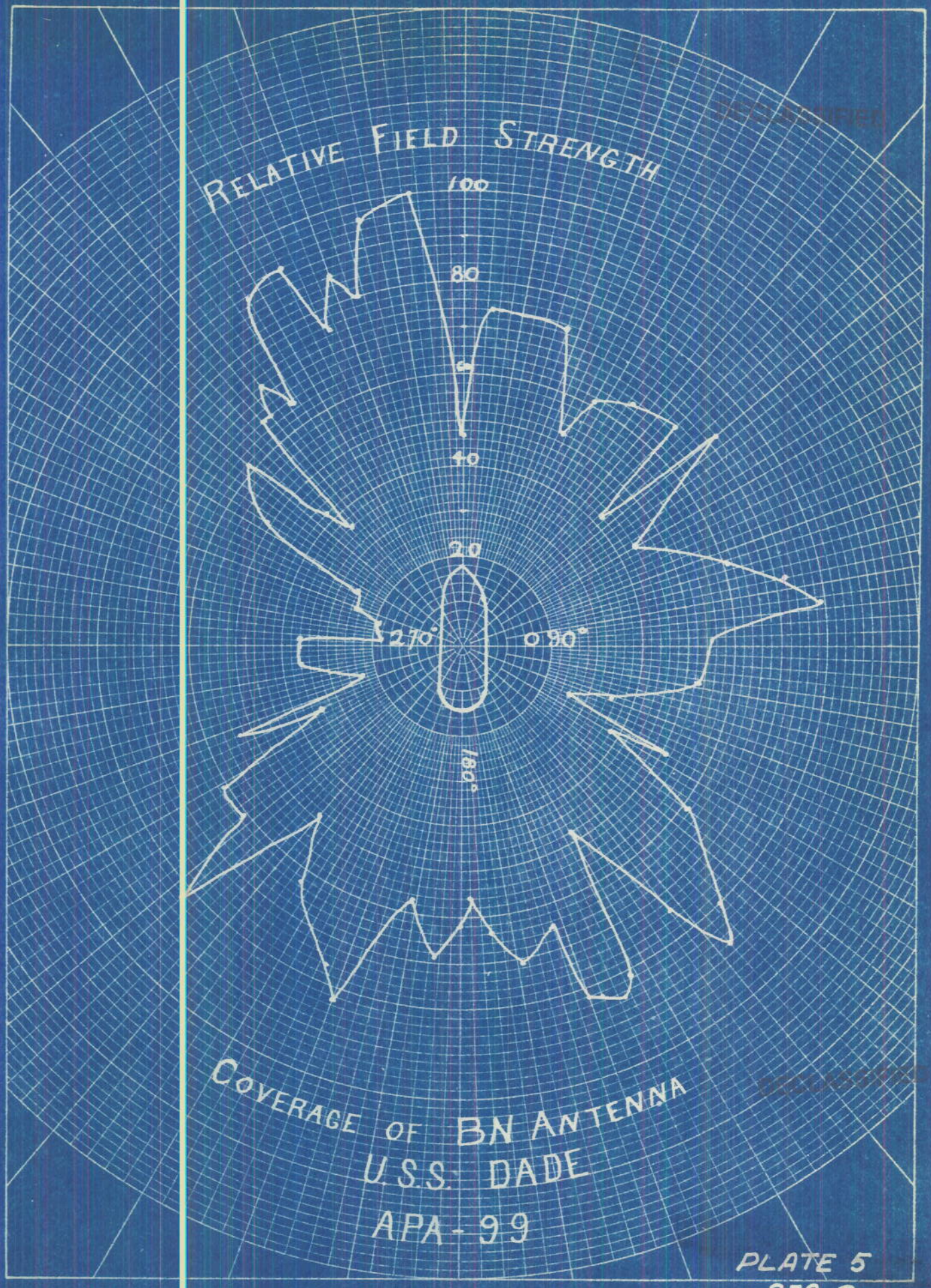


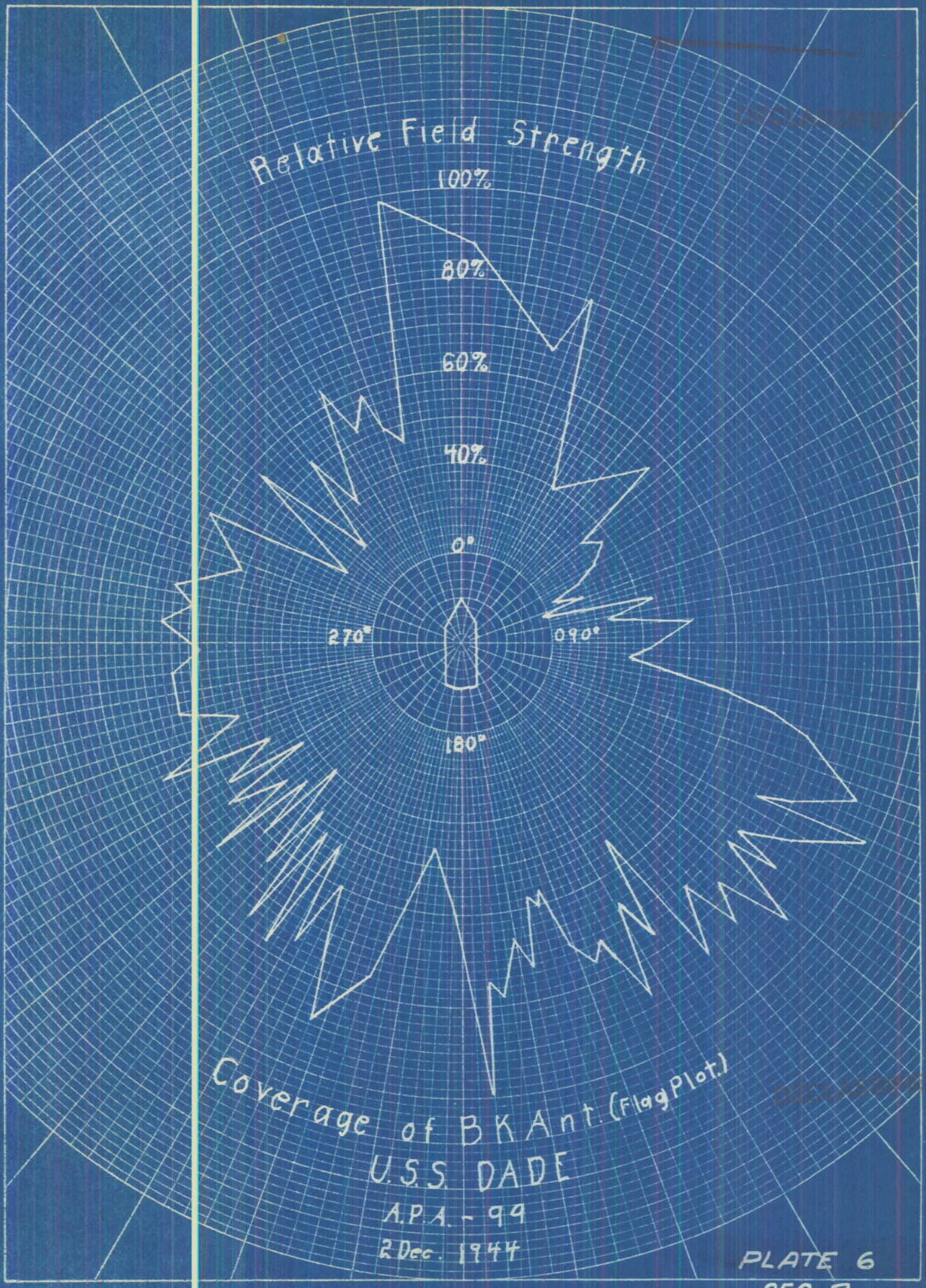
PLATE 5

SEC. 2

KEUFFEL & ESSER CO., N.Y. NO. 343B

POLAR CO-ORDINATE

MADE IN U.S.A.



Coverage of BK Ant. (Flag Plot.)

U.S.S. DADE

A.P.A. - 99

2 Dec. 1944

PLATE 6

SEC. 2

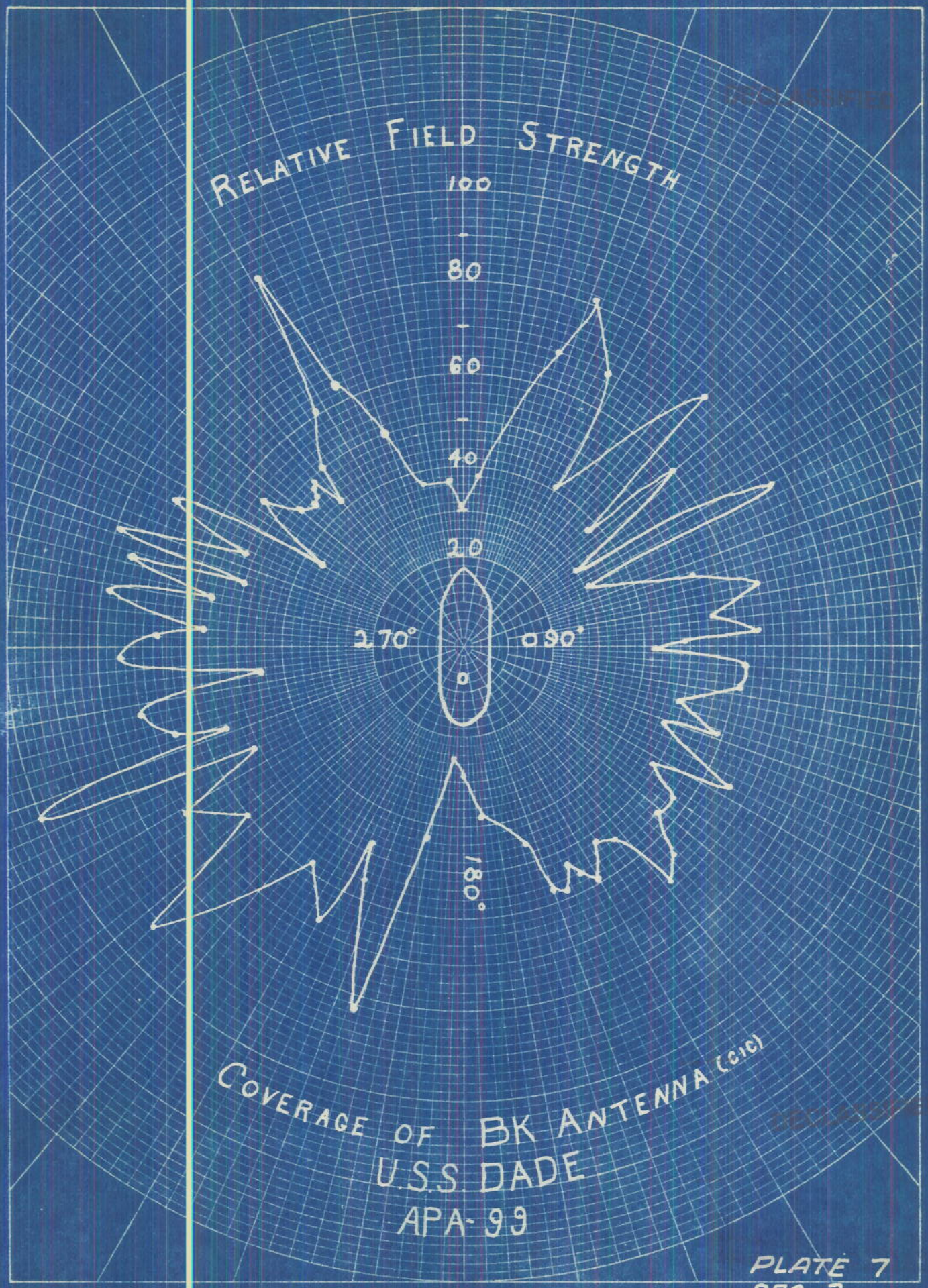


PLATE 7
SEC. 2

KEUFFEL & ESSER CO. N.Y. NO. 343B
POLAR CO-ORDINATE
MADE IN U.S.A.

SECTION 3

ANTENNA MEASUREMENTS OF THE SG-1 RADAR ON THE APA-99 - USS DADE

Enclosures: Graph (Plate I)

3-1. Procedure

3-1-1. Antenna measurements were made on 3 December 1944 of the SG-1 radar installed on the APA-99 - USS DADE.

3-1-2. The SG-1 antenna pattern was measured from the shore while the DADE circled in the Bay at ranges from about 8750-9750 yards. The DADE's SG-1 antenna was kept trained on the receiving antenna by means of a telescope. The telescope was kept trained at all times on the shore antenna with the telescope driving a 5G selsyn. The selsyn was connected to the SG at a place where the output of the ship's gyro is normally connected; thus the antenna followed the telescope at all times. A superheterodyne receiver which had been calibrated previously in this Laboratory, and whose output was displayed on an oscilloscope, was used to measure the received signal. The antenna for this receiver was located on a movable car on an inclined railway at a height above water intended to produce high signal strength from aboard the DADE.

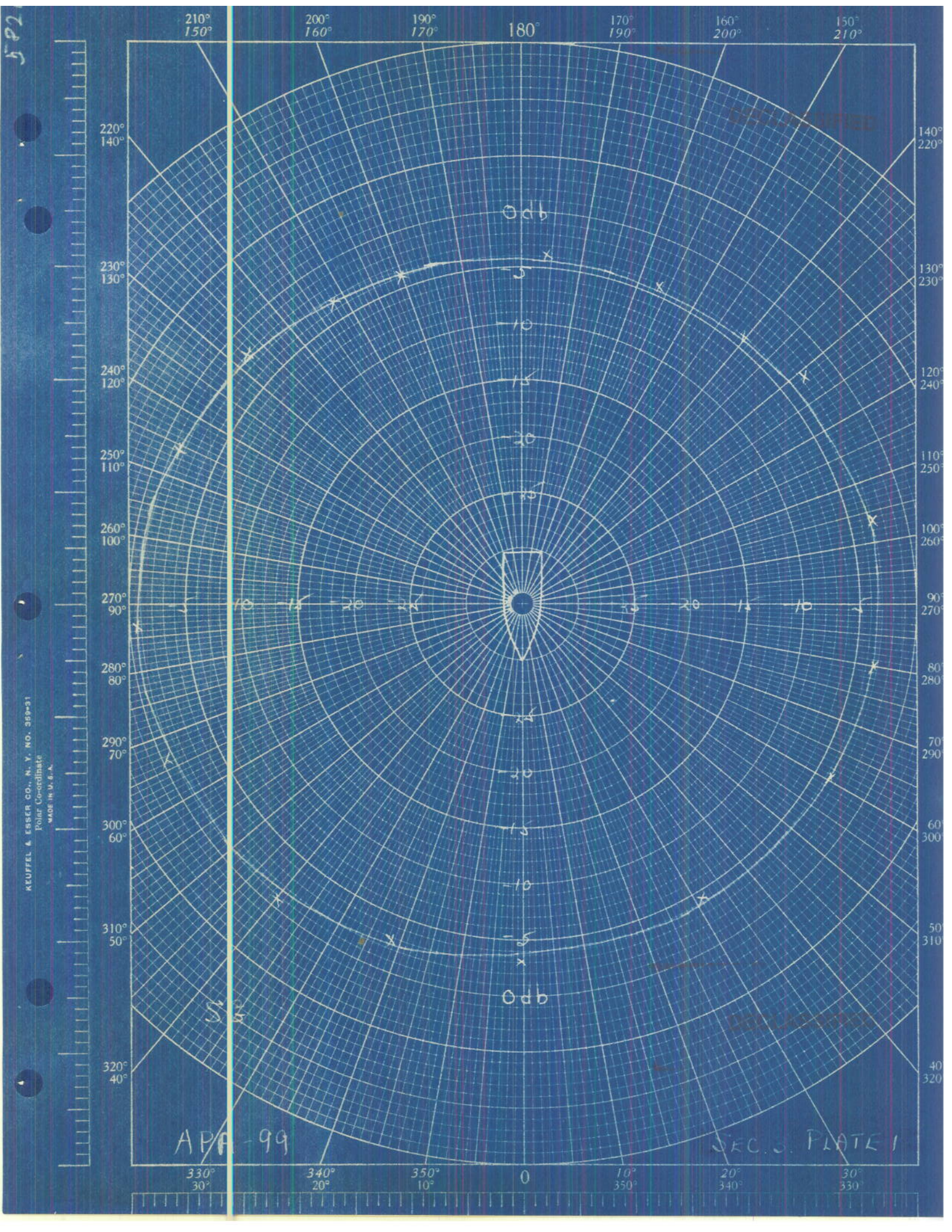
3-1-3. The enclosed graph (Plate I) gives relative bearings versus relative signal strength in db. The signal strength is correct to within 2 db.

3-2. Discussion

3-2-1. Minor variations in signal strength are evident for the various headings. However, these variations are well within the limits of experimental accuracy.

3-3. Conclusion

3-3-1. The graph demonstrates that the SG-1 equipment gives good coverage over the entire 360 degrees.


210° 150°
200° 160°
190° 170°
180°
170° 190°
160° 200°
150° 210°
220° 140°
230° 130°
240° 120°
250° 110°
260° 100°
270° 90°
280° 80°
290° 70°
300° 60°
310° 50°
320° 40°
330° 30°
340° 20°
350° 10°
0
10° 350°
20° 340°
30° 330°
140° 220°
130° 230°
120° 240°
110° 250°
100° 260°
90° 270°
80° 280°
70° 290°
60° 300°
50° 310°
40° 320°
0db
-5
-10
-15
-20
-25
-30
-35
0db
KEUFFEL & ESSER CO., N. Y. NO. 359-31
Polar Co-ordinate
MADE IN U. S. A.
APA-99
SEC. PLATE 1