AD-A071 341 HAZELTINE CORP BRAINTREE MASS ELECTRO-ACOUSTIC SYSTE--ETC F/G 17/1
HAZELTINE (AN/BQS-6) TRANSDUCER ELEMENT. SUPPLEMENT.(U)
FEB 64 R A PLANTE

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LEVEL # (1)

(6) Hazeltine

(AN/BQS-6)

Transducer Element, Supplement.

(9) Test Report,

Report No. EASL-AS-9

(11) 25 February 25, 1964 (14) EASL-AS-9

(12) 19p.

Hazeltine Corporation

Electro-Acoustic Systems Laboratory

Avon, Massachusetts

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Manager, Acoustic Systems

Electro-Acoustic Systems Laboratory

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Report No. EASL-AS-9
February 25, 1964

I. INTRODUCTION

This Test Report is submitted as a supplement to a Hazeltine Report No. EASL-AS-6, December 5, 1963. A company sponsored program was initiated at EASL to make available four (4) Hazeltine developed AN/BQS-6 elements for Navy prototype qualification tests per MIL-S-22974(SHIPS), 31 May 1962. The program was also directed toward gaining information on element uniformity to aid in establishing material procurement tolerances and new assembly techniques. This Report presents the results of tests made on the first two (2) elements completed under this program. Two (2) more elements now being assembled will be tested and a report issued. The major portion of these tests were conducted at an ambient temperature of 4°C. Since low temperature is the greatest single cause for transducer efficiency degradation, the test results presented here represent the near minimum operational efficiency of the Hazeltine AN/BQS-6 elements.

II. ELEMENT DESCRIPTION

The elements are the same as pictured and described in Report No. EASL-AS-6. The active element consists of a lead zirconate ceramic cylinder which will meet the requirements of Paragraph 3.8.18.2.3 MIL-S-22974(SHIPS), 31 May 1962. A titanium front mass is used to ensure uniform piston motion with a minimum weight. The front housing and titanium mass are joined by a watertight bond of acoustically isolating elastomer. The rear steel mass, active ceramic, and front mass are cemented together with an epoxy adhesive and mechanically biased with a tie rod. The ceramic element and rear mass are treated to improve heat dissipation. A pressure release system is utilized to separate the active portion of the transducer from the front housing and the main cylindrical steel housing. The rear of the housing is secured with a steel plate bonded to the cable and sealed to the housing by an "O" ring.

III. MEASUREMENTS PROGRAM

The water temperature at the EASL Open Water Test Site during the test period was 4°C and all the acoustic measurements were made at this temperature. Each element was subjected to the following tests:

Hydrostatic Pressure

Impedance in Air and Water

Frequency Response

Directivity

Power Linearity

The pulse technique was used for all water measurements. All measurements except power linearity were made without a tuning coil in the transducer circuit. Tests were conducted according to procedures established in the ASA Publication Z24.24-1957 of 31 December 1957.

IV. TEST RESULTS

The test results are presented in Figures I through XI and Test Data Sheet I.

The calibration accuracy for all measurements is estimated to be ±1 db.

V. CONCLUSIONS

The test results show that an efficiency better than 50% can be obtained at 4°C. The data also indicates that a high degree of uniformity is possible when good quality control, and assembly techniques are used.

The elements tested comply with the requirements of MIL-S-22974(SHIPS), 31 May 1962, and it is recommended that they be made available to the Navy for AN/BQS-6 qualification tests.

R. A. Plante

R. A. Plante

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Figure 1

HAZELTINE AN/BQS-6 #7 and #8
Precision Bridge
Air Impedance Measurements
Temperature 20°C
31 January 1961

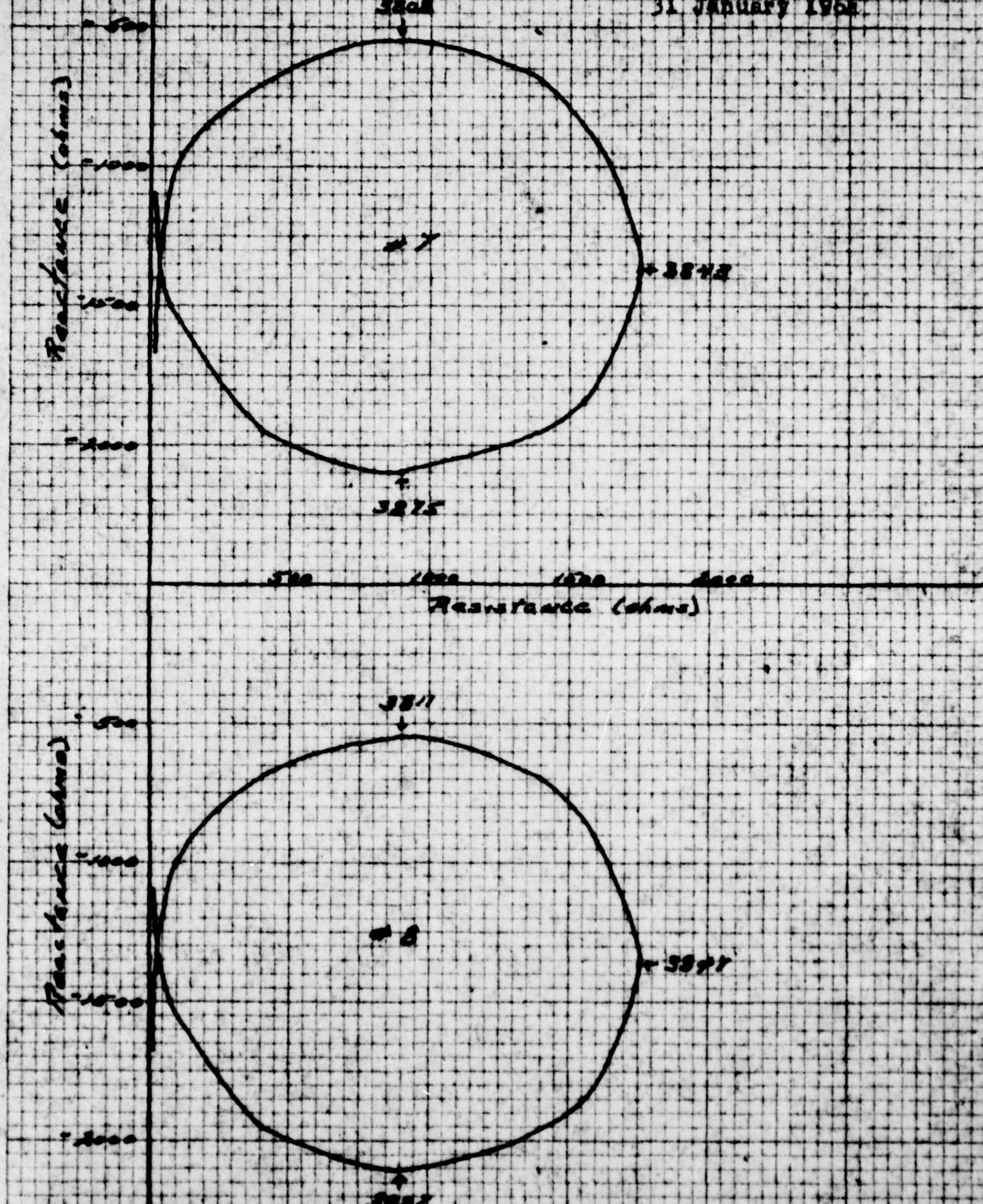

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Figure 8

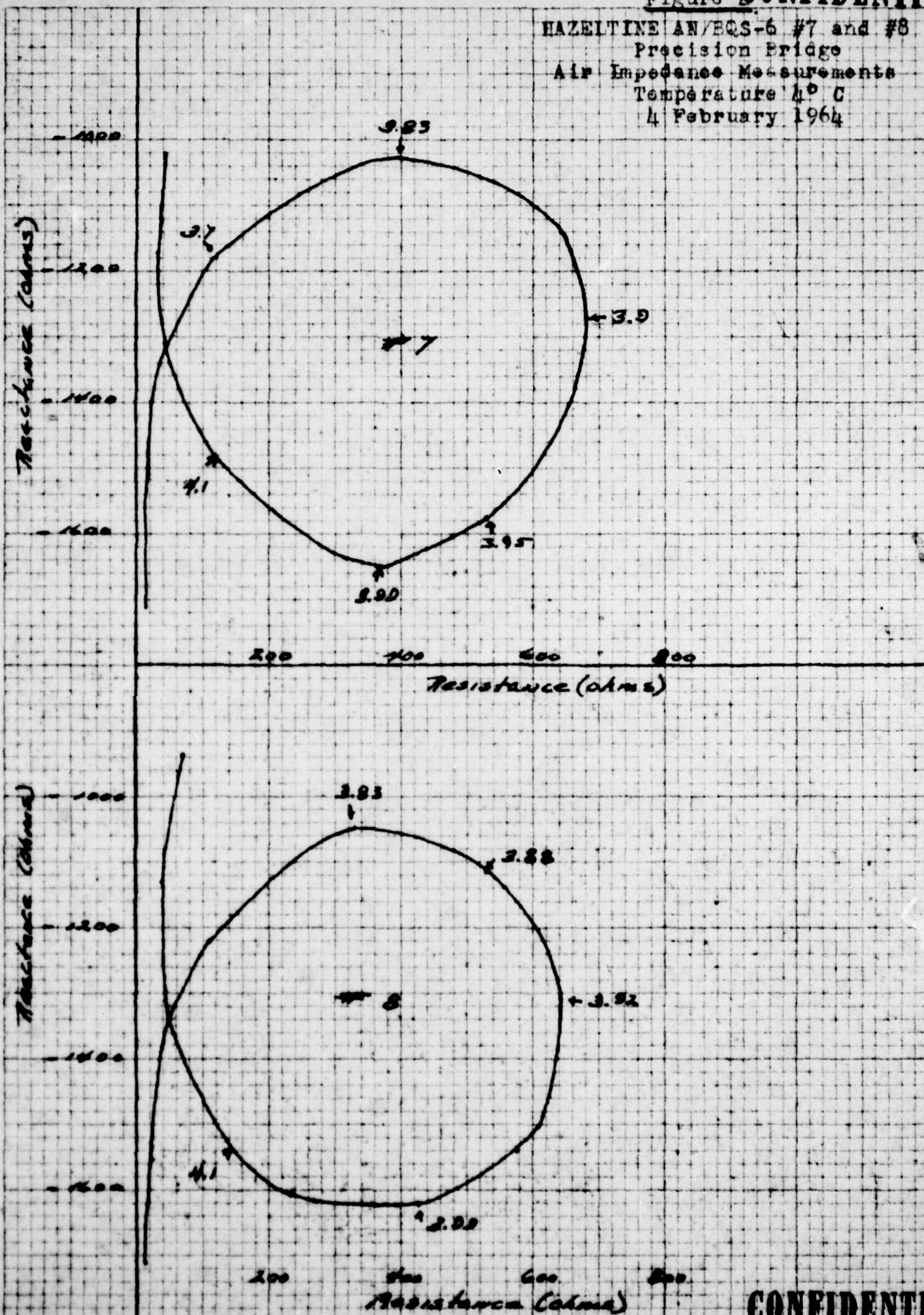
HAZELTINE AN/BQS-6 #7 and #8
Precision Bridge
Air Impedance Measurements
Temperature 4° C
4 February 1964
Reactance (ohms)
1000
1200
1400
1600
3.83
3.7
3.9
#7
4.1
3.95
3.90
200
400
600
800
Resistance (ohms)
3.83
3.88
#8
3.92
4.1
3.93
Resistance (ohms)

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Figure 3

HAZELTINE AN/BQS-6 #7 and #8
Precision Bridge
Water Impedance Measurements
Temperature 4° C.
4 February 1964

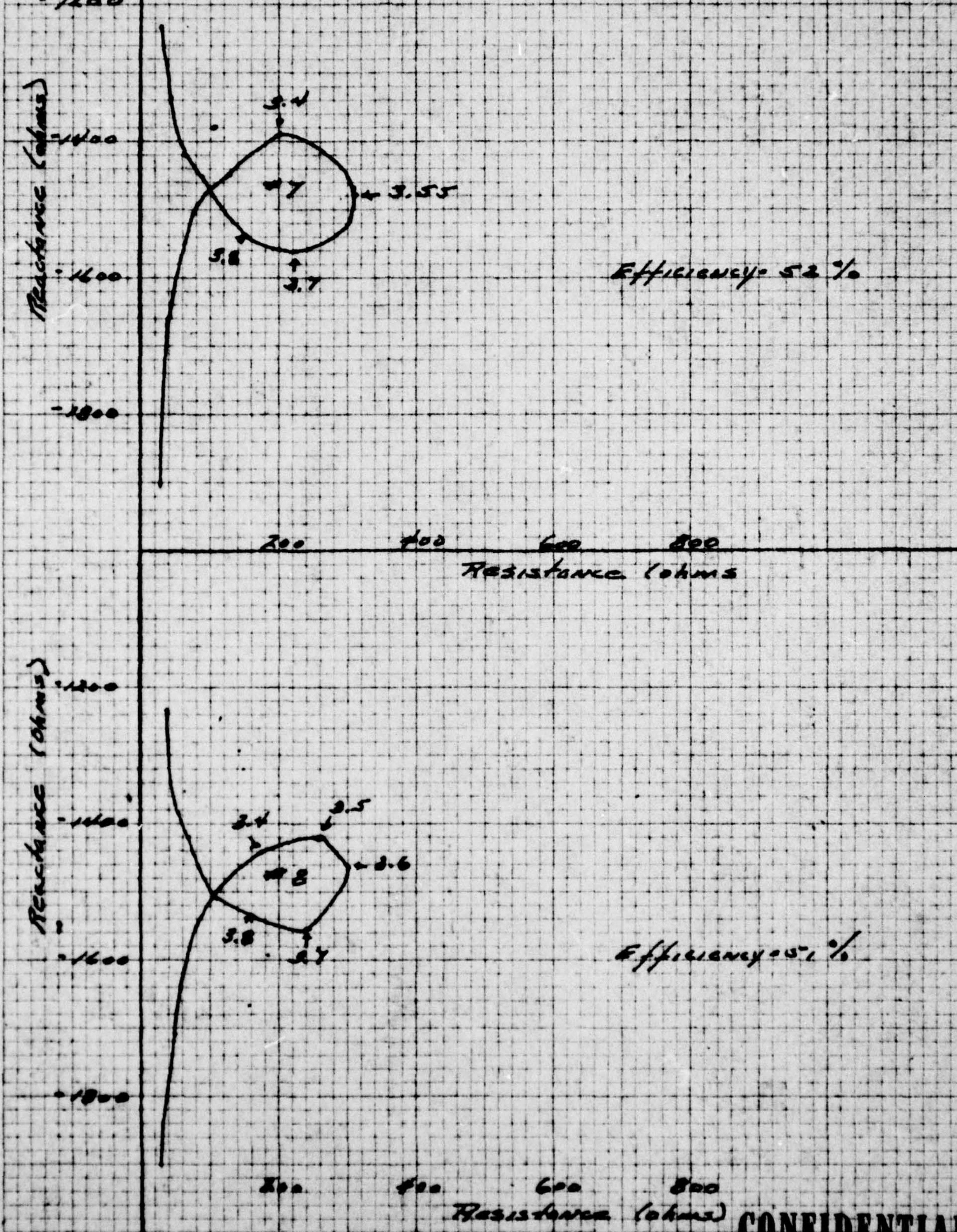

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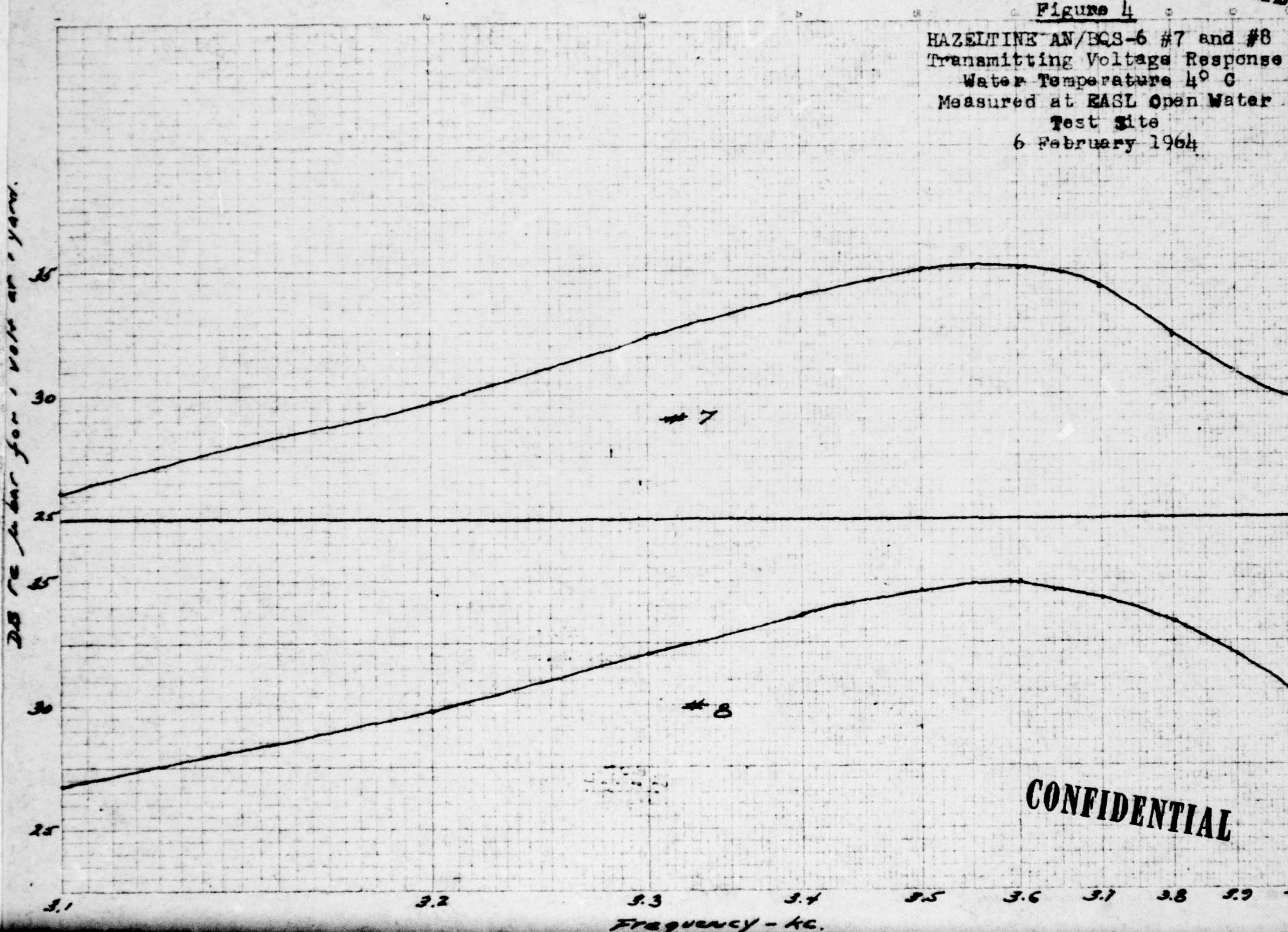
Figure 4

HAZELTINE AN/BQS-6 #7 and #8
Transmitting Voltage Response
Water Temperature 4° C
Measured at EASL Open Water
Test Site
6 February 1964



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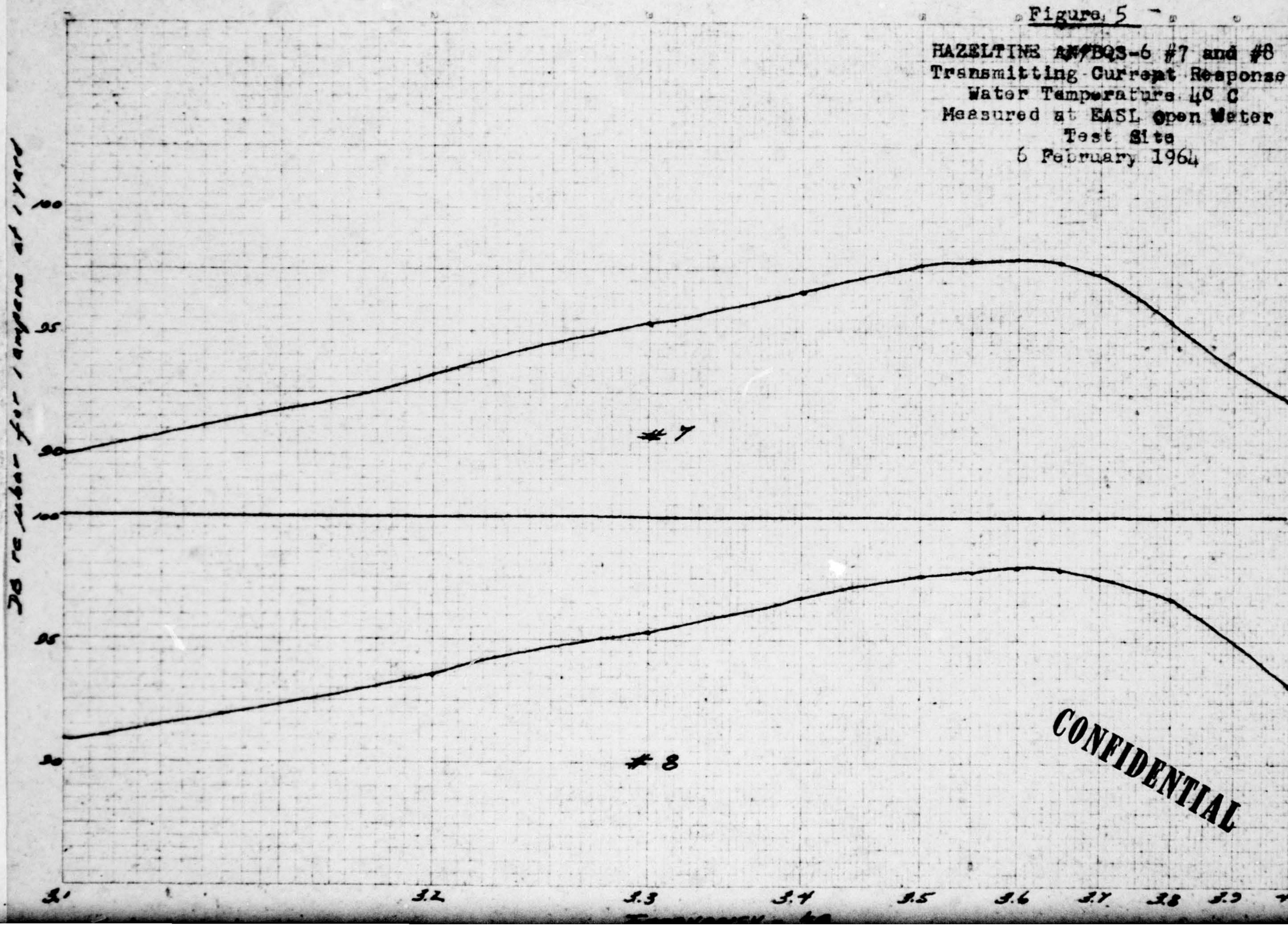

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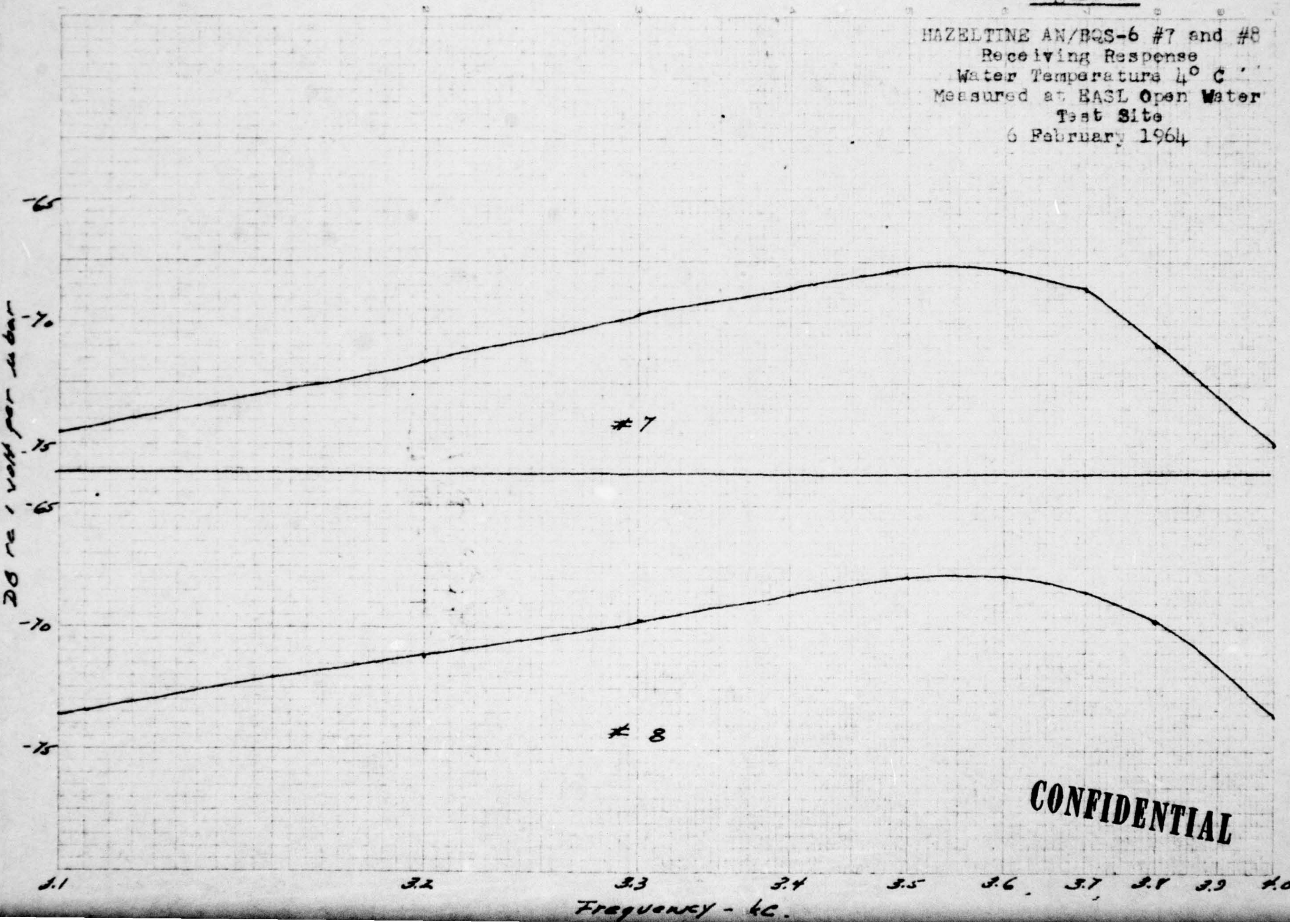
Figure 6

HAZELTINE AN/BQS-6 #7 and #8
Receiving Response
Water Temperature 4° C
Measured at EASL Open Water
Test Site
6 February 1964



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HAZELTINE ELECTRONICS DIVISION
ELECTRO-ACOUSTIC SYSTEMS LABORATORY
AVON, MASSACHUSETTS

PROJECT: [illegible]	
3.5 KC Pulsed	
[illegible]	DATE: [illegible]
[illegible] RESPONSE	STD: 2 CR-7
WATER TEMP: [illegible] DEPTH: 18' 9"	SEP: 2 YDS.

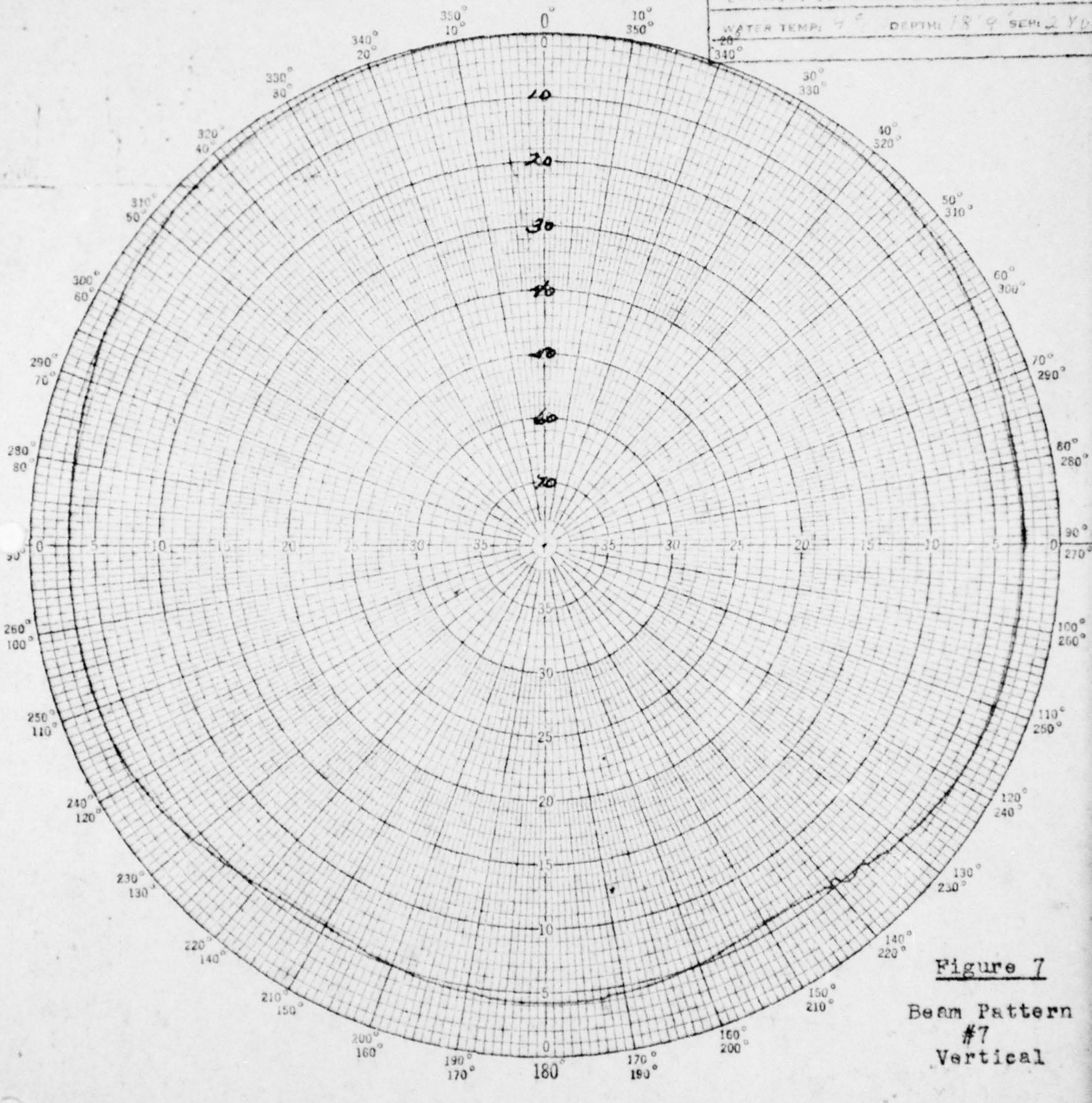

Figure 7

Beam Pattern
#7
Vertical

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Polar Chart No. 127D
SCIENTIFIC-ATLANTA, INC.
ATLANTA, GEORGIA

HAZELTINE ELECTRONICS DIVISION
ELECTRO-ACOUSTIC SYSTEMS LABORATORY
AVON, MASSACHUSETTS

PROJECT: BQS-6, SER. NO. 7
3.5 KC Pulse
FACE NORM. A. | DATE: 1-6-64
TRANSMITTING RESPONSE | STD: TP-210
WATER TEMP: 4°C DEPTH: 18' 9" SEP: 27 Ds

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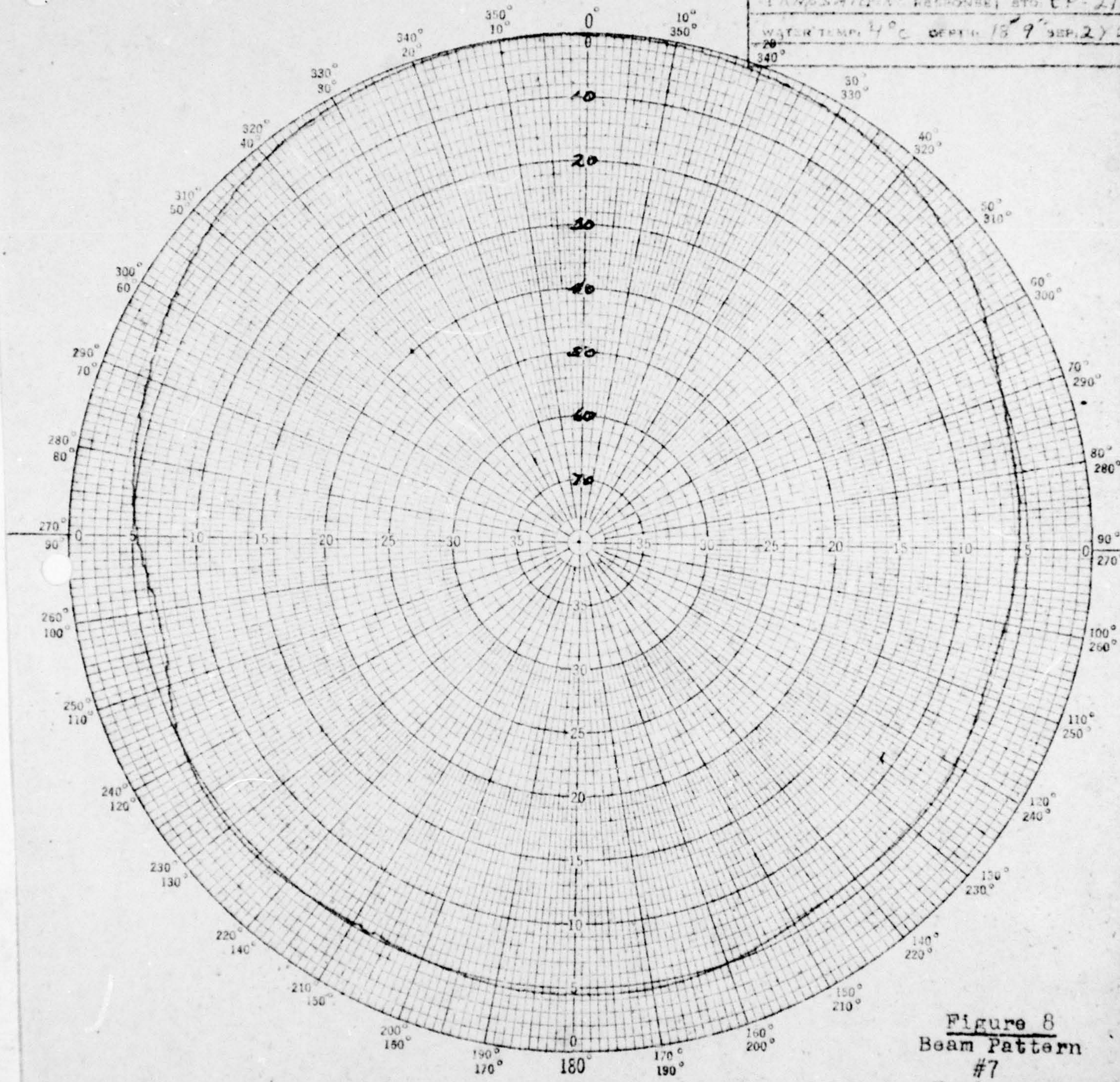

Figure 8
Beam Pattern
#7
Horizontal

Polar Chart No. 127D
SCIENTIFIC-ATLANTA, INC.
ATLANTA, GEORGIA

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HAZELTINE ELECTRONICS DIVISIO[N]		
ELECTRO - ACOUSTIC SYSTEMS LABORATORY AVON, MASSACHUSETTS		
PROJECT: BQS-6 #8		
3.5Kc Vertical		DATE: 2/6/6[illegible]
Trans	RESPONSE	STD:
WATER TEMP: 4°C	DEPTH: 18'9'	SEP: 2 m[illegible]

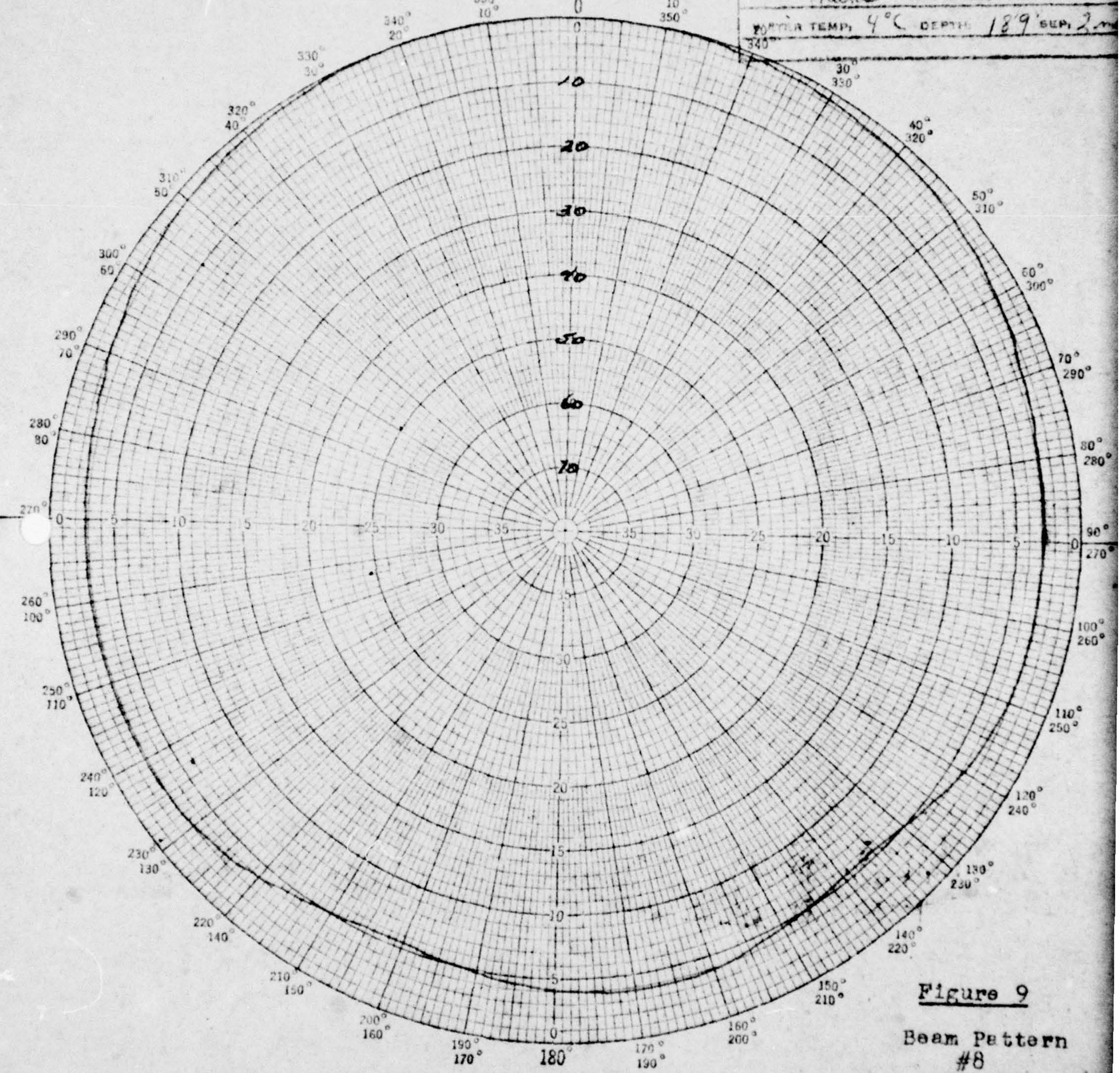

Figure 9

Beam Pattern
#8
Vertical

Polar Chart No. 127D
SCIENTIFIC-ATLANTA, INC.
ATLANTA, GEORGIA

HAZELTINE ELECTRO[illegible]ICS DIVISION ELECTRO-ACOUST C SYSTEM[illegible] L[illegible]BORATORY AVON, MASSA HU[illegible]	
PROJECT: BQS-6, SER NO. 8	
3.5 KC PULSED	
HORIZ	DATE: 1-6-64
TRANSMITTING RESPONSE	STD: BQR-4
WATER TEMP: 4°C DEPTH: 18'9" SEP: 24 YDS	

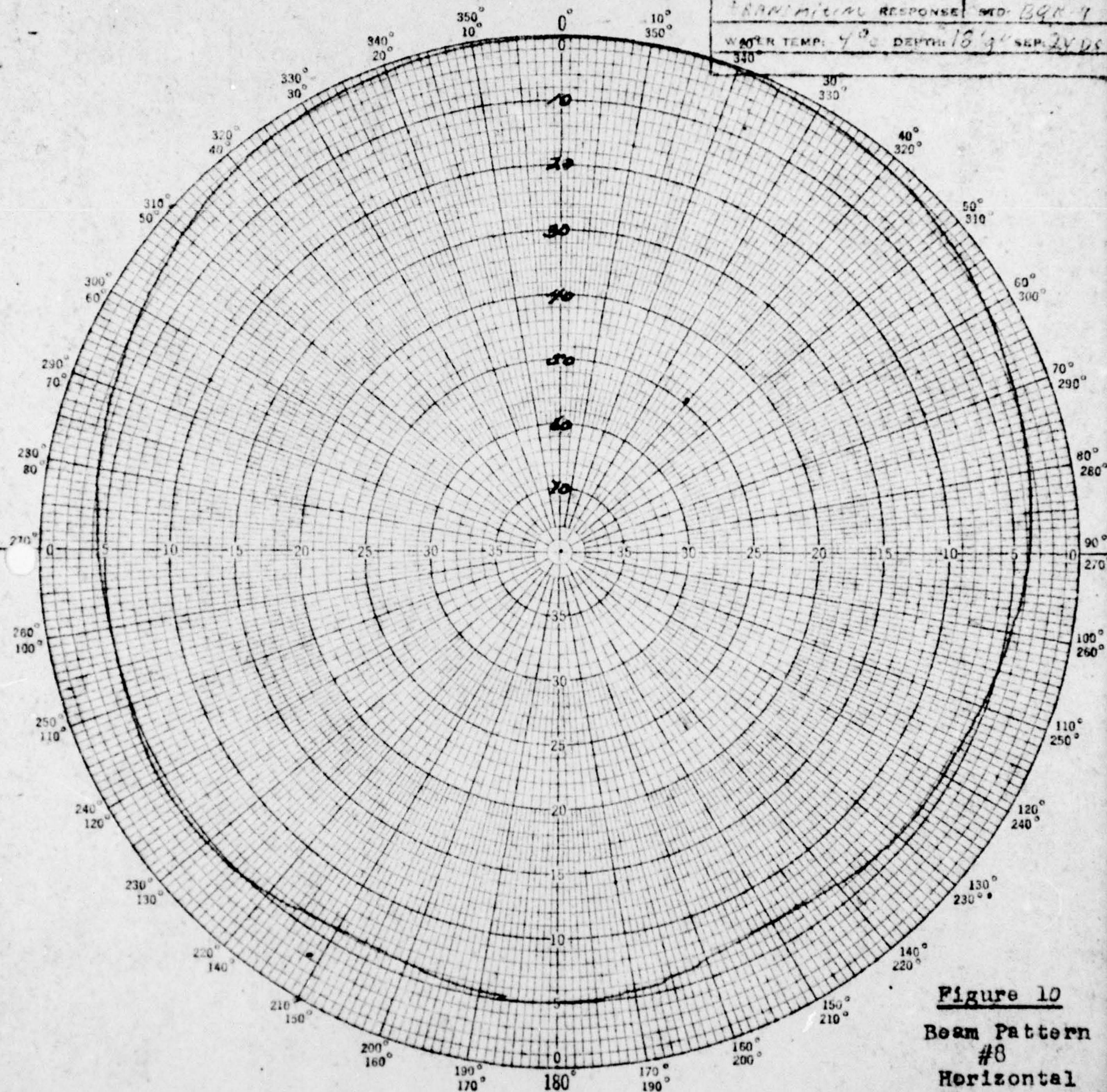

Figure 10

Beam Pattern
#8
Horizontal

Polar Chart No. 127D
SCIENTIFIC-ATLANTA, INC.
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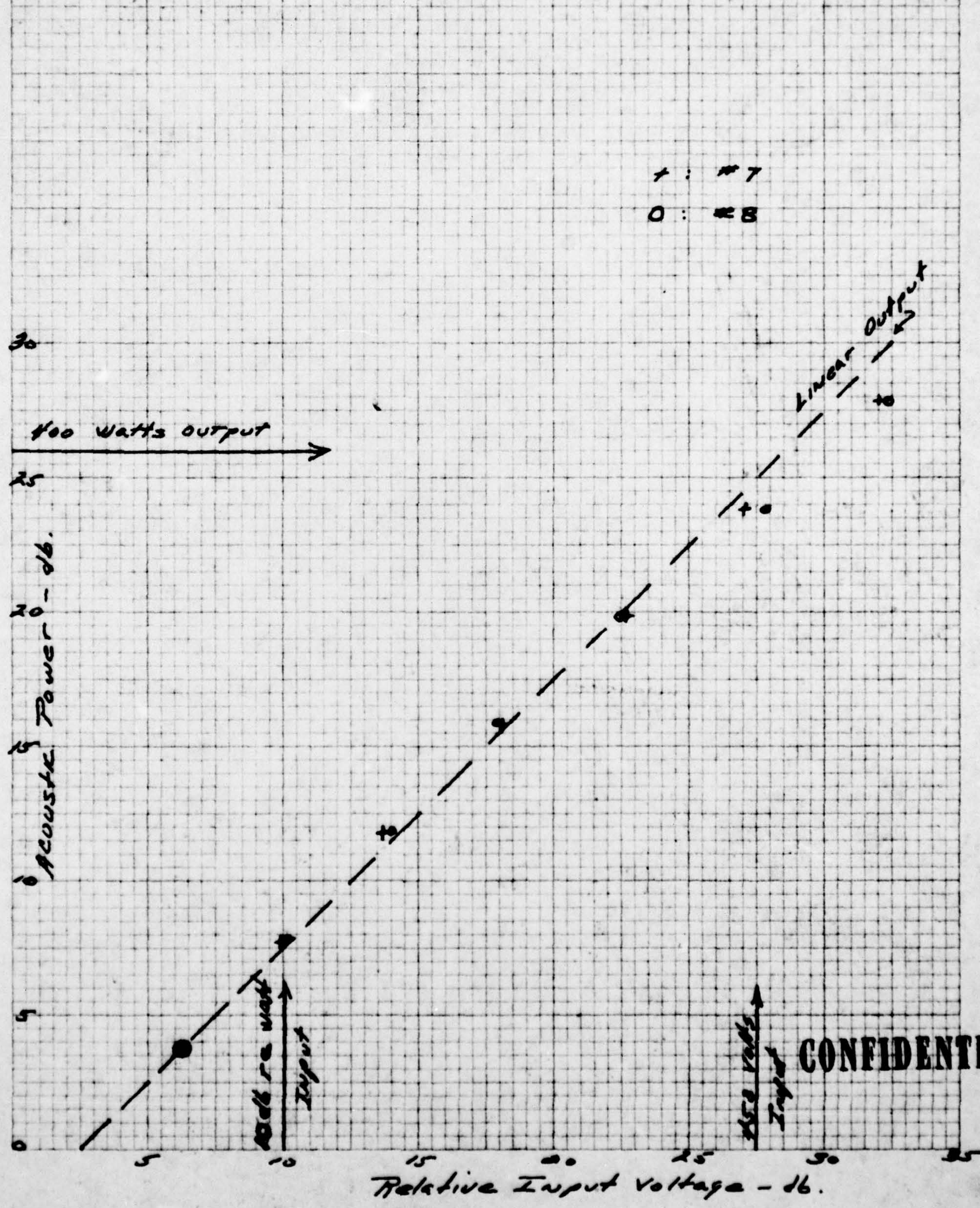
Figure 11

HAZELTINE AN/BQS-6 #7 and #8
Power Linearity Measurement
At 3.5 Kc
Water Temperature 4° C
Measured at EASL Open Water
Test Site
12 February 1964



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TEST DATA SHEET I

HAZELTINE AN/BQS-6 ELEMENTS #7 and #8

HYDROSTATIC PRESSURE TEST

DC Resistance	0 psi water #7	0 psi water #8	1000 psi water #7	1000 psi water #8	0 psi Air #7	0 psi Air #8
Black to Shield	Inf	Inf	Inf	Inf	Inf	Inf
White " "	"	"	"	"	"	"
Black " White	"	"	"	"	"	"
Shield" Casing	"	"	"	"	"	"
Black " "	"	"	"	"	"	"
White " "	"	"	"	"	"	"

20 Feet of cable in pressure tank. 500 VDC Megger used for measuring.

Cycles 1000 psi	Time at peak pressure
Cycle 1	30 minutes
Cycle 2,3, and 4	5 to 10 seconds
Cycle 5	30 minutes

ELECTRICAL TESTS

	#7	#8
Transducer Capacity at 1Kc and 20°C	.0295 mf	.0297 mf
Tangent of dielectric loss angle at 1Kc and 20°C	.004	.004
Polarity Test	White Lead pos.	White Lead pos.
Maximum Voltage (for 400 watt output)	600 Volts	600 Volts

ACOUSTICAL TESTS IN WATER AT 4°C

		#7	#8
Resonant Frequency	(Voltage Response)	3550 cps	3575 cps
Mechanical Q	(Voltage Response)	6.8	6.2
Efficiency	(Voltage Response and DI=4)	-1.9 db or 64%	-2.1 db or 62%
Efficiency	(Current Response and DI=4)	-2.7 db or 54%	-2.6 db or 55%
Efficiency	(Air and Water Impedance)	-2.8 db or 52%	-2.9 db or 51%

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EQUIPMENT DATA SHEET I

ITEM		MODEL NO.	HED NO.	SERIAL	CALIBRATION DATE	
1	20,000 PSI ENVIRONMENTAL PRESSURE TANK (16" SHELL)	NA		NA	NA	Pressure/Temp. Tests
2	Vector Impedance Lotus Plotter Chesapeake Inst. Co.	100	LY 10,017	30	10/15/63	Impedance Measurements
3	X-Y Recorder Moseley	2 DXY	LY 10,012	1095	7/16/63	Impedance Measurements
4	2KW Generator, Electronic CML	N2000-7A	LY 10,000	101	NA	Power Linearity Tests I^2T Test
5	Impedance Bridge General Radio Co.	1650-A	LY 10,015	4943	10/14/63	Impedance Measurements
6	Impedance Bridge ESI	Z250DA	LY 10,143	249-33	7/15/63	Impedance Measurements
7	Repeat Cycle Timer Technitron	27	LY 10,006		NA	Pressure/Temp./Power Tests
8	Unit Amplifier General Radio Co.	1206 B	LY 10,037	1195	7/1/63	Pressure/Temp./Power Tests
9	Unit Oscillator General Radio Co.	1210C	LY 10,126	3041	7/1/63	Pressure/Temp./Power Tests
10	Oscilloscope Hewlett Packard	130BR	LY 10,120	8309	8/30/63	Pressure/Temp./Power Tests

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[redacted]

EQUIPMENT DATA SHEET I

ITEM	EQUIPMENT	MODEL NO.	HED NO.	SERIAL	CALIBRATION DATE	
11	Electronic Counter Hewlett Packard	523CR	LY 10,119	1859	7/30/63	Pressure/Temp./Power Tests
12	Electronic Voltmeter Ballantine Laboratories	300H	LY 10,134	819	9/30/63	Pressure/Temp./Power Tests
13	Acoustic Tank Measurement System	1996	Not Assigned	#2	*See notation at bottom	Trans/Rec Responses
14	Standard Hydrophone USN/USRL	TP210	GFE	18	2/15/63	Trans/Rec Responses
15	Meter, Secondary, Phase Acton Laboratory	709A	LY 10,094	232	12/30/63	Power Linearity Test
16	Band Pass Filter Krohn-Hite	310AB	LY 10,118	2352	1/14/63	Power Linearity Test
17	Precision Admittance Bridge Hazeltine	NA	NA	NA	NA	Admittance Measurements
18	Megger - Biddle	9679	LY 6182	1108479	NA	Resistance/Pressure Measurement
19	J-9 Transducer	J-9	NA	134	10/15/63	Rec Response

**Measurement System was designed and built by Hazeltine for use by the Navy and Hazeltine's Open Water Test Site. System has the provision for daily self calibration and is always used in conjunction with standard hydrophones calibrated and provided by the U.S. Navy.