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SUBJECT

Tests on Model RAV Aircraft Receiving Equipment

Manufactured by Aircraft Radio Corp

BY

NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

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NAVY DEPARTMENT

REPORT ON

TESTS ON MODEL RAV AIRCRAFT RECEIVING EQUIPMENT MANUFACTURED BY AIRCRAFT RADIO CORP.

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ANACOSTIA STATION
WASHINGTON, D.C.

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Date of Tests: September 16, 1940 to November 22, 1940

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TABLE OF CONTENTS

	Page
Authorization	1
Object of Test	1
Abstract of Test	1
(a) Conclusions	1 a
(b) Recommendations	1 b
Description of Equipment Under Test	2
Method of Test	2
Data Recorded During Test	5
Discussion of Probable Errors	6
Results of Tests	6
Conclusions	10

APPENDICES

Weight and Dimensions	Table 1
Current Drain	2
Frequency range, calibration accuracy and overlap	3 to 10 inc.
Sensitivity	11 & 12
Spurious response ratios	13
Selectivity	14 & 15
Audio Fidelity	16
Audio Distortion	17
Overload	18 & 19
Frequency drift for 1 hour from a cold start	20 & 21
Frequency stability with variation of primary supply voltage	22
Frequency stability with variable temperature	23 to 33 inc.
CW heterodyne oscillator stability for 1 hour from a colt start and with variation of primary power supply	34 to 36 inc.
CW beat frequency shift for 10 minutes (after warm-up period)	37
Power output change for 30 minutes from a cold start	38
Power output change with variation of primary supply voltage	39
Microvolt sensitivity reduction when putting a second receiver in operation	40
Dial calibration and frequency spread per degree	41
Reset	42
Frequency stability and output with variable humidity	43

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APPENDICES (Cont.)

Selectivity	Plates 1 to 26 inc.
Audio fidelity	27 to 42 inc.
Overload	43 to 58 inc.
Frequency drift for 1 hour from a cold start	59 to 66 inc.
Frequency drift with variable temperature	67 to 81 inc.
CW heterodyne oscillator stability.	82 to 88 inc.
Power output change for 30 minutes from a cold start.	89 to 96 inc.
Frequency stability and output with variable humidity	97 to 100 inc.

(A) Naval Air Station Report on Flight Tests.

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AUTHORIZATION

1. The tests herein reported were authorized by Bureau of Engineering letter, reference (a). Additional references pertinent to these tests are listed as references (b) and (c).

Reference: (a) BuEng. Let. C-NOs-72445(9-12-DRI) of 17 Sept. 1940.
(b) Specifications RE 13A 582A.
(c) Specifications RE 13A 585A.

OBJECT OF TEST

2. The object of these tests was to determine the compliance of the equipment with the requirements of the specifications, reference (b), and to determine its adaptability for use in the Naval Aircraft Service.

ABSTRACT OF TEST

3. The equipment was tested for mechanical construction, electrical performance and its adaptability for installation and operation in Navy planes and suitability for use in the Naval Service.

4. The tests covered the following points:

(a) Mechanical.

(1) Workmanship.
(2) Material used.
(3) Size and weight.
(4) Shock mounting.
(5) Ruggedness.

(b) Electrical

(1) Frequency range, overlap and calibration accuracy.
(2) Sensitivity
(3) Selectivity.
(4) Audio fidelity.
(5) Audio distortion.
(6) Stability under conditions of vibration and variation of temperature, humidity and primary voltage supply.
(7) Noise output.
(8) Microphone tendencies.
(9) Sensitivity control action.
(10) Heterodyne oscillator action.
(11) Overload characteristics.
(12) Current drain.
(13) Interaction between receivers in multiple.
(14) Reset.
(15) Image response and I.F. rejection.

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Conclusions

The following conclusions were reached as a result of these tests:

(a) The material used appears to be the best known for each specific purpose and the workmanship is excellent. Throughout the tests there was no failure of performance of any part of the equipment. No. 7 dynamotor produced a hum in the output considerably greater than any other of the dynamotors. However, the magnitude was such as not to interfere with the reception of signals considerably less than standard output. Otherwise the performance of this dynamotor was comparable with the seven other units. The total current drain was well within the specified limits.

(b) Following is listed those characteristics wherein the equipment fails to meet the requirements of the specifications:

Overlap
Stray fields from heterodyne and CW oscillators.
Selectivity.
Audio fidelity.
Interaction between receivers.
Power output change due to warm-up.
Frequency stability.

(c) The equipment does not meet all of the specific dimensions but is within the cubic area.

(d) The holes in the antenna and ground binding posts are slightly undersize.

(e) With the exception of the stray field from the beat frequency and CW heterodyne oscillators, the points wherein the equipment fails to meet the requirements of the specifications are of a minor nature and will not seriously detract from satisfactory operation in the Naval aircraft service.

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Recommendations

As a result of the tests the following recommendations are made:

That further effort be made to correct those points wherein the equipment fails to meet the requirements of the specifications, reference (b), in particular suppression of stray fields from the beat frequency and CW heterodyne oscillators.

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DESCRIPTION OF EQUIPMENT UNDER TEST

5. The subject equipment, manufactured by the Aircraft Radio Corporation of Boonton, New Jersey, and known as the Model RAV radio receiving equipment, consists of two racks, each accommodating four receiving units. These eight units cover the frequency range of 190 Kc to 27 Mc. The receivers are of the conventional super-heterodyne type and designed for the reception of CW, MCW and voice signals. The two receivers covering the frequency range of 190 to 1500 Kc. have the additional feature of permitting loop reception.

6. The design of the control circuits is such as to permit individual operation of each unit or simultaneous operation of any group of two to eight units in a single pair of headphones.

7. Each receiver unit is provided with an independent gain control and an independent dynamotor for a high voltage supply. The source of power for the entire equipment is the airplane's 24 volt battery.

8. Each receiver unit employs six tubes of the 12 volt heater type and are as follows: a type 12 SK7 as an R.F. amplifier, a type 12K8 as a mixer, two type 12SK7's as I.F. amplifiers, a type 12 SR7 as a detector and CW oscillator and a type 12A6 as an audio amplifier.

METHOD OF TEST

9. A description of the methods used in conducting the tests follows. Each unit was checked for size, weight and mechanical construction. They were then assembled and tested for electrical performance.

10. For all tests, except those to determine interaction between receivers, each receiver was tested separately.

11. To determine the frequency range, overlap and calibration accuracy, measurements were made, with the use of a crystal frequency indicator, at the extreme ends and at the calibration markings of the tuning dials.

12. To determine the strength of possible stray fields from the heterodyne oscillator, the receivers were connected in multiple and the antenna posts grounded. The various receivers were tuned through the fundamental frequency or harmonics thereof of its own or any other receiver's CW heterodyne oscillator and the output measured with an output voltmeter.

13. To determine the radiation of the r.f. oscillators outside of the receiver, two units were put in operation in separate racks and with a separate antenna. One receiver was tuned to the r.f. oscillator frequency of the other receiver and the output measured.

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14. The sensitivity measurements were made with the use of a standard signal generator and an output meter. The output of the standard signal generator was connected to the input terminals of the receiver through leads approximately 5 inches in length. The output of the receiver was coupled to an output voltmeter having 300 ohms of non-inductive resistance across the input terminals. With the gain control adjusted for the specified signal/noise ratio, the microvolts input necessary to produce standard output were recorded. These tests were made on both MCW and CW conditions of the receivers.

15. The spurious response ratio measurements were made at the intermediate frequency, image frequency and twice the desired frequency plus the intermediate frequency. A standard signal generator and an output voltmeter were used to make these measurements. The receivers were adjusted for standard output at resonance then with all other controls remaining fixed an input at the above frequencies was introduced of an order to again obtain standard output. The spurious response ratio was determined as the ratio of these inputs with respect to the input at resonance.

16. To determine the selectivity a standard signal generator and an output voltmeter were used. The signal generator was adjusted to produce standard output at resonance. Then with all controls of the receiver remaining fixed the signal generator was detuned and the input to the receiver increased two, ten, one hundred and one thousand times successively and in each condition retuned toward resonance until standard output is again obtained. This was done at both above and below resonance. The selectivity was determined as the frequency displacement of the carrier frequency at these settings from that at resonance. This test was also conducted at reduced gain.

17. The audio fidelity was determined with the use of a beat frequency oscillator, a standard signal generator, and an output voltmeter. The beat frequency oscillator was used as an external source of modulation for the standard signal generator. The equipment was adjusted for 2 volts output at resonance with an input modulated 30% at 400 cycles. Then with all other controls remaining fixed the modulation frequency was varied in steps from 60 cycles to 3000 cycles and the output recorded at each step. The audio fidelity was determined as the percentage of output at each step with reference to that at 400 cycles.

18. The audio distortion was determined with the use of a beat frequency oscillator, a standard signal generator, an output voltmeter, and a wave analyzer. The beat freqjency oscillator provided the desired modulation frequency. The receiver was adjusted for the desired output at the percentage of modulation and modulation frequency to be measured. The output was coupled to the wave analyzer and with all other controls remaining fixed the output was measured at successive harmonics of the modulation frequency. The audio distortion was determined as the R.M.S. of these values.

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19. The overload characteristics were determined with the use of a standard signal generator and an output voltmeter. The receiver was adjusted for standard output at maximum gain, after which the input was increased in steps to the maximum of the standard signal generator. The output was recorded at each step. This test was conducted on both CW and MCW conditions of the receiver.

20. To determine the effect of tuning one receiver through the same frequency on which another is receiving pure CW signals, two receivers with overlapping frequency bands were put into operation with the antenna posts in common. One receiver was tuned to a pure CW signal from a standard signal generator and the second receiver then tuned through this same frequency. The output voltage and audio beat note were observed during this operation.

21. To determine the possible interference from the H.F. heterodyne oscillator and the CW heterodyne oscillator, the receivers were all connected for operation but with the antenna posts directly grounded. Each receiver was tuned to the fundamental frequency or harmonics of any oscillator that fell within its tuning range and the outputs recorded.

22. To determine the performance of the equipment with variation of the primary voltage a precision voltmeter was connected across the power input terminals to the receiver and a variable resistor in series in the circuit to permit relatively rapid changes of the primary voltage.

23. All frequency stability measurements were made with the use of a crystal frequency indicator.

24. For frequency stability measurements at a constant ambient temperature the input to the receiver was adjusted to produce approximately 2 volts output. Measurements were made immediately after turning on the receiver and at five minute intervals for a period of 1 hour. After the initial measurement the receiver controls remained fixed.

25. For frequency stability with variation of the primary voltage, the receiver was adjusted for two volts output after a warmup period of at least 10 minutes. The change of primary voltage and frequency measurements was made within a time interval of 1 minute.

26. To determine the frequency stability with variation of the ambient temperature, the receivers were installed in a temperature control chamber. Temperature was varied over the specified range and measurements made at 15 minute intervals and between 1 and 1-1/2 minutes after the receiver was turned on. The receiver was turned off immediately after each measurement. The temperature was maintained at the upper and lower limits for a sufficient length of time (30 minutes) for the equipment to assume this temperature.

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27. To determine the beat frequency shift over a 10 minute period when receiving a CW signal, the receiver was adjusted for standard output. After a warmup period measurements were made at intervals for a period of 10 minutes. A beat frequency oscillator was used to beat with the output signal of the receiver in making these measurements.

28. To determine the output change over a period of one-half hour from a cold start, the receiver was adjusted for the desired output immediately after being turned on and the output recorded at intervals for one-half hour.

29. The output change due to variation of the primary power supply was recorded as the primary voltage was varied over the specified range. A warmup period was allowed before conducting this test.

30. The change of sensitivity between the condition of one receiver in operation and that with another in simultaneous operation was observed by noting the input necessary for standard output with one receiver in operation and the increase in input necessary to again obtain the same output after a second receiver had been turned on for simultaneous operation.

31. The degrees of arc used for the calibrated portions of the tuning dial and the frequency spread within these limits were measured. The number of kilocycles per degree of arc was determined from the results of these measurements.

32. The resetability was determined by tuning the receiver to a predetermined setting several times from both a clockwise and counter-clockwise direction and measuring the frequency at each setting. The resetability was determined as an average of these frequency measurements.

33. The total current drain was determined by connecting an ammeter in the primary power supply circuit and observing the current drain with the eight units in simultaneous operation.

DATA RECORDED DURING TEST

34. Data recorded during tests in the form of tables, charts and photographs are appended to this report. This and other data pertinent to the tests are discussed in "Results of Tests".

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DISCUSSION OF PROBABLE ERRORS

35. Following is a list of apparatus used with the margin of error according to the manufacturer's guarantee:

			Accuracy
Weston d.c. voltmeter	Model 45	Ser. # 41660	± .05%
Weston d.c. ammeter	Model 45	Ser. # 41433	± .05%
Radio Research Co. crystal frequency indicator	Type LM-2	Ser. # 583	± .001%
Radio Research Co. crystal frequency indicator.	Type LM-1	Ser. # 5	± .001%
General Radio output voltmeter	Type 483-F	Ser. #67	±5.0%
General Radio output voltmeter.	Type 483-F	Ser. # 552	±5.0%
General Radio standard signal generator.	Type 605-B	Ser. # 1137	±10.0%
General Radio wave analyzer.	Type 736-A	Ser. #276	±5.0%
General Radio beat frequency oscillator.	Type 713-B	Ser. # 209	±2.0%
Ferris standard signal generator.	Type 16-C	Ser. # 44	±10.0%
Hygrometer.	G. Luff		-15 %
Refrigerator.	Frigidaire		± 2.0°

RESULTS OF TESTS

36. The results of the tests of the subject equipment will be discussed with regards to its compliance with the specifications, reference (b). In those paragraphs not discussed the equipment will be regarded as in full compliance with the specifications. The numbers of the subparagraphs are in agreement with those of the specifications.

I. INTRODUCTION

The items in this section pertain in general to flight tests and will be discussed in the flight test report appended to this report. The equipment does not meet all of the requirements for weight and dimensions as specified in paragraphs 1 - 7, and 5 - 10. The results of this investigation are shown on Table 1. The results of the test for power drain are shown on Table 2. Parts for remote control were not furnished with this equipment.

V. STRUCTURAL REQUIREMENTS

5-3 (3) A (c) The holes in the antenna and ground binding posts were found to be slightly under the required 0.1285 inch or approximately 0.125 inch.

5-10 As stated previously, the equipment does not meet all of the dimension requirements of this paragraph. The results are shown on Table 1.

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VI. OPERATING CHARACTERISTICS

The requirements of this section are covered in detail later in this report.

VII. DEFINITIONS

This section deals with information for guidance in conducting the tests.

VIII. ELECTRICAL REQUIREMENTS

8-1 No plug-in inductance systems for frequency changing are employed.

8-2 Radio amplifier coil assemblies are plug-in but are securely fastened in place and no change is necessary as an operating procedure.

8-3 The frequency range between 200 kilocycles and 27 megacycles is covered in eight bands, each band covering the frequency range specified in this paragraph.

8-4 The receivers are of the uni-controlled type, each having but one main tuning control. The equipment covers the entire specified frequency range without hiatus but does not in all cases meet the 2% overlap requirement. The results of this test are shown on Tables 3 to 10 inclusive.

8-5 It is possible to operate the entire equipment on the same antenna and with a single ground connection.

8-11 Equipment was not available to provide a 5 volt signal across the input terminals. However, the equipment operated satisfactorily with a 2 volt signal.

8-12 The restriction of stray fields from the heterodyne oscillator do not in all cases meet the requirements of this paragraph. For identification purposes the receiver units will be referred to as Nos. 1 to 8, No. 1 being the lowest frequency band and increasing progressively to the highest. The greatest output occurs when tuning No. 7 receiver to the heterodyne oscillator frequency of No. 6 receiver. An output of 38.7 milliwatts was recorded. Other combinations of receivers resulted in outputs varying from this value to a minimum of 1.2 milliwatts.

8-13 The equipment does not meet the requirements of this paragraph regarding radiation of the r.f. oscillators outside of the receivers. With two receivers in operation in separate racks, approximately four feet apart and each with a separate antenna four feet long, both operating from the same primary power supply, a 160 milliwatt signal was observed when tuning one of the receivers to the r.f. oscillator frequency of the other.

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8-16 The equipment meets the sensitivity requirements as shown on Tables 11 and 12.

8-17 The equipment meets the spurious response ratio requirements of this paragraph. The results are shown on Table 13.

8-18 The equipment meets the selectivity requirements of this paragraph except on a few points at 2 times the resonance input. The results of the test are shown on Tables 14 and 15 and plates 1 to 26 inclusive.

8-19 The equipment does not entirely meet the audio fidelity requirements of this paragraph. The results of this test are shown in Table 16 and Plates 27 to 42 inclusive.

8-20, 8-21 The equipment meets the undistorted output requirements of these paragraphs. The results are shown on Table 17.

8-22 The equipment does not meet the requirements of output change when tuning one receiver through the same frequency on which another is receiving CW signals. Measurements were made at 550 kilocycles and 20 megacycles. In both cases the maximum output power change was 47%. There was no change of beat note frequency.

8-23 The design of the CW heterodyne oscillator is such that on the CW position and with no incoming signal, audible beat notes are produced at no more than four frequencies on any band. However, the equipment does not meet the output requirements of this paragraph. On the 6 to 9 Mc receiver an output of 213 milliwatts was observed. This was a condition wherein the second harmonic of the CW heterodyne oscillator falls in the overlap portion, i.e. (below the specified frequency range) of the receiver. The maximum output at any frequency that falls within the specified range was 120 milliwatts.

8-27 The equipment is capable of receiving signal voltages in excess of 50 times as great as is necessary to produce 10 milliwatts output without blocking the receiver or rendering it impossible on CW to adjust the heterodyne beat note to a value suitable for reception. Overload characteristics are shown on Tables 18 and 19.

8-30 (1) The equipment does not entirely meet the requirements for frequency drift for one hour from a cold start. At all frequencies it is well within the requirements for the first 10 minutes but on several frequencies is outside of the requirements for the succeeding 50 minutes. The results are shown on Tables 20 and 21 and Plates 59 to 66 inclusive.

8-30 (2) The equipment meets the requirements for frequency stability with variation of the primary voltage. The results are shown on Table 22.

8-30 (3) The equipment does not meet the frequency stability with variable temperature requirements of this paragraph. The results are shown on Tables 23 to 33 and Plates 67 to 81 inclusive.

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8-30 (4) The equipment does not entirely meet the frequency stability requirements during a warm-up period. The results are shown on Tables 34 and 35 and Plates 82 to 88 inclusive, but is well within the requirements for variation of the primary supply voltage. The results of the latter are shown on Table 36.

8-31 The equipment meets the requirements for CW beat frequency shift for 10 minutes after a warm up except for the highest frequency band. The results are shown on Table 37.

8-32 The equipment does not meet the requirements for power output change for a 30 minute change from a cold start. The results are shown on Table 38 and Plates 89 to 96 inclusive.

8-33 The equipment meets the requirements for output power with variation of the primary power supply voltage. The results are shown on Table 39.

8-34 The equipment does not meet the requirements of this paragraph for reduction of sensitivity as measured with one receiver in operation alone and with another in operation for simultaneous reception. The results are shown on Table 40.

8-36 The equipment meets the requirements for dial calibration and frequency spread per degree of arc. The results are shown on Table 41.

8-37 The equipment is well within the requirements for calibration accuracy. The results are shown on Tables 3 to 10 inclusive.

8-38 The equipment meets the reset requirements of this paragraph. The results are shown on Table 42.

8-42 The receiver dynamotors are interchangeable.

8-44 The equipment meets the current drain requirements of this paragraph. The results are shown on Table 2.

8-45 and 8-46 The equipment performed without failure of any parts or tubes throughout the tests. No continuous run approaching 168 hours was made. However, numerous continuous runs for 8 hour periods were made totaling well in excess of 168 hours. At no time was there evidence of excessive heating.

Frequency stability and output measurements were made under conditions of variable humidity. The results of these tests are shown on Table 43 and Plates 97 to 100 inclusive.

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CONCLUSIONS

37. The following conclusions were reached as a result of these tests:

(a) The material used appears to be the best known for each specific purpose and the workmanship is excellent. Throughout the tests there was no failure of performance of any part of the equipment. No. 7 dynamotor produced a hum in the output considerably greater than any other of the dynamotors. However, the magnitude was such as not to interfere with the reception of signals considerably less than standard output. Otherwise the performance of this dynamotor was comparable with the seven other units. The total current drain was well within the specified limits.

(b) Following is listed those characteristics wherein the equipment fails to meet the requirements of the specifications:

Overlap.
Stray fields from heterodyne and CW oscillators.
Selectivity.
Audio fidelity.
Interaction between receivers.
Power output change due to warm-up.
Frequency stability.

(c) The equipment does not meet all of the specific dimensions but is within the cubic area.

(d) The holes in the antenna and ground binding posts are slightly undersize.

(e) With the exception of the stray field from the beat frequency and CW heterodyne oscillators, the points wherein the equipment fails to meet the requirements of the specifications are of a minor nature and will not seriously detract from satisfactory operation in the Naval aircraft service.

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TABLE 1

MODEL RAV RECEIVING EQUIPMENT
WEIGHT AND DIMENSIONS
RECEIVER UNITS

	Depth	Width	Height	Weight
Actual Measurements	11-7/8 in.	4-13/16 in.	5-5/8 in.	9-3/4 lbs.
Spec. Requirement	11-1/2 in.	5 in.	5-3/4 in.	10 lbs.
± Deviation from Spec.Requirements	+ 3/8 in.	-3/16 in.	-1/8 in.	-1/4 lbs.

4 UNITS MOUNTED FOR LOCAL CONTROL OPERATION

Actual Measurements	14-1/8 in.	21-1/2 in.	7-3/8 in.	45 lbs.
Spec. Requirements	13-1/2 in.	22 in.	7-1/2 in.	45 lbs.
± Deviation from Spec.Requirements	+ 5/8 in.	-1/2 in.	-1/8 in.	0

TOTAL EQUIPMENT (8 UNITS) MOUNTED FOR LOCAL CONTROL OPERATION

Actual Measurements	95 lbs.
Spec. Requirements	96 lbs.
± Deviation from Spec.Requirements	- 1 lb.

RECEIVER MOUNTING

Actual Measurements	13-1/4 in.	21-1/2 in.	5-1/8 in.
Spec. Requirements	14 in.	22-1/2 in.	4-3/4 in.
± Deviation from Spec.Requirements	-3/4 in.	- 1 in.	+ 3/8 in.

					Deviation
Power Cable	Length	10 Ft.	Weight	1.5 lbs.	- 1 lb.
Connection Cable	"	5 Ft.	"	1.0 lb.	-0.5 lb.

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TABLE 2

MODEL RAV RECEIVING EQUIPMENT

CURRENT DRAIN

Pri. Voltage Held Constant at 24 volts.

Rec. Units in Operation	Current Drain Amps.
1	1.4
2	2.8
3	4.3
4	5.7
5	7.15
6	8.6
7	10.1
Total 8	11.5
Spec. Allowance	13.0

TABLE 3

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY RANGE, CALIBRATION ACCURACY, OVERLAP

190 - 550 KC Band

Rec. Setting KCS	Measured Freq.	% Off. Cal.	Overlap %
Min.	188.000 KC		-6.0
200	199.956	-0.022	
250	249.830	-0.068	
300	300.070	+0.023	
350	350.091	+0.026	
400	400.016	+0.004	
450	450.000	0	
500	499.754	-0.049	
550	549.890	-0.02	
Max.	559.620		+1.75

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TABLE 4

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY RANGE, CALIBRATION ACCURACY, OVERLAP

520 - 1500 KC Band

Rec. Setting KC	Measured Freq.	% Off Cal.	Overlap %
Min.	508.847 KC		- 1.95
520	520.457	+0.087	
600	599.553	-0.075	
700	699.360	-0.09	
800	799.960	-0.005	
900	900.208	+0.023	
1000	1000.564	+0.056	
1100	1101.200	+0.109	
1200	1200.715	+0.06	
1300	1301.110	+0.085	
1400	1401.250	+0.09	
1500	1500.608	+0.04	
Max.	1532.610		+ 2.17

TABLE 5

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY RANGE, CALIBRATION ACCURACY, OVERLAP

1.5 - 3.0 MC Band

Rec. Setting MC	Measured Freq.	% Off. Cal.	Overlap %
Min.	1452.900 KC		- 3.15
1.5	1501.280	+0.085	
1.6	1601.168	+0.073	
1.8	1802.000	+0.11	
2.0	2000.387	+0.02	
2.2	2203.225	+0.145	
2.4	2404.000	+0.165	
2.6	2603.800	+0.145	
2.8	2804.550	+0.16	
3.0	3003.000	+0.1	
Max.	3066.712		+ 2.2

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TABLE 6

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY RANGE, CALIBRATION ACCURACY, OVERLAP

3.0 - 6.0 MC Band

Rec. Setting MC	Measured Freq.	% Off Cal.	Overlap %
Min.	2908.712 KC		- 3.04
3.0	2998.315	-0.056	
3.5	3498.000	-0.057	
4.0	4000.261	+0.006	
4.5	4498.000	-0.05	
5.0	5002.380	+0.047	
5.5	5501.045	+0.019	
6.0	5999.360	-0.006	
Max.	6109.000		+ 1.8

TABLE 7

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY RANGE, CALIBRATION ACCURACY, OVERLAP

6.0 - 9.0 MC Band

Rec. Setting MC	Measured Freq.	% Off. Cal.	Overlap %
Min.	5657.0 KC		- 5.7
6.0	6000.0	0	
6.5	6502.0	+0.03	
7.0	7004.0	+0.057	
7.5	7505.26	+0.07	
8.0	8004.0	+0.05	
8.5	8504.0	+0.047	
9.0	9003.0	+0.033	
Max.	9285.0		+ 3.17

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TABLE 8

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY RANGE, CALIBRATION ACCURACY, OVERLAP

9.0 - 13.5 MC Band

Rec. Setting MC	Measured Freq. KC	% Off Cal.	Overlap %
Min.	8992.00 KC		- 5.6
9.0	9002.48	+0.027	
9.5	9501.2	+0.012	
10.0	10005.14	+0.051	
10.5	10509.0	+0.085	
11.0	11005.14	+0.046	
11.5	11504.0	+0.035	
12.0	12004.0	+0.033	
12.5	12504.0	+0.032	
13.0	13004.0	+0.031	
13.5	13502.0	+0.015	
Max.	13792.0		+ 2.15

TABLE 9

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY RANGE, CALIBRATION ACCURACY, OVERLAP

13.5 - 20.0 MC Band

Rec. Setting MC	Measured Freq. MC	% Off.Cal.	Overlap %
Min.	12866.0		- 4.7
13.5	13496.0	-0.029	
14.0	14004.0	+0.028	
15.0	15002.0	+0.013	
16.0	16007.5	+0.047	
17.0	17010.0	+0.059	
18.0	18006.0	+0.028	
19.0	19005.0	+0.026	
20.0	20002.0	+0.01	
Max.	20426.0		+ 2.13

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TABLE 10

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY RANGE, CALIBRATION ACCURACY, OVERLAP

20 - 27 MC Band

Rec. Setting MC	Measured Freq. KC	% Off Cal.	Overlap %
Min.	18,930.00		- 5.35
20	20,005.32	+0.026	
21	21,003.24	+0.015	
22	22,004.00	+0.018	
23	22,996.74	-0.014	
24	24,002.00	+0.008	
25	24,996.00	-0.016	
26	25,996.00	-0.015	
27	26,989.76	-0.038	
Max.	27,358.5		+ 1.33

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TABLE 11

MODEL RAV RECEIVING EQUIPMENT

SENSITIVITY

Rec. Adjusted for Standard Output (10 MW) at 28 volts primary supply.

Band	Freq	MCV Input MCW	MCV Input CW
190 - 550 KC	190 KC	9.8	2.5
	350 "	4.0	1.05
	550 "	4.7	1.3
550- 1500 KC	520 KC	9.2	3.2
	1000 "	3.9	0.8
	1500 "	7.8	1.95
1.5 - 3.0 MC	1.5 MC	5.9	1.45
	2.25 "	4.6	1.1
	3.0 "	4.8	1.1
3.0 - 6.0 MC	3.0 MC	5.2	1.05
	4.5 "	5.2	1.1
	6.0 "	7.1	1.6

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TABLE 12

MODEL RAV RECEIVING EQUIPMENT

SENSITIVITY

Rec. Adjusted for Standard Output (10 MW) at 28 volt primary supply.

Band	Freq.	Input MCV	
		MCW	CW
6 - 9 MC	6.0 MC	10.0	2.6
	7.5 "	6.2	1.8
	9.0 "	7.0	2.2
9- 13.5 MC	9.0 "	10.0	3.0
	11.25"	19.0	5.1
	13.5 "	18.0	4.5
13.5-20 MC	13.5 "	27	7.4
	16.25"	22	6.6
	20.0 "	25	7.8
20 - 27 MC	20.0 "	23.5	5.6
	23.5 "	19.5	5.5
	27.0 "	17.5	5.5

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TABLE 13

MODEL RAV RECEIVING EQUIPMENT

SPURIOUS RESPONSE RATIOS

Freq.	Resonance Input MCV	Image		I.F.		2X Desired Freq. + I.F.	
		V	Ratio	V	Ratio	V	Ratio
350 KC	3.0	.05	16600	.25	83,000	.25	83000
1000 "	3.8	.066	17400	.2	52,000	.56	148000
2.3 MC	3.7	.22	59000	.13	35,000	2.2	590000
4.5 "	3.8	.25	65000	.125	32,900	.25	65000
7.5 "	5.0	.72	145000	.18	36,000	2.0	400000
11.0 "	22.0	2.0	90000	.66	30,000	2.0	90000
16.0 "	23.0	.46	20000	2.2+	100,000+	Out of Sig.Gen.Range	
24.0 "	Out of Sig.Gen.Range			2.2+	100,000+	Out of Sig.Gen.Range	

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TABLE 14

MODEL RAV RECEIVING EQUIPMENT

MCW SELECTIVITY

Freq.	Times Res. Input 2 KC	10 KC	100 KC	1000 KC
190 KC	1.725	3.15	4.4	5.65
350 "	1.65	3.15	4.25	5.6
550 "	1.85	3.5	4.87	6.35
520 "	2.97	4.82	6.5	8.4
1000 "	3.0	4.75	6.75	8.5
1500 "	3.37	5.25	7.5	9.92
1.5 MC	4.0	6.2	9.2	12.8
2.25 "	3.4	5.3	9.3	12.7
2.8 "	5.5	8.0	9.5	13.3
3.5 "	7.0	12.25	17.5	25.0
4.5 "	7.2	12.35	18.5	27.0
6.0 "	7.5	12.0	18.7	26.2
6.0 "	10.5	23.2	45.0	75.0
7.5 "	13.12	26.2	50.0	83.5
9.0 "	12.37	24.7	50.5	89.7

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TABLE 15

MODEL RAV RECEIVING EQUIPMENT

MCW SELECTIVITY

Freq.	Times Res. Input			
	2 KC	10 KC	100 KC	1000 KC
10 MC	12.5	31.25	60.0	95.0
11.25 MC	8.42	25.25	53.5	100.0
13.5 "	12.8	28.5	57.5	97.75
13.5 "	13.5	35.3	66.0	116.5
16.75 "	12.5	35.6	73.1	123.2
20.0 "	12.5	27.5	69.5	125.0
20.0 "	10.0	35.0	72.5	130.0
23.5 "	11.75	35.0	79.2	135.0
27.0 "	6.75	27.0	70.75	135.0
Sensitivity Reduced to 1/10 of above condition.				
350 KC	1.44	3.27	4.42	5.58
23.5 MC	14.68	35.0	64.62	137.5

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TABLE 16

MODEL RAV RECEIVING EQUIPMENT

AUDIO FIDELITY

Freq.	Pot. Output with Reference to that at 400 cycles							
	60 Cy.	100 Cy.	200 Cy.	400 Cy.	1000 Cy.	2000 Cy.	3000 Cy.	5000 Cy.
190 KC	65	84	97.5	100	82.5	40	30	25
550 "	59	82.5	96.5	100	86.5	42.5	25	17.5
520 "	60	78.5	94.0	100	100.0	77.5	57.5	31
1500 "	55	72.5	93.5	100	100.0	78.5	72.0	12
1.5 MC	60	80.0	94.0	100	100.0	77.5	61.0	35
3.0 "	56	77.5	93.0	100	100.0	71.5	59.0	19
3.0 "	56	72.5	95.0	100	102.0	91.5	101.0	52.5
6.0 "	49	74.5	91.5	100	104.0	91.5	104.0	50.0
6.0 "	45	69.0	91.5	100	102.0	86.5	90.0	50.0
9.0 "	46	72.0	91.5	100	105.0	88.0	91.0	49.0
9.0 "	47.5	71.5	91.5	100	100	85.0	94.0	51.0
13.5 "	47.5	74.0	94.0	100	100	87.5	94.0	52.0
13.5 "	52.5	77.5	95.0	100	101	89.0	95.0	54.0
20.0 "	50.5	75.5	92.5	100	100	87.5	92.5	50.0
20.0 "	43.5	68.5	90	100	100	90.0	95.0	50.0
27.0 "	44.0	68.5	90	100	101	93.0	101.0	60.0

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TABLE 17

MODEL RAV RECEIVING EQUIPMENT

AUDIO DISTORTION

MW Output	Mod. Freq. Cy.	% Mod.	Rms Pct. of Fund 350 KC	900 KC	2.5 MC	4.5 MC	7.5 MC	11.25 MC	15.5 MC	23.5 MC
200	200	10	11.9	14.2	8.05	6.29	16.6	8.26	13.2	12.8
"	"	30	11.6	12.5	7.16	7.66	16.0	8.65	12.9	12.7
"	"	80	10.1	10.6	8.71	9.09	12.0	9.2	12.5	9.8
"	400	10	8.1	9.25	5.18	4.85	8.75	5.12	8.09	7.25
"	"	30	6.9	7.59	4.96	5.26	9.24	6.19	8.09	7.85
"	"	80	7.34	8.41	8.11	8.23	9.00	8.26	10.25	10.1
"	1000	10	5.72	5.26	5.46	4.71	6.42	5.27	4.89	5.54
"	"	30	4.44	5.16	5.11	5.72	7.05	5.35	5.61	4.62
"	"	80	5.21	7.52	8.24	11.7	11.6	12.9	11.6	7.28
"	3000	10	1.38	3.85	6.54	5.91	3.65	5.34	4.15	3.96
"	"	30	3.86	3.51	6.07	5.74	4.51	5.24	4.15	5.11
"	"	80	3.23	6.69	11.6	12.6	13.1	16.1	12.5	13.6
400	400	30	11.8	10.6	8.21	8.53	14.3	9.18	13.8	10.5

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TABLE 18

MODEL RAV RECEIVING EQUIPMENT

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MCW OVERLOAD

MCV Input	Milliwatts Output							
	550 KC	1000 KC	2.25 MC	4.5 MC	7.5 MC	11.25 MC	18.25 MC	24.5 MC
10	53	53	68	48	25	8.0		8
20	150	187	220	235	90	13.5	9	20
30	280	333	400	400	180	30	19	47
40	420	520	580	610	290	82	32	77
50	520	730	760	800	370	77	51	112
60	520	850	870	910	495	90	66	140
70	480	940	930	990	650	112	85	180
80	440	960	940	1030	750	140	108	230
90	400	940	890	1070	830	168	140	275
100	370	910	860	1080	875	210	168	330
200	320	730	730	850	975	635	456	920
400	330	680	700	700	830	830	720	1140
600	370	720	700	730	770	680	910	1080
800	400	750	730	760	770	650	850	1040
1000	440	770	760	780	780	645	810	1020
10000	1050	1200	1020	1040	940	730	850	1140
100000	1220	1080	1090	1190	1100	975	1020	1200
10^6	1330	1040	1330	880	1150	1070	1080	1210

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TABLE 19

MODEL RAV RECEIVING EQUIPMENT

CW OVERLOAD

MCV Input	Milliwatts Output							
	350 KC	1000 KC	2.25 MC	4.5 MC	7.5 MC	11.25 MC	15.25 MC	24.5 MC
10	570	520	530	490	245	140	47	41
20	875	830	940	570	590	173	158	124
30	930	860	875	565	760	333	270	210
40	930	850	840	550	800	490	395	355
50	895	830	800	540	820	635	480	400
60	890	790	770	500	820	770	560	440
70	860	760	760	490	800	840	635	500
80	840	750	760	480	780	875	660	520
90	820	740	770	470	770	875	660	550
100	770	740	780	460	760	875	700	560
200	495	635	780	495	635	770	750	610
400	320	635	730	495	550	650	680	580
600	280	635	650	480	480	520	625	570
800	280	645	635	480	490	610	660	580
1000	280	660	600	470	495	565	660	610
10000	280	940	480	400	750	410	345	520
100000	300	930	370	355	1020	395	345	560
10^6	270	770	320	300	1200	400	380	460

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TABLE 20

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY DRIFT FOR 1 HOUR FROM A COLD START
TEMPERATURE CONSTANT AT +25°C.

Time Min.	333.0 KC	1000 KC	2.25 MC	4.5 MC
0	333.320 KC	1000.0 KC	2250 KC	4500.0
1	333.410	999.8	2248.9	4498.8
3	333.410	999.6	2248.8	4498.3
5	333.225	999.4	2248.65	4497.8
10	333.175	999.22	2248.55	4497.6
15	333.175	999.22	2248.4	4497.3
20	333.096	999.22	2248.1	4497.1
25	333.0	999.02	2247.75	4496.8
30	333.0	998.82	2247.6	4496.4
35	332.955	998.64	2247.4	4496.0
40	"	998.64	2247.2	4495.8
45	"	998.44	"	4495.3
50	"	998.24	"	4494.8
55	"	"	"	4494.6
60	"	"	"	"
10 Min. Drift	0.255 KC	0.780 KC	1.45 KC	2.4 KC
Pct.	0.076	0.078	0.065	0.053
Next 50 Min.	0.225 KC	0.980 KC	1.35 KC	3.0 KC
Pct.	0.068	0.098	0.06	0.067

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TABLE 21

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY DRIFT FOR 1 HOUR FROM COLD START
TEMPERATURE CONSTANT AT +25°C.

Time Min.	7.5 MC	10 MC	16.25 MC	24 MC
0	7495.3 KC	10,001.4 KC	16,247.5 KC	24,000.0 KC
1	7495.0	9,999.8	16,247.0	23,998.8
3	7494.5	9,998.8	16,245.8	23,994.4
5	7494.1	9,998.6	16,245.0	23,992.4
10	7493.9	9,997.6	16,244.5	23,991.2
15	7493.6	9,997.4	16,243.8	23,989.6
20	7493.4	9,997.2	16,243.8	23,989.2
25	7493.1	9,996.6	16,243.8	23,989.2
30	7493.1	9,996.0	16,243.3	23,988.0
35	7492.9	9,995.6	16,243.0	23,987.2
40	"	9,995.0	16,242.8	23,987.2
45	"	"	16,242.5	23,986.8
50	"	"	"	"
55	"	"	"	"
60	"	"	"	"
10 Min. Drift	1.4 KC	3.8 KC	3.0 KC	6.8 KC
Pct.	0.0187	0.038	0.0185	0.036
Next 50 Min.	1.0 KC	2.6 KC	2.0 KC	4.4 KC
Pct.	0.0134	0.026	0.0123	0.018

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TABLE 22

MODEL RAV RECEIVING EQUIPMENT

FREQUENCY STABILITY WITH VARIATION OF
PRIMARY SUPPLY VOLTAGE

Pri. Input Volts	22	28	30	Max.Freq. Change KC	% Change
450 KC	453.87 KC	453.93 KC	453.94	0.07	0.0154
1000 "	999.28	999.40	999.42	0.14	0.014
2.25 MC	2249.9	2250.1	2250.15	0.25	0.011
4.5 "	4495.2	4495.6	4495.9	0.7	0.0156
8.0 "	8003.8	8004.0	8004.4	0.6	0.0075
11.0 "	10999.4	11000.0	11000.8	1.2	0.01
17.5 "	17498.25	17499.25	17500.5	2.25	0.0128
24.0 "	23997.6	24000.8	24001.6	4.0	0.0166

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TABLE 25

MODEL RAV RECEIVING EQUIPMENT

REW FREQ. STABILITY WITH VARIABLE TEMPERATURE
300 KC

Time Min.	Temp. °C	Freq. KC	Time Min.	Temp. °C	Freq. Mc.
0	+23	300.00	195	-19	300.75
15	+14	300.45	210	-20	300.77
30	+12	300.65	240	-20	300.75
45	+ 4	300.4	255	-12	300.51
60	+ 1	300.8	270	+ 2	300.15
75	- 4	300.85	285	+12	299.85
90	- 8	300.86	300	+23	299.75
105	-10	300.87	315	+31	299.75
120	-12	300.89	330	+40	299.725
135	-14	300.7	360	+41	299.96
150	-16	300.72	375	+30	300.15
165	-17	300.75	390	+23	300.42
180	-18	300.725			

Max. Change Overall 1.045 KC = 0.35 Pct.

Max. Change over any 15 Min. Period (0 to 15 min.) 0.45 KC = 0.15 Pct.

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TABLE 24

MODEL RAV RECEIVING EQUIPMENT
HCW FREQUENCY STABILITY WITH VARIABLE TEMPERATURE
1000 KC

Time Min.	Temp. °C	Freq. KC	Time Min.	Temp °C	Freq. KC
0	+23	1000.00	195	-19	1001.028
15	+14	1000.82	210	-20	1001.066
30	+12	1000.814	240	-20	1000.895
45	+ 4	1000.857	255	-12	1000.709
60	+ 1	1000.971	270	+ 2	1000.571
75	- 4	1000.953	285	+12	1000.533
90	- 8	1000.8	300	+23	1000.438
105	-10	1000.895	315	+31	1000.8
120	-12	1000.971	330	+40	1000.618
135	-14	1000.857	360	+41	1000.876
150	-16	1000.895	375	+30	1001.104
165	-17	1000.953	390	+23	1000.971
180	-18	1000.895			

Max. Change Overall 1.104 KC 0.1104 Pct.
Max. Change Over Any 15 Min. Period (0-15 Min) .819 KC 0.08 Pct.

TABLE 25

MODEL RAV RECEIVING EQUIPMENT
HCW FREQUENCY STABILITY WITH VARIABLE TEMPERATURE
2.25 MC

Time Min.	Temp °C	Freq. KC	Time Min.	Temp. °C	Freq. KC
0	+23	2260.00	195	-19	2262.55
15	+14	2261.24	210	-20	2262.70
30	+12	2261.62	240	-20	2262.85
45	+ 4	2262.15	255	-12	2262.60
60	+ 1	2262.30	270	+ 2	2262.35
75	- 4	2262.45	285	+12	2262.20
90	- 8	2262.60	300	+23	2261.86
105	-10	2262.75	315	+31	2261.76
120	-12	2262.60	330	+40	2261.38
135	-14	2262.45	360	+41	2261.14
150	-16	2262.55	375	+30	2261.76
165	-17	2262.50	390	+23	2261.86
180	-18	2262.65			

Max. Change Overall 2.85 KC 0.127 PCT
Max. Change Over Any 15 Min Period (0-15 Min. 1.24 KC 0.055 PCT

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TABLE 26

MODEL RAV RECEIVING EQUIPMENT
HCW FREQUENCY STABILITY WITH VARIABLE TEMPERATURE
4.5 MC

Time Min.	Temp. °C	Freq. KC	Time Min.	Temp. °C	Freq. KC
0	+23	4500.00	195	-19	4505.80
15	+14	4503.24	210	-20	4506.00
30	+12	4504.20	240	-20	4506.80
45	+ 4	4504.50	255	-12	4506.00
60	+ 1	4504.80	270	+ 2	4505.80
75	- 4	4505.00	285	+12	4505.00
90	- 8	4505.70	300	+23	4504.00
105	-10	4506.00	315	+31	4505.00
120	-12	4506.20	330	+40	4503.40
135	-14	4506.00	360	+41	4503.00
150	-16	4505.80	375	+30	4504.10
165	-17	4506.20	390	+23	4505.00
180	-18	4506.00			

Max. Change Overall 3.8 KC 0.085%
Max. Change Over Any 15 Min. Period (0 to 15 Min.) 1.76 KC 0.39%

TABLE 27

MODEL RAV RECEIVING EQUIPMENT
HCW FREQUENCY STABILITY WITH VARIABLE TEMPERATURE
6.5 MC

Time Min.	Temp. °C	Freq. KC	Time Min	Temp. °C	Freq. KC
0	+21	6495.6	195	- 7	6499.80
15	+13	6498.4	210	+ 2	6499.30
30	+ 4	6498.6	225	+11	6498.95
45	- 2	6498.95	240	+20	6498.60
60	- 8	6498.6	255	+26	6498.60
75	-11	6498.6	270	+32	6498.60
90	-13	6498.7	285	+40	6497.60
105	-16	6499.05	315	+40	6497.30
120	-18	6499.10	330	+32	6497.20
135	-19	6499.20	345	+20	6497.60
150	-20	6499.30	360	+20	6498.60
180	-20	6499.30			

Max. Change Overall 4.2 KC 0.065 %
Max. Change Over Any 15 Min. Period (0 to 15 Min). 2.8 KC 0.043 %

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TABLE 28

MODEL RAV RECEIVING EQUIPMENT
MCW FREQUENCY STABILITY WITH VARIABLE TEMPERATURE
13 MC

Time Min.	Temp. °C	Freq. KC	Time Min.	Temp. °C.	Freq. KC
0	+21	12,996.80	195	- 7	13,007.40
15	+13	13,002.20	210	+ 2	13,006.20
30	+ 4	13,003.10	225	+11	13,004.60
45	- 2	13,004.60	240	+20	13,001.20
60	- 8	13,005.20	255	+26	12,999.20
75	-11	13,005.80	270	+32	12,997.60
90	-13	13,006.20	285	+40	12,995.20
105	-16	13,007.10	315	+40	12.995.20
120	-18	13,007.60	330	+32	12,996.20
135	-19	13,008.20	345	+20	12,999.00
150	-20	13,008.80	360	+20	13,000.80
180	-20	13,009.00			

Max. Change Overall	13.8 KC	0.106 %
Max. Change Over Any 15 Min. Period 0 to 15 Min).	5.4 KC	0.0415%

TABLE 29

MODEL RAV RECEIVING EQUIPMENT
MCW FREQUENCY STABILITY WITH VARIABLE TEMPERATURE
16.25 MC

Time Min.	Temp. °C	Freq. KC	Time Min.	Temp. °C	Freq. KC
0	+21	16,242.75	195	- 7	16,259.00
15	+13	16,247.60	210	+ 2	16,258.00
30	+ 4	16,254.75	225	+11	16,256.75
45	- 2	16,255.87	240	+20	16,255.87
60	- 8	16,256.25	255	+26	16,254.00
75	-11	16,256.75	270	+32	16,253.00
90	-13	16.257.25	285	+40	16,252.75
105	-16	16.257.75	315	+40	16,250.50
120	-18	16,258.00	330	+32	16.252.25
135	-19	16.258.50	345	+20	16,253.50
150	-20	16,259.00	360	+20	16.255.00
180	-20	16.259.25			

Max. Change Overall	16.50 KC	0.103%
Max. Change Over Any 15 Min. Period (15 to 30 Min)	7.75 KC	0.0475%

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TABLE 32

MODEL RAV RECEIVING EQUIPMENT
LOW FREQUENCY STABILITY WITH VARIABLE TEMPERATURE
26 MC

Time Min.	Temp. °C	Freq. KC	Time Min.	Temp. °C	Freq. KC
0	+21	25,987.40	195	- 7	26,008.80
15	+13	25,977.60	210	+ 2	26,005.60
30	+ 4	25,998.80	225	+11	26,003.60
45	- 2	26,008.40	240	+18	25,996.00
60	- 8	26,004.40	255	+26	25,994.40
75	-11	26,005.60	270	+32	25,990.40
90	-13	26,005.60	285	+40	25,988.00
105	-16	26,005.60	315	+40	25,987.80
120	-18	26,005.60	330	+32	25,988.00
135	-19	26,007.20	345	+20	25,994.40
150	-20	26,009.20	360	+20	25,995.20
180	-20	26,008.00			

Max Change Overall	21.8 KC	0.084%
Max. Change Over Any 15 Min. (0 to 15 Min).	10.2 KC	0.039%

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TABLE 31

MODEL RAV RECEIVING EQUIPMENT
ON HETERODYNE OSCILLATOR STABILITY WITH VARIABLE TEMPERATURE.

Time Min.	Temp. °C	.500 to 1.500 KC Rec. Freq. Kc	1.5 to 3 MC Rec. Freq. Kc.	3 to 6 Mc. Rec. Freq. Kc.
0	+23	238.081	704.643	1415.76
15	+16	238.071	704.442	1415.41
30	+ 4	238.062	704.6	1415.76
45	- 3	238.052	704.678	1416.08
60	- 8	238.052	704.8	1416.18
75	-11	238.043	704.878	1416.43
90	-14	238.038	704.948	1416.5
105	-16	238.033	704.982	1416.544
120	-18	238.029	705.008	1416.624
135	-20	238.024	705.04	1416.688
165	-20	238.024	705.088	1416.704
180	- 4	238.005	704.913	1416.46
195	+ 8	237.991	704.6	1415.84
210	+18	237.957	704.4	1415.5
225	+24	237.962	704.39	1415.31
240	+30	238.067	704.458	1415.18
255	+37	238.1	704.525	1415.23
270	+40	238.235	704.73	1415.41
285	+28	238.2	704.6	1415.29
300	+23	238.150	704.45	1415.16
Max. Overall Change		0.278 KC	0.698 KC	1.524 KC
Pct. Change		0.117	0.099	0.1075

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TABLE 38

MODEL RAV RECEIVING EQUIPMENT

CH. HETERODYNE OSCILLATOR STABILITY WITH VARIABLE TEMPERATURE

Time Min.	Temp. °C	6 to 9 MC Osc. Freq. KC	9 to 13.5 MC Osc. Freq. KC
0	+19	2831.55	4199.0
15	+11	2831.73	4199.6
30	+ 2	2831.91	4200.4
45	- 4	2833.14	4201.2
60	- 9	2833.82	4203.0
75	-13	2835.0	4204.0
90	-15	2835.3	4204.9
105	-18	2836.05	4205.3
120	-19	2836.14	4205.7
135	-20	2836.52	4206.1
165	-20	2836.67	4206.7
180	- 5	2835.70	4205.3
195	+ 7	2834.14	4203.0
210	+15	2831.86	4200.6
225	+23	2831.36	4198.9
240	+31	2830.29	4197.8
255	+40	2829.76	4197.0
285	+40	2829.43	4196.7
300	+27	2829.57	4197.0
315	+19	2830.24	4197.6
Max. Overall Change		7.24 KC	10.0 KC
Pct. Change		0.256	0.238

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[redacted]

MODEL RAV RECEIVING EQUIPMENT
CW. HETERODYNE OSCILLATOR STABILITY WITH VARIABLE TEMPERATURE

		13.5 to 20 MC Rng.	20 to 27 MC Rng.
Time Min.	Temp. °C	Freq. KC	Freq. KC
0	+19	4199.00	4201.5
15	+11	4200.00	4202.5
30	+ 2	4201.05	4203.1
45	- 4	4201.9	4203.6
60	- 9	4203.9	4205.7
75	-13	4204.7	4206.3
90	-15	4205.6	4207.2
105	-18	4205.8	4207.4
120	-19	4206.3	4208.0
135	-20	4206.8	4208.1
165	-20	4207.2	4208.7
180	- 5	4206.3	4207.6
195	+ 7	4206.05	4204.4
210	+15	4201.1	4202.9
225	+23	4199.2	4201.05
240	+31	4198.3	4200.0
255	+38	4197.6	4199.5
285	+40	4197.5	4199.0
300	+27	4197.5	4199.3
315	+19	4197.7	4199.7
Max. Overall Change		9.7 KC	9.7 KC
Pct. Change		0.23	0.23

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[redacted]

MODEL RAV RECEIVING EQUIPMENT
CW HET. OSC. STABILITY FOR 1 HR. FROM COLD START.

Time Min	520 to 1500 KC Rec. Freq. KC	1.5 to 3 MC Rec. Freq. KC	3 to 6 MC Rec. Freq. KC
0	239.955	707.745	1419.930
5	239.945	707.691	1419.756
10	239.950	707.664	1419.[illegible]99
15	239.960	707.664	1419.739
20	239.980	707.682	1419.739
25	240.0	707.727	1419.670
30	240.085	707.8	1419.836
35	240.040	707.843	1419.912
40	240.060	707.904	1419.895
45	240.070	707.974	1419.912
50	240.090	708.061	1420.0
55	240.1	708.087	1420.07
60	240.11	708.130	1420.139
Change for First 10 Min	0.01 KC	0.061 KC	0.191 KC
Pct.	0.004	0.0115	0.0135
Next 50 Min	0.16 KC	0.466 KC	0.4 KC
Pct.	0.066	0.068	0.028

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TABLE 35

MODEL RAV RECEIVING EQUIPMENT

CW HET. OSC. STABILITY FOR 1 HOUR FROM COLD START.

Time Min.	6 to 9 MC Rec. Freq. KC	9 to 13.5 MC Rec. Freq. KC	13.5 to 20 MC Rec. Freq. KC	20 to 27 MC Rec Freq. KC
0	2831.63	4201.7	4200.8	4202.4
5	2831.05	4200.8	4200.1	4201.8
10	2830.63	4200.2	4199.6	4201.3
15	2830.26	4199.2	4199.0	4200.8
20	2829.95	4198.9	4198.8	4200.4
25	2829.74	4198.8	4198.4	4200.0
30	2829.53	4198.6	4198.2	4199.9
35	2829.42	4198.4	4198.0	4199.6
40	2829.26	4198.2	4198.0	4199.4
45	2829.21	4198.0	4197.9	4199.3
50	2829.11	4198.2	4197.9	4199.1
55	2829.05	4198.2	4197.9	4199.1
60	2829.05	4198.1	4197.9	4199.0
Changes for First 10 Min	1.0 KC	1.5 KC	1.2 KC	1.1 KC
Pct.	0.035	0.0357	0.0285	0.026
Next 50 Min.	1.58	2.2 KC	1.7 KC	2.3 KC
Pct.	0.056	0.052	0.04	0.055

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TABLE 36

MODEL RAV RECEIVING EQUIPMENT
CW HET. OSC. STABILITY WITH PRIMARY SUPPLY VOLTAGE VARIATION.

Rec. Freq.	Freq. Change With Voltage Change From 22 to 30 volts.	Pct. Change
350 KC	0.055 KC	0.0157
1000 KC	0.03	0.0033
2.5 MC	0.012	0.00048
4.5 MC	0.220	0.0049
7.5 MC	0.5	0.0067
11.5 MC	0.7	0.006
16.5 MC	1.225	0.0074
23.5 MC	2.35	0.01

TABLE 37

MODEL RAV RECEIVING EQUIPMENT
CW BEAT FREQUENCY SHIFT FOR 10 MINUTES
30 MIN. WARM-UP

Rec. Freq.	Beat Freq. Change For 10 Min.	Pct. Change
350 KC	.014 KC	0.004
1000 KC	.05 KC	0.005
2.25MC	.041 KC	0.0018
4.5 MC	.036 KC	0.0008
7.5 MC	.150 KC	0.002
11.25MC	.410 KC	0.0036
16.25 MC	.520 KC	0.004
23.5 MC	2.400 KC	0.01

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TABLE 38

MODEL RAV RECEIVING EQUIPMENT
POWER OUTPUT CHANGE FOR 30 MIN. FROM COLD START.

Initial Adjustment 10 MW (INCW)

Time (Min.)	0	5	10	15	20	25	30	Returned
	Pct. Output With Reference to Start							
350 KC	100.0	87.5	78.0	70.0	61.0	52.0	48.0	52.0
900 KC	100.0	88.0	74.0	68.0	64.0	55.0	47.0	59.0
2.25 MC	100.0	80.0	67.0	58.0	50.0	46.5	42.0	65.0
4.5 MC	100.0	85.0	73.0	65.0	58.0	52.0	48.0	75.0
7.5 MC	100.0	85.0	75.0	65.0	59.0	55.0	50.0	58.0
11.0 MC	100.0	75.0	65.0	59.0	52.0	48.0	44.0	49.0
16.0 MC	100.0	65.0	56.0	49.5	45.0	41.0	39.0	59.0
24.0 MC	100.0	75.0	61.0	46.5	39.0	30.0	27.0	56.0

TABLE 39

MODEL RAV RECEIVING EQUIPMENT
POWER OUTPUT CHANGE WITH VARIATION OF PRI. POWER SUPPLY

Pri. Voltage	22	28	30
	Power Output MW		
350 KC	5.2	10.0	11.9
1000 KC	4.03	10.0	11.5
2.25 MC	4.4	10.0	11.8
4.5 MC	4.63	10.0	11.9
7.5 MC	5.2	10.0	11.7
11.0 MC	5.63	10.0	11.8
16.0 MC	5.2	10.0	11.8
24.0 MC	4.8	10.0	10.8

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TABLE 40

MODEL RAV RECEIVING EQUIPMENT
MICROVOLT SENSITIVITY REDUCTION.

CW

	Input	Output
One Receiver Adjusted for Standard Output	4.23 MCV	1.73 V
Another Receiver Put in Operation	5.6 "	1.73 V
MCV Sensitivity Reduction	1.37 " =	32 Pct.

MCW

One Receiver Adjusted for Standard Output	16 MCV	1.73 V
Another Receiver Put in Operation	20 "	1.73 V
MCV Sensitivity Reduction	4 " =	25 Pct.

The above measurements are of the combinations producing the greatest sensitivity reduction. Other combinations varied from the above values (32 Pct) down to 22 Pct.

TABLE 41

MODEL RAV RECEIVING EQUIPMENT
DEGREES OF ARC OF CALIBRATED PORTIONS OF TUNING DIAL.
FREQUENCY DENSITY PER DEGREE OF ARC.

Rec.	Dial Cal. Deg.	Actual Freq. Range	Average KC Spread Per Degree
200 - 550 KC	317	349.934 KC	1.1
520 -1500 KC	313	980.151 KC	3.13
1.5 - 3.0 MC	295	1501.72 "	5.1
3.0 - 6.0 "	300	3001.045 "	10.0
6.0 - 9.1 "	291	3003.0 "	10.3
9.0- 13.5 "	289	4499.52 "	15.57
13.5 -20.0 "	291	6506.0 "	22.4
20.0 -27.0 "	284	6984.44 "	24.6

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TABLE 42

MODEL RAV RECEIVING EQUIPMENT

RESET

Band	Base Freq.	Average Deviation of Clockwise and Counterclockwise Resets KC	Pct
200 to 550 KC	250 KC	0.076	0.03
" "	500 "	0.08	0.016
520 to 1500 "	600 "	0.045	0.0075
" " "	1500 "	0.15	0.01
1.5 to 3 MC	1.6 MC	0.06	0.004
" " "	3 "	0.25	0.008
3 to 6 "	3 "	0.5	0.0166
" " " "	6 "	0.31	0.005
6 to 9 "	6.5 "	0.58	0.009
" 9 "	9 "	0.39	0.0043
9 to 13.5 "	9 "	1.07	0.012
" " "	13 "	0.55	0.0042
13.5 to 20 "	14 "	1.12	0.004
" " "	20 "	1.12	0.0056
20 to 27 "	20 "	2.12	0.01
" " "	26 "	1.32	0.0051

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TABLE 43

MODEL RAV RECEIVING EQUIPMENT
FREQUENCY STABILITY WITH VARIABLE HUMIDITY.

Temperature Constant at +40°C

		500 KC		4.5 MC	
Time Min	Pct. Humidity	Freq. KC	Output Volts	Freq. KC	Output Volts
0	24	498.26	1.9	4497.12	1.65
30	36	498.46	1.9	4497.24	1.65
60	40	498.51	1.8	4497.38	1.6
90	47	498.64	1.7	4497.5	1.6
120	89	498.57	1.7	4496.38	1.6
150	100	498.47	1.6	4495.34	1.4
180	100	498.18	1.6	4494.38	1.2
Max. Freq. Change		0.46		3.12	
Pct. Change		0.092		0.069	

		6.5 MC		26 MC	
Time Min	Pct. Humidity	Freq. KC	Output Volts	Freq. KC	Output Volts
0	24	6499.05	1.75	25994.8	1.85
30	36	6498.85	1.75	25995.6	1.85
60	40	6498.7	1.6	25997.2	1.5
90	47	6498.7	1.6	25995.2	1.5
120	89	6498.8	1.6	25992.8	1.5
150	100	6497.6	1.6	25986.8	1.6
180	100	6497.1	1.5	25982.8	1.6
Max. Freq. Change		1.95		14.4	
Pct. Change		0.03		0.055	

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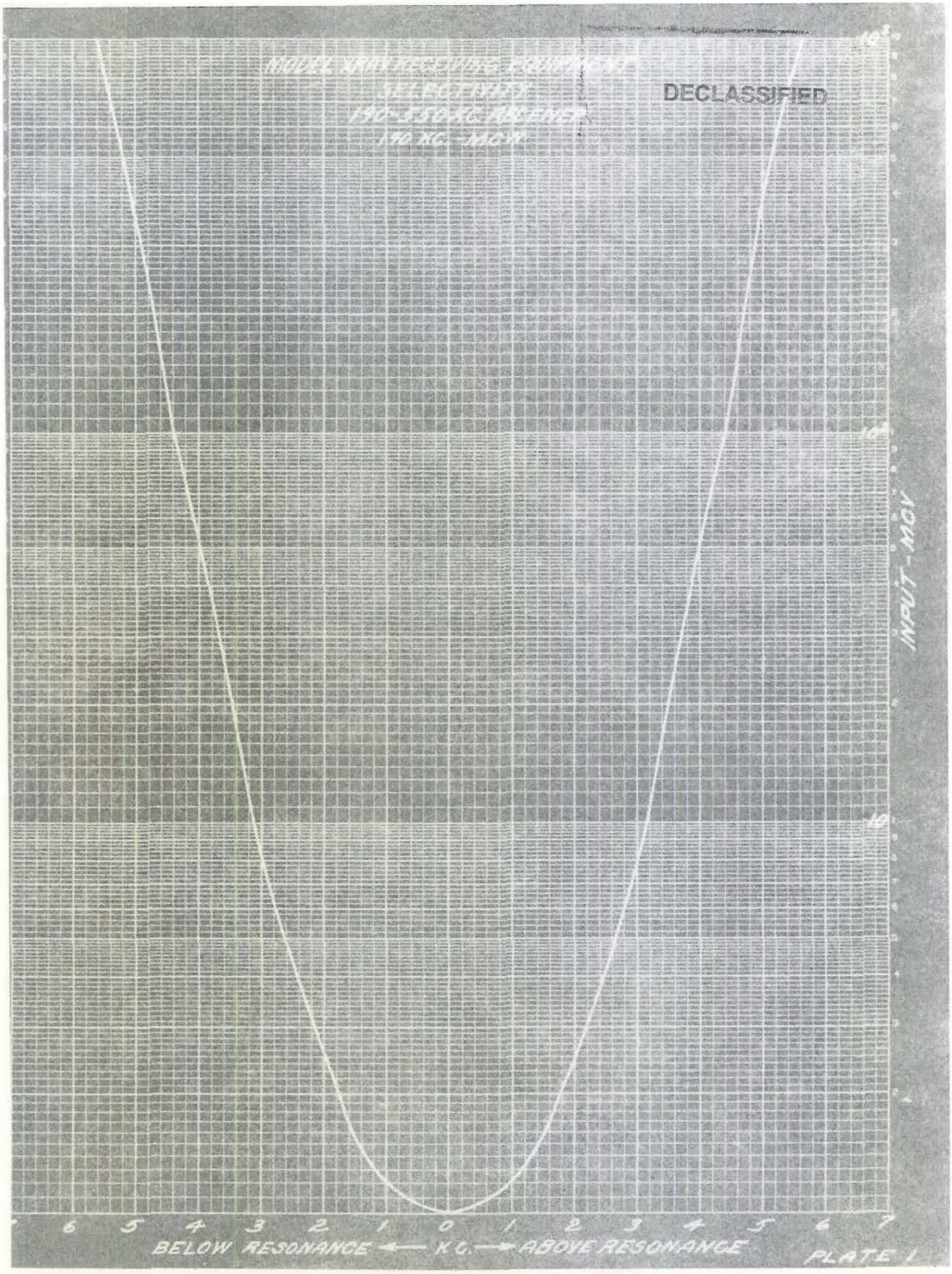

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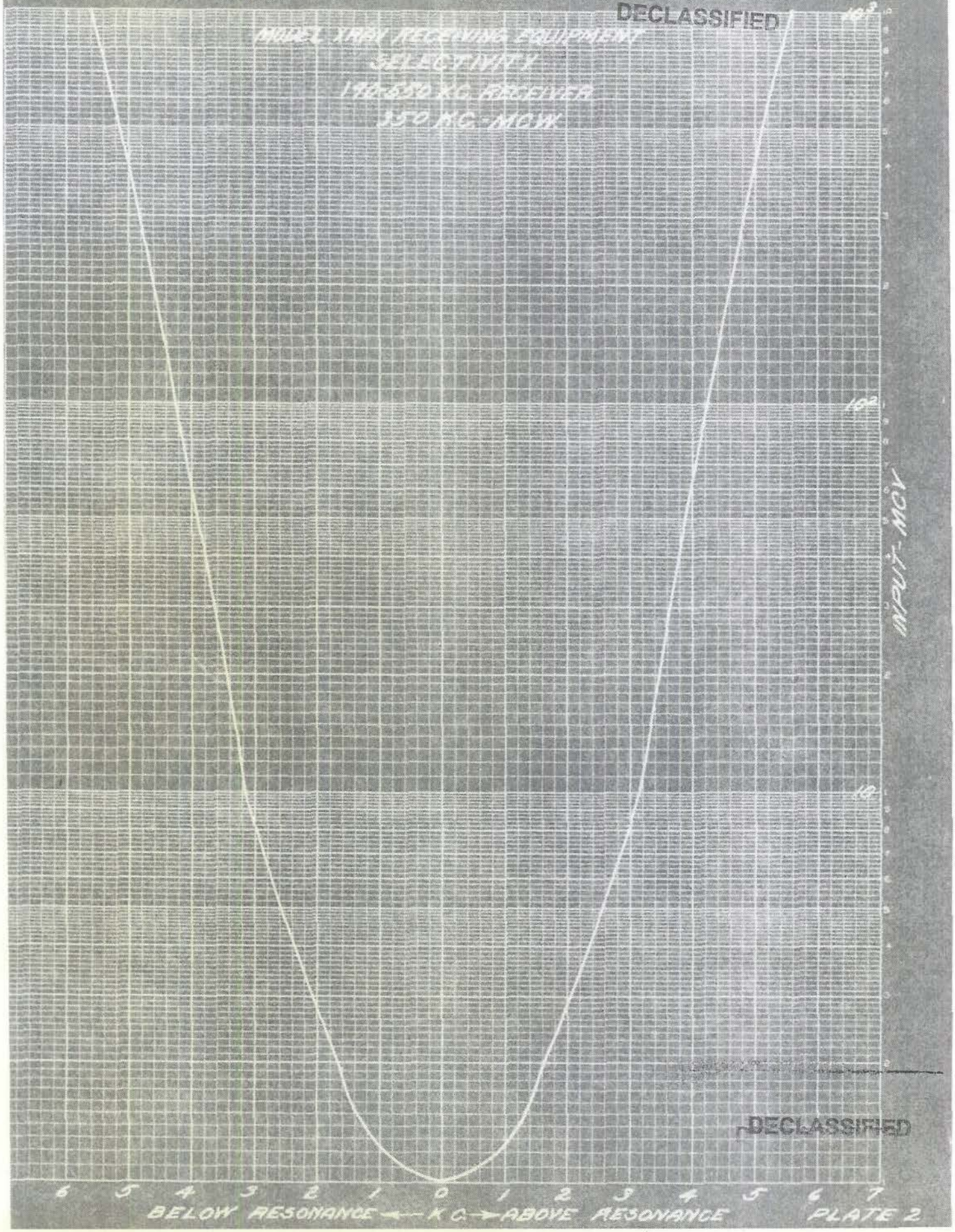

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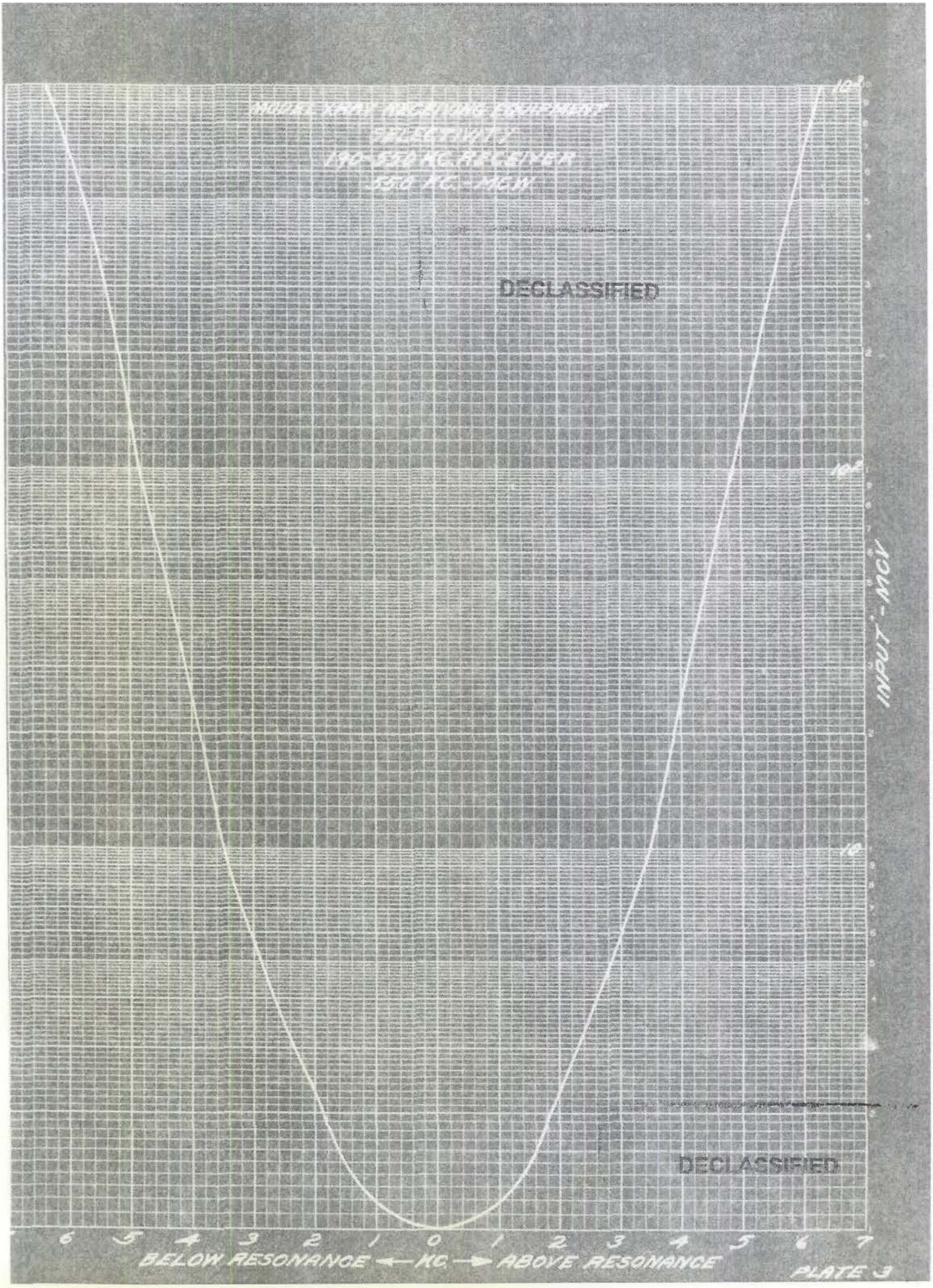
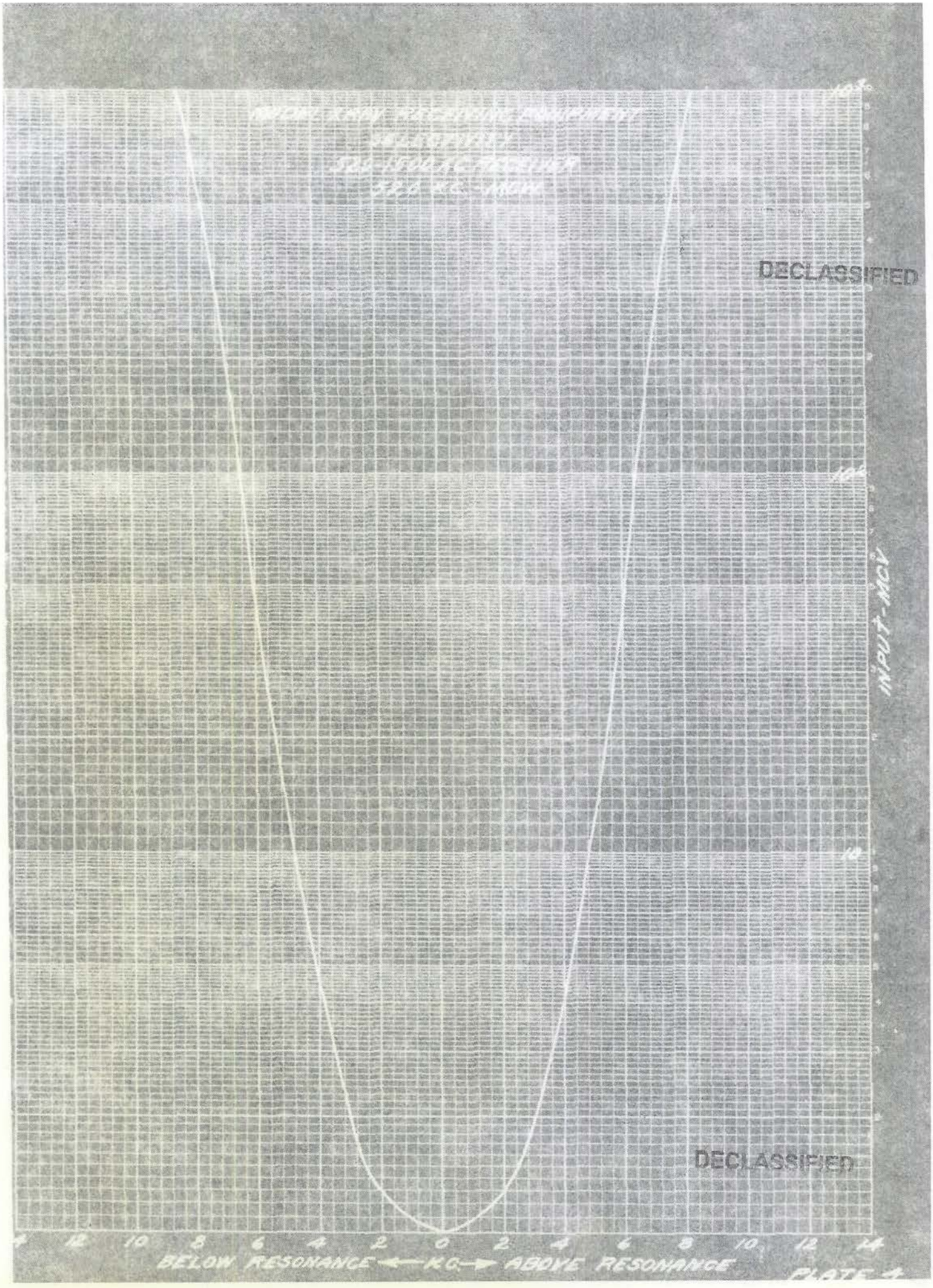
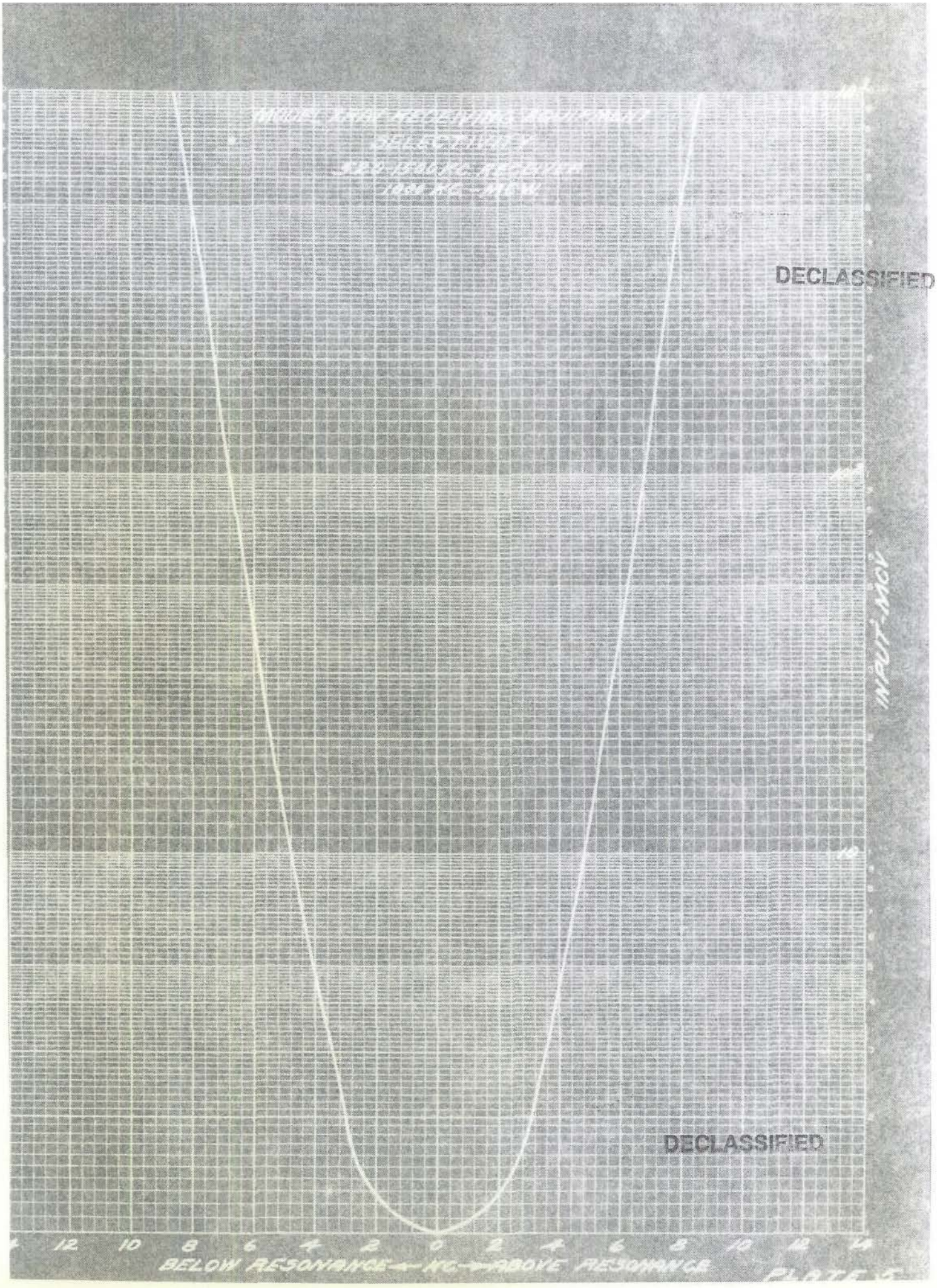
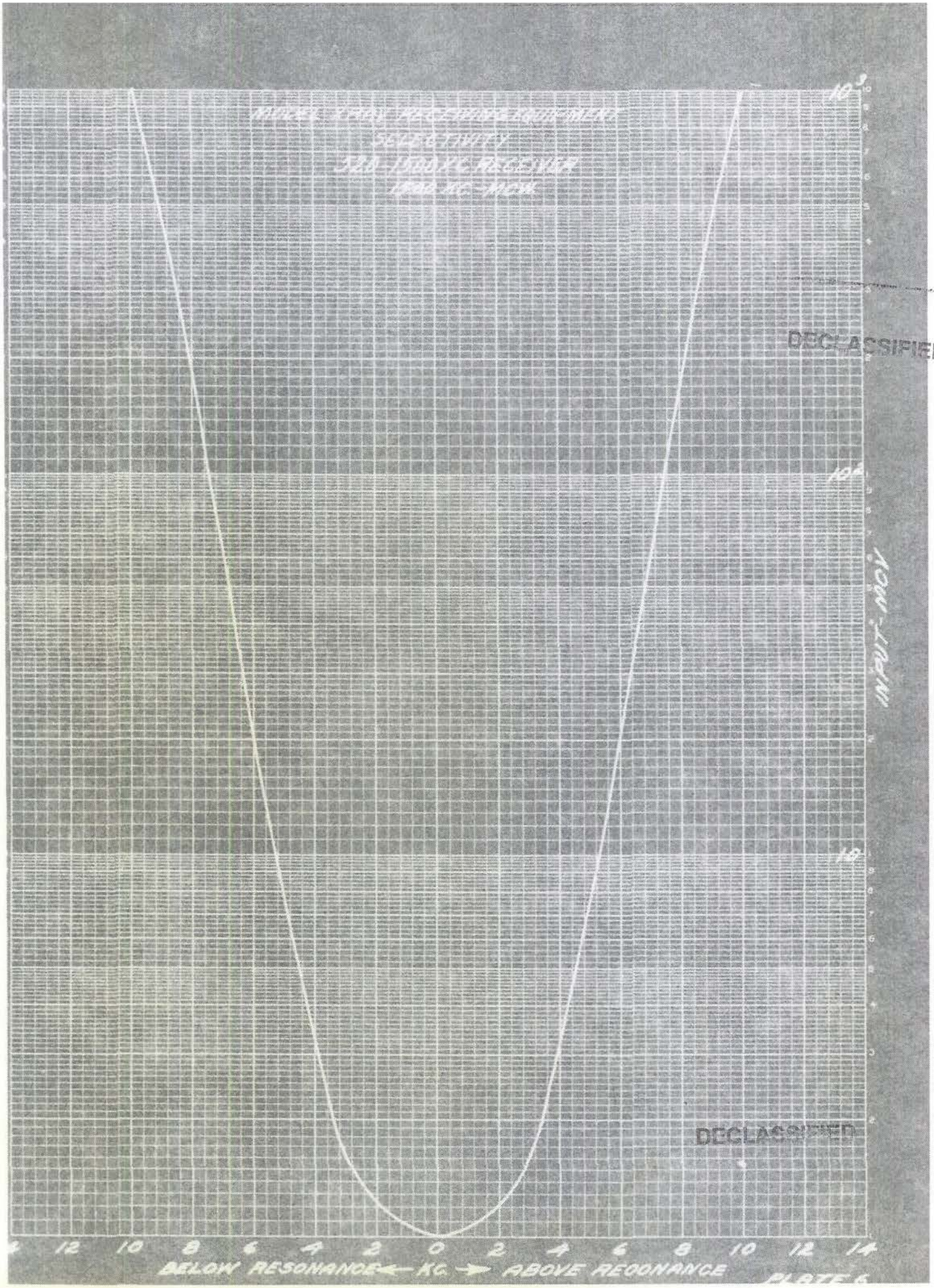
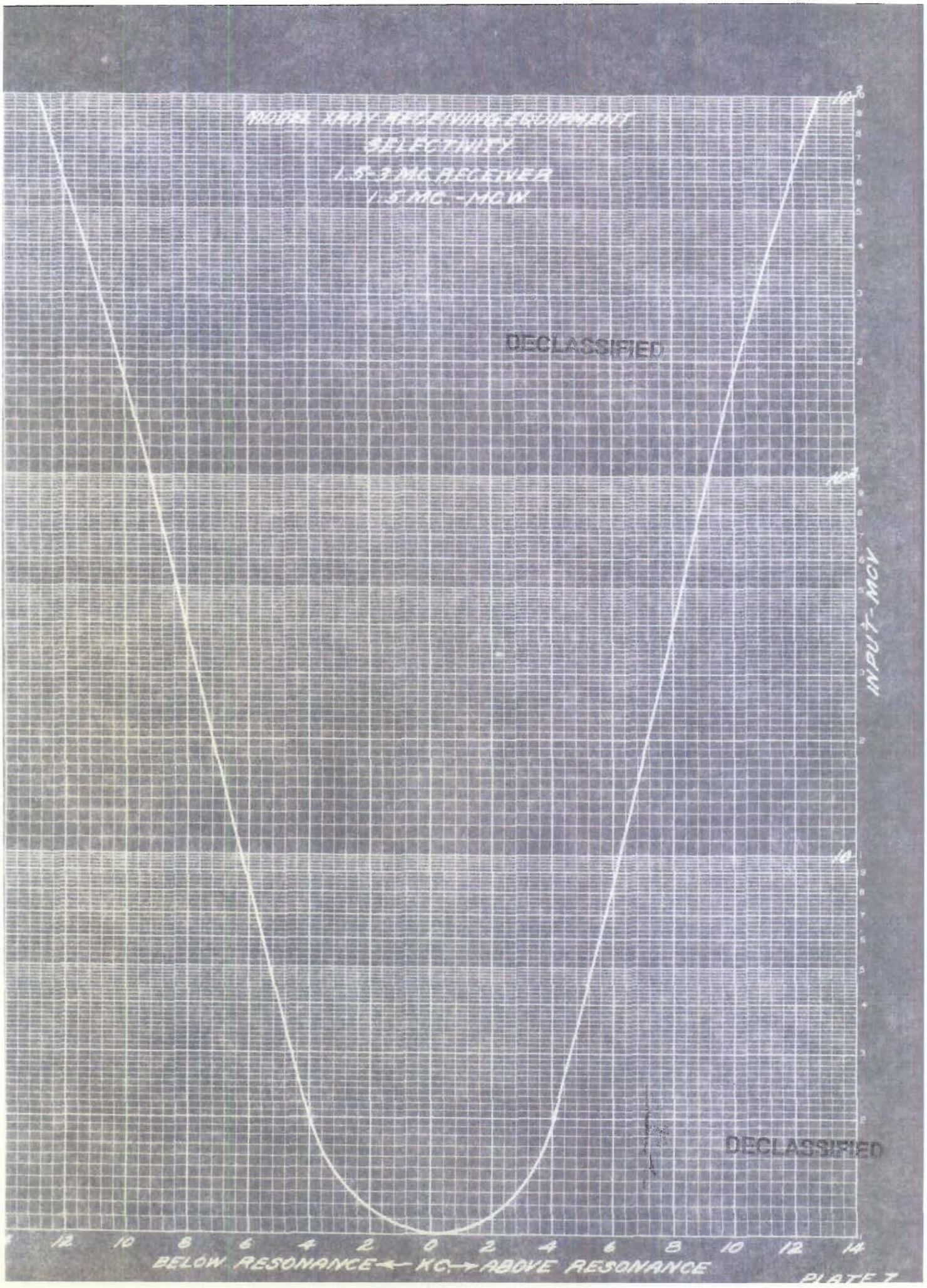
PLATE 2

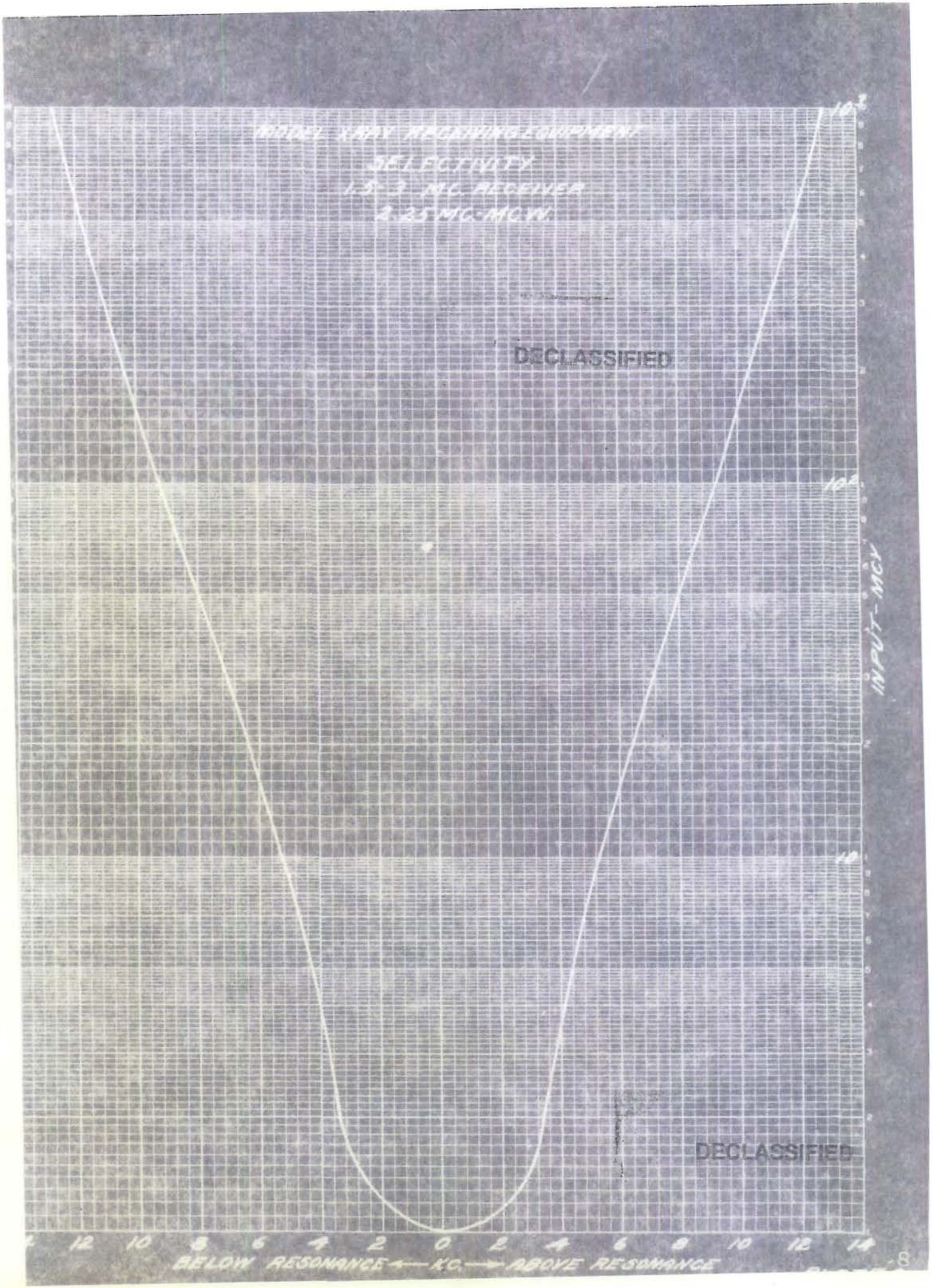

DECLASSIFIED
DECLASSIFIED
INPUT - MW
10
10²
10³
6 5 4 3 2 1 0 1 2 3 4 5 6 7
BELOW RESONANCE ← KC → ABOVE RESONANCE
PLATE 3

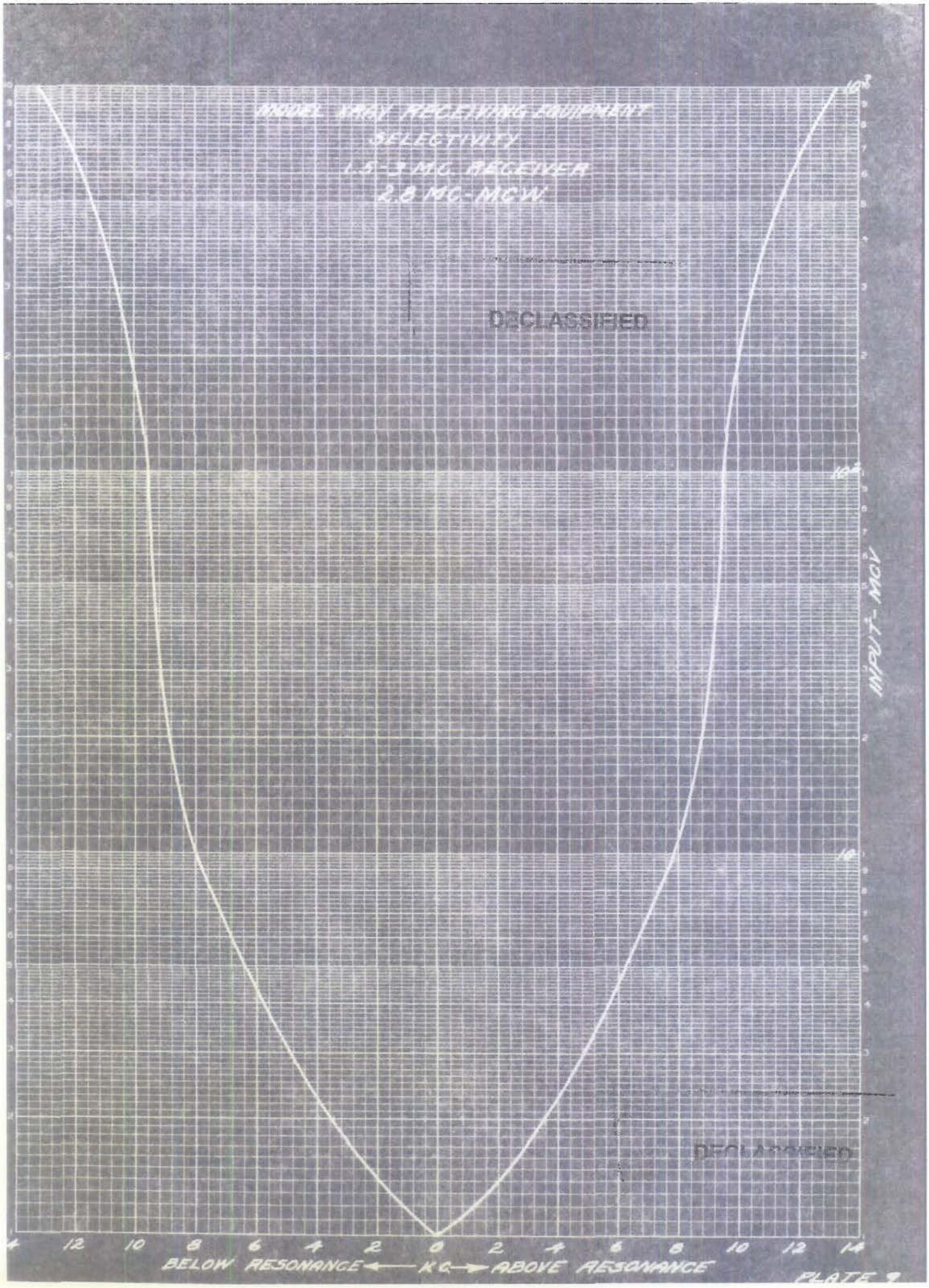

DECLASSIFIED
DECLASSIFIED
IMPEDANCE - MOV
14 12 10 8 6 4 2 0 2 4 6 8 10 12 14
BELOW RESONANCE ← KC → ABOVE RESONANCE
PLATE 4

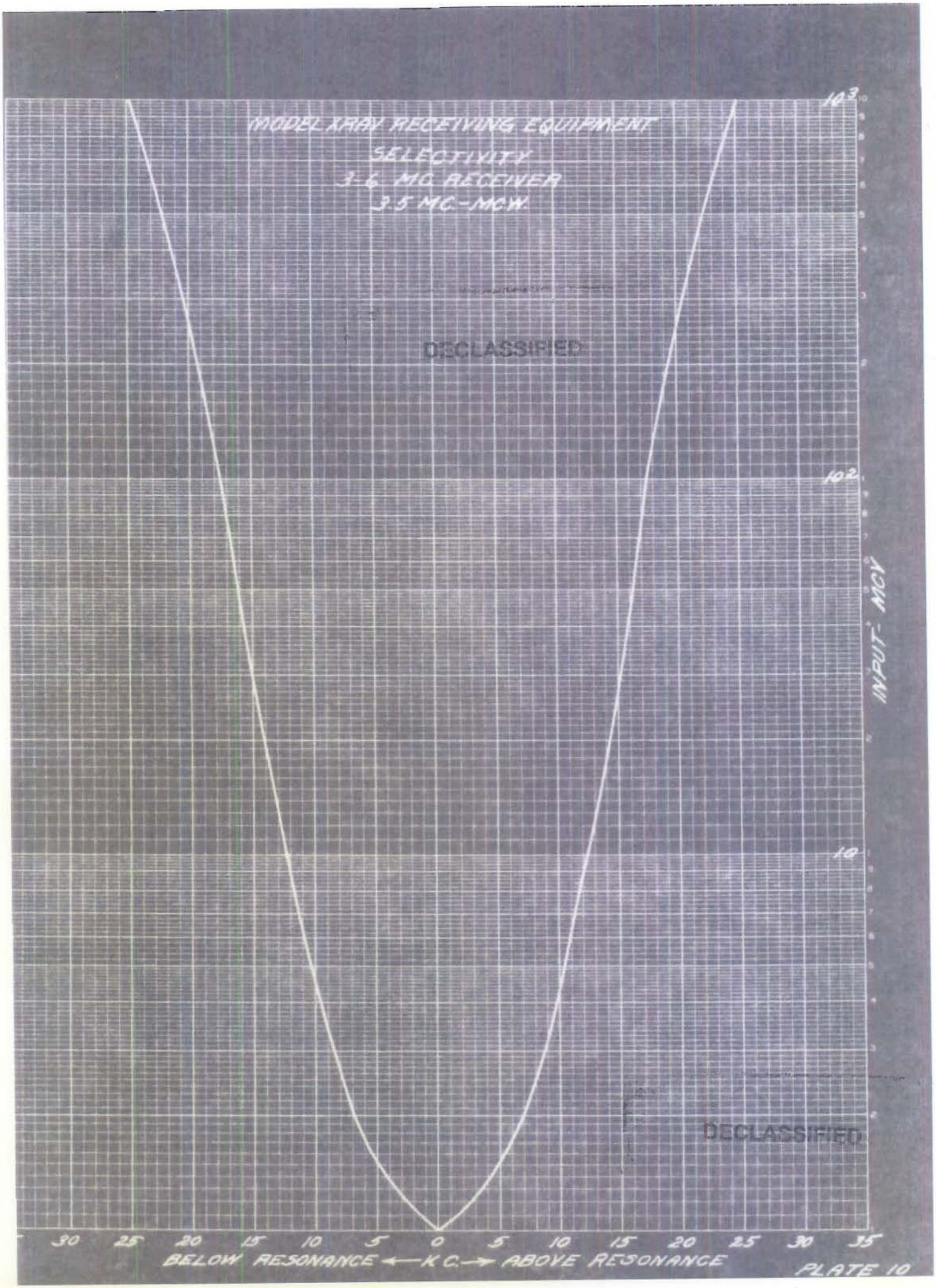

DECLASSIFIED
DECLASSIFIED
12 10 8 6 4 2 0 2 4 6 8 10 12 14
BELOW RESONANCE ← NC → ABOVE RESONANCE
PLATE 5

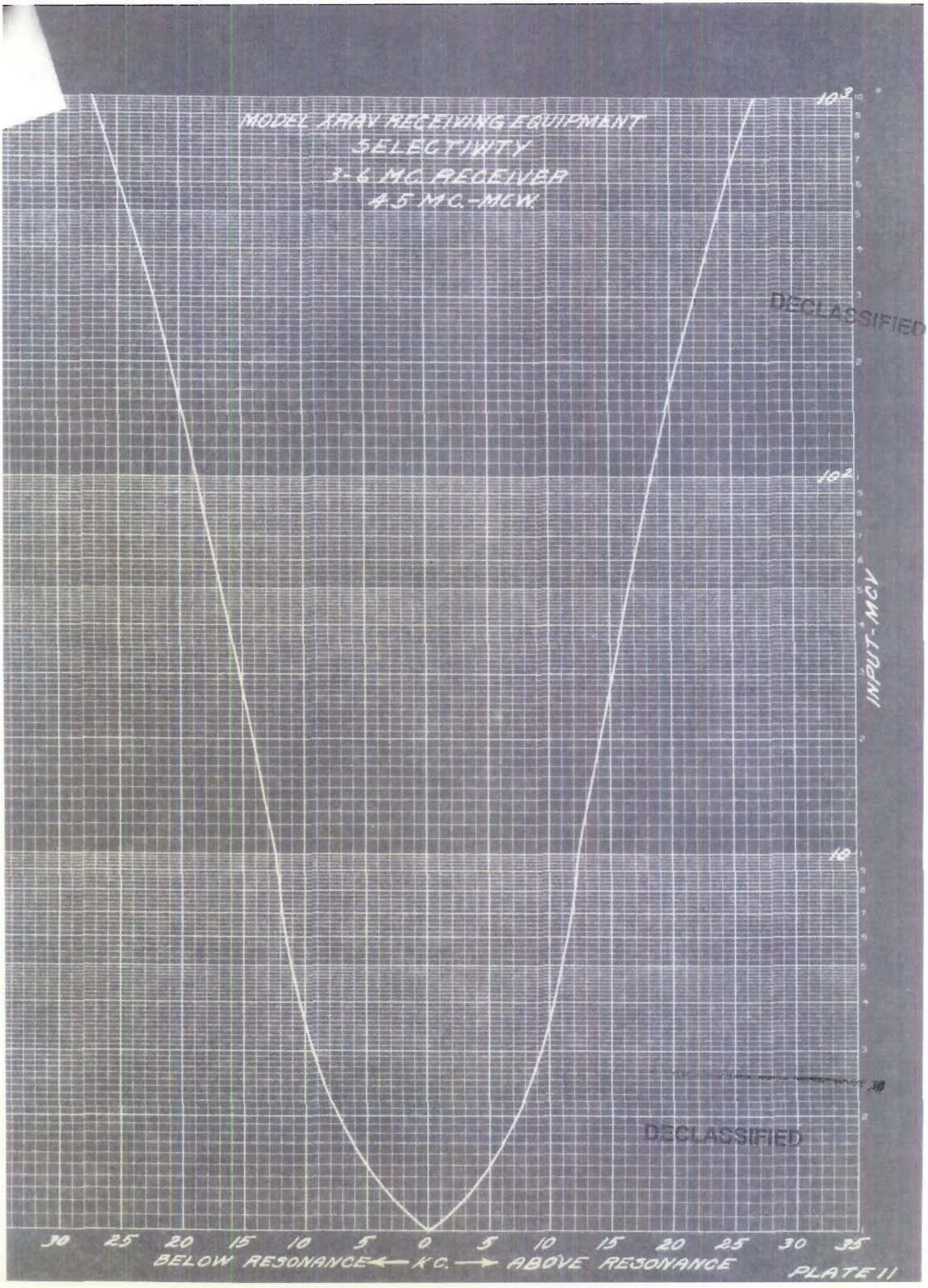

DECLASSIFIED
DECLASSIFIED
BELOW RESONANCE ← KC. → ABOVE RESONANCE
PLATE 6


MODEL XMAT RECEIVING EQUIPMENT
SELECTIVITY
1.5-3 MC. RECEIVER
1.5 MC. - MC.W.
DECLASSIFIED
DECLASSIFIED
INPUT-MICROVOLTS
12 10 8 6 4 2 0 2 4 6 8 10 12 14
BELOW RESONANCE ← KC. → ABOVE RESONANCE
PLATE 7


SELECTIVITY
1.5 - 2 MC. RECEIVER
A. 25 MCCMCW
DECLASSIFIED
DECLASSIFIED
INPUT-MCY
12 10 8 6 4 2 0 2 4 6 8 10 12 14
BELOW RESONANCE ← KC. → ABOVE RESONANCE

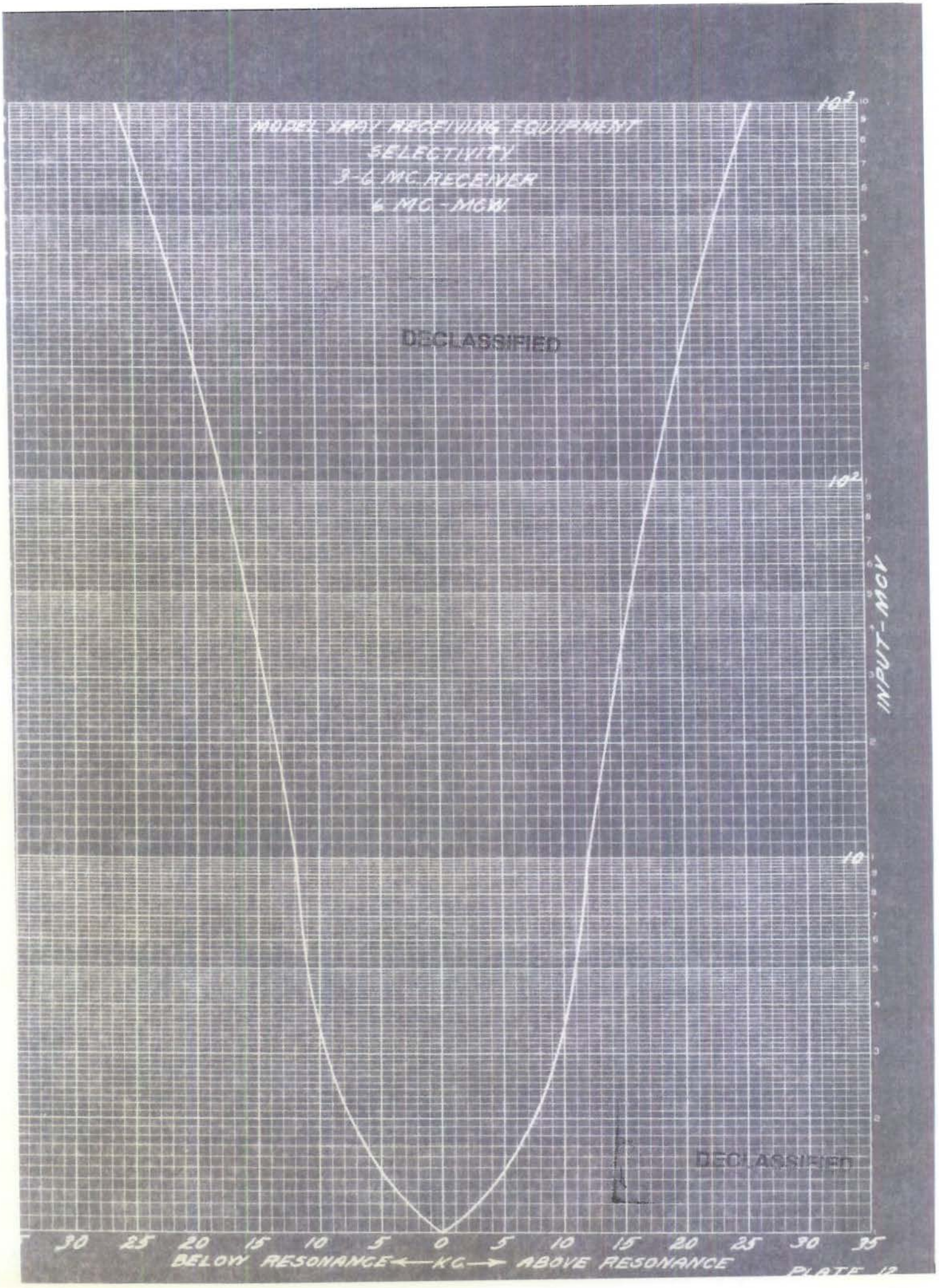

MODEL XRAY RECEIVING EQUIPMENT
SELECTIVITY
1.4-2 MC. RECEIVER
2.8 MC-MCW
DECLASSIFIED
INPUT - MCV
DECLASSIFIED
14 12 10 8 6 4 2 0 2 4 6 8 10 12 14
BELOW RESONANCE ← KC → ABOVE RESONANCE
PLATE 2

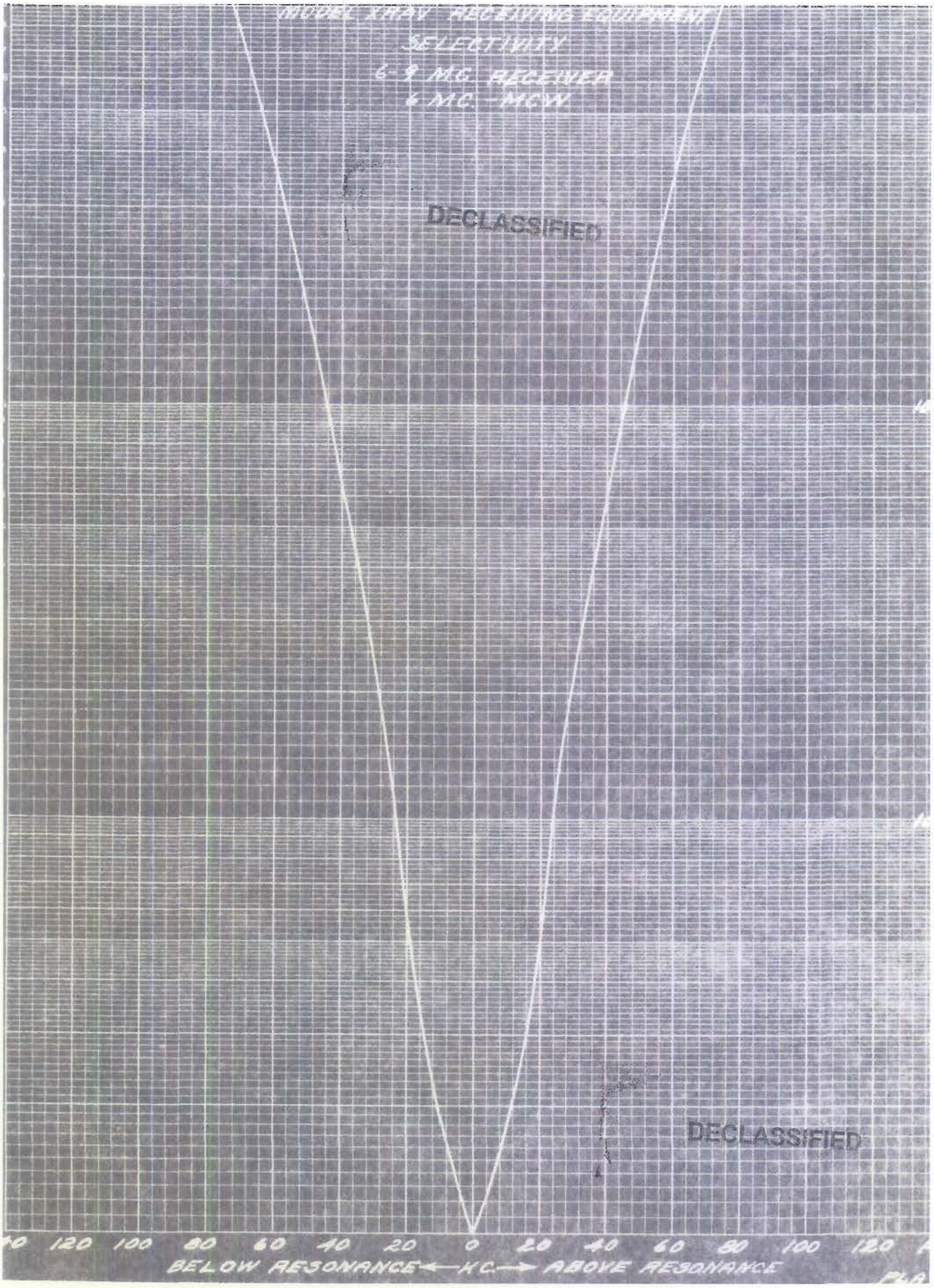

MODEL XRAY RECEIVING EQUIPMENT
SELECTIVITY
3-6 MC. RECEIVER
3.5 MC.-MCW.
DECLASSIFIED
DECLASSIFIED
10³
10²
10
INPUT - MCV
30 25 20 15 10 5 0 5 10 15 20 25 30 35
BELOW RESONANCE ← K.C. → ABOVE RESONANCE
PLATE 10



DECLASSIFIED

DECLASSIFIED


MODEL XRAY RECEIVING EQUIPMENT
SELECTIVITY
3-6 MC. RECEIVER
6 MC - MCW.
DECLASSIFIED
10^3
10^2
10
INPUT - MCV
30 25 20 15 10 5 0 5 10 15 20 25 30 35
BELOW RESONANCE ← KC → ABOVE RESONANCE
DECLASSIFIED
PLATE 12


MODEL XMAV RECEIVING EQUIPMENT
SELECTIVITY
6-9 MC. RECEIVER
6 MC. - MCW
DECLASSIFIED
DECLASSIFIED
120 100 80 60 40 20 0 20 40 60 80 100 120
BELOW RESONANCE ← KC → ABOVE RESONANCE

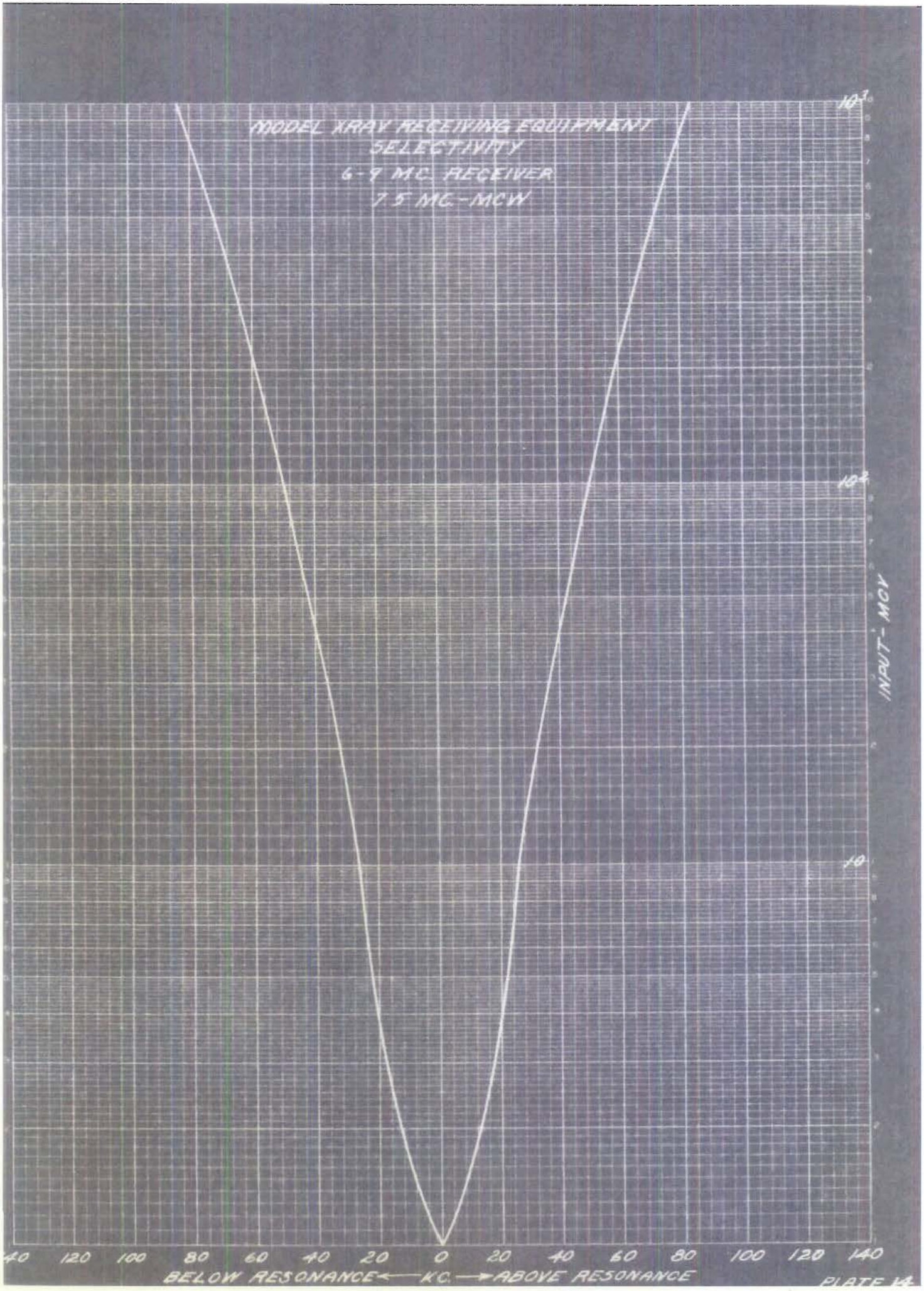

MODEL XRAY RECEIVING EQUIPMENT
SELECTIVITY
6-9 MC. RECEIVER
7.5 MC.-MCW
10³
10²
10
INPUT-MCV
140 120 100 80 60 40 20 0 20 40 60 80 100 120 140
BELOW RESONANCE ← K.C. → ABOVE RESONANCE

PLATE 14

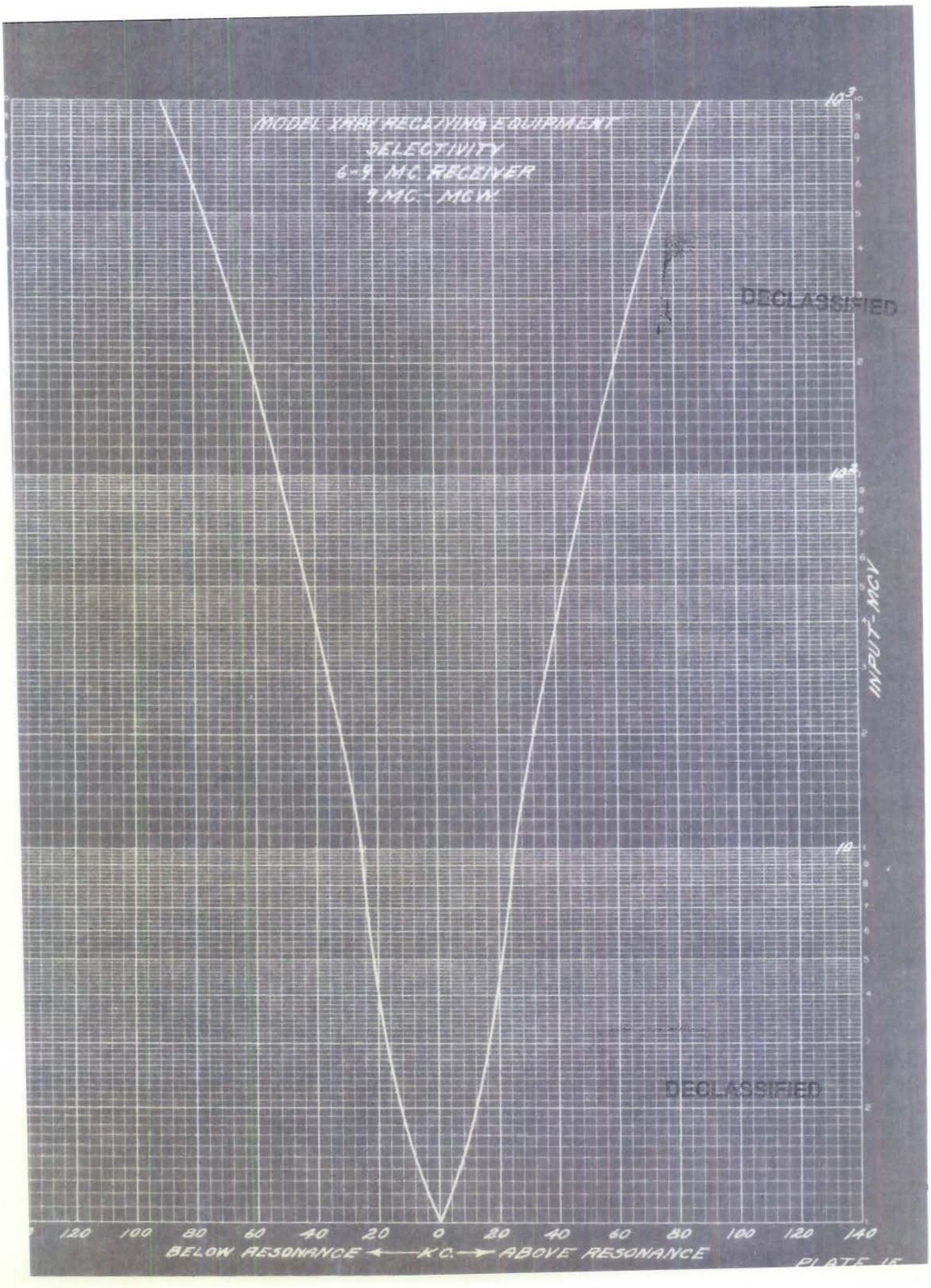

MODEL XABY RECEIVING EQUIPMENT
SELECTIVITY
6-9 MC. RECEIVER
9 MC. - MCW
DECLASSIFIED
INPUT - MCV
DECLASSIFIED
120 100 80 60 40 20 0 20 40 60 80 100 120 140
BELOW RESONANCE ← — K.C. — → ABOVE RESONANCE

PLATE 15

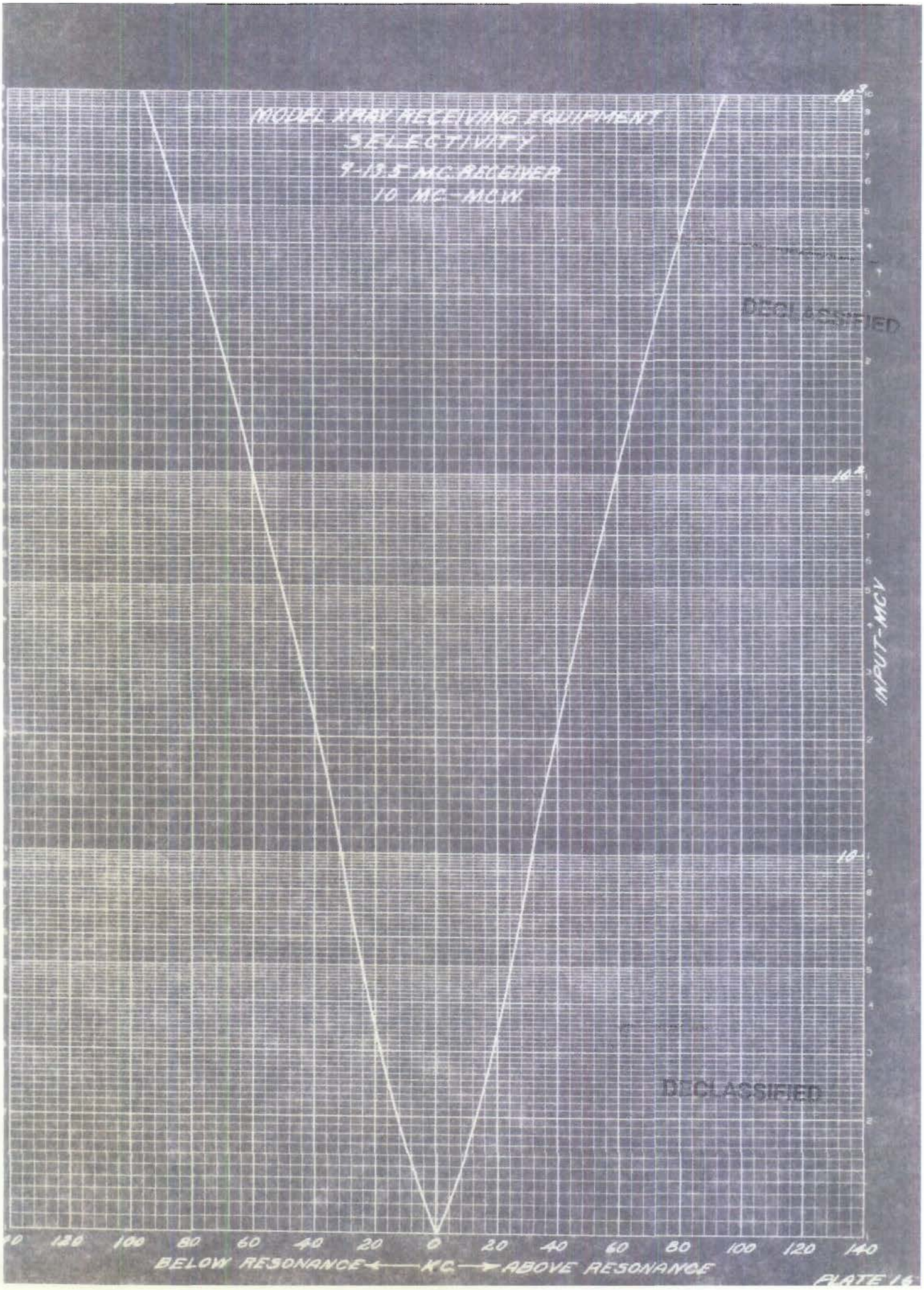
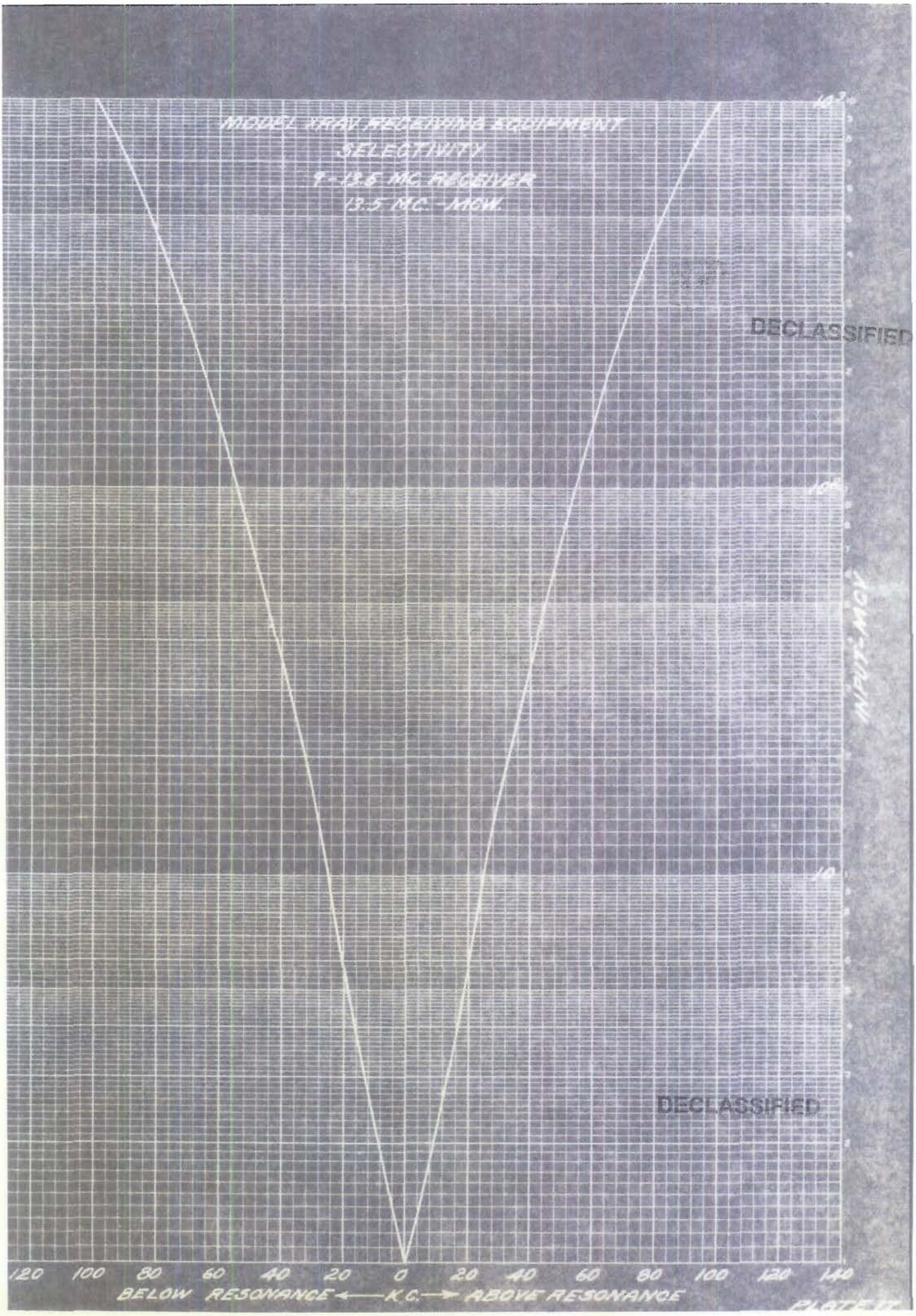
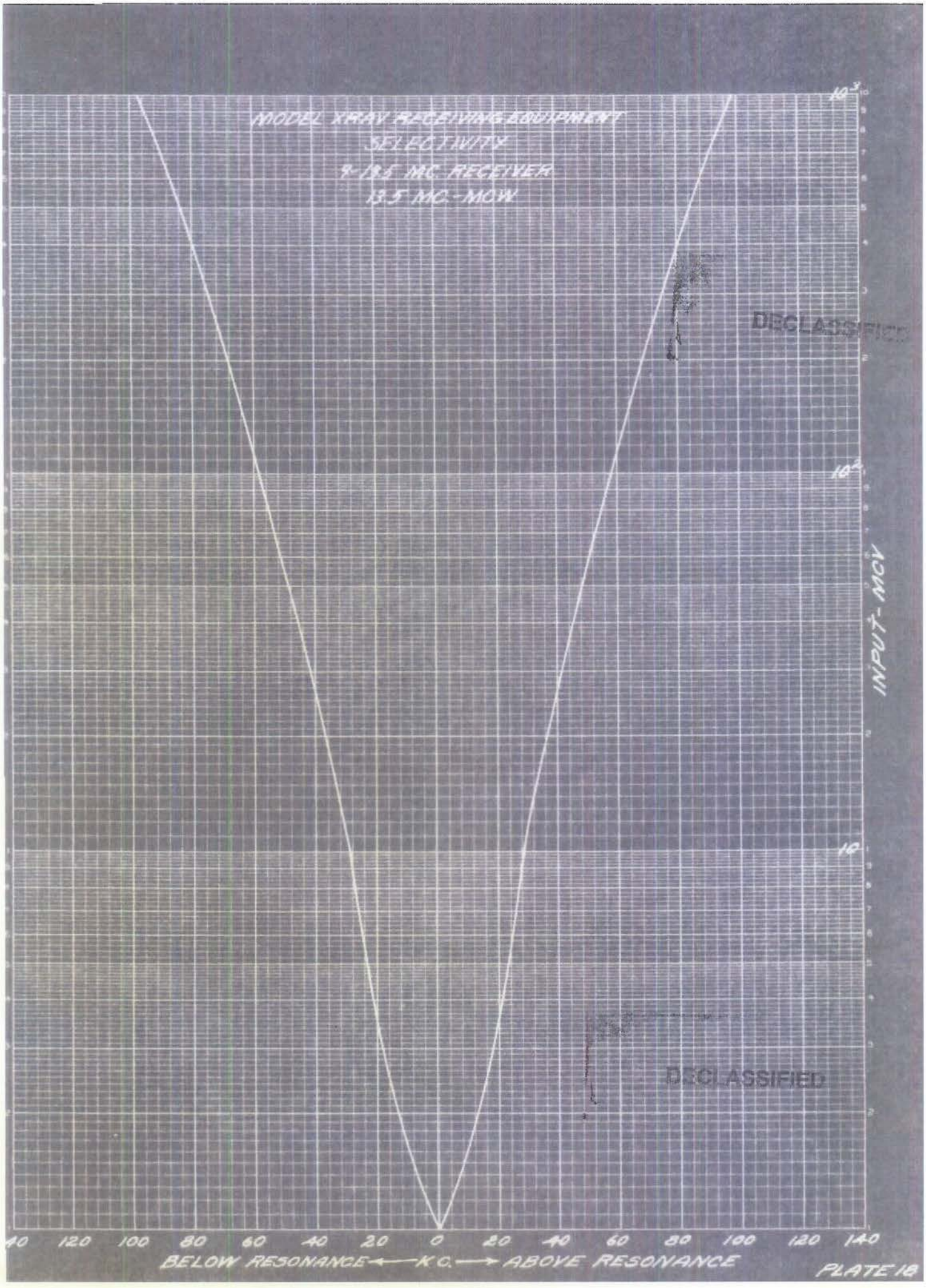
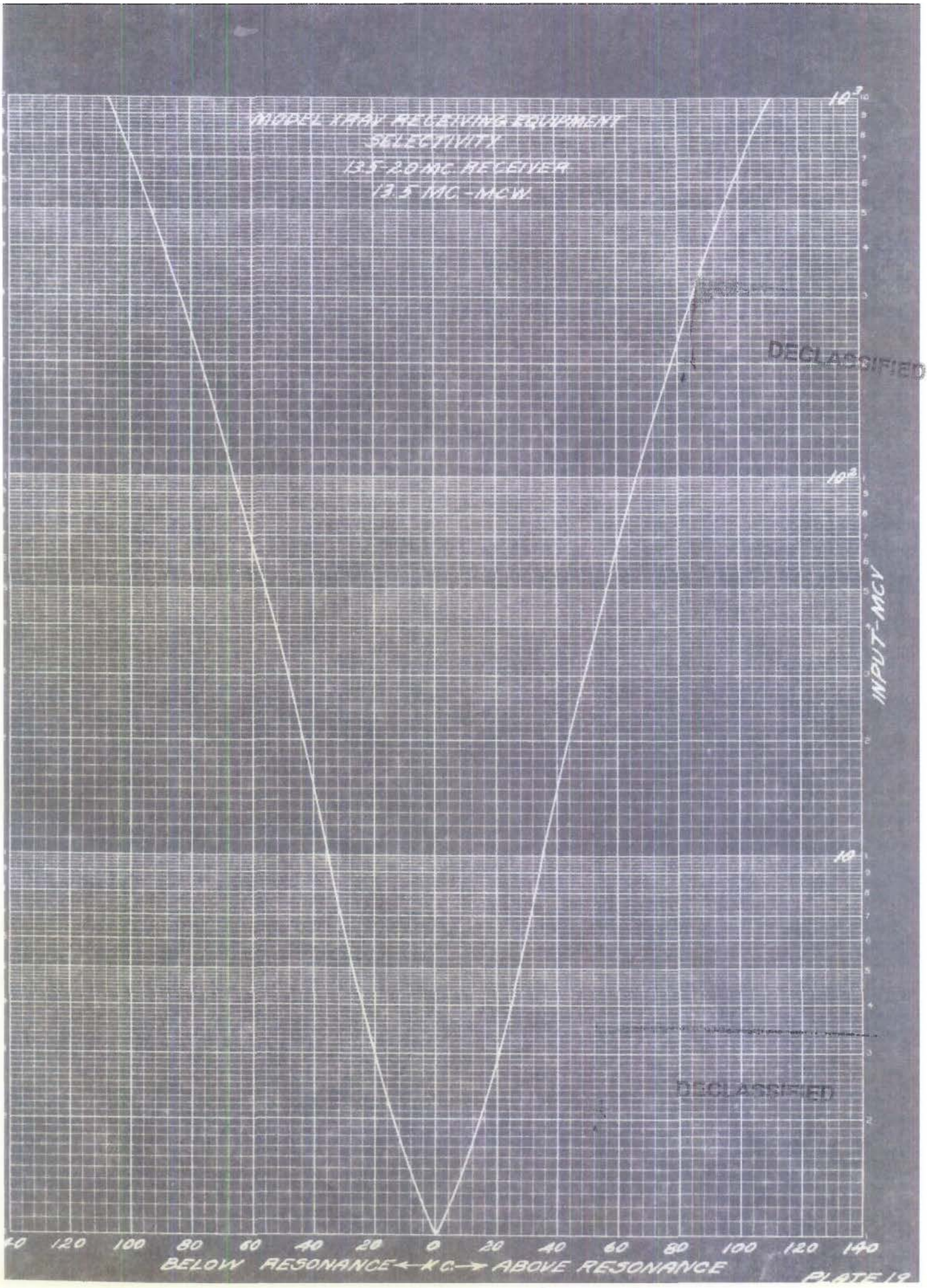
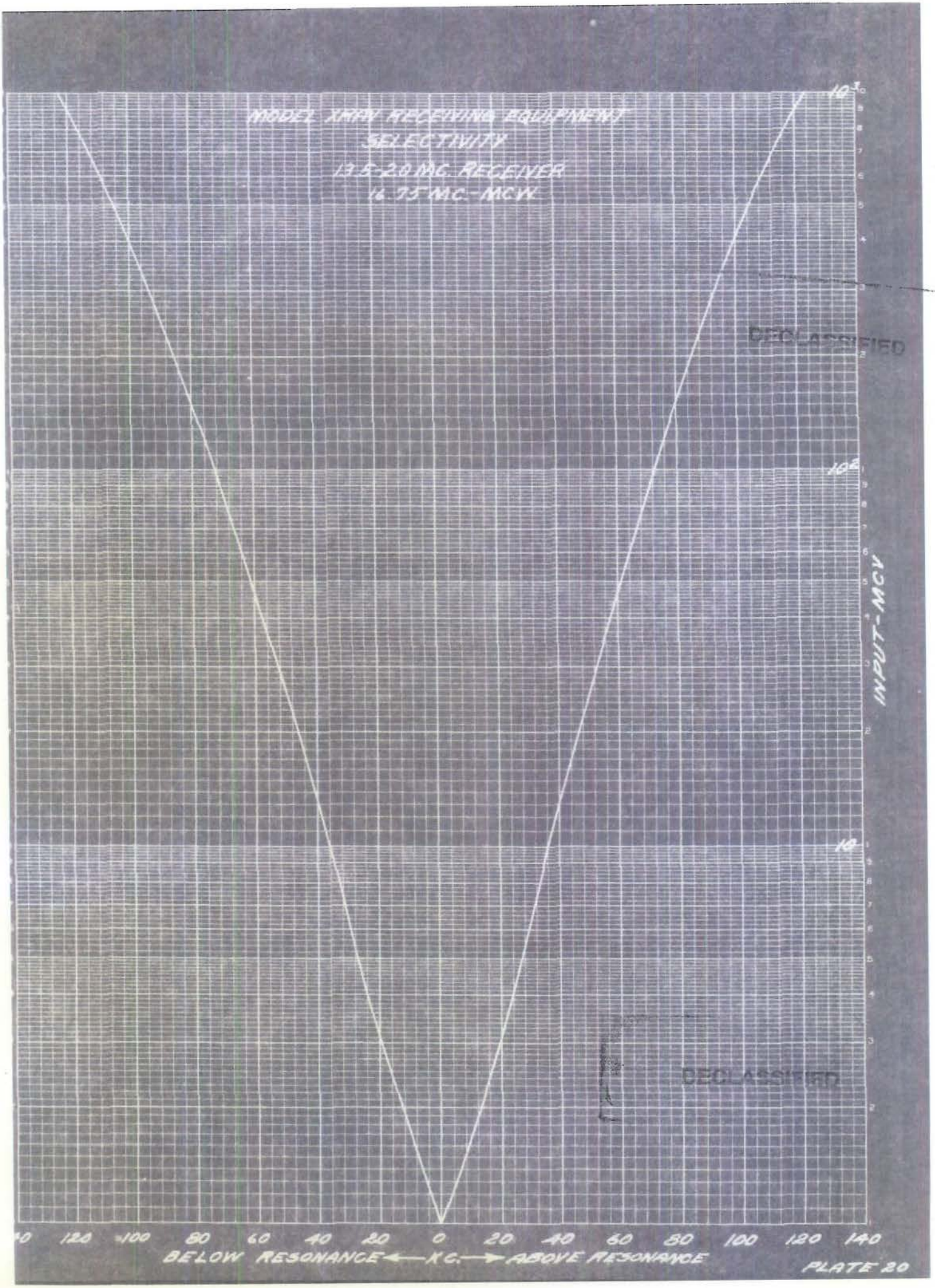

MODEL XMAV RECEIVING EQUIPMENT
SELECTIVITY
9-10.5 MC. RECEIVER
10 MC - MCW
DECLASSIFIED
DECLASSIFIED
INPUT-MCV
140 120 100 80 60 40 20 0 20 40 60 80 100 120 140
BELOW RESONANCE ← KC → ABOVE RESONANCE

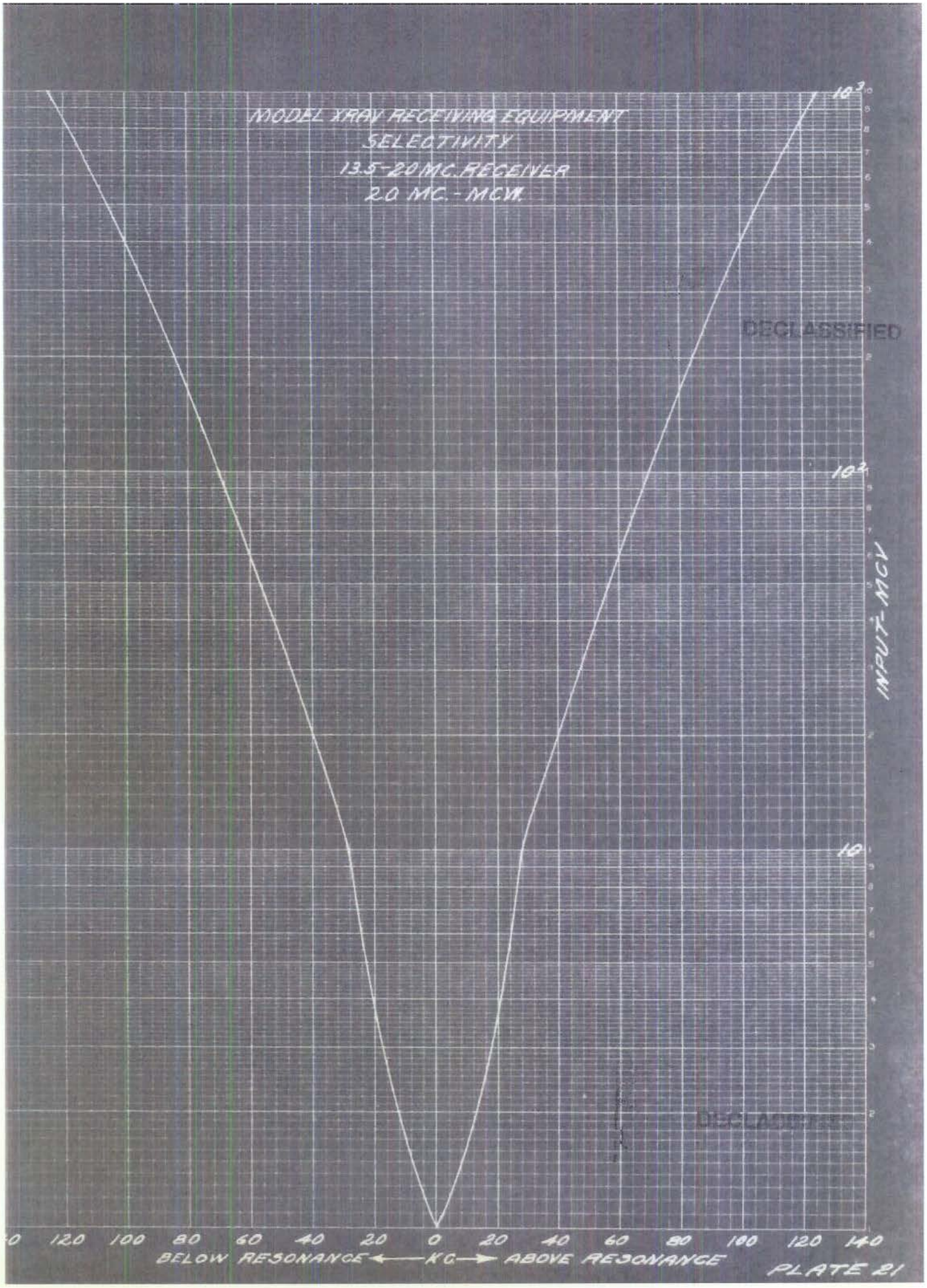
PLATE 14


MODEL XRAV RECEIVING EQUIPMENT
SELECTIVITY
F-13.5 MC RECEIVER
13.5 MC - M.O.W.
DECLASSIFIED
DECLASSIFIED
120 100 80 60 40 20 0 20 40 60 80 100 120 140
BELOW RESONANCE ← K.C. → ABOVE RESONANCE


MODEL XRAV RECEIVING EQUIPMENT
SELECTIVITY
9-10 MC RECEIVER
13.5 MC.-MCW
DECLASSIFIED
DECLASSIFIED
INPUT-MCW
10⁻³
10⁻⁴
10⁻⁵
140 120 100 80 60 40 20 0 20 40 60 80 100 120 140
BELOW RESONANCE ← K.C. → ABOVE RESONANCE
PLATE 18

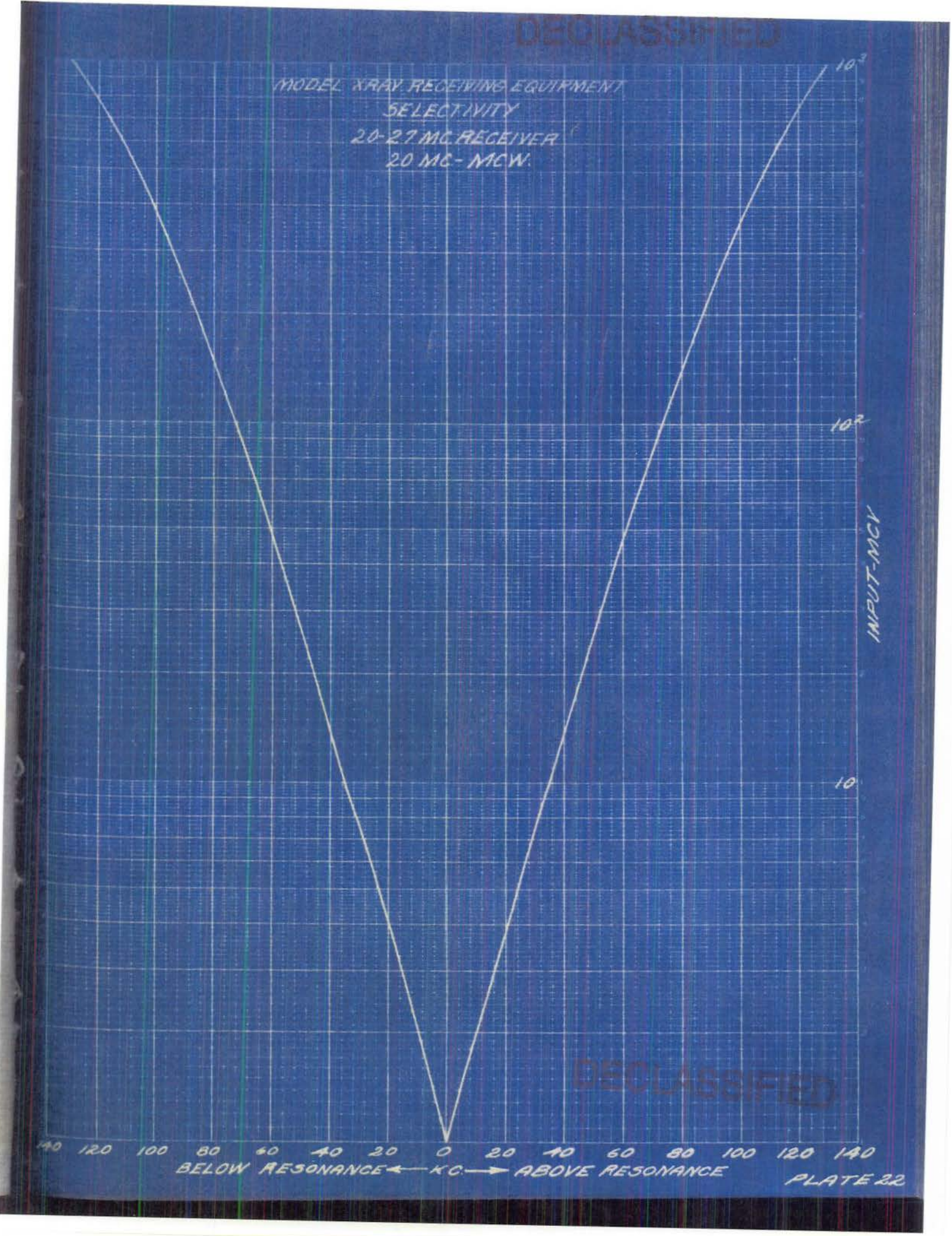

MODEL XRAY RECEIVING EQUIPMENT
SELECTIVITY
13.5-20 MC. RECEIVER
13.5 MC. - MCW.
10^3
10^2
10
IMPEDANCE - MEGOHMS
DECLASSIFIED
DECLASSIFIED
140 120 100 80 60 40 20 0 20 40 60 80 100 120 140
BELOW RESONANCE ← K.C. → ABOVE RESONANCE
PLATE 19


MODEL XMAN RECEIVING EQUIPMENT
SELECTIVITY
13.5-20 MC. RECEIVER
16.75 MC. - MCW
10³
10²
10
INPUT - MCV
DECLASSIFIED
DECLASSIFIED
120 100 80 60 40 20 0 20 40 60 80 100 120 140
BELOW RESONANCE ← K.C. → ABOVE RESONANCE
PLATE 20



DECLASSIFIED

DECLASSIFIED



DECLASSIFIED

DECLASSIFIED

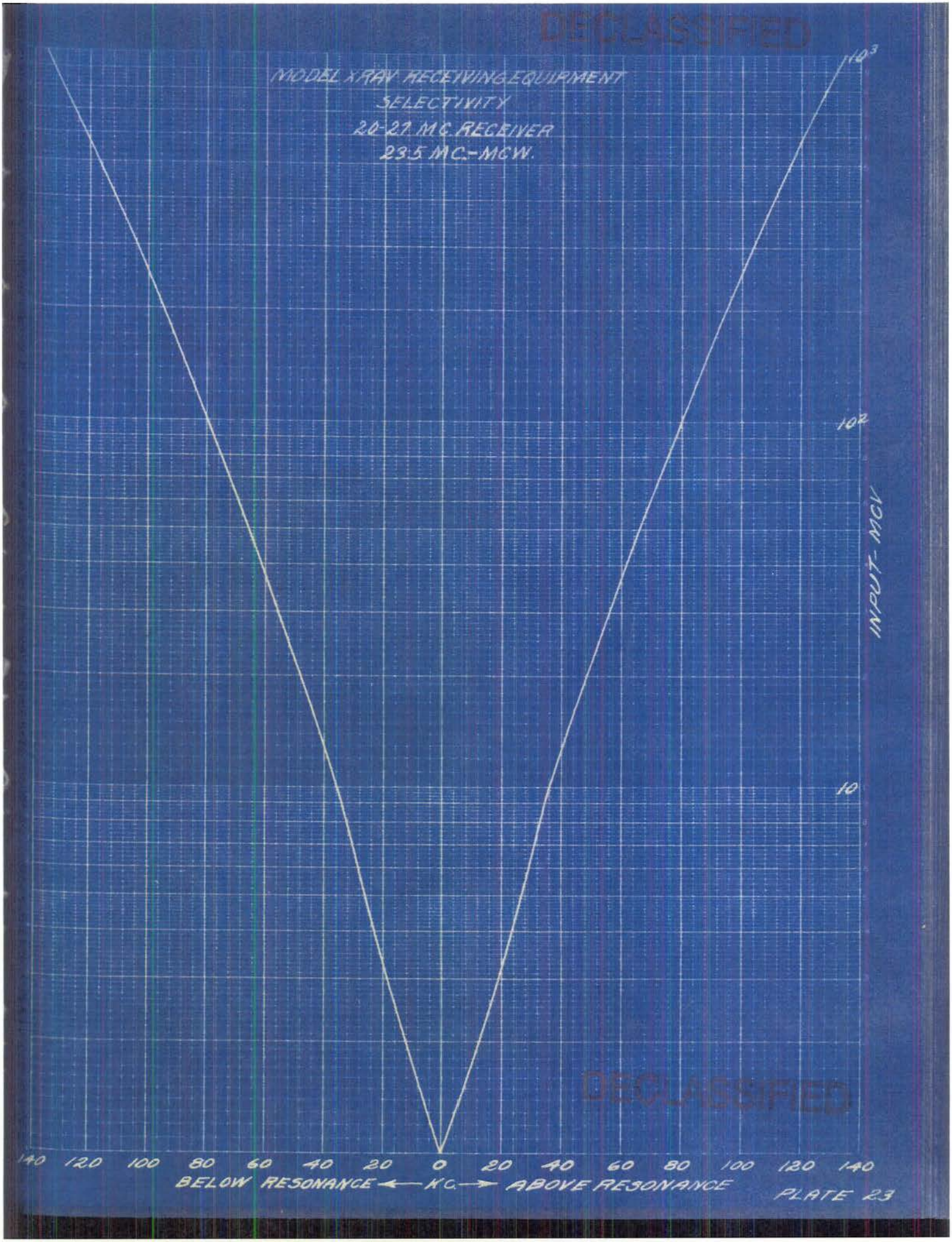
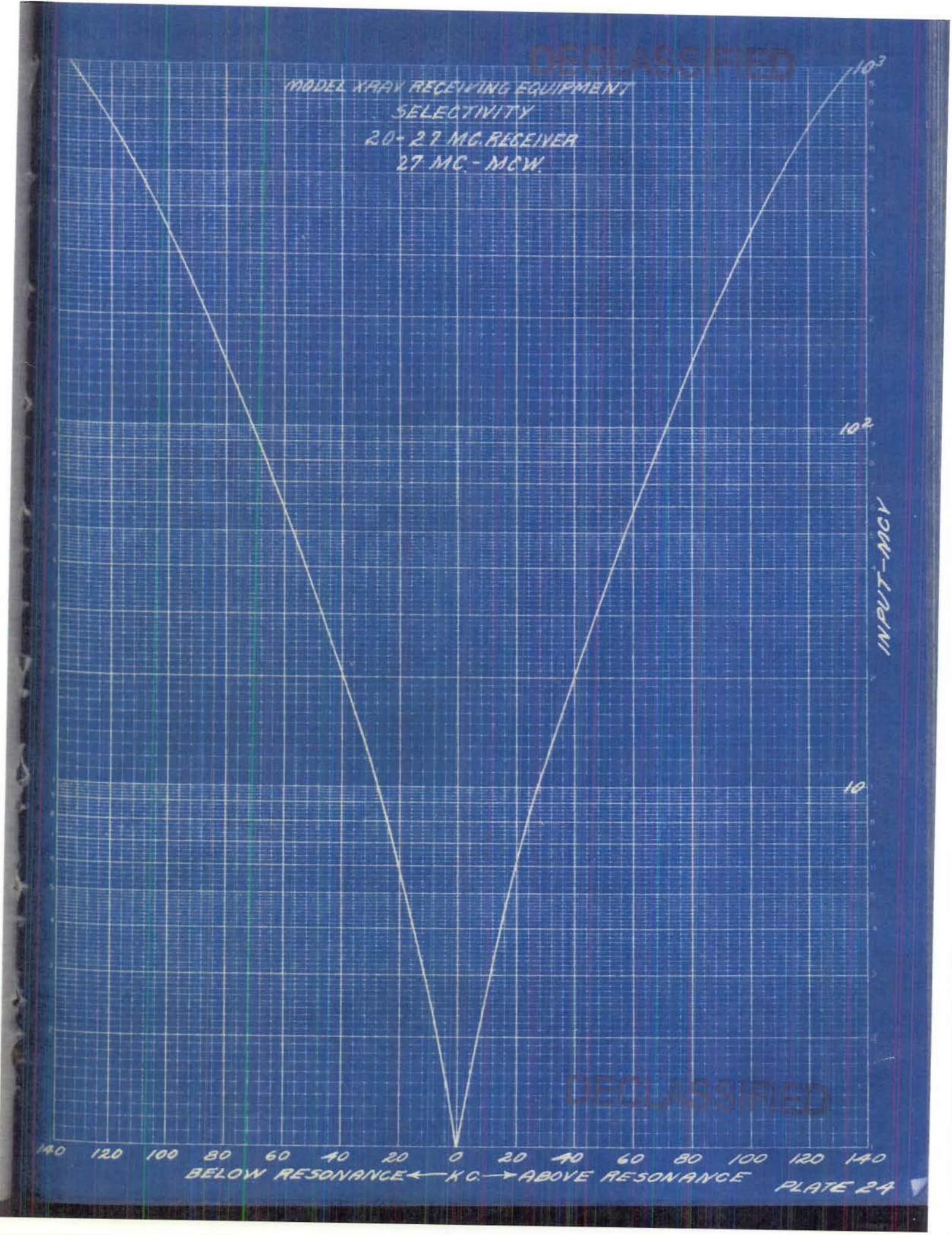


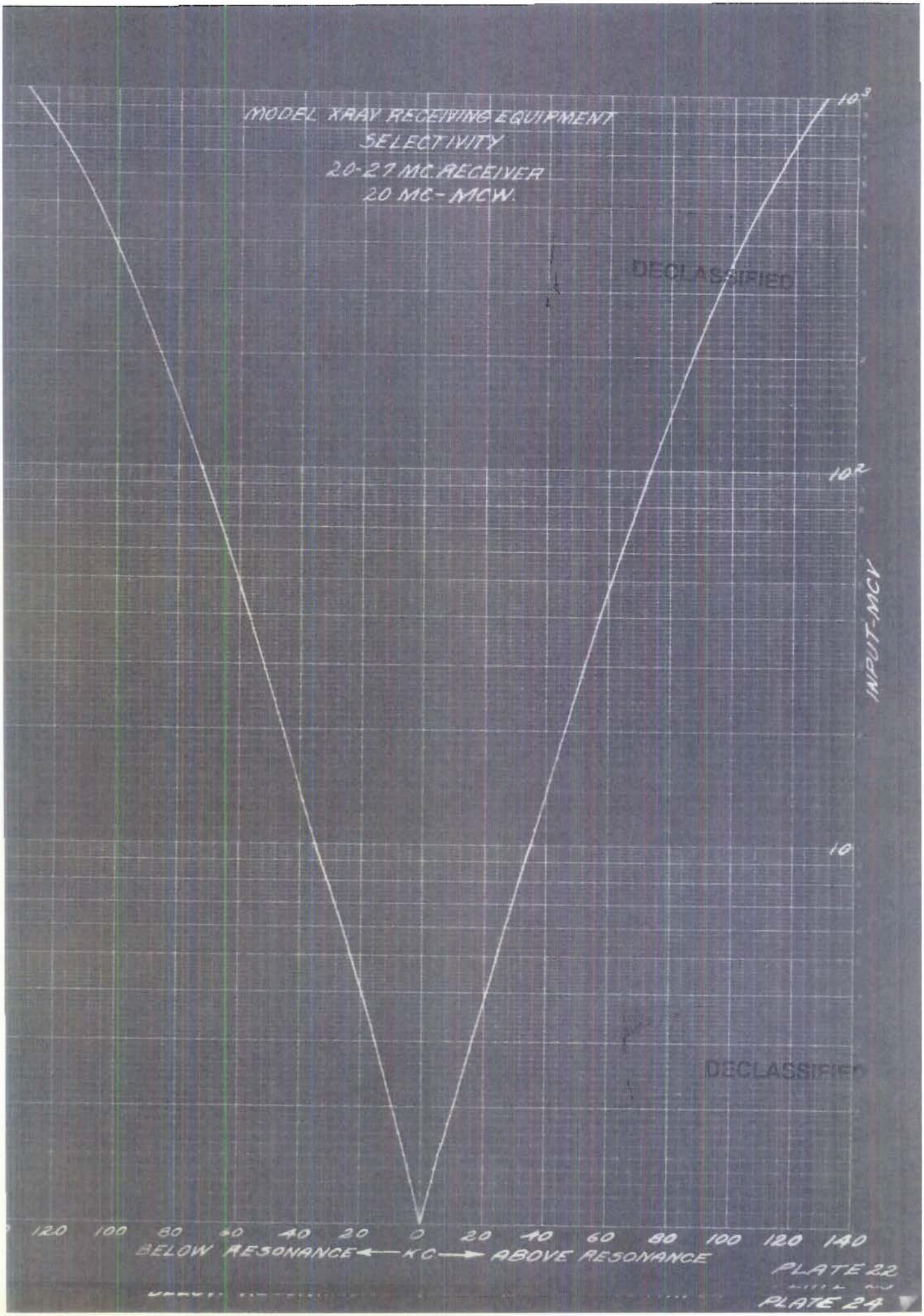
PLATE 23

DECLASSIFIED

DECLASSIFIED



DECLASSIFIED

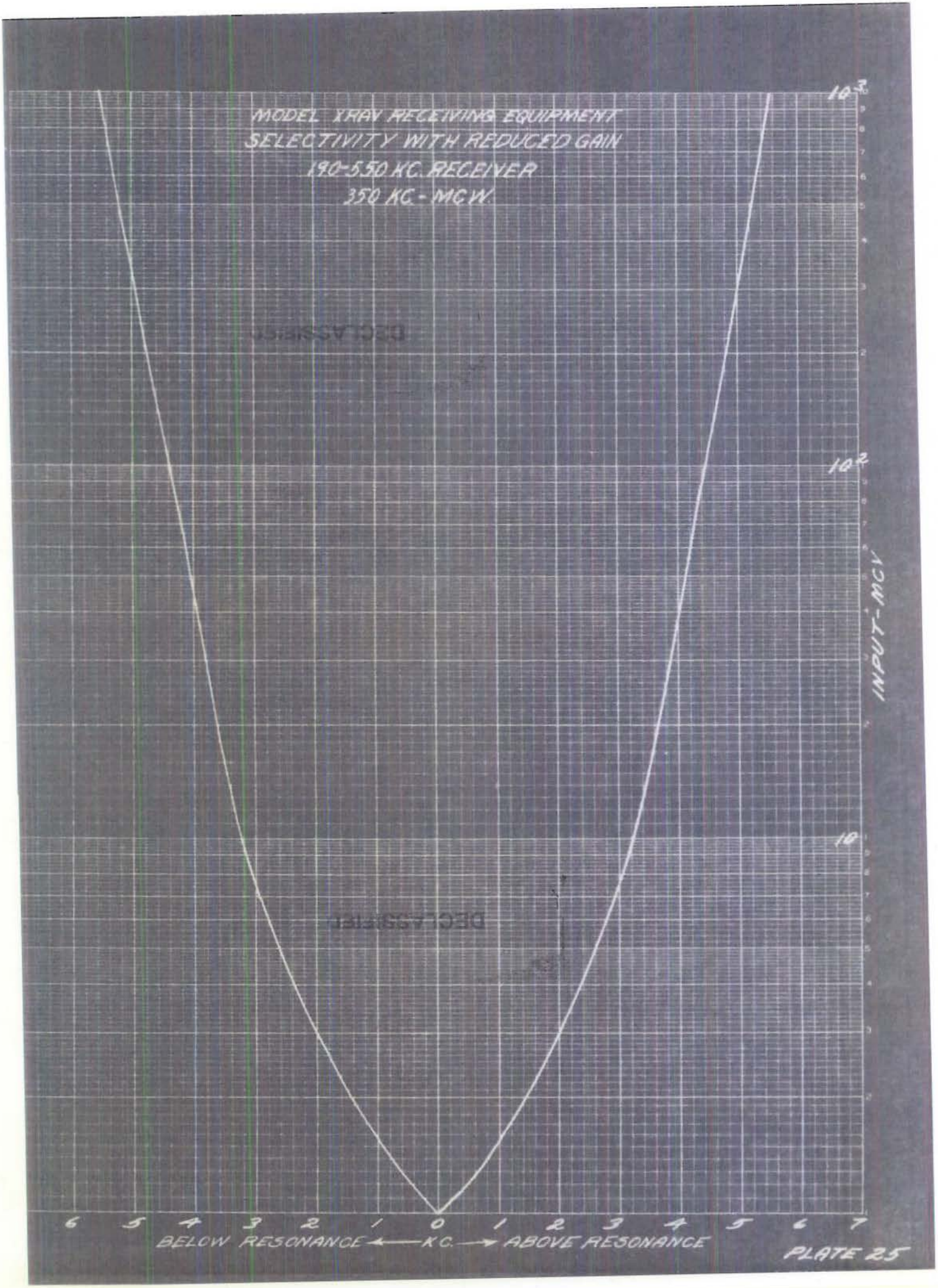


DECLASSIFIED

DECLASSIFIED

PLATE 22

PLATE 24


MODEL XRAY RECEIVING EQUIPMENT
SELECTIVITY WITH REDUCED GAIN
190-550 KC. RECEIVER
350 KC. - MCW.
10²
10
INPUT-MCV.
6 5 4 3 2 1 0 1 2 3 4 5 6 7
BELOW RESONANCE ← KC. → ABOVE RESONANCE
PLATE 25

DECLASSIFIED

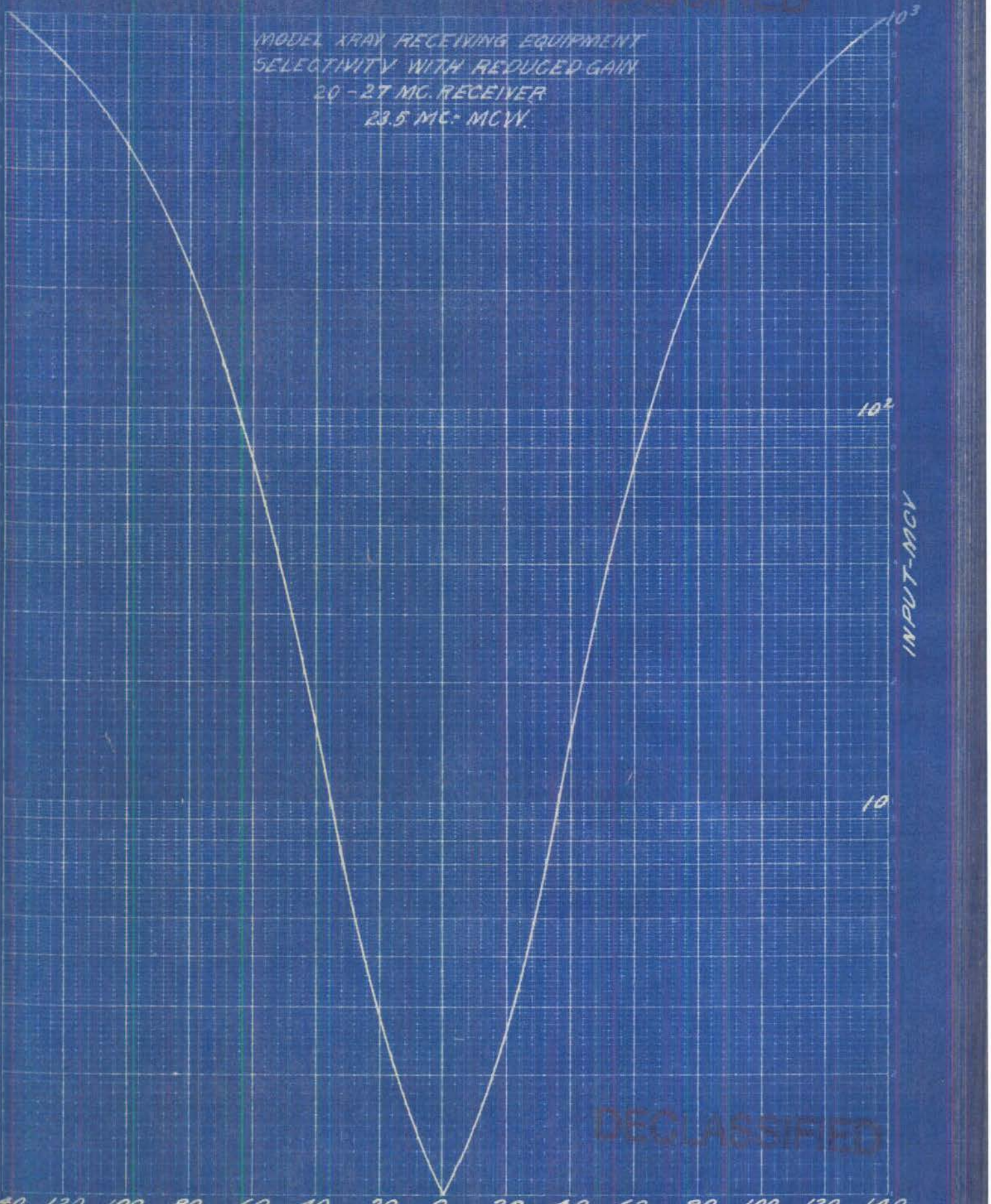
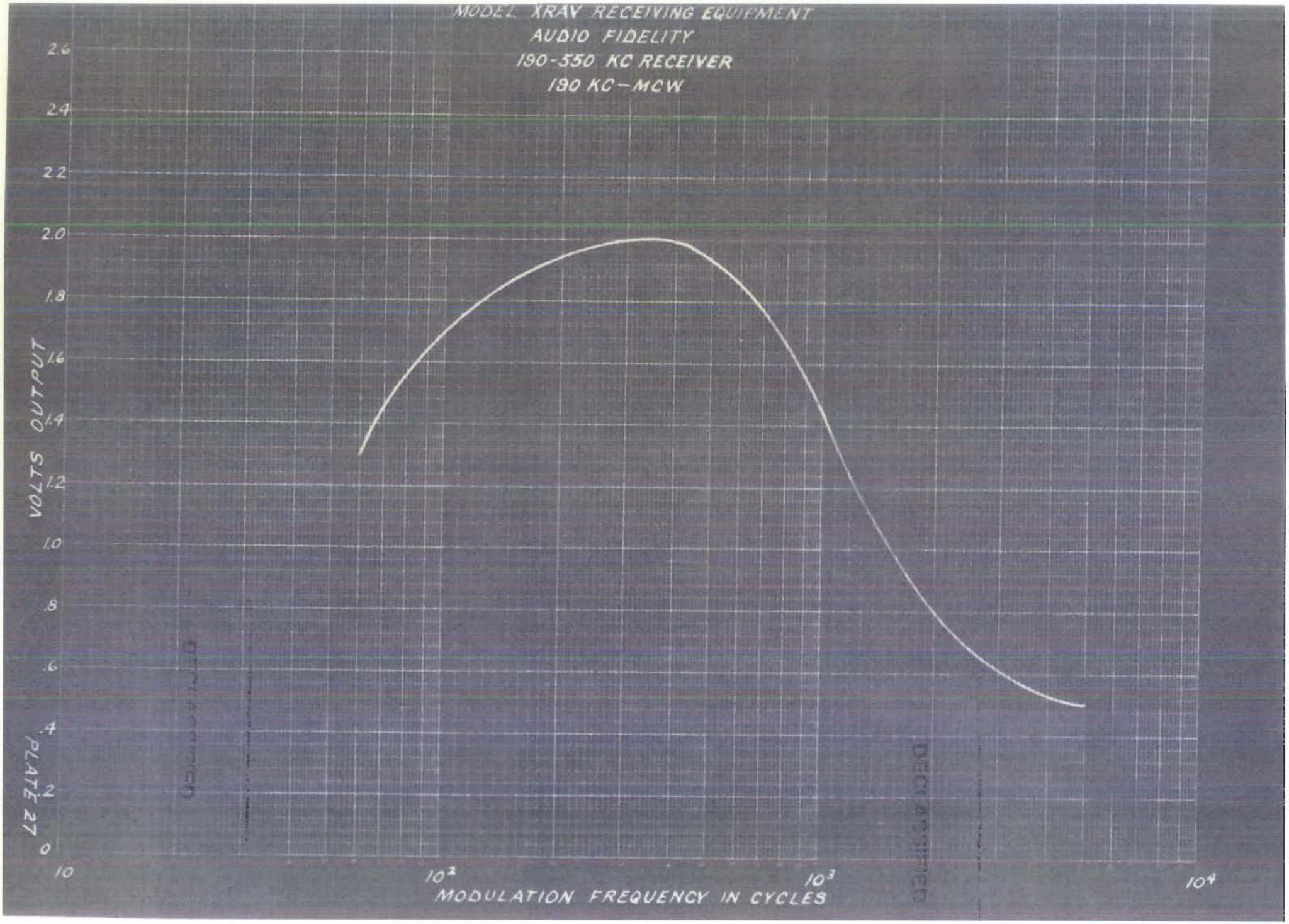
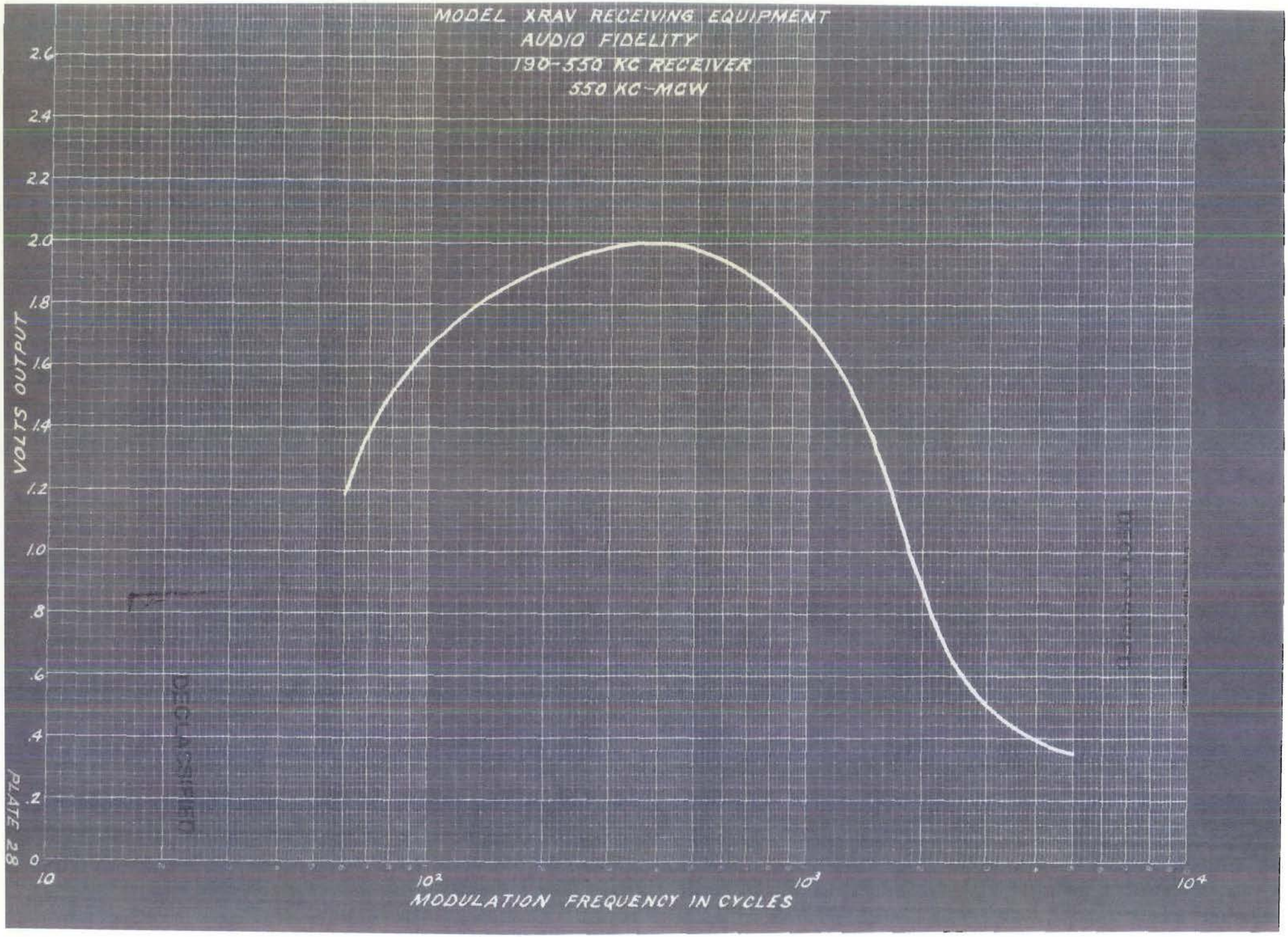
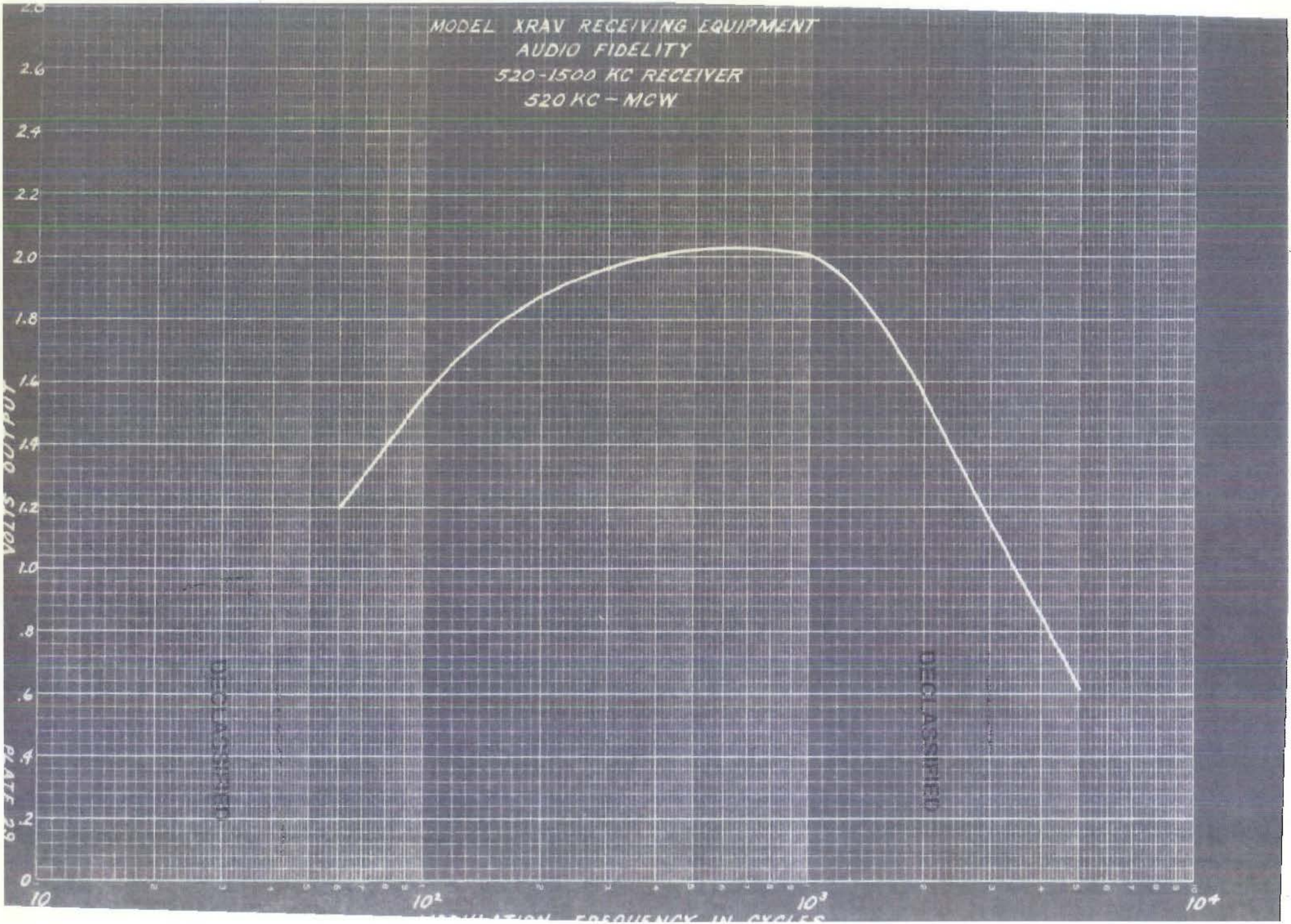


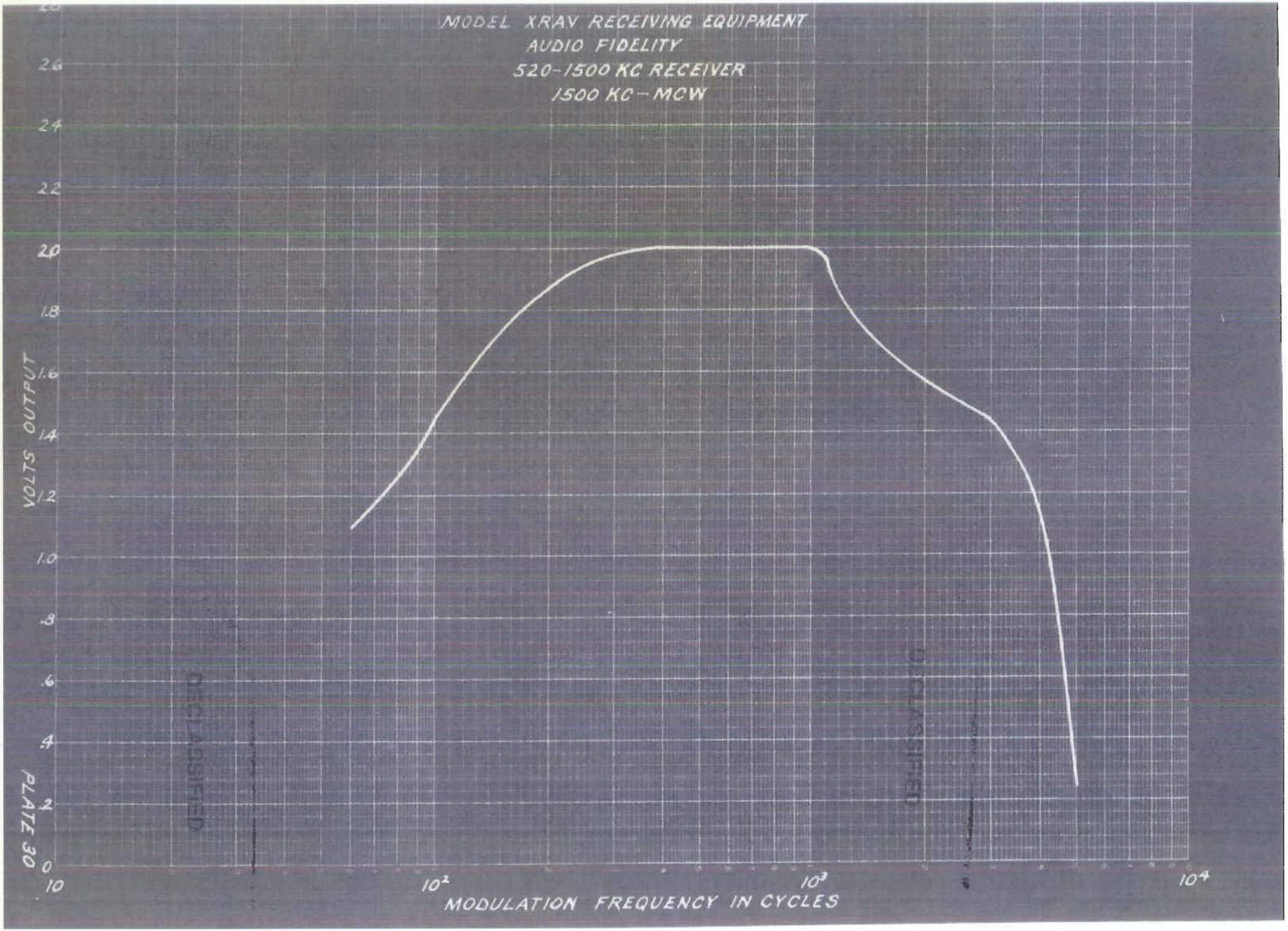
PLATE 26

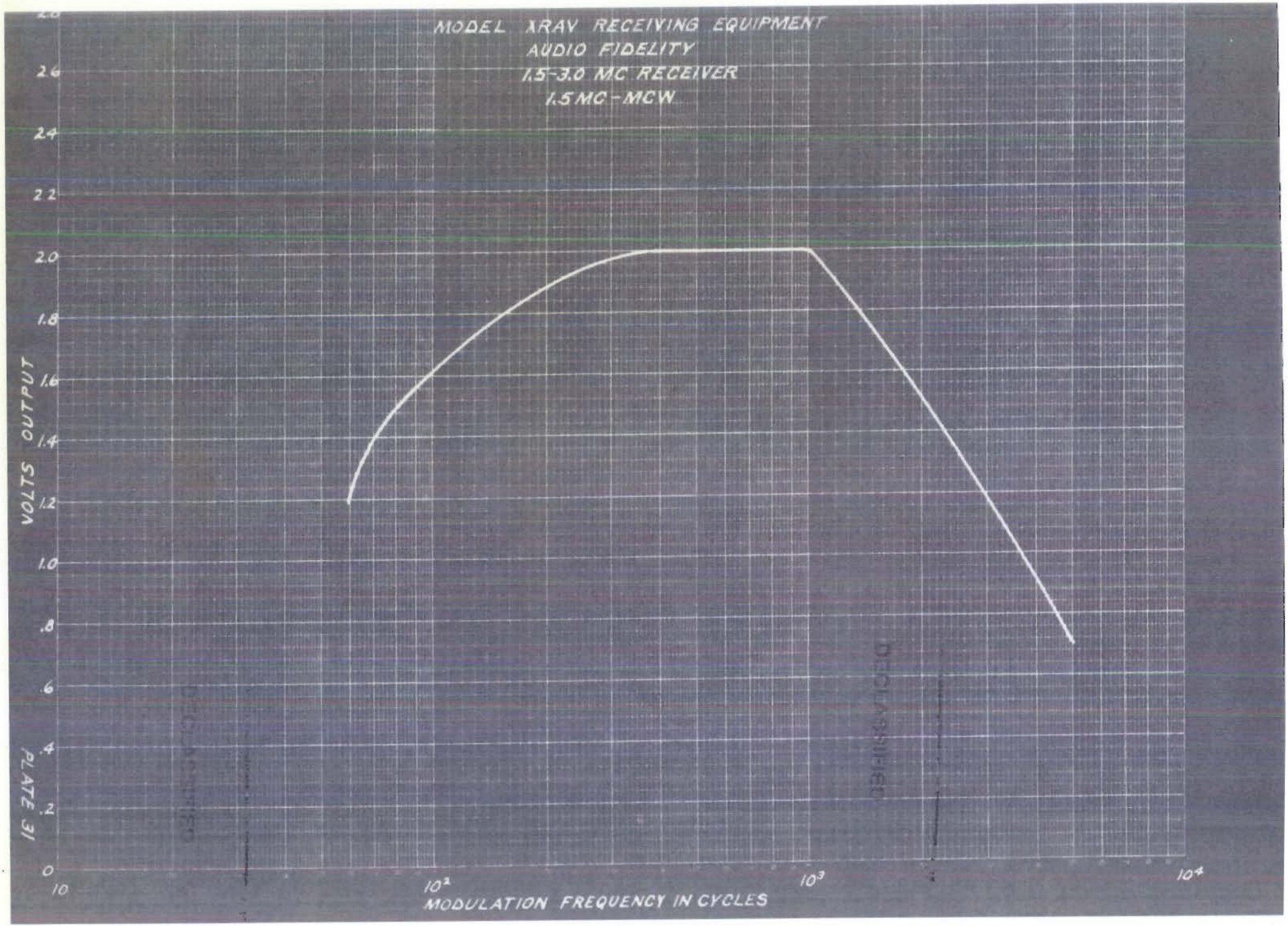
DECLASSIFIED

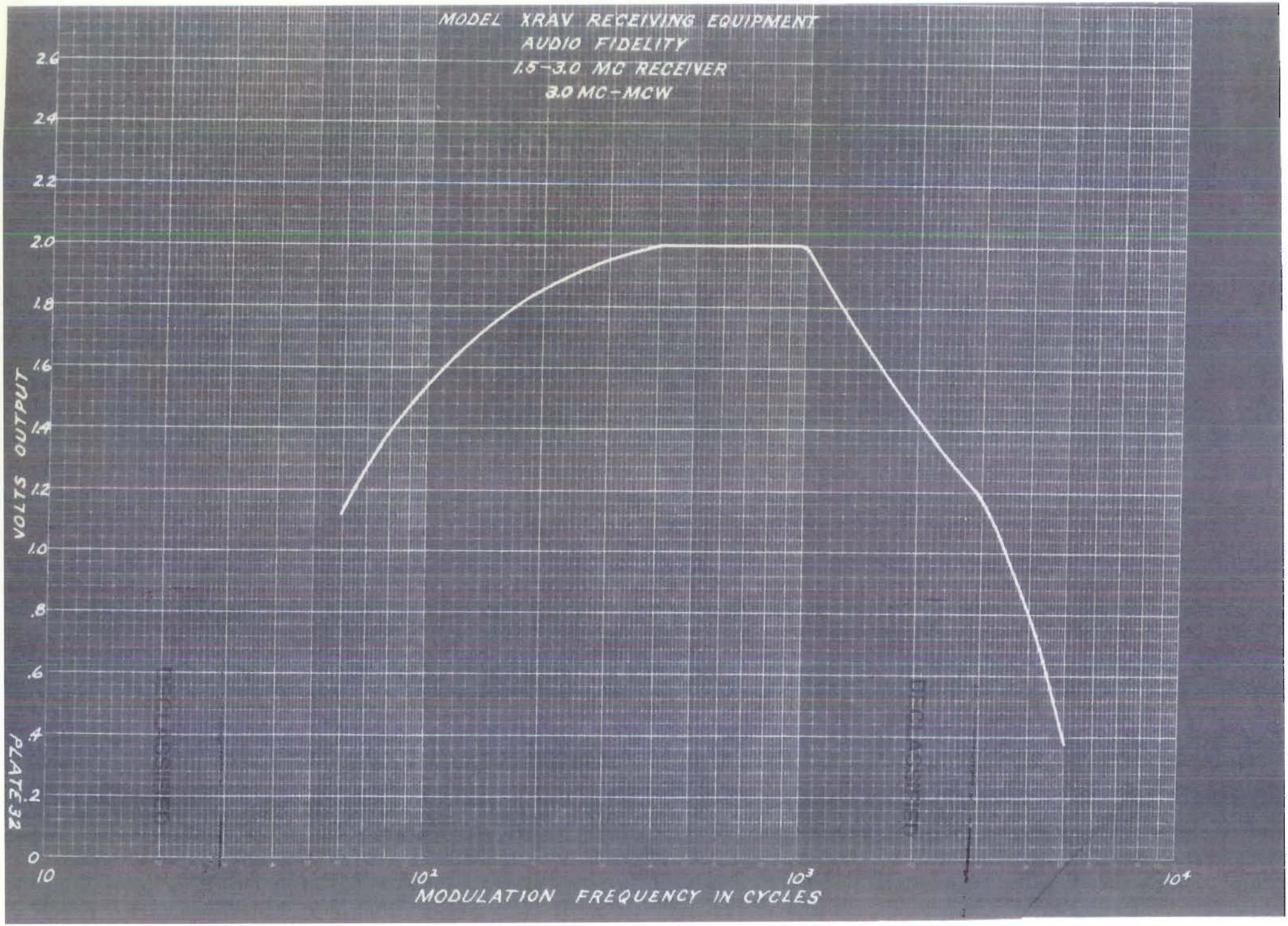

MODEL XRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
190-550 KC RECEIVER
190 KC - MCW
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
VOLTS OUTPUT
PLATE 27
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES

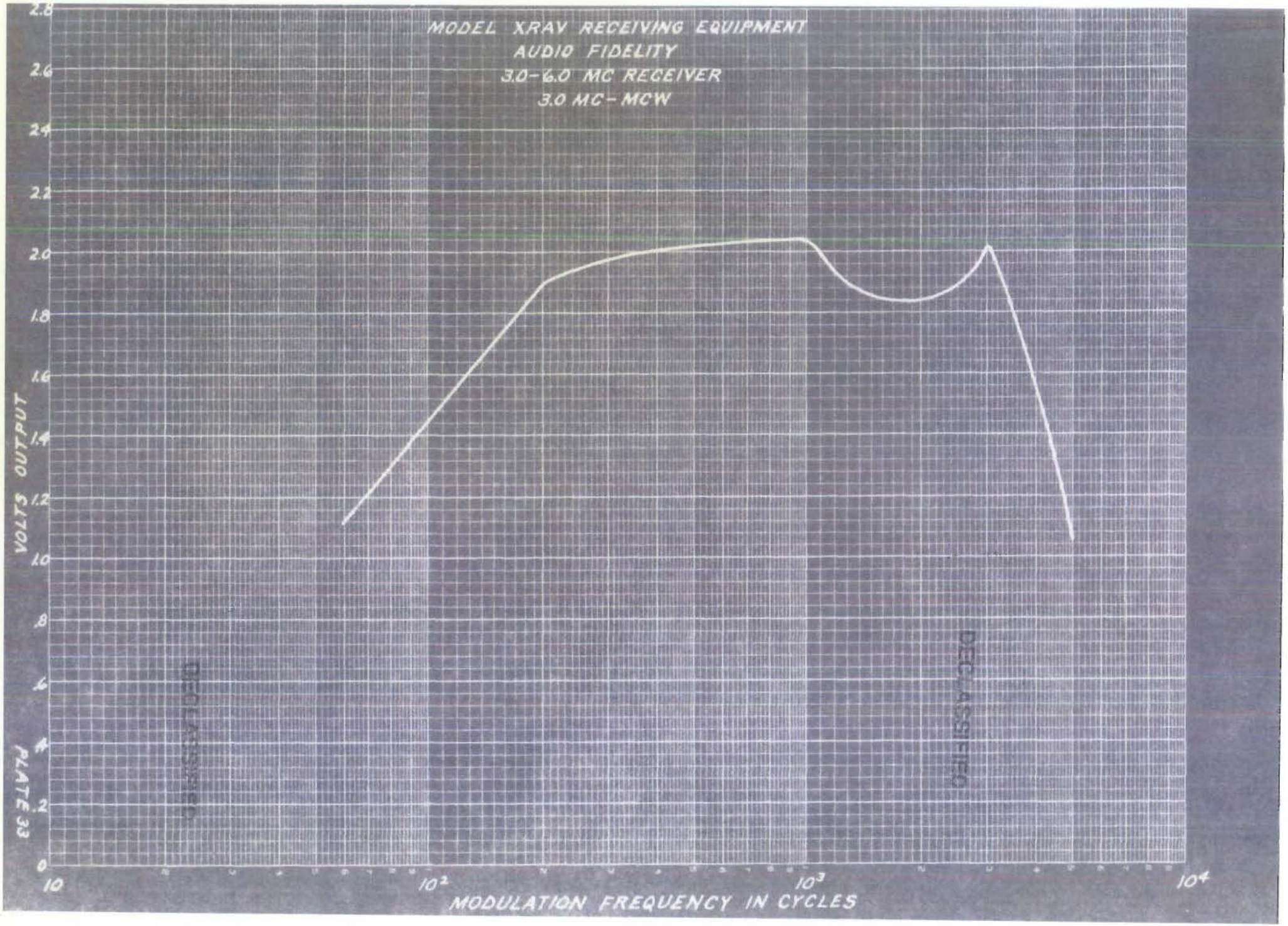

MODEL XRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
190-550 KC RECEIVER
550 KC-MCW
VOLTS OUTPUT
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
PLATE 28

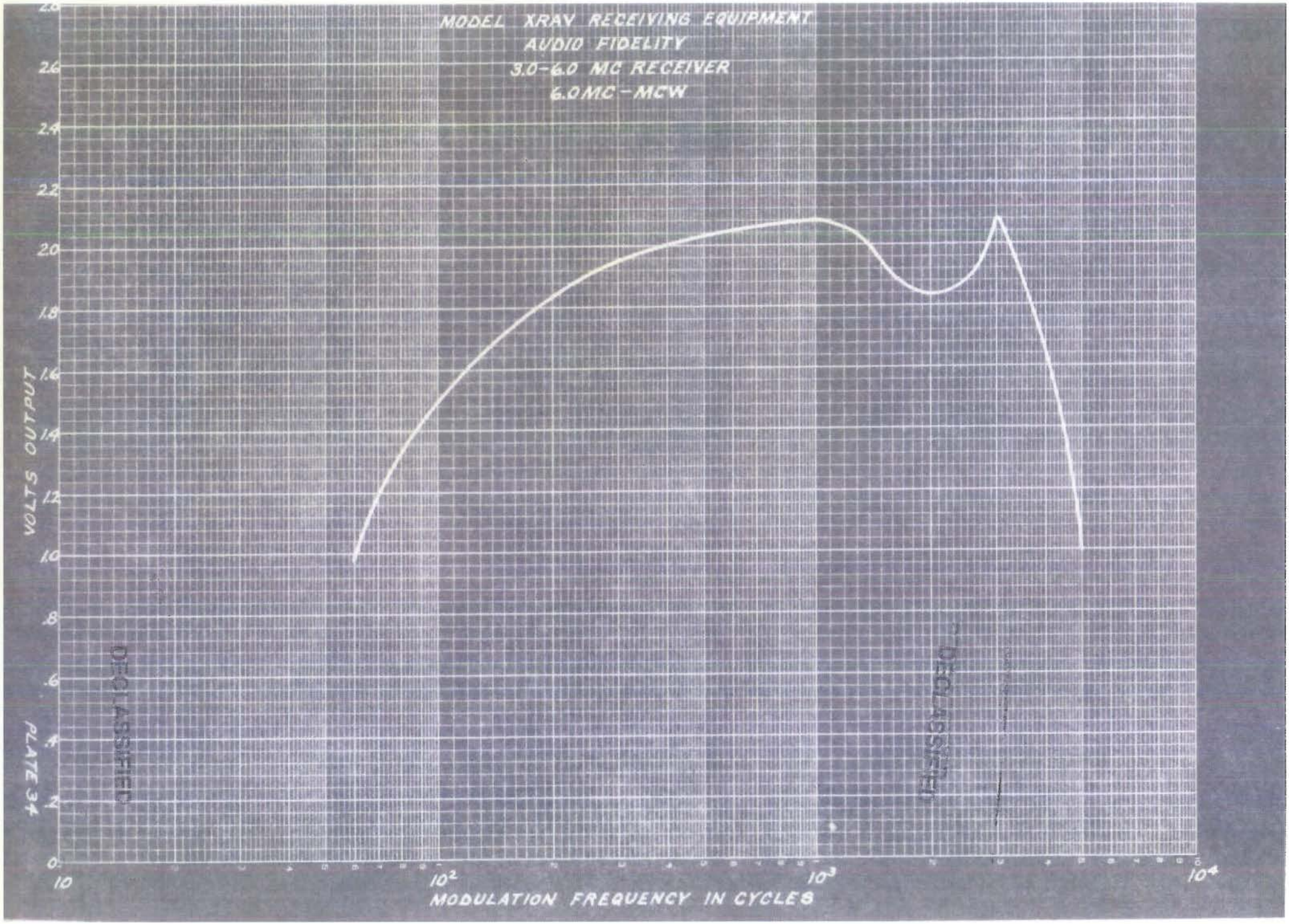

MODEL XRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
520-1500 KC RECEIVER
520 KC - MCW
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
VOLTS ACROSS 1,000 OHMS
PLATE 28
10
10^2
10^3
10^4
DECLASSIFIED
DECLASSIFIED

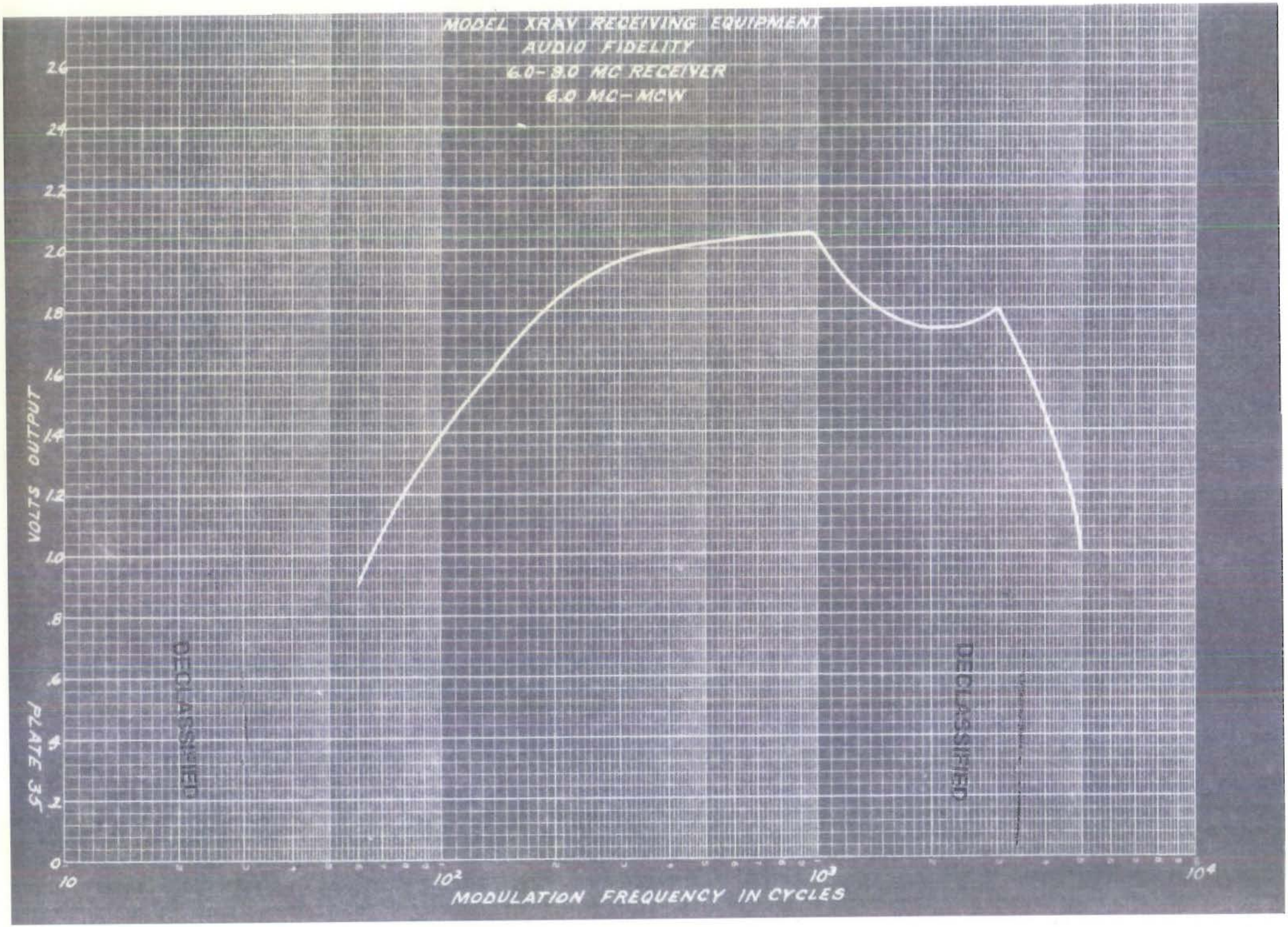

MODEL XRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
520-1500 KC RECEIVER
1500 KC - MCW
VOLTS OUTPUT
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
PLATE 30
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
DECLASSIFIED
DECLASSIFIED

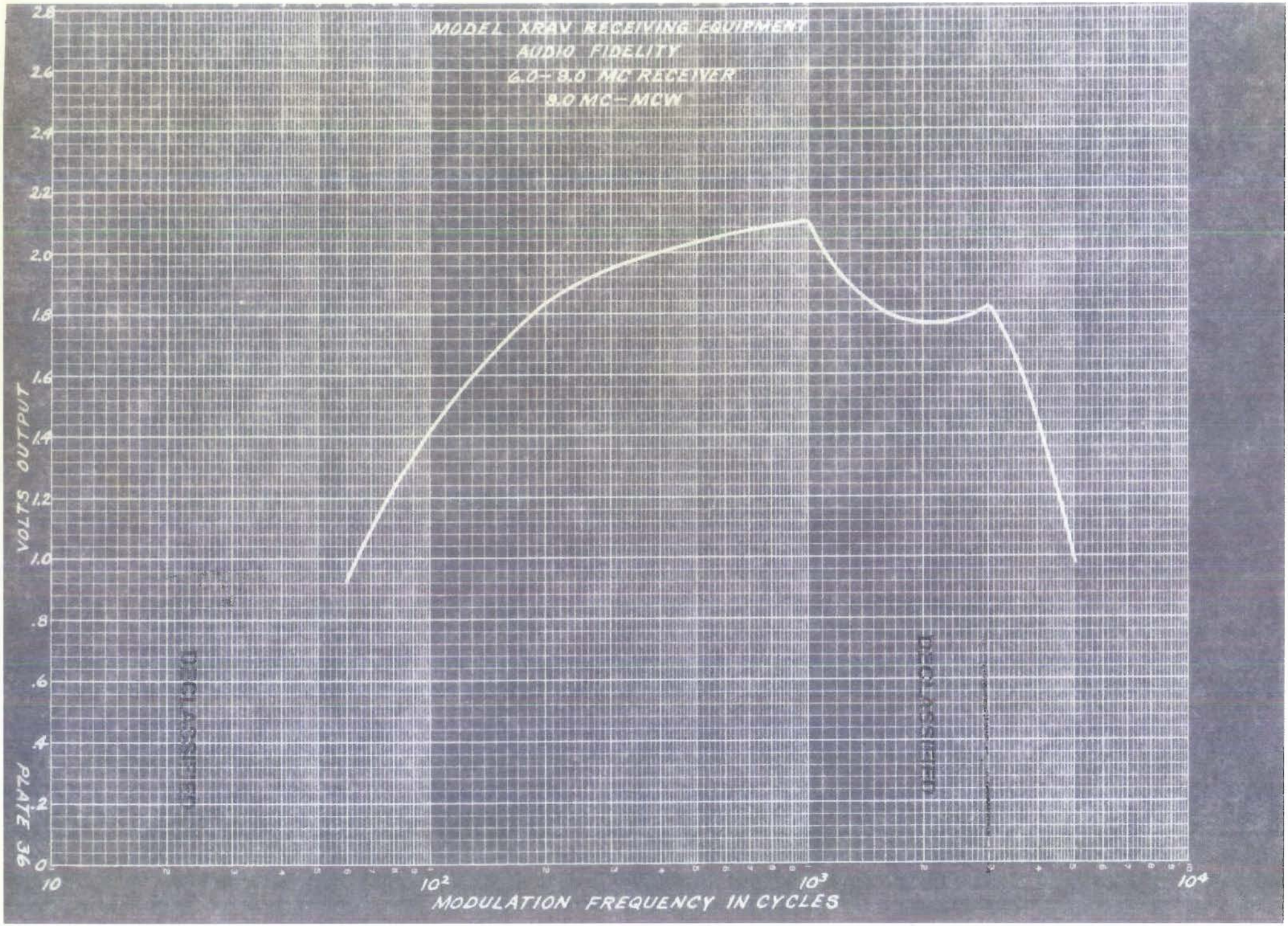

MODEL XRAY RECEIVING EQUIPMENT
AUDIO FIDELITY
1.5-3.0 MC RECEIVER
1.5 MC - MCW
VOLTS OUTPUT
PLATE 31
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
OBSERVED
OBSERVED

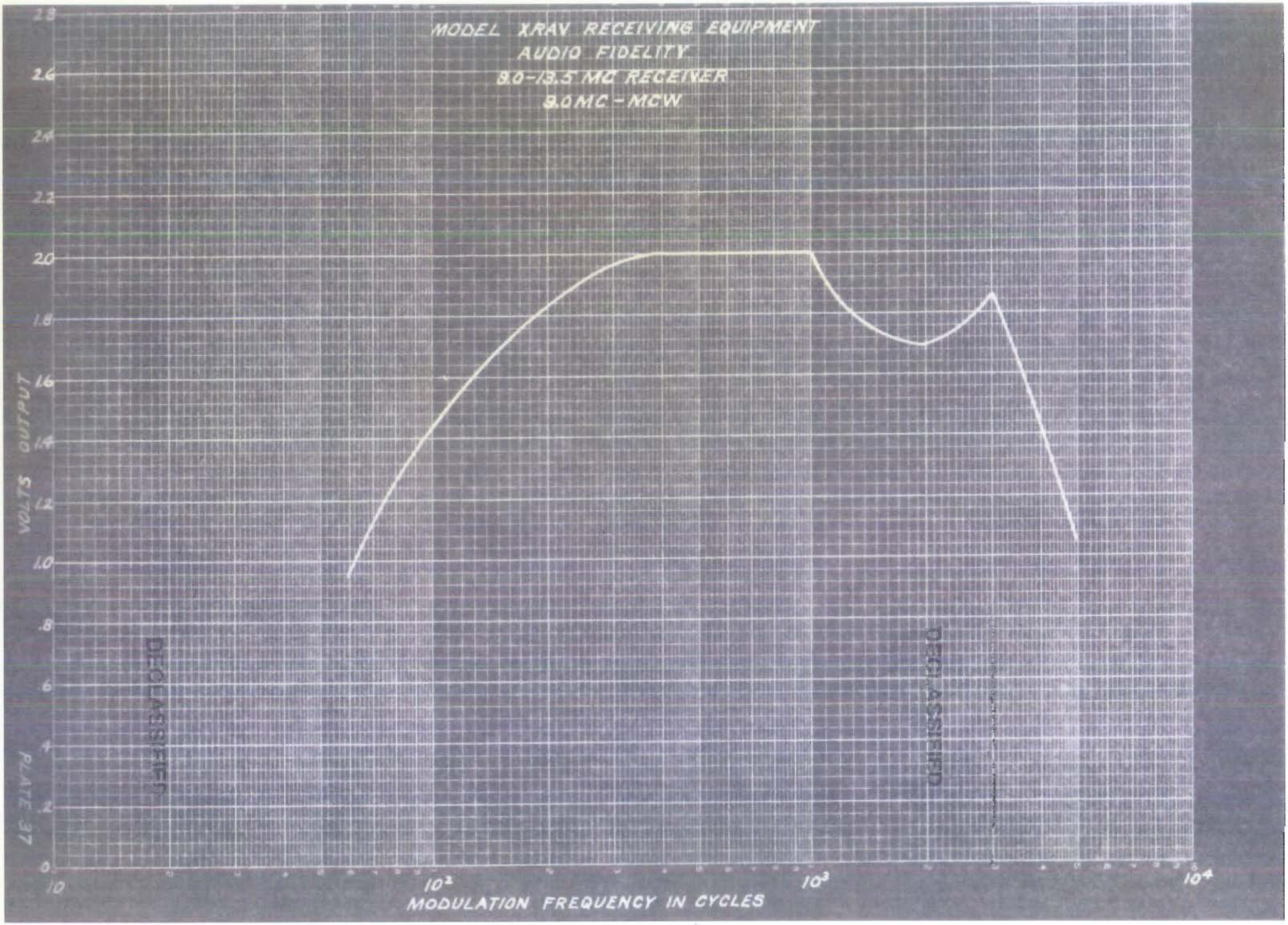

MODEL XRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
1.5-3.0 MC RECEIVER
3.0 MC-MCW
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
VOLTS OUTPUT
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
PLATE 32

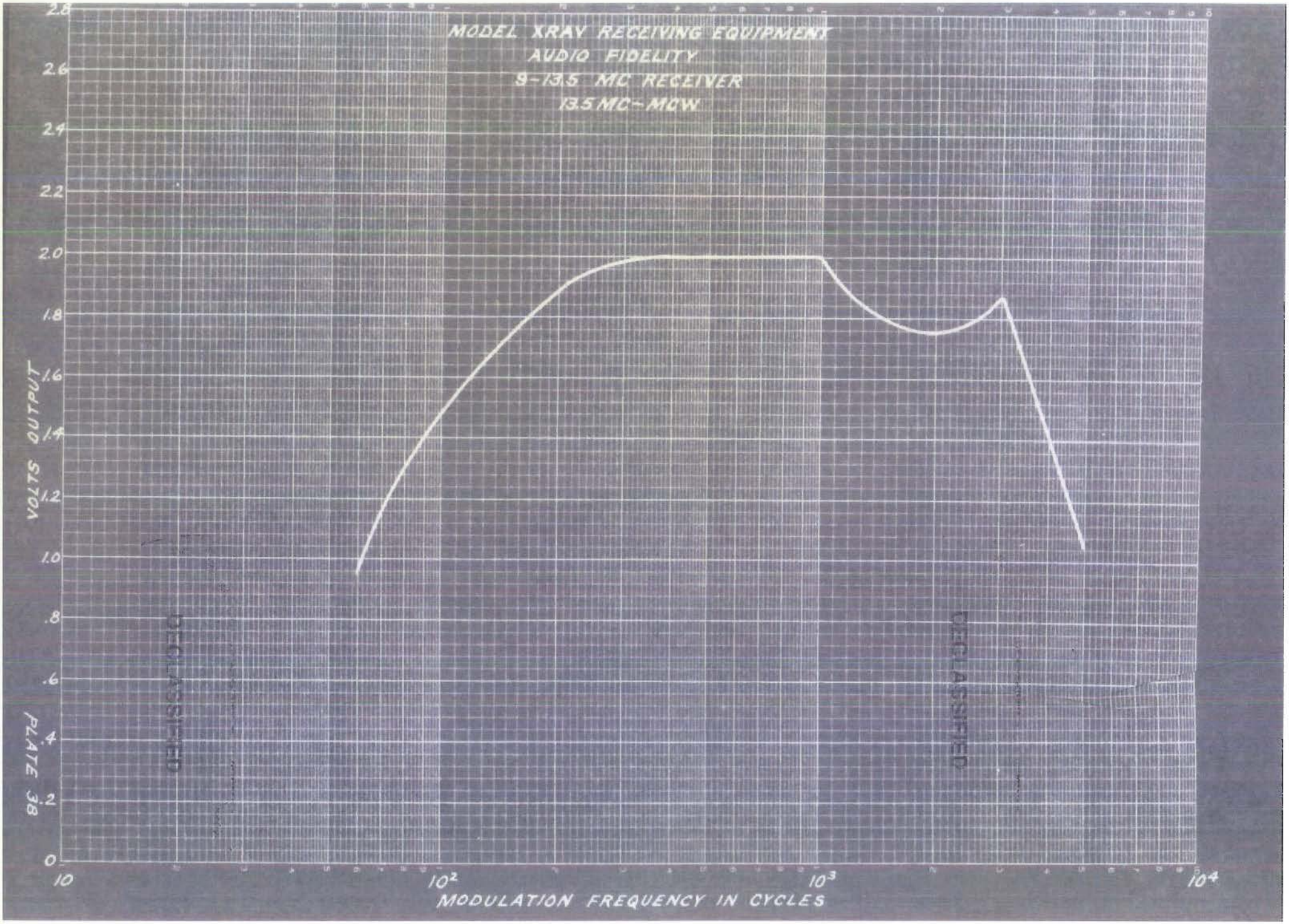

MODEL XRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
3.0-6.0 MC RECEIVER
3.0 MC - MCW
VOLTS OUTPUT
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
PLATE 33
DECLASSIFIED
DECLASSIFIED

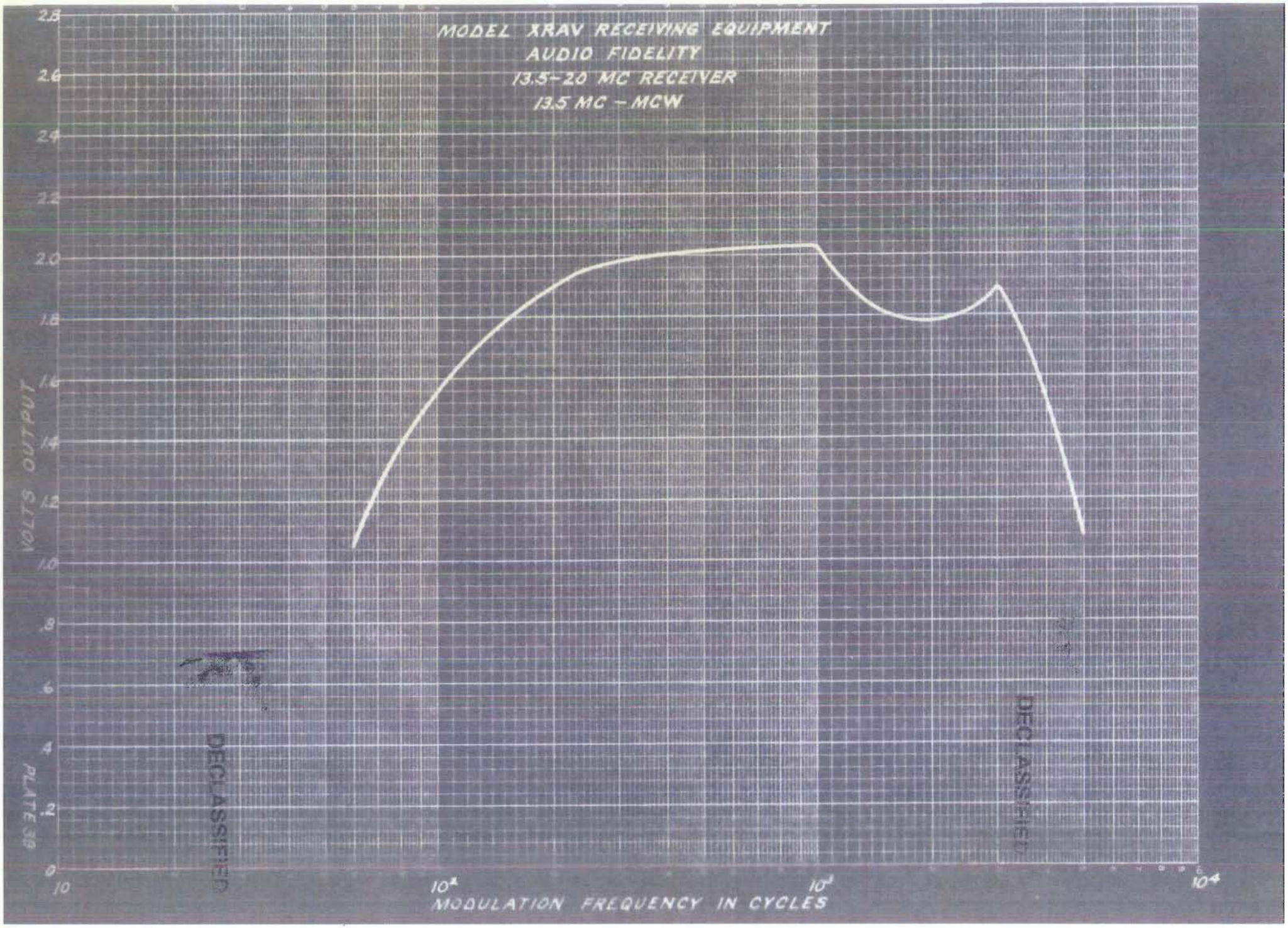

MODEL XRAY RECEIVING EQUIPMENT
AUDIO FIDELITY
3.0-6.0 MC RECEIVER
6.0MC-MCW
VOLTS OUTPUT
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
PLATE 34
DECLASSIFIED
DECLASSIFIED

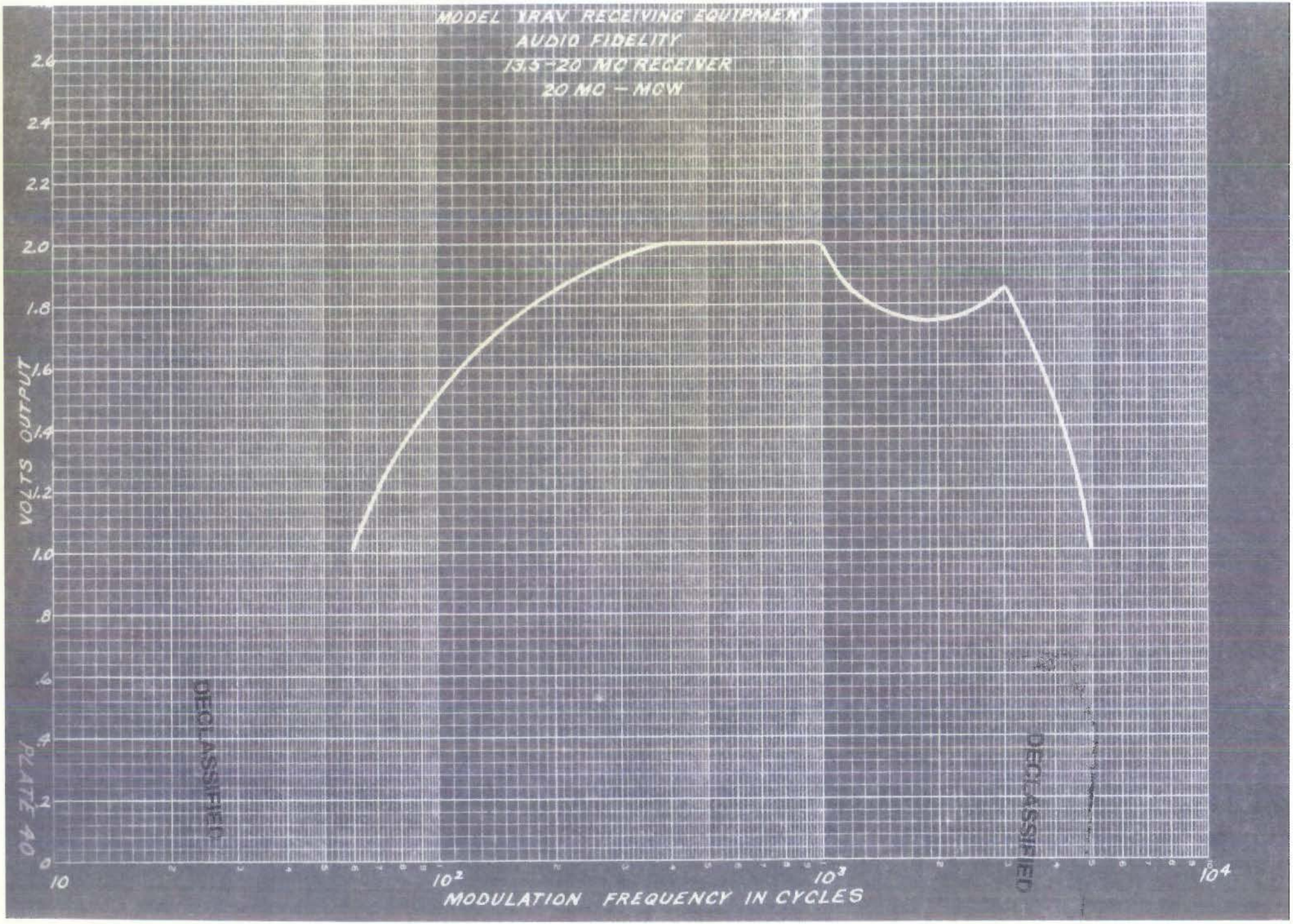

MODEL XRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
6.0-9.0 MC RECEIVER
6.0 MC-MCW
VOLTS OUTPUT
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
DECLASSIFIED
DECLASSIFIED
PLATE 35

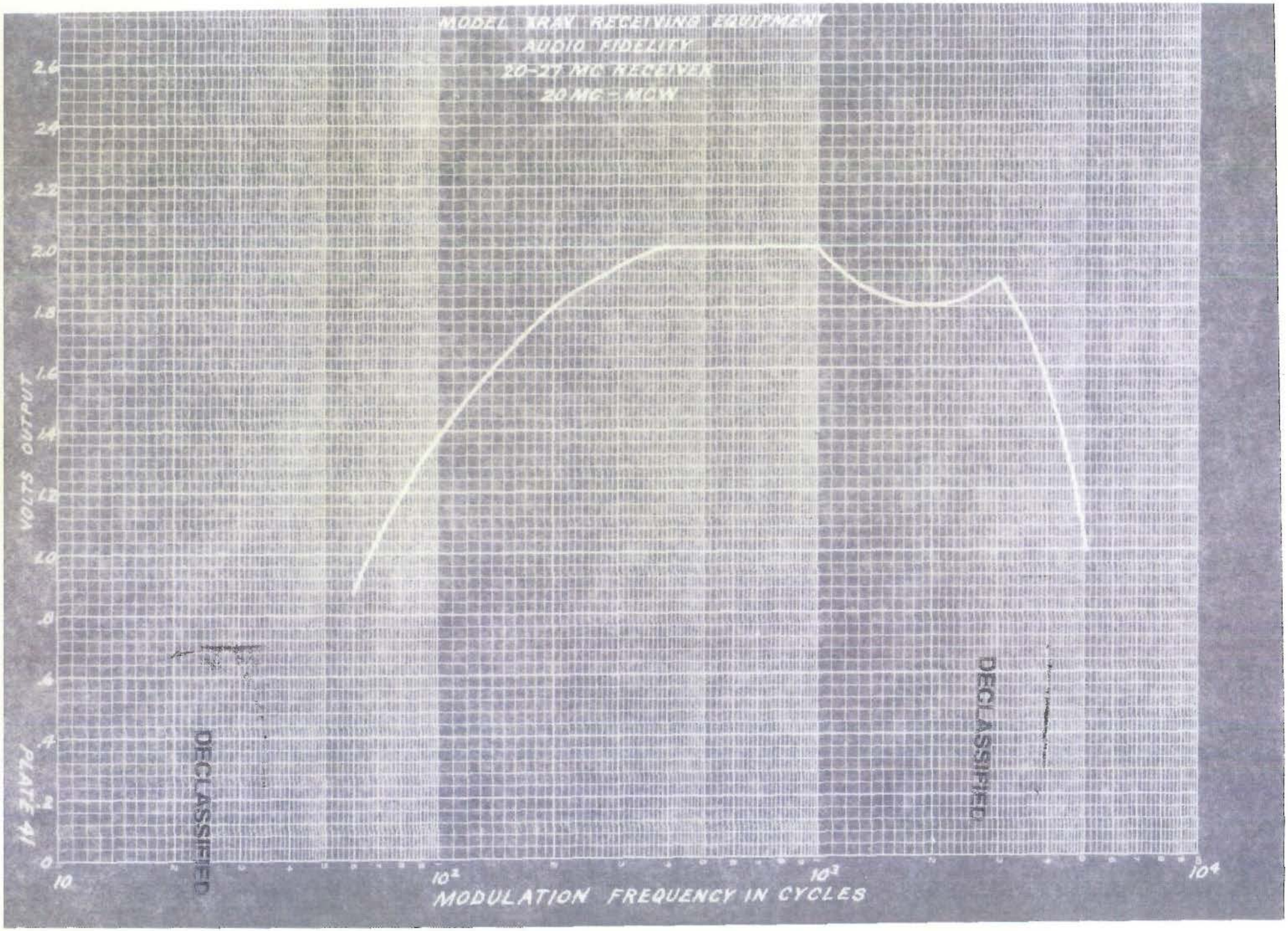

MODEL XRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
6.0-9.0 MC RECEIVER
9.0 MC-MCW
VOLTS OUTPUT
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
PLATE 36
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES

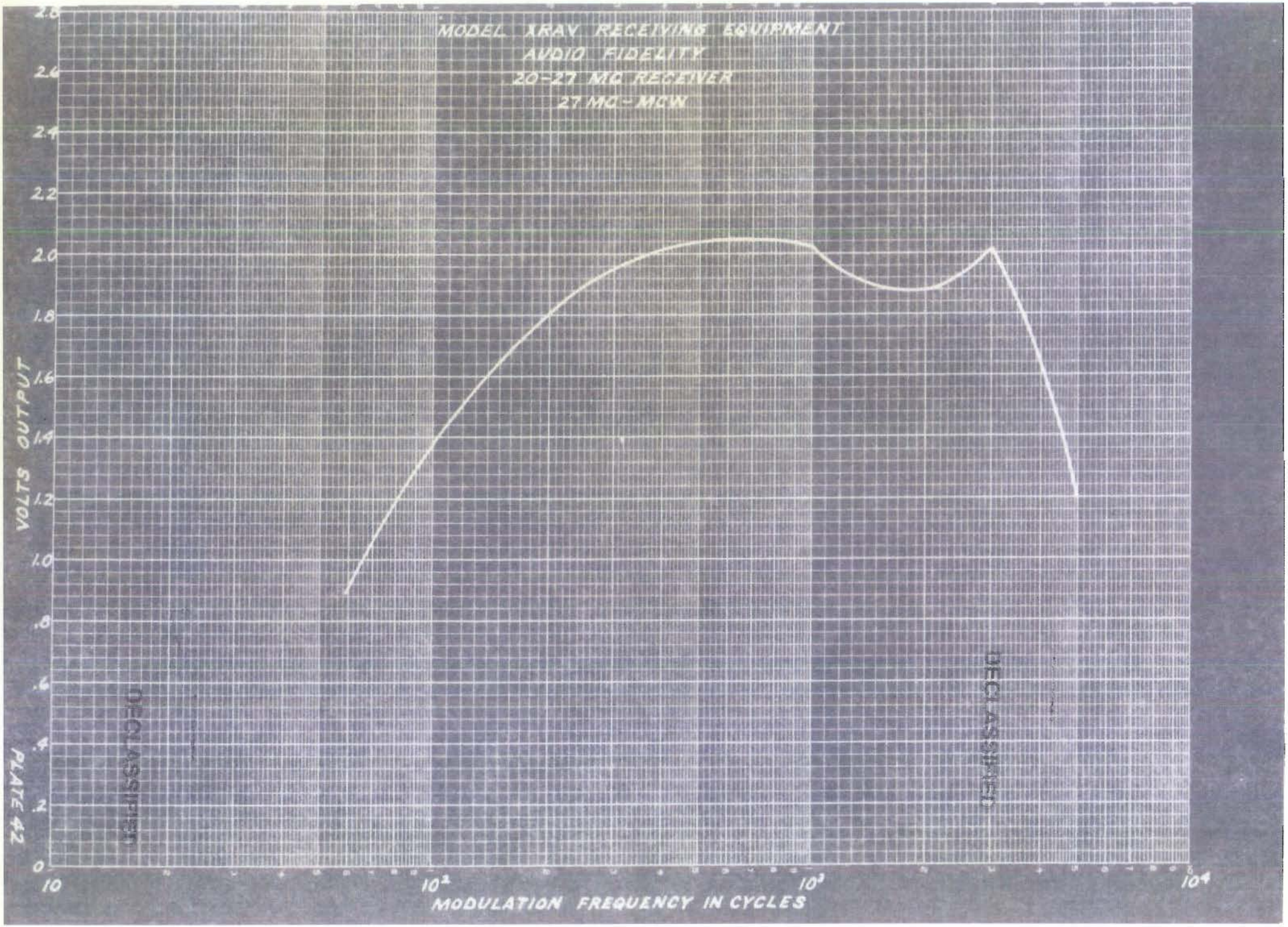

MODEL XRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
8.0-13.5 MC RECEIVER
9.0 MC - MCW
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
VOLTS OUTPUT
PLATE 37
DE-EMPHASIZED
PRE-EMPHASIZED
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES


MODEL XRAY RECEIVING EQUIPMENT
AUDIO FIDELITY
9-13.5 MC RECEIVER
13.5 MC-MCW
VOLTS OUTPUT
PLATE 38
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
DECLASSIFIED
DECLASSIFIED


MODEL XRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
13.5-20 MC RECEIVER
13.5 MC - MCW
VOLTS OUTPUT ACROSS 3.9 OHMS
2.8
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
10
10²
10³
10⁴
MODULATION FREQUENCY IN CYCLES
DECLASSIFIED
DECLASSIFIED


MODEL YRAV RECEIVING EQUIPMENT
AUDIO FIDELITY
13.5-20 MC RECEIVER
20 MO - MCW
VOLTS OUTPUT
PLATE 40
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
DECLASSIFIED
DECLASSIFIED


MODEL XRAY RECEIVING EQUIPMENT
AUDIO FIDELITY
20-27 MC RECEIVER
20 MC = MCW
VOLTS OUTPUT ACROSS 10 OHMS
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
DECLASSIFIED
DECLASSIFIED
PLATE 41


MODEL XRAY RECEIVING EQUIPMENT
AUDIO FIDELITY
20-27 MC RECEIVER
27 MC - MCW
VOLTS OUTPUT
2.6
2.4
2.2
2.0
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0
PLATE 42
10
10^2
10^3
10^4
MODULATION FREQUENCY IN CYCLES
DECLASSIFIED
DECLASSIFIED

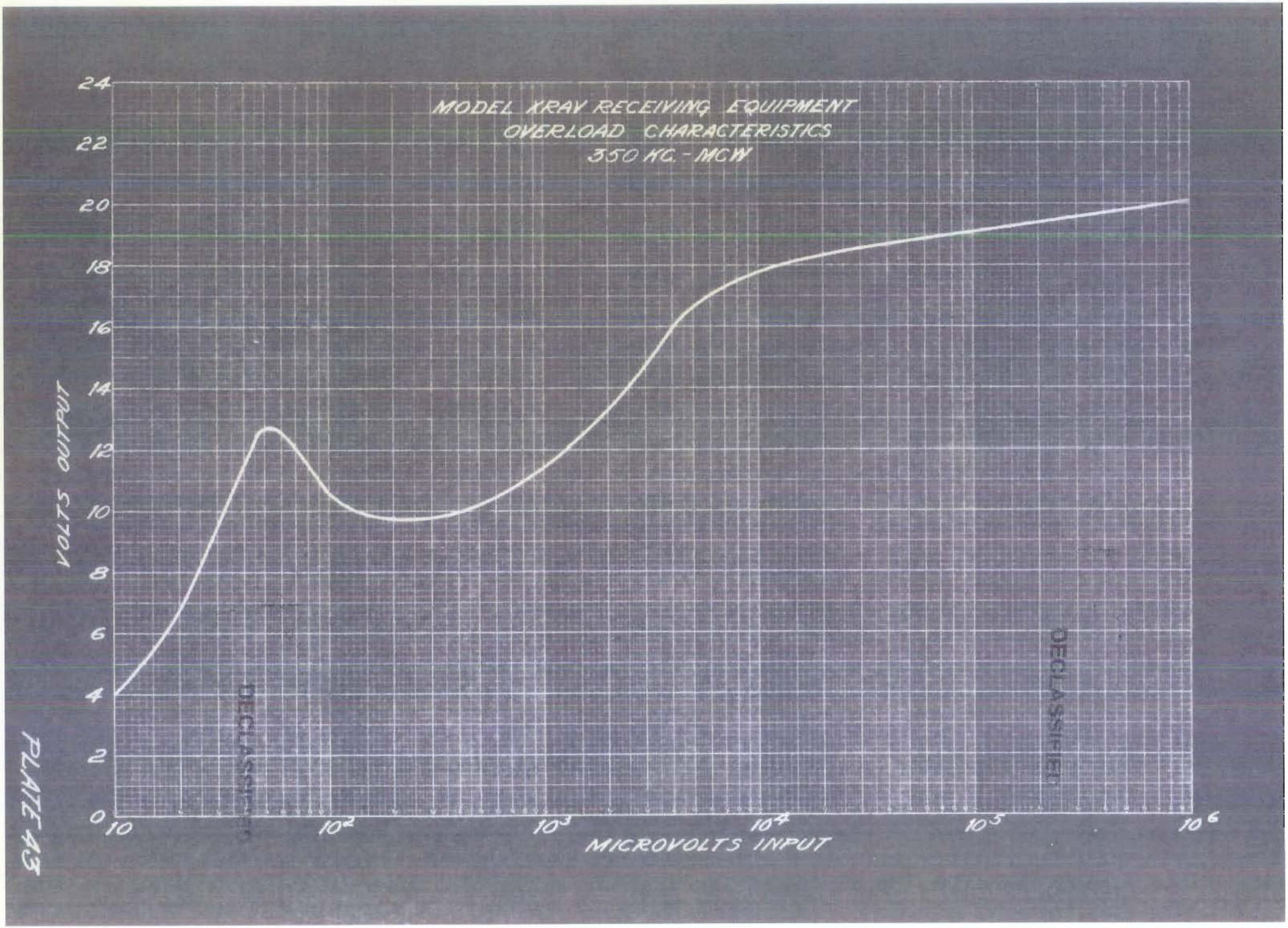

MODEL XRAY RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTICS
350 KC. - MCW
VOLTS OUTPUT ACROSS 1000Ω
24
22
20
18
16
14
12
10
8
6
4
2
0
10
10^2
10^3
10^4
10^5
10^6
MICROVOLTS INPUT
DECLASSIFIED
DECLASSIFIED

PLATE 43

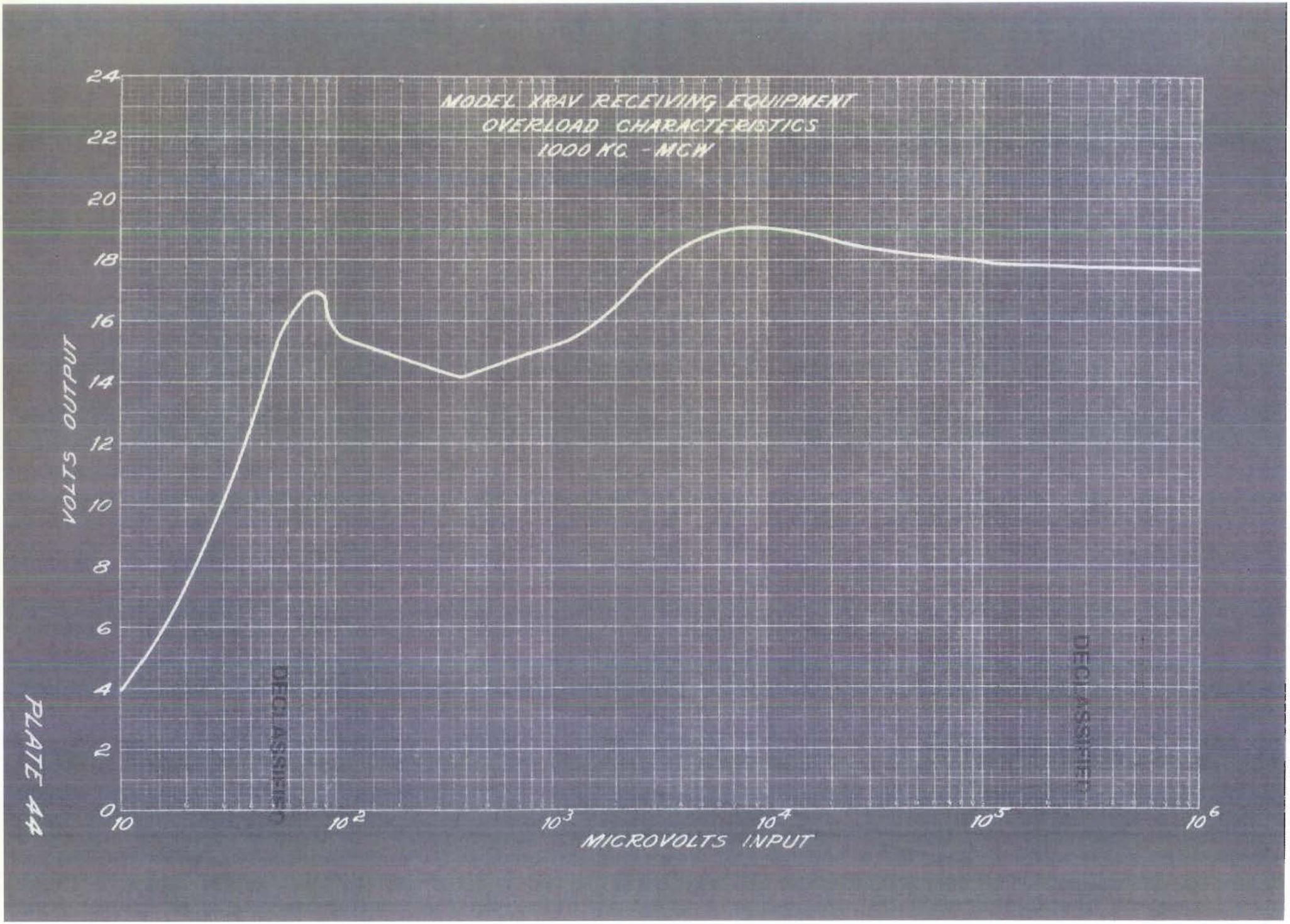

MODEL XRAV RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTICS
1000 KC. - MCW
VOLTS OUTPUT
0
2
4
6
8
10
12
14
16
18
20
22
24
MICROVOLTS INPUT
10
10^2
10^3
10^4
10^5
10^6
DEGLASSIFIED
DEGLASSIFIED

PLATE 44

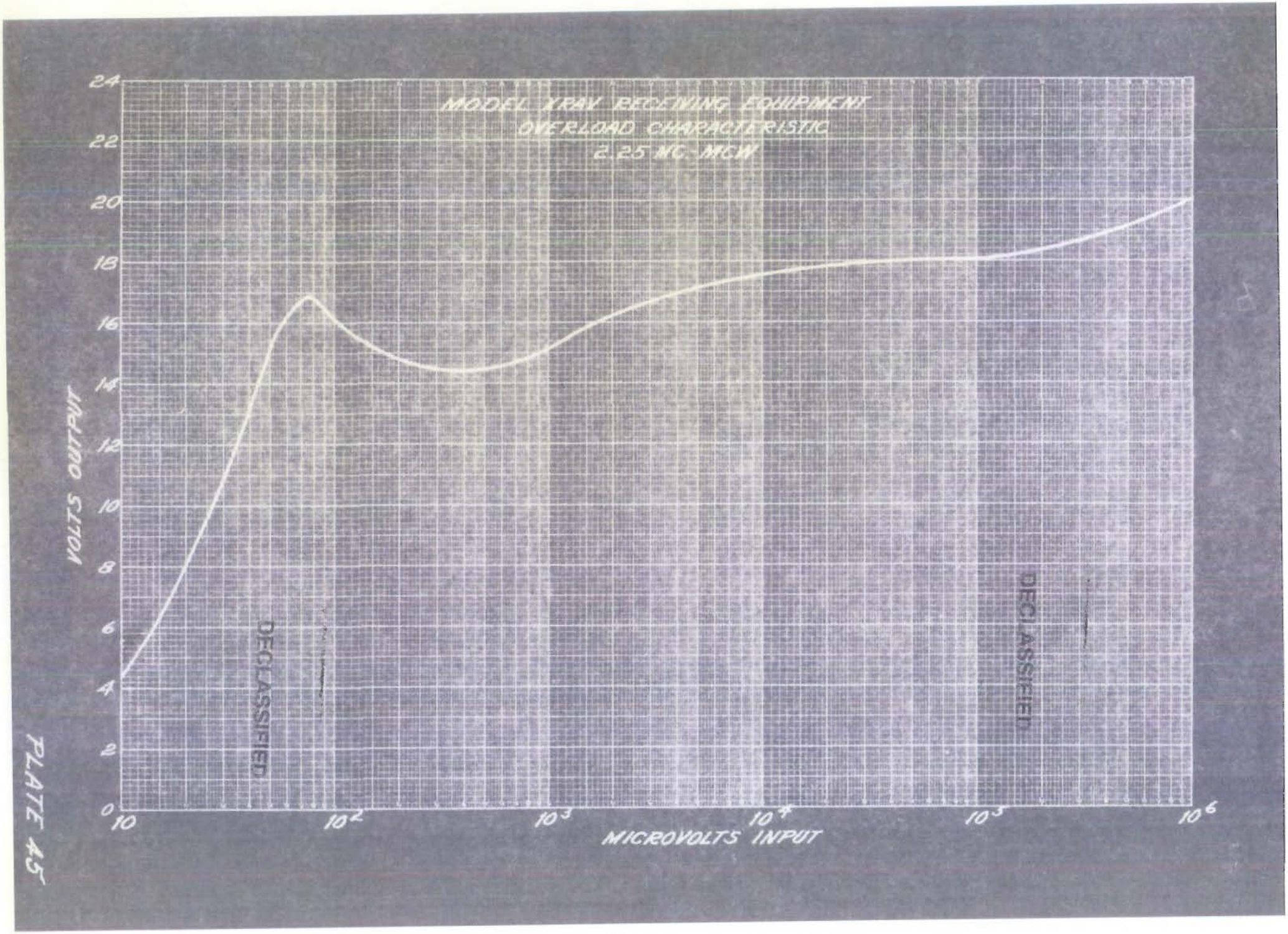

MODEL XRAY RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTIC
2.25 MC MCW
VOLTS OUTPUT
0
2
4
6
8
10
12
14
16
18
20
22
24
MICROVOLTS INPUT
10
10^2
10^3
10^4
10^5
10^6
DECLASSIFIED
DECLASSIFIED

PLATE 45

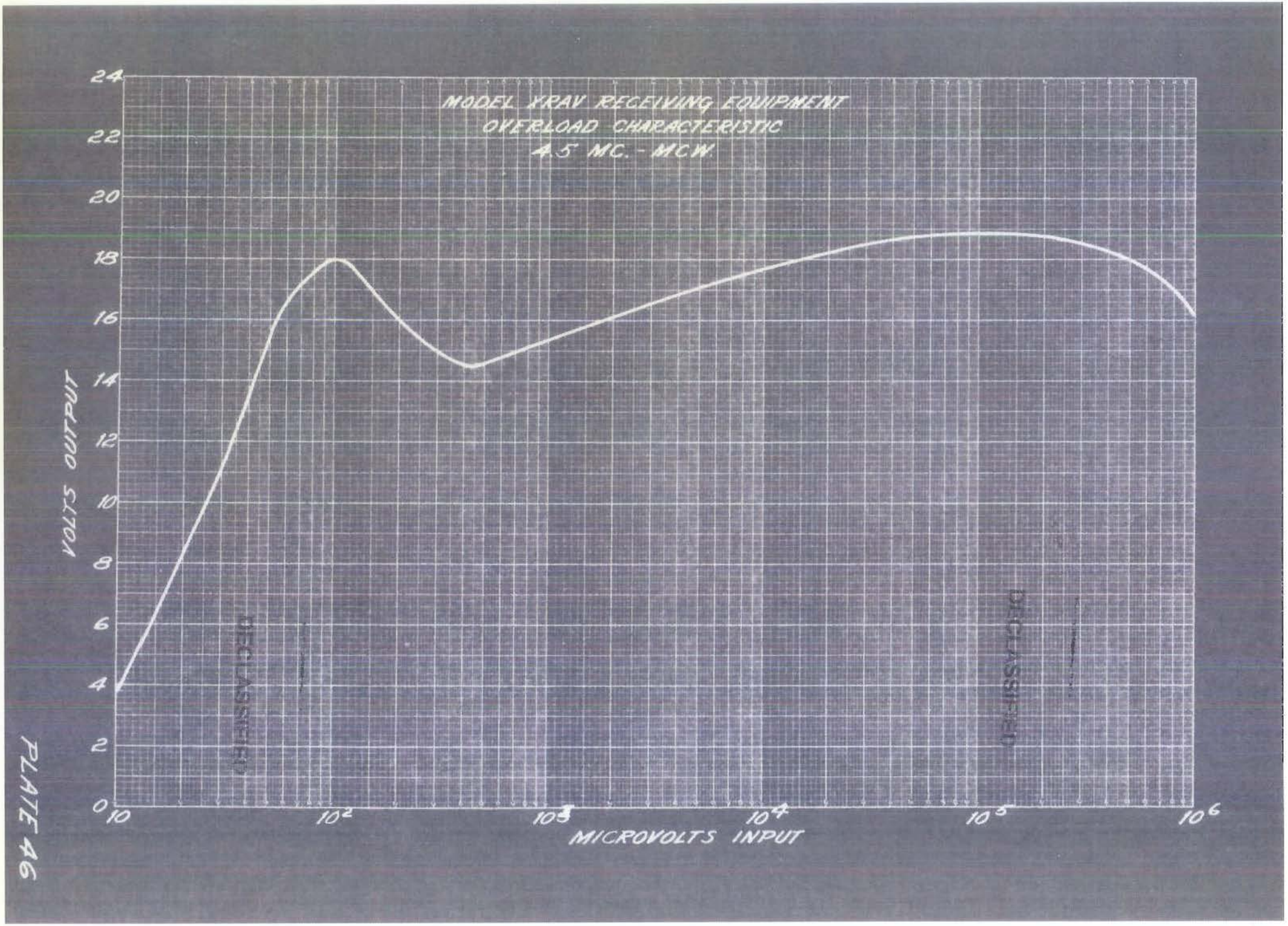
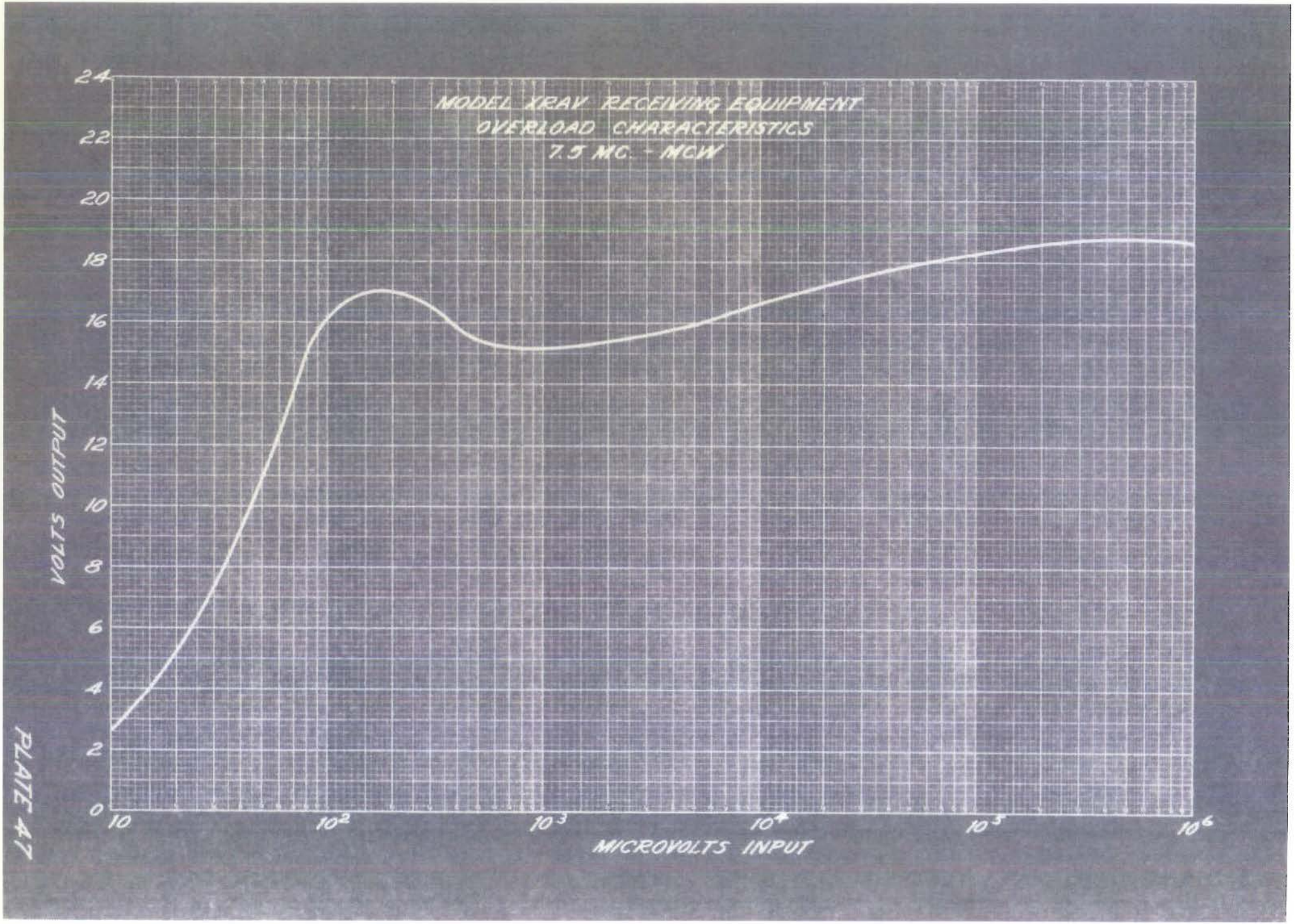

MODEL XRAV RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTIC
4.5 MC. - MCW.
VOLTS OUTPUT
0
2
4
6
8
10
12
14
16
18
20
22
24
10
10^2
10^3
10^4
10^5
10^6
MICROVOLTS INPUT
DECLASSIFIED
DECLASSIFIED

PLATE 46


MODEL XRAY RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTICS
7.5 MC. - MCW
VOLTS OUTPUT
0
2
4
6
8
10
12
14
16
18
20
22
24
10
10^2
10^3
10^4
10^5
10^6
MICROVOLTS INPUT
PLATE 47

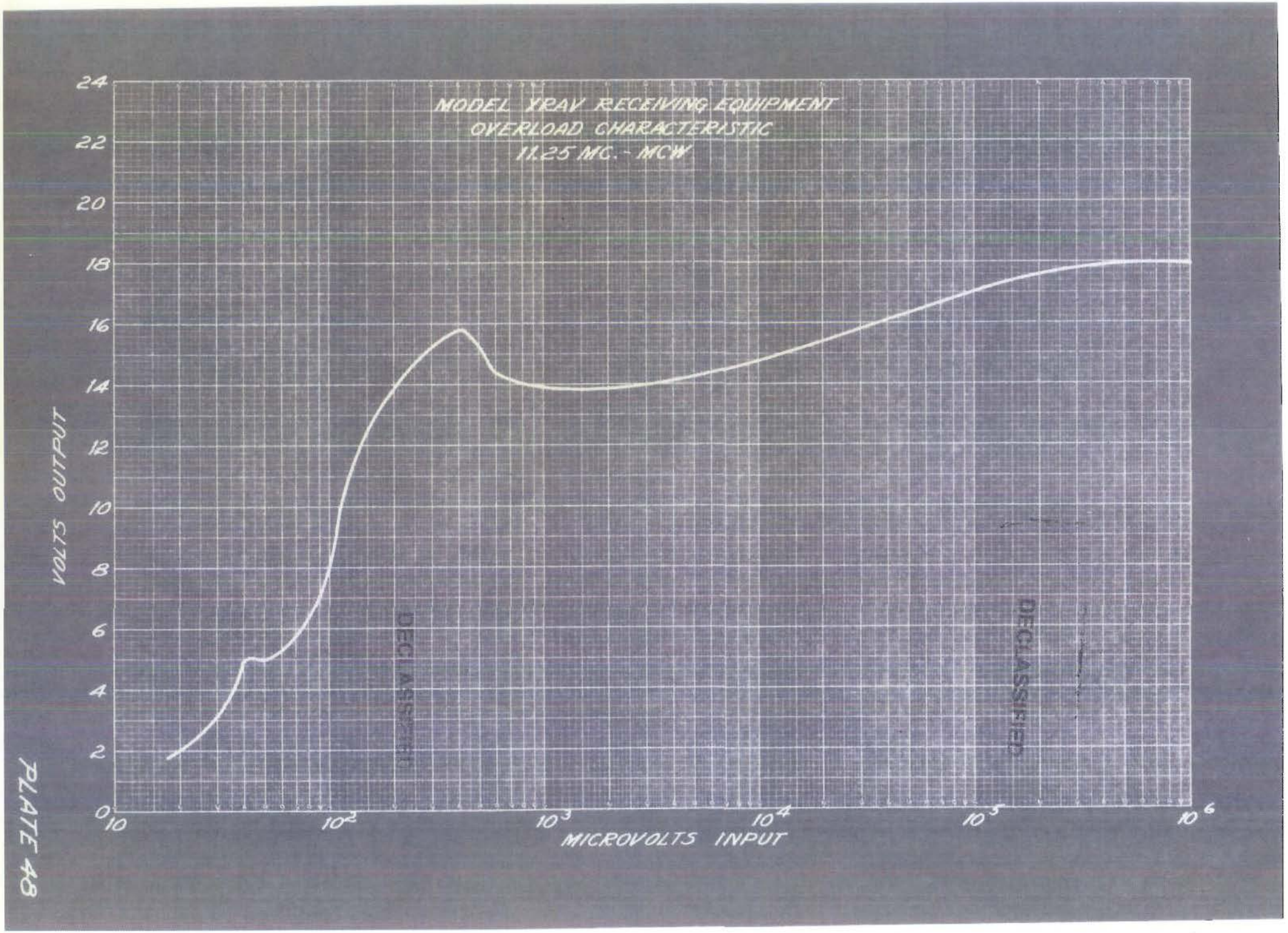

MODEL XRAV RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTIC
11.25 MC. - MCW
VOLTS OUTPUT
0
2
4
6
8
10
12
14
16
18
20
22
24
MICROVOLTS INPUT
10
10^2
10^3
10^4
10^5
10^6
DECLASSIFIED
DECLASSIFIED

PLATE 48

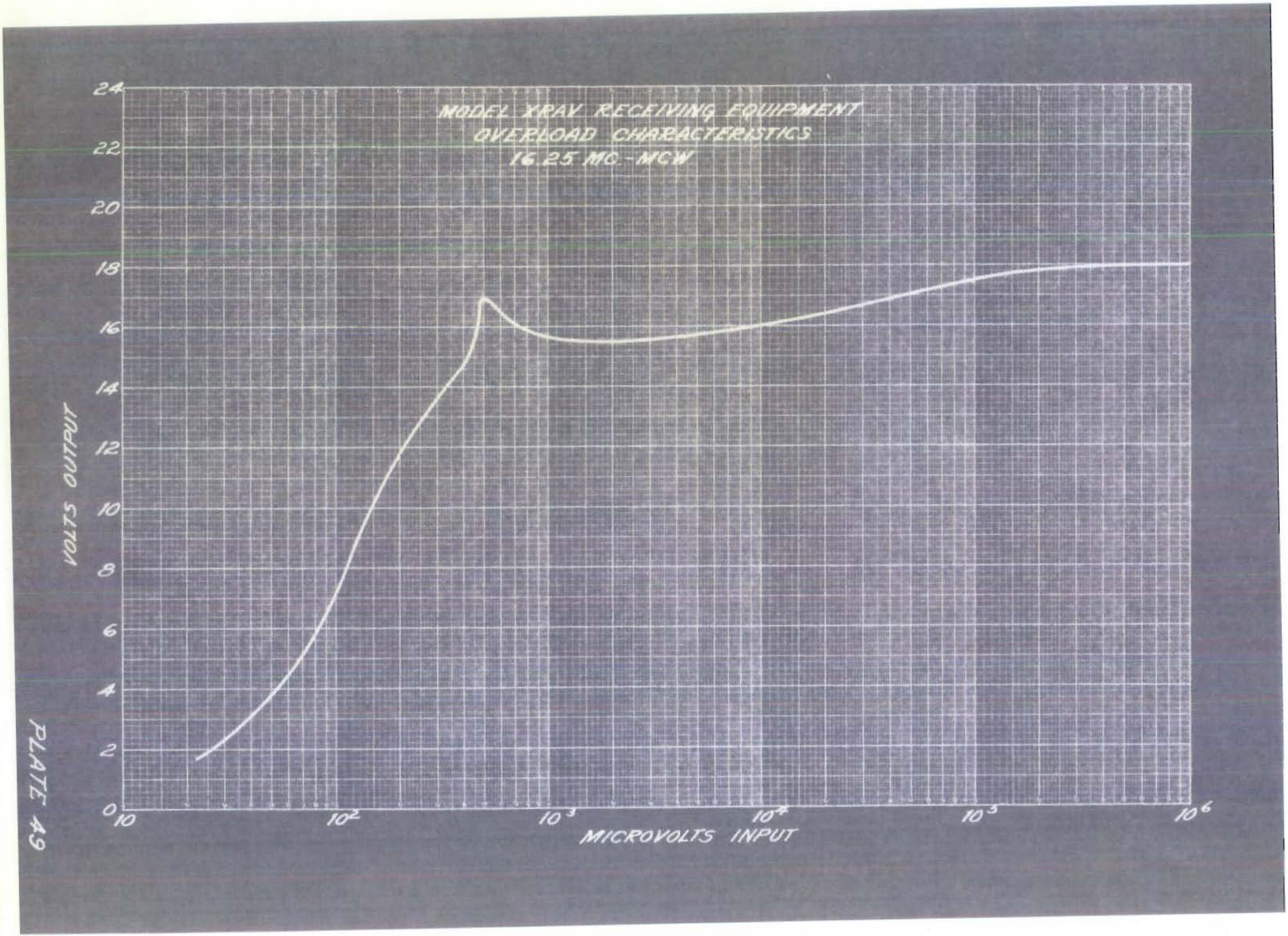

MODEL XRAV RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTICS
16.25 MC.-MCW
VOLTS OUTPUT
0
2
4
6
8
10
12
14
16
18
20
22
24
10
10^2
10^3
10^4
10^5
10^6
MICROVOLTS INPUT

PLATE 49

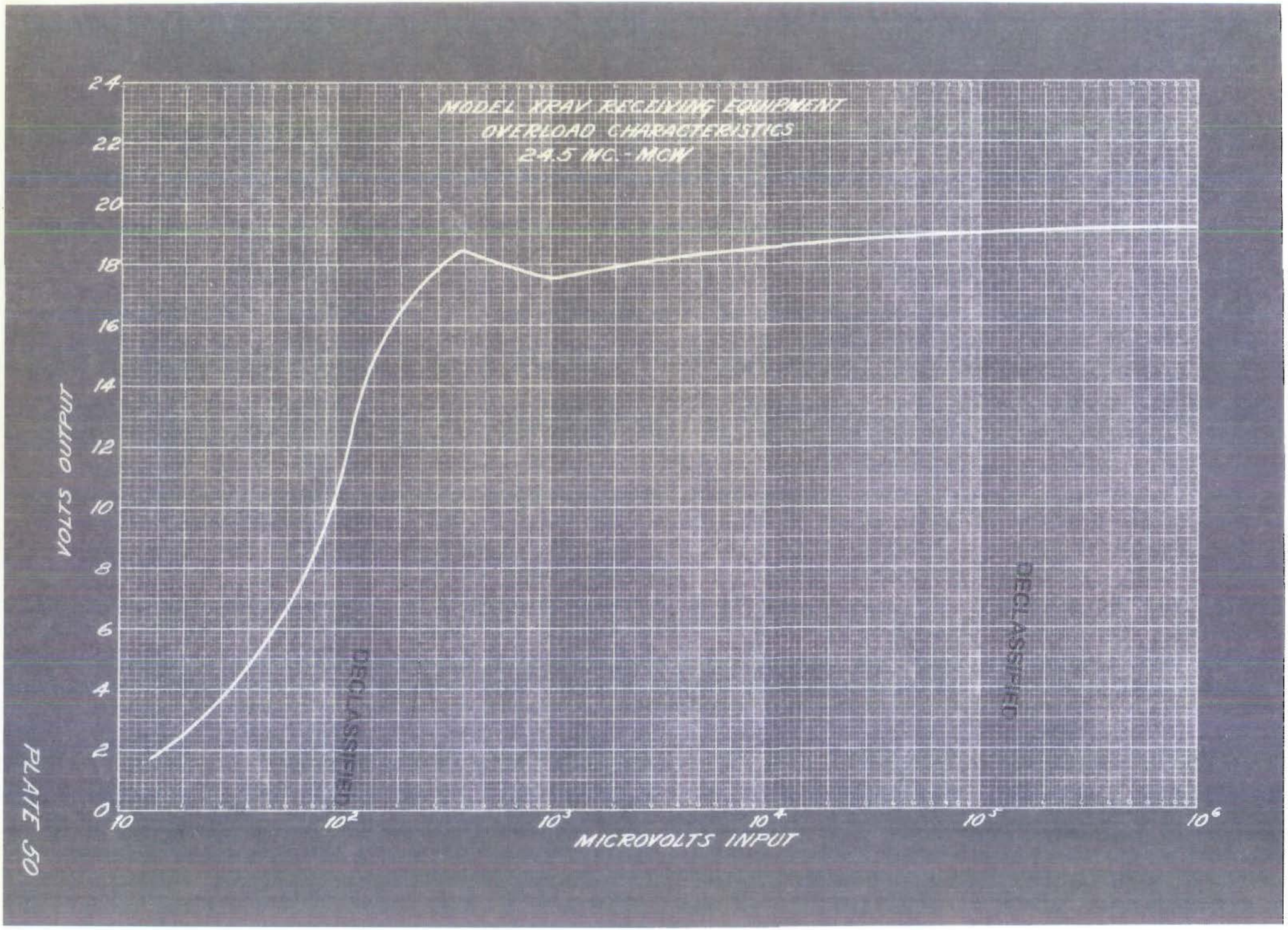
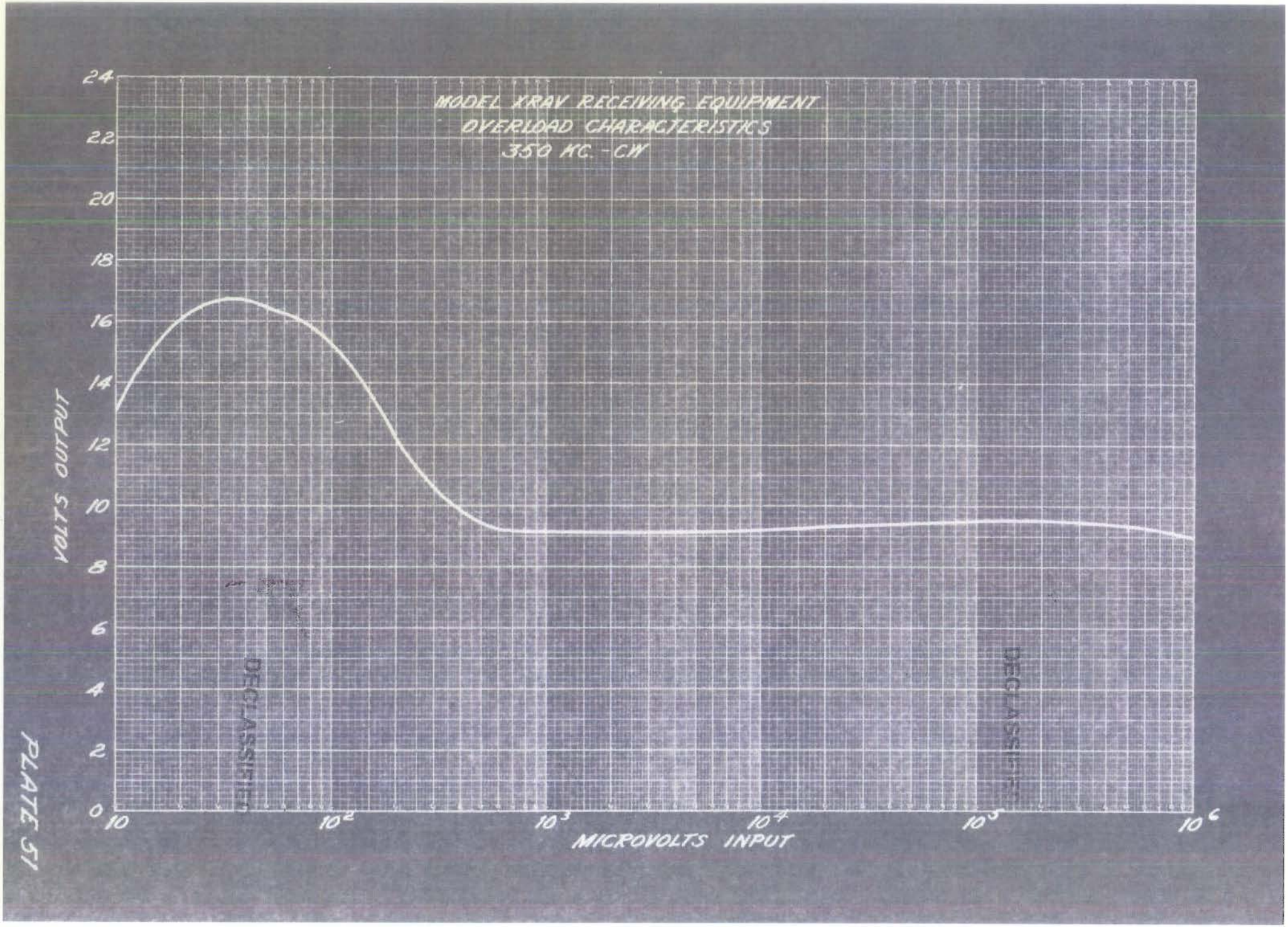

MODEL XRAV RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTICS
24.5 MC. - MCW
VOLTS OUTPUT
MICROVOLTS INPUT
0
2
4
6
8
10
12
14
16
18
20
22
24
10
10^2
10^3
10^4
10^5
10^6
DECLASSIFIED
DECLASSIFIED

PLATE 50


MODEL XRAV RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTICS
350 KC. - CW
VOLTS OUTPUT
24
22
20
18
16
14
12
10
8
6
4
2
0
10
10^2
10^3
10^4
10^5
10^6
MICROVOLTS INPUT
DECLASSIFIED
DECLASSIFIED
PLATE 51

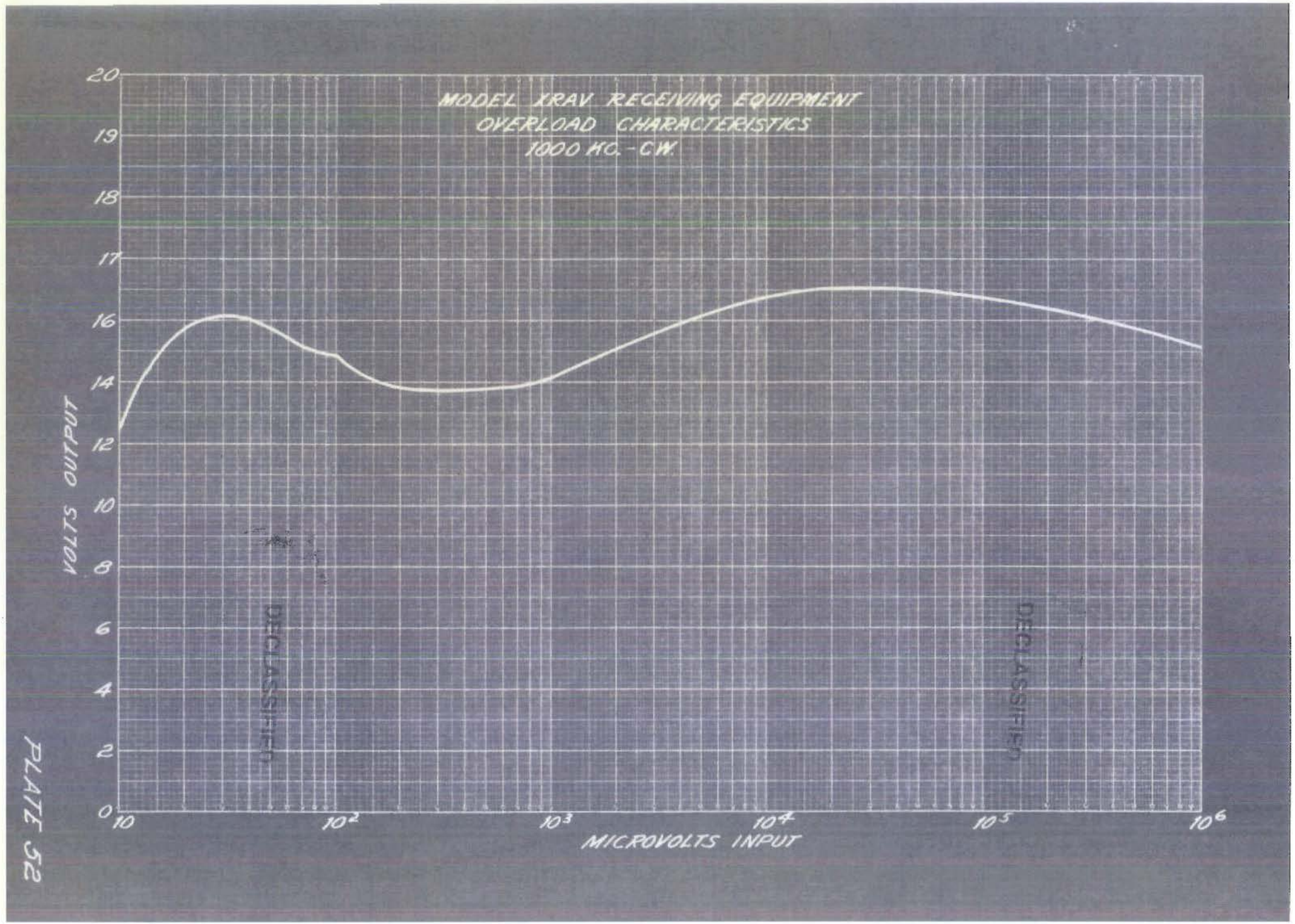

MODEL XRAV RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTICS
1000 KC. - CW.
VOLTS OUTPUT
20
19
18
17
16
14
12
10
8
6
4
2
0
10
10^2
10^3
10^4
10^5
10^6
MICROVOLTS INPUT
DECLASSIFIED
DECLASSIFIED

PLATE 52

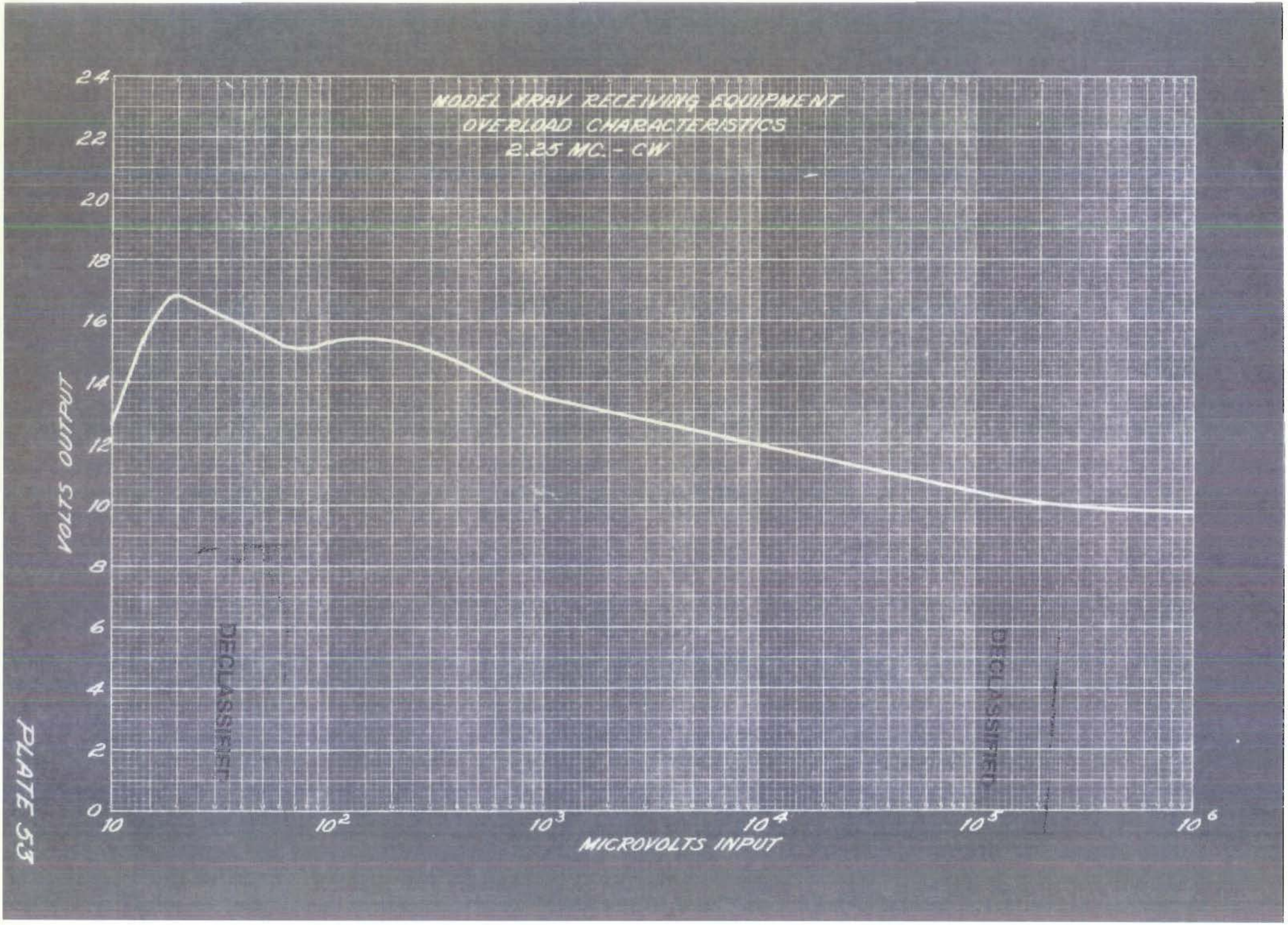

MODEL XRAY RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTICS
2.25 MC. - CW
VOLTS OUTPUT
0
2
4
6
8
10
12
14
16
18
20
22
24
MICROVOLTS INPUT
10
10^2
10^3
10^4
10^5
10^6
DECLASSIFIED
DECLASSIFIED

PLATE 53

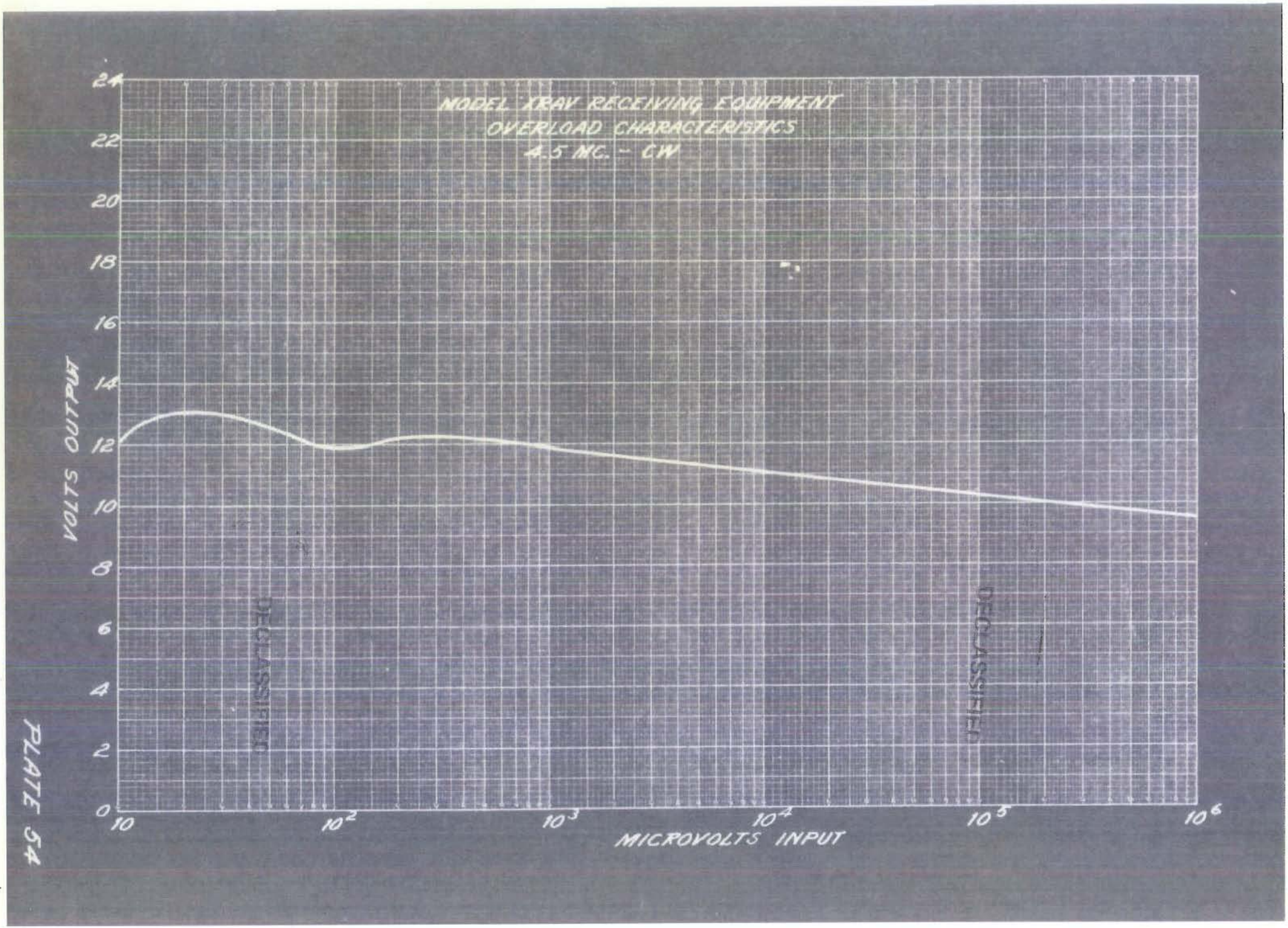

MODEL XRAV RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTICS
4.5 MC. - CW
VOLTS OUTPUT
24
22
20
18
16
14
12
10
8
6
4
2
0
10
10^2
10^3
10^4
10^5
10^6
MICROVOLTS INPUT
UNCLASSIFIED
UNCLASSIFIED

PLATE 54

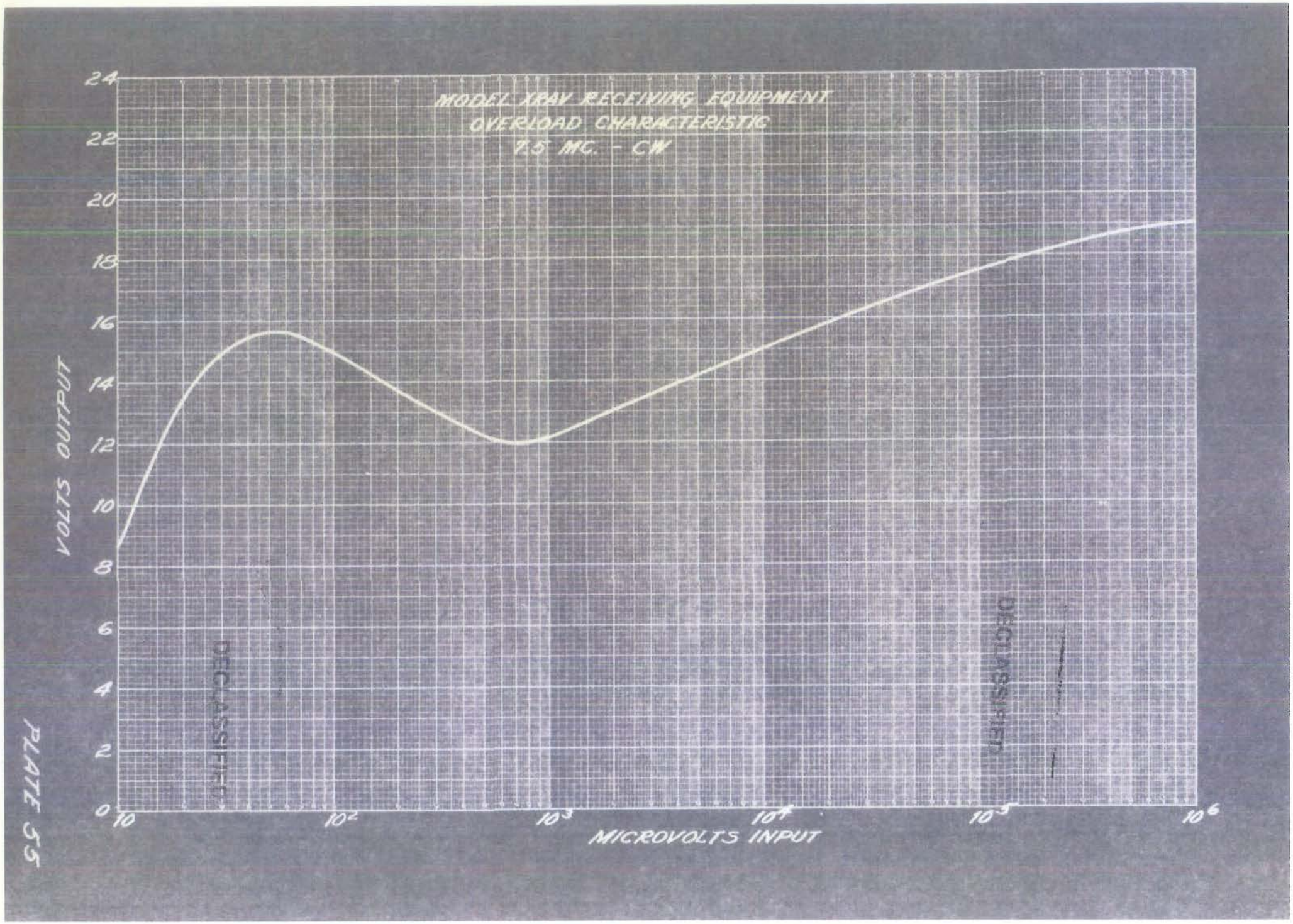

MODEL XRAV RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTIC
7.5 MC. - CW
VOLTS OUTPUT
MICROVOLTS INPUT
0
2
4
6
8
10
12
14
16
18
20
22
24
10
10^2
10^3
10^4
10^5
10^6
DECLASSIFIED
DECLASSIFIED

PLATE 55

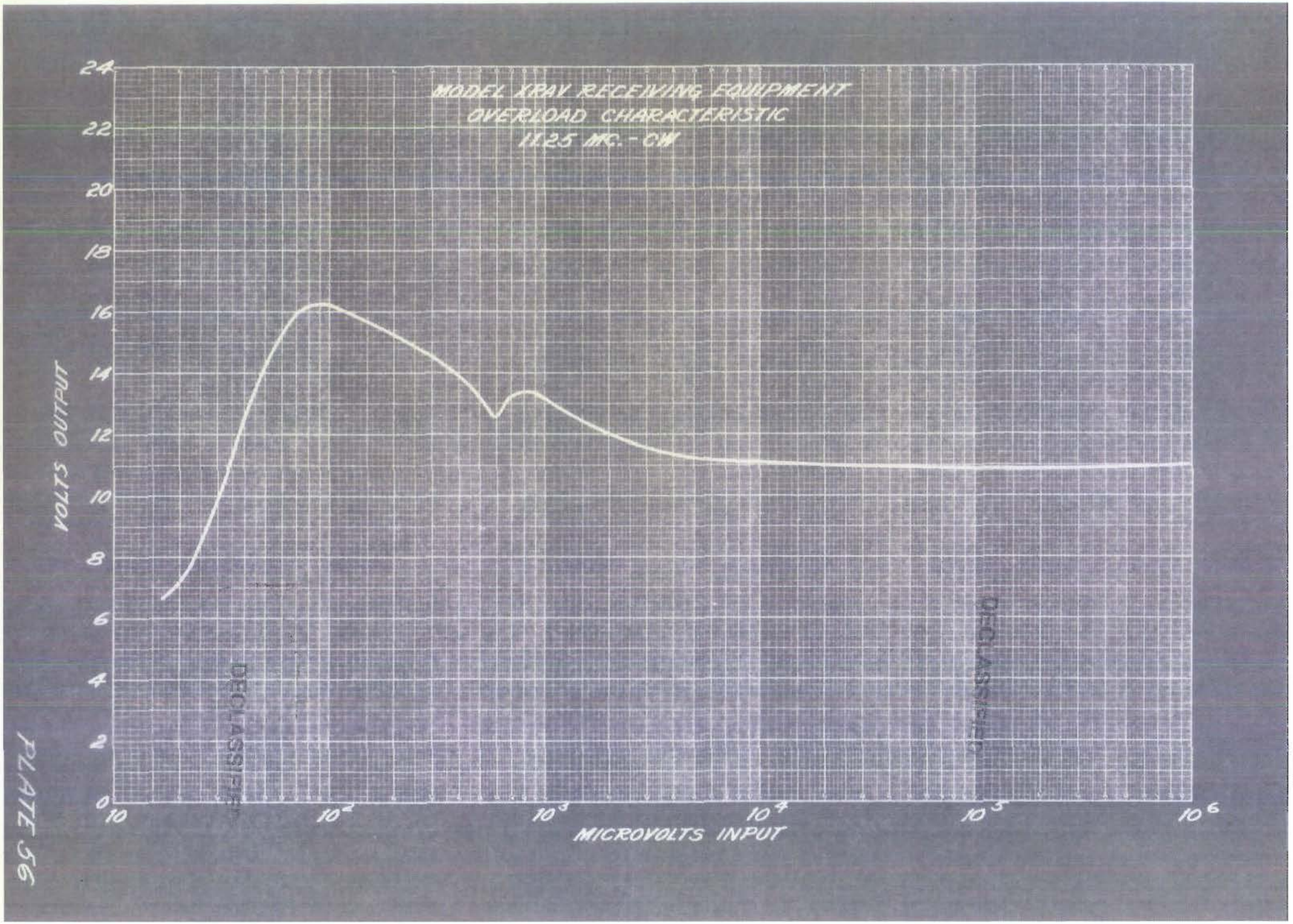
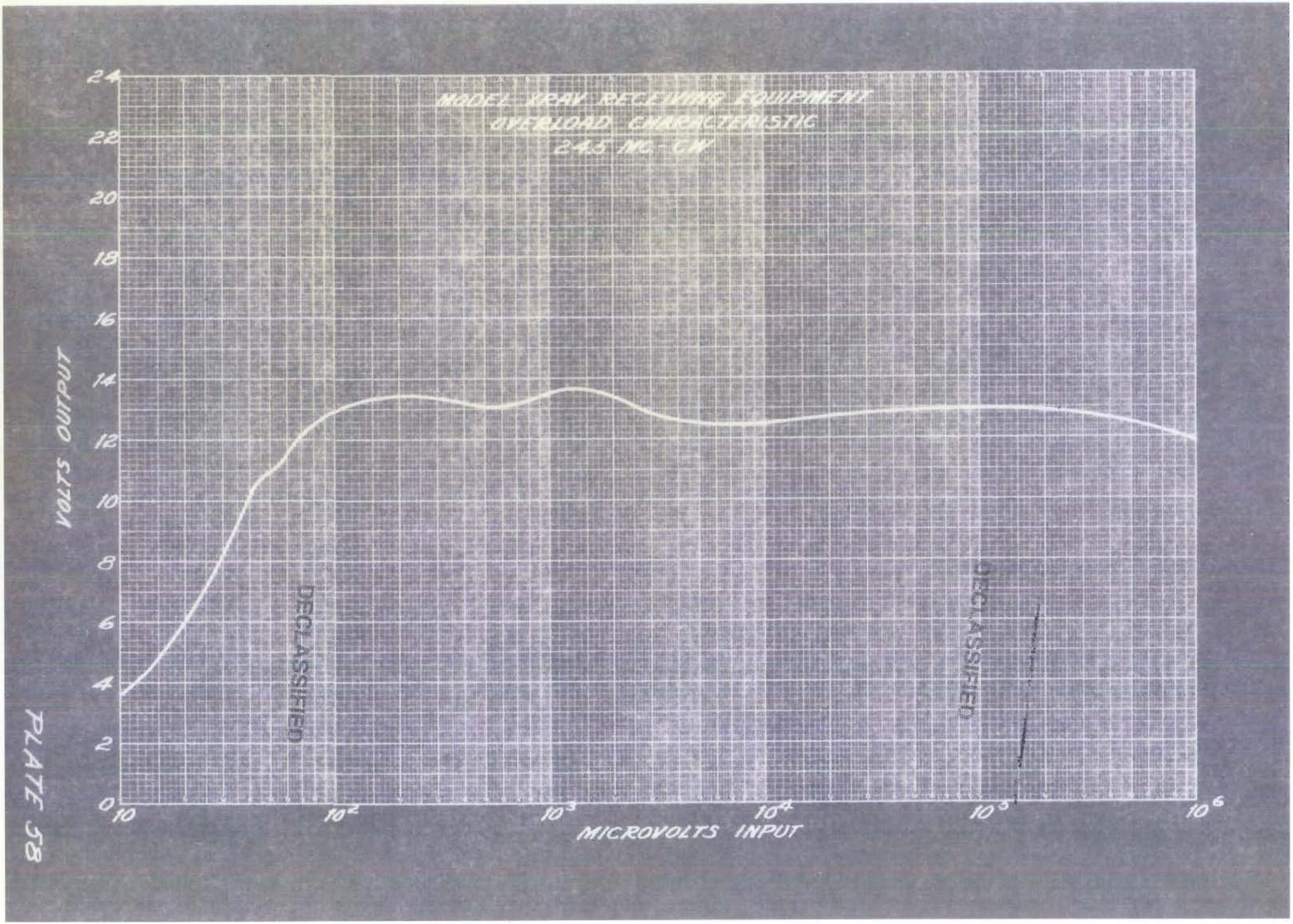

MODEL XRAY RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTIC
11.25 MC. - CW
VOLTS OUTPUT
0
2
4
6
8
10
12
14
16
18
20
22
24
MICROVOLTS INPUT
10
10^2
10^3
10^4
10^5
10^6
DECLASSIFIED
DECLASSIFIED

PLATE 56

MODEL PRAL RADIATION EQUIPMENT
OVERALL CHARACTERISTIC
10-34 KC
VOLTS OUTPUT
MICROVOLTS INPUT
DECLASSIFIED
DECLASSIFIED

PLATE 57


MODEL XRAY RECEIVING EQUIPMENT
OVERLOAD CHARACTERISTIC
245 MC - CW
VOLTS OUTPUT
24
22
20
18
16
14
12
10
8
6
4
2
0
10
10^2
10^3
10^4
10^5
10^6
MICROVOLTS INPUT
DECLASSIFIED
DECLASSIFIED
PLATE 58

BELLEVUE, D. C.

DATE

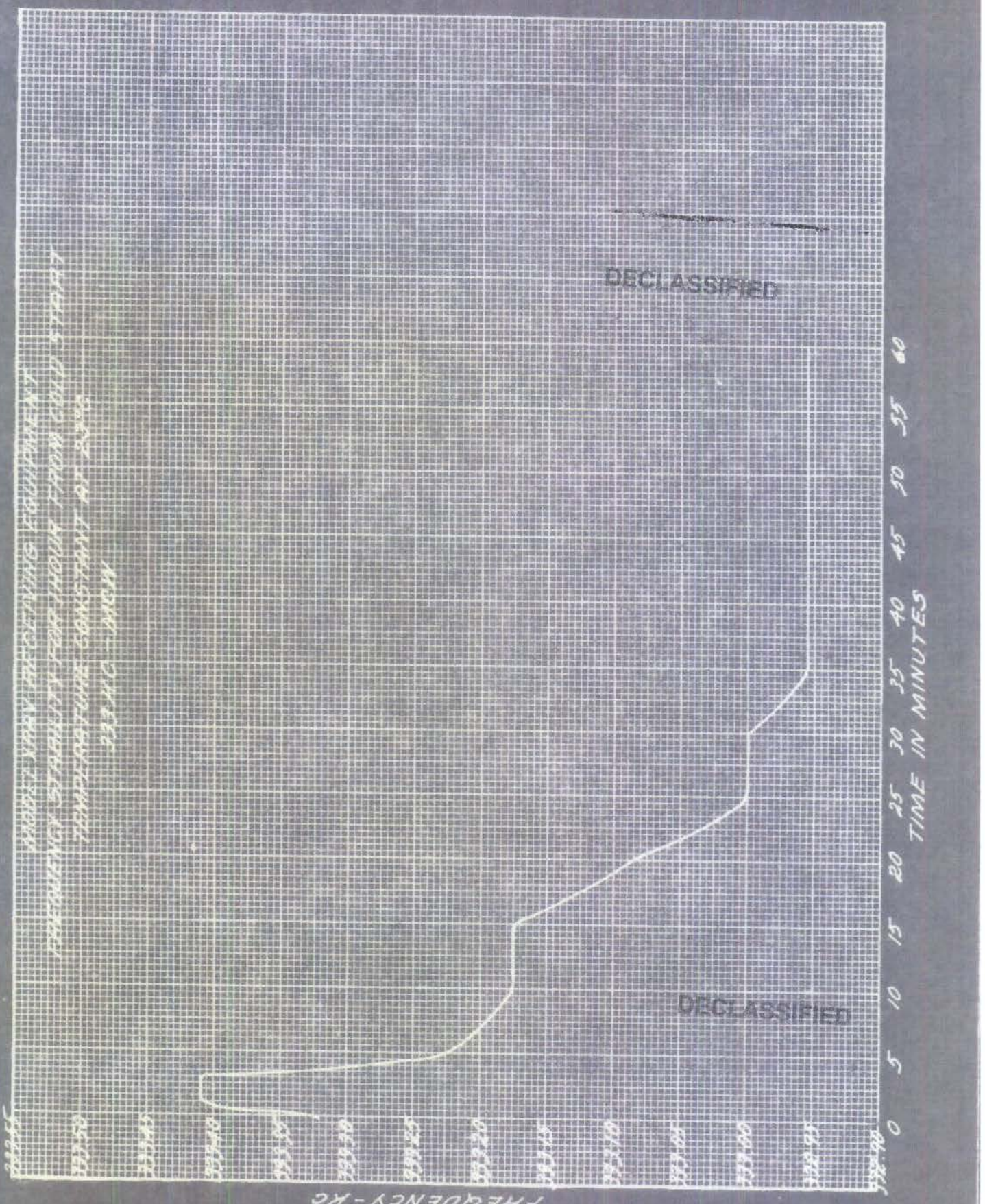


PLATE 59

BELLEVUE, D. C.

DATE

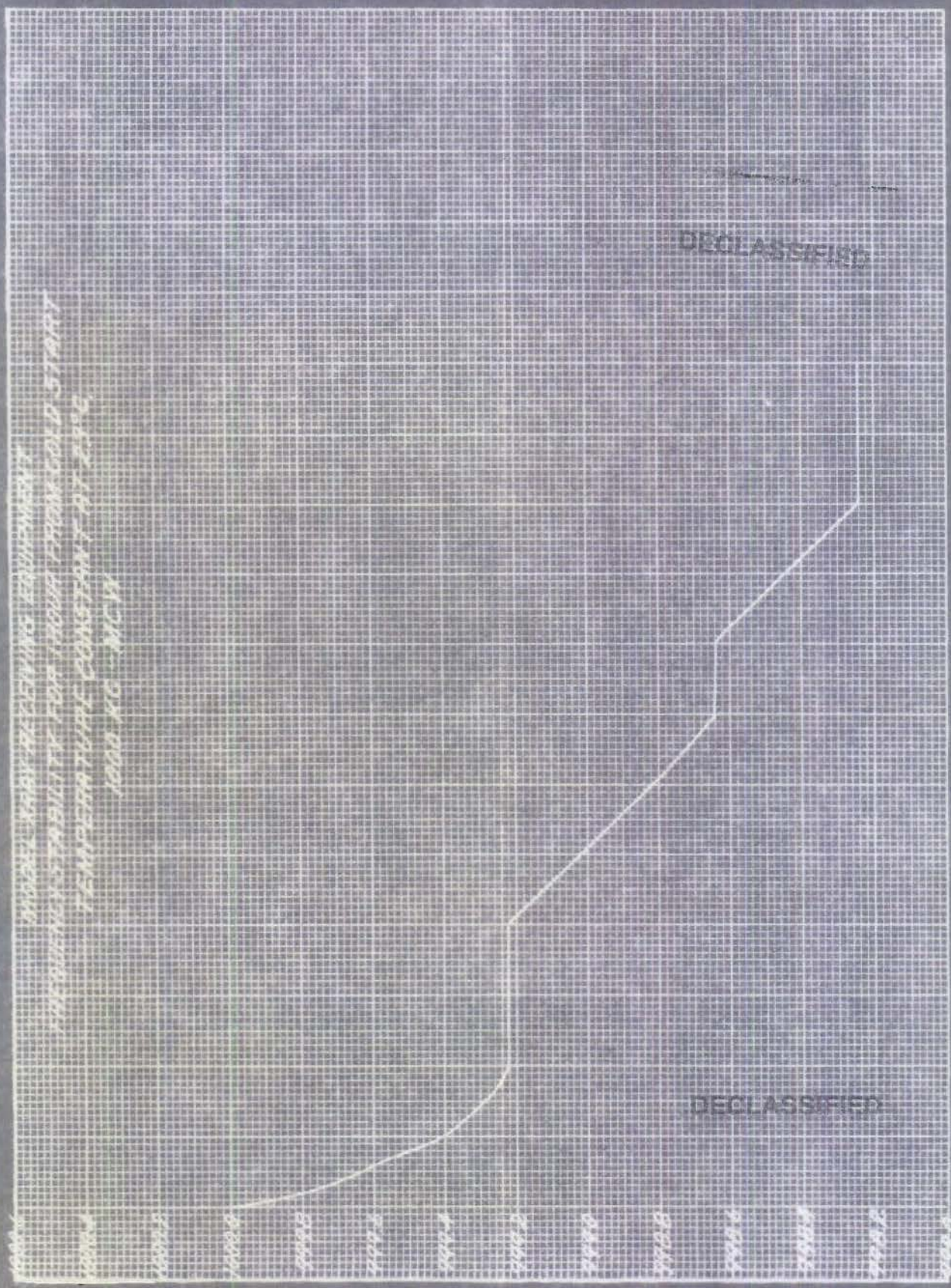


PLATE 60

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

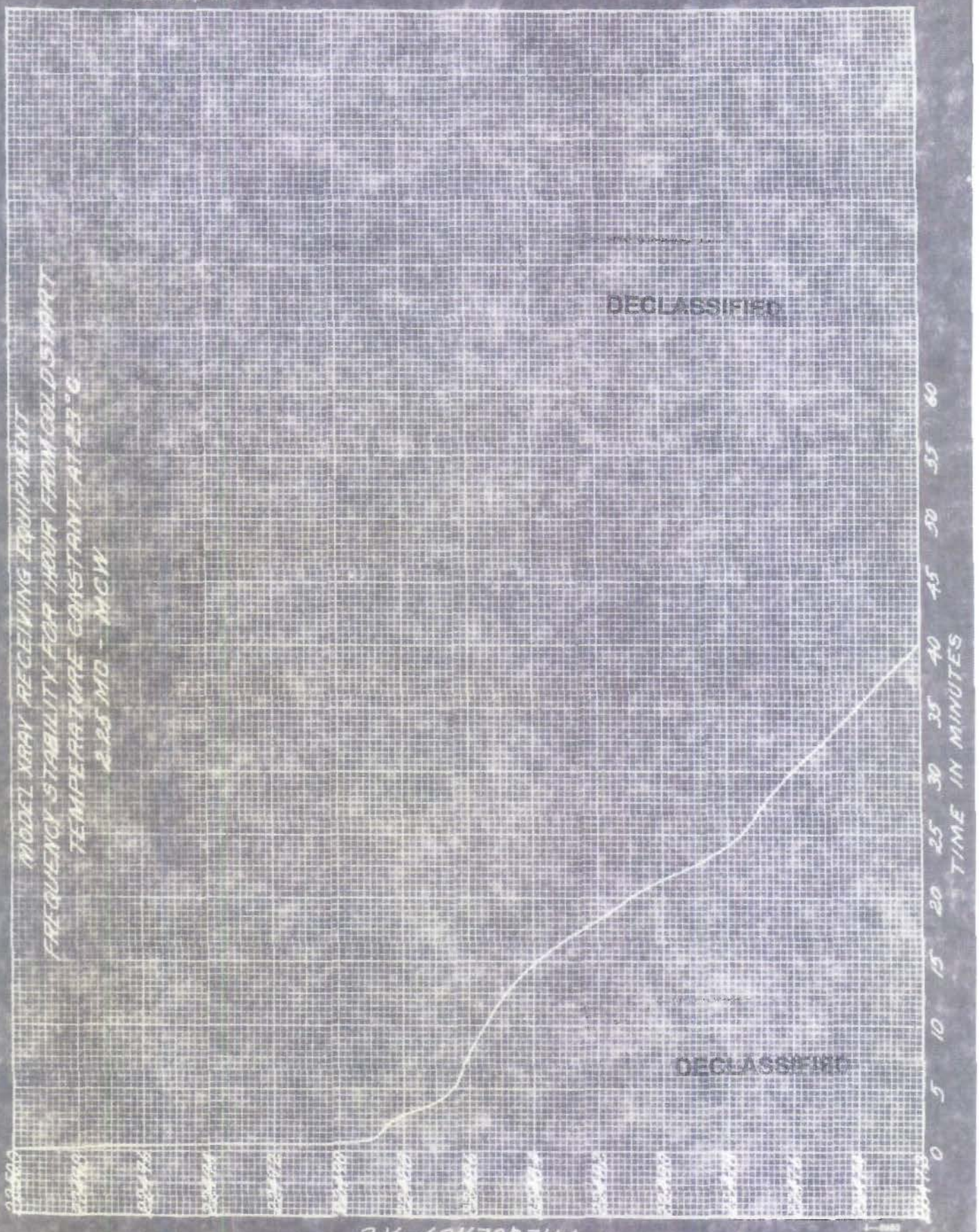


PLATE 61

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

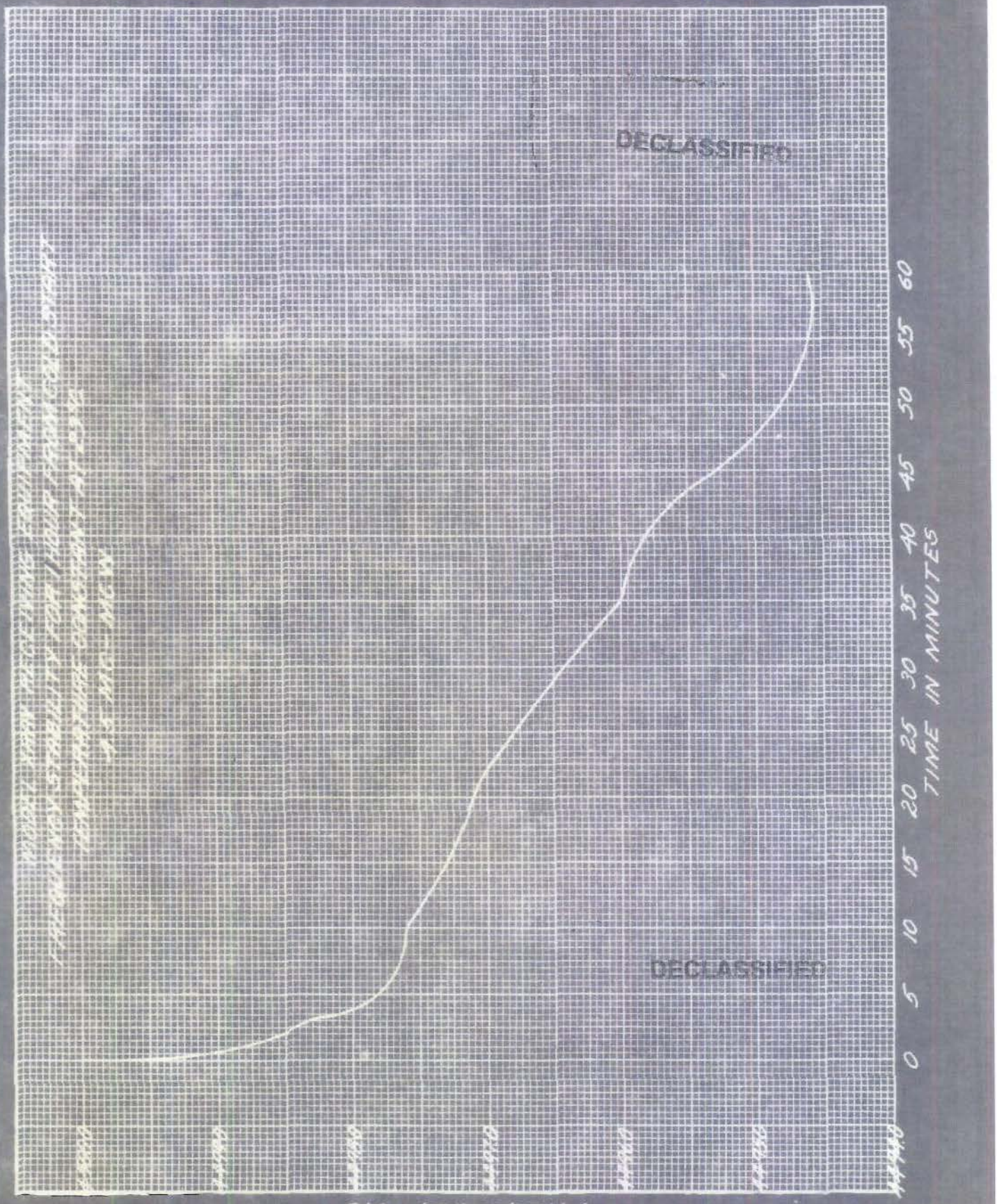


PLATE 62

DECLASSIFIED
DECLASSIFIED
FREQUENCY - KC
TIME IN MINUTES
0 5 10 15 20 25 30 35 40 45 50 55 60

PLATE 63

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

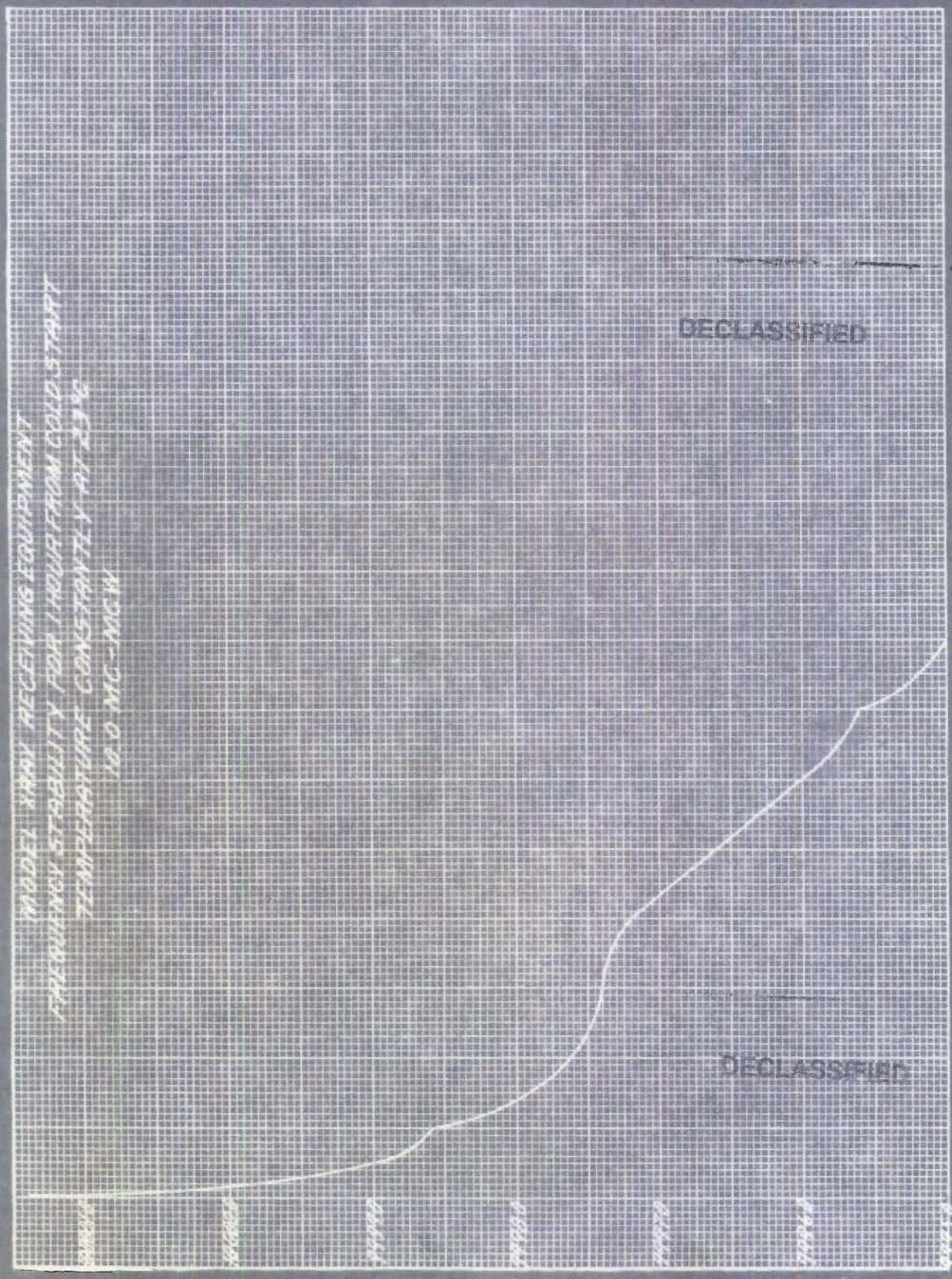


PLATE 64

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

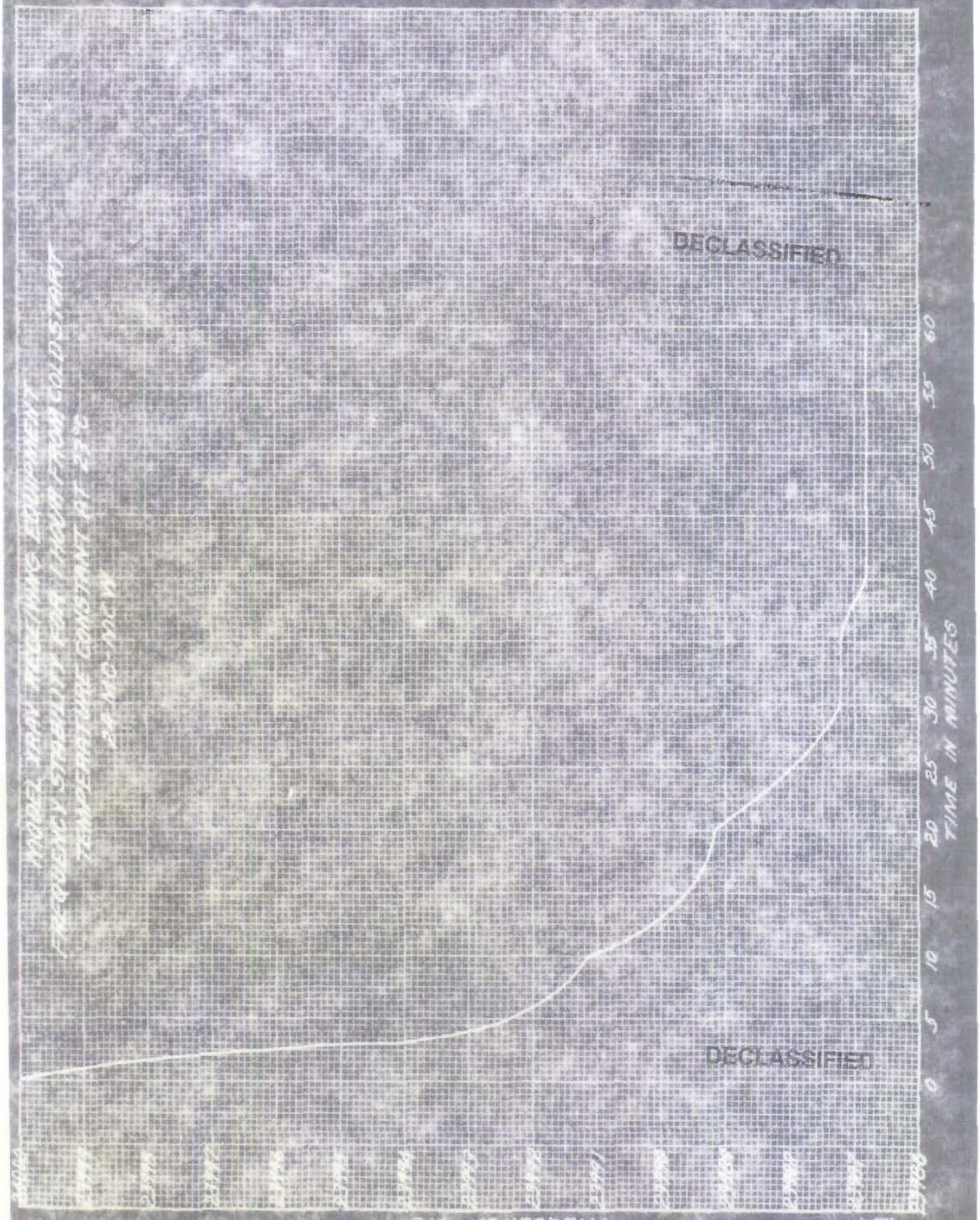
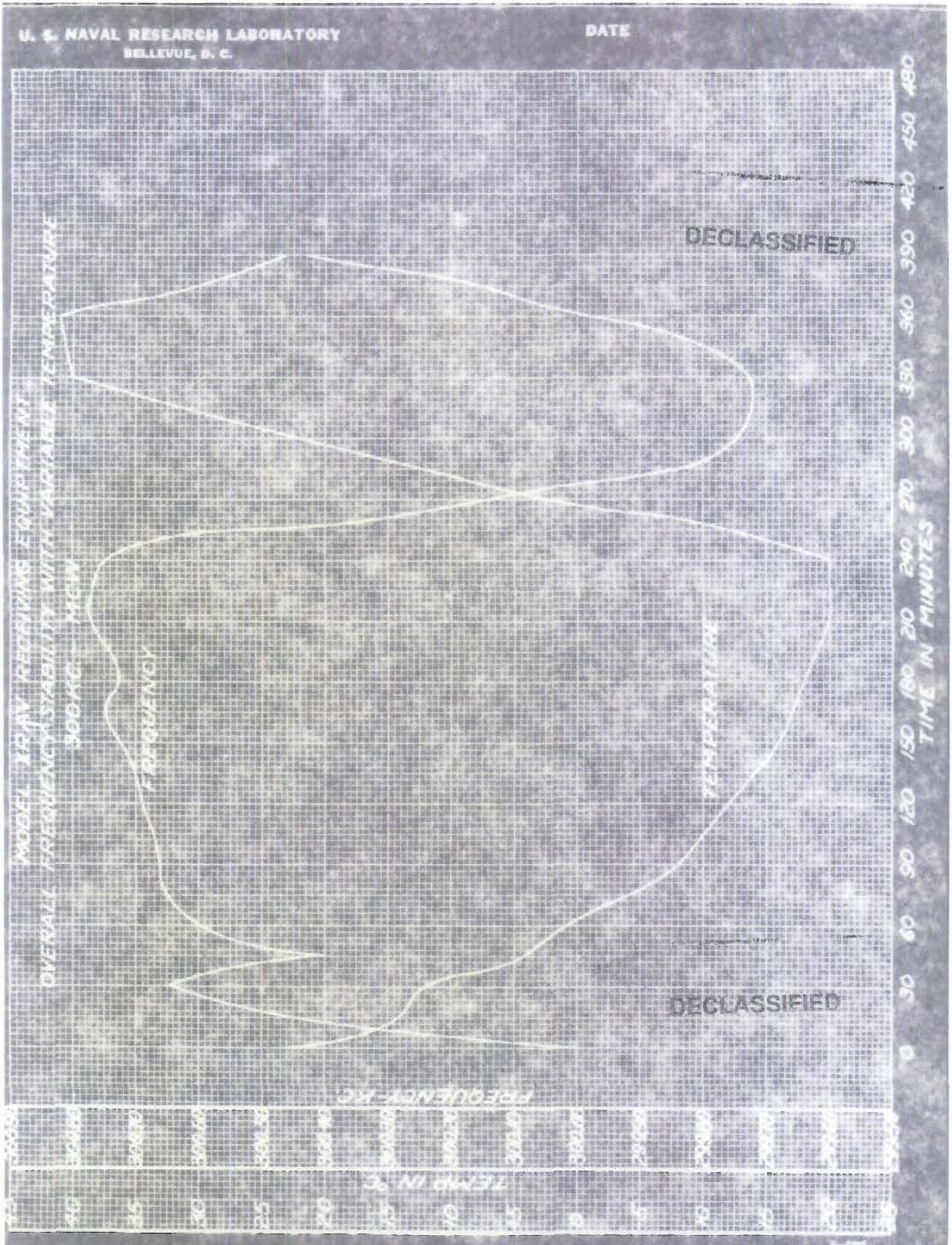


PLATE 6

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

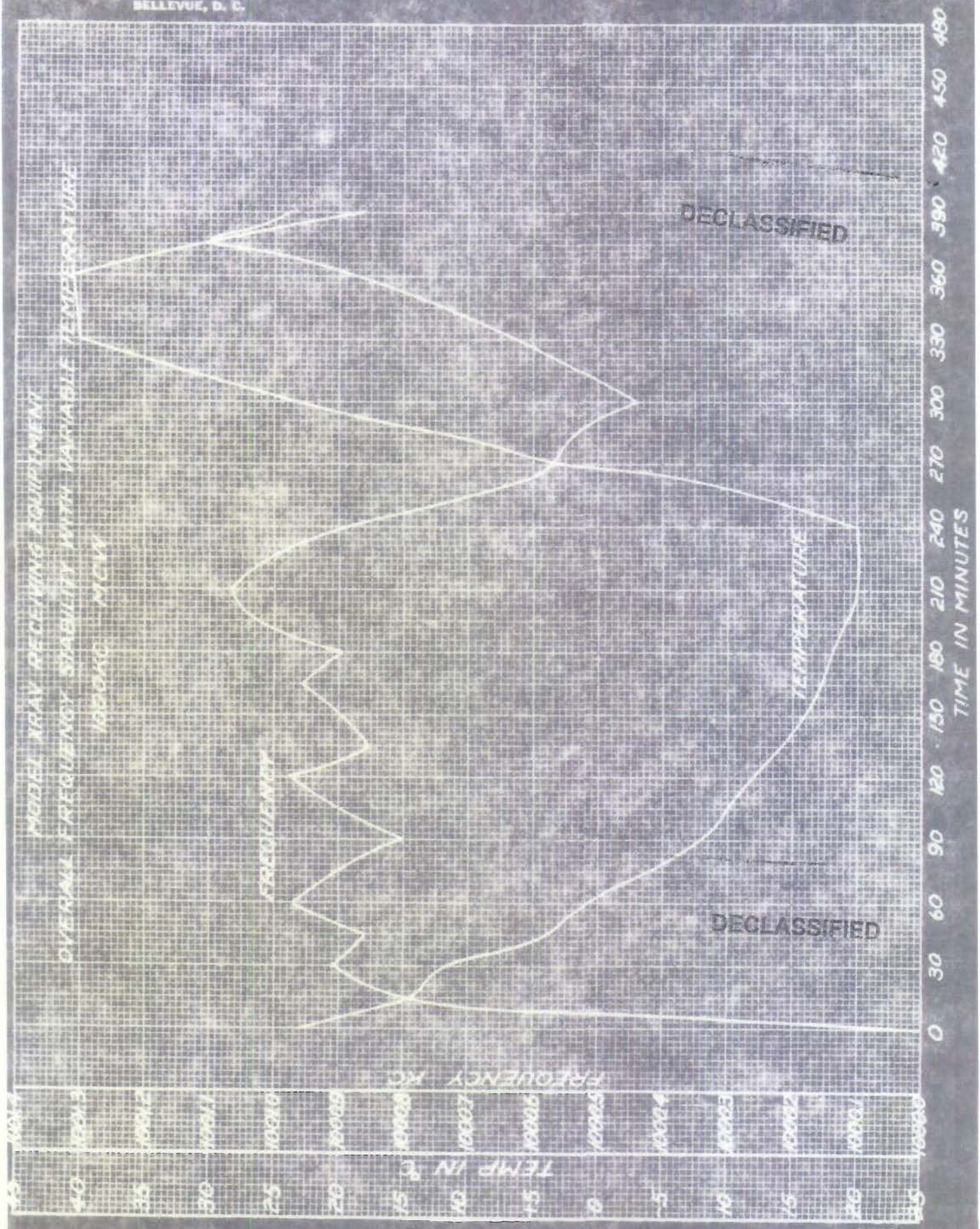


SHEET

PLATE 67

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE



SHEET

PLATE 68

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

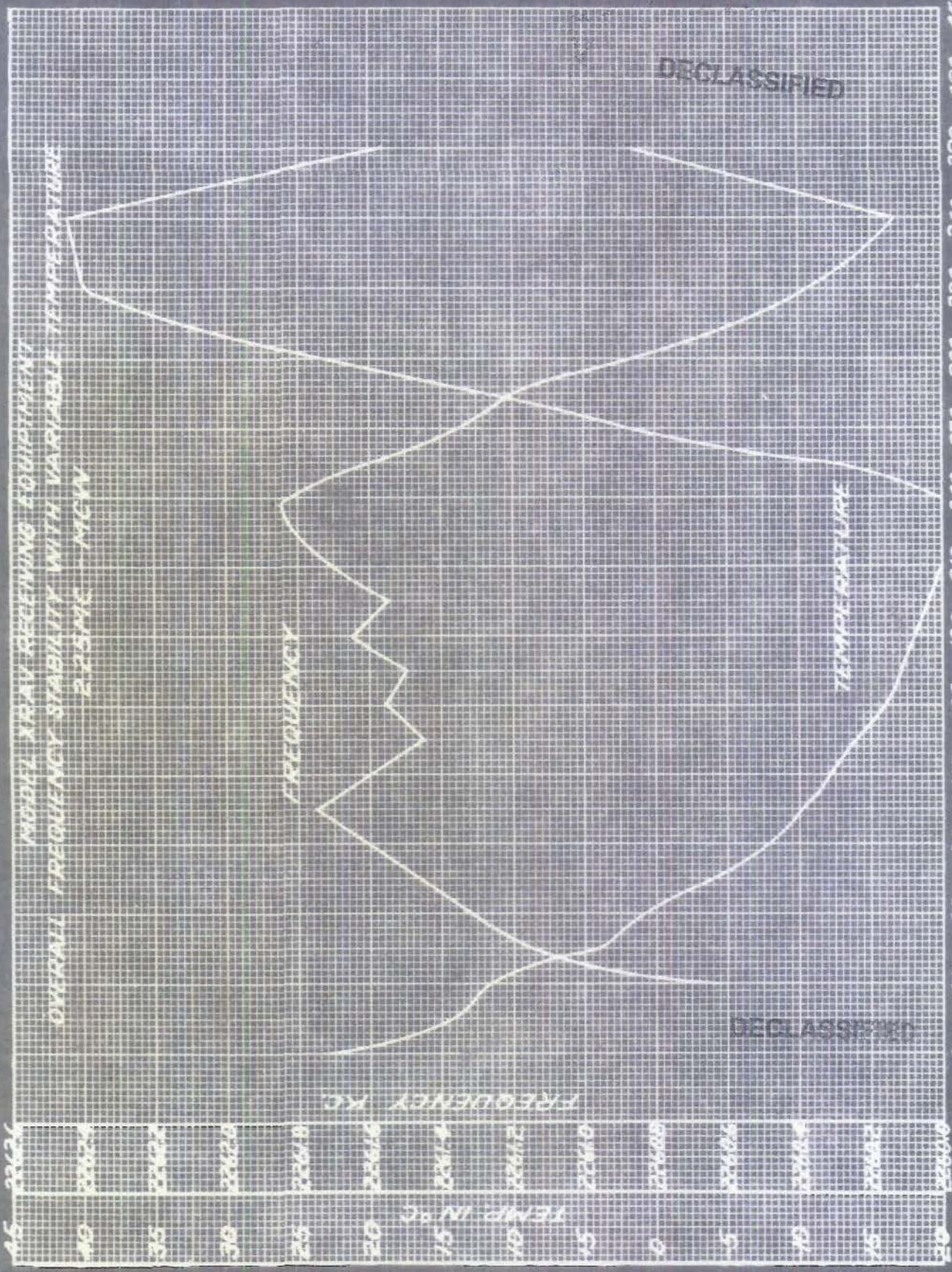
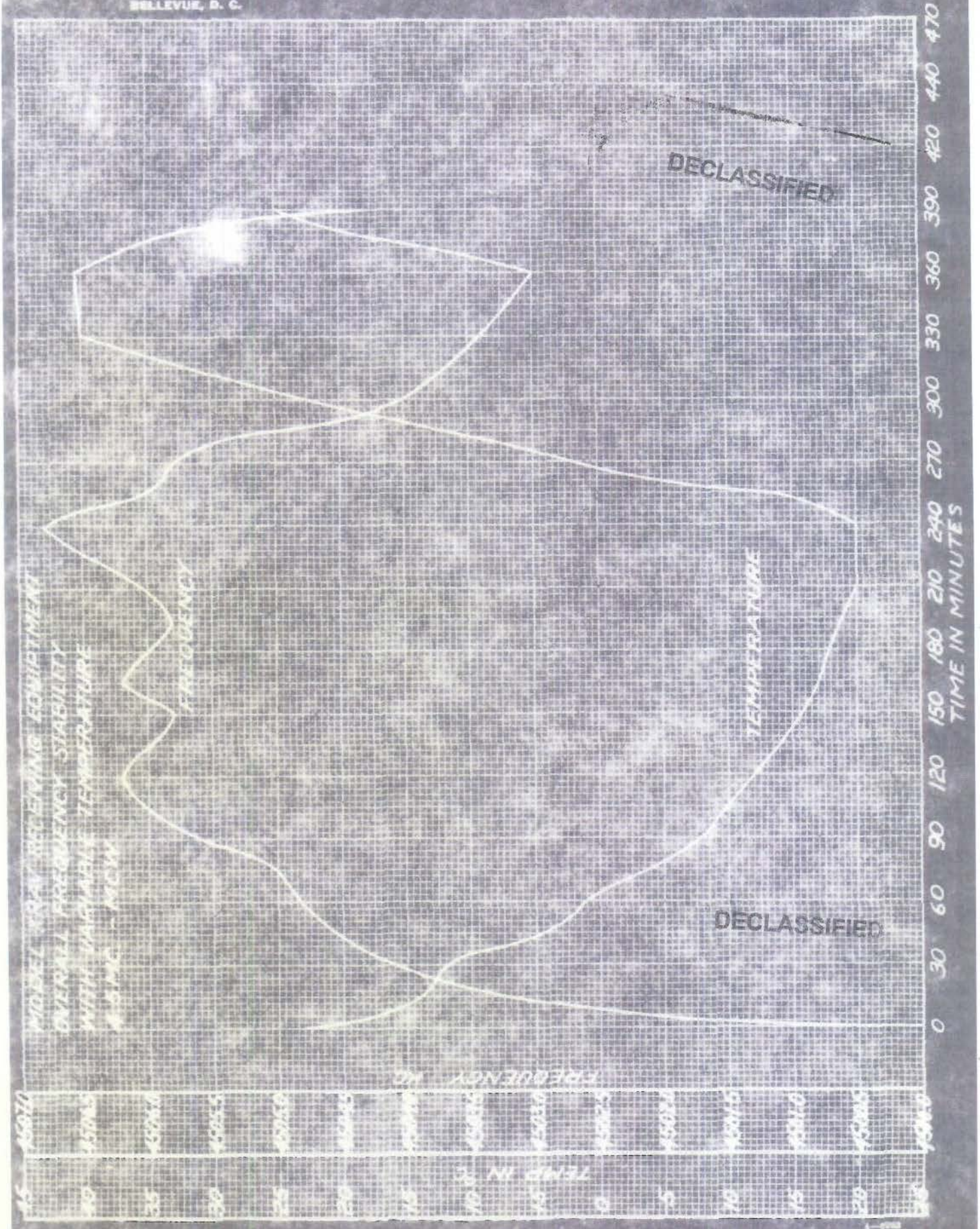


PLATE 69

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE



SHEET

PLATE-70

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

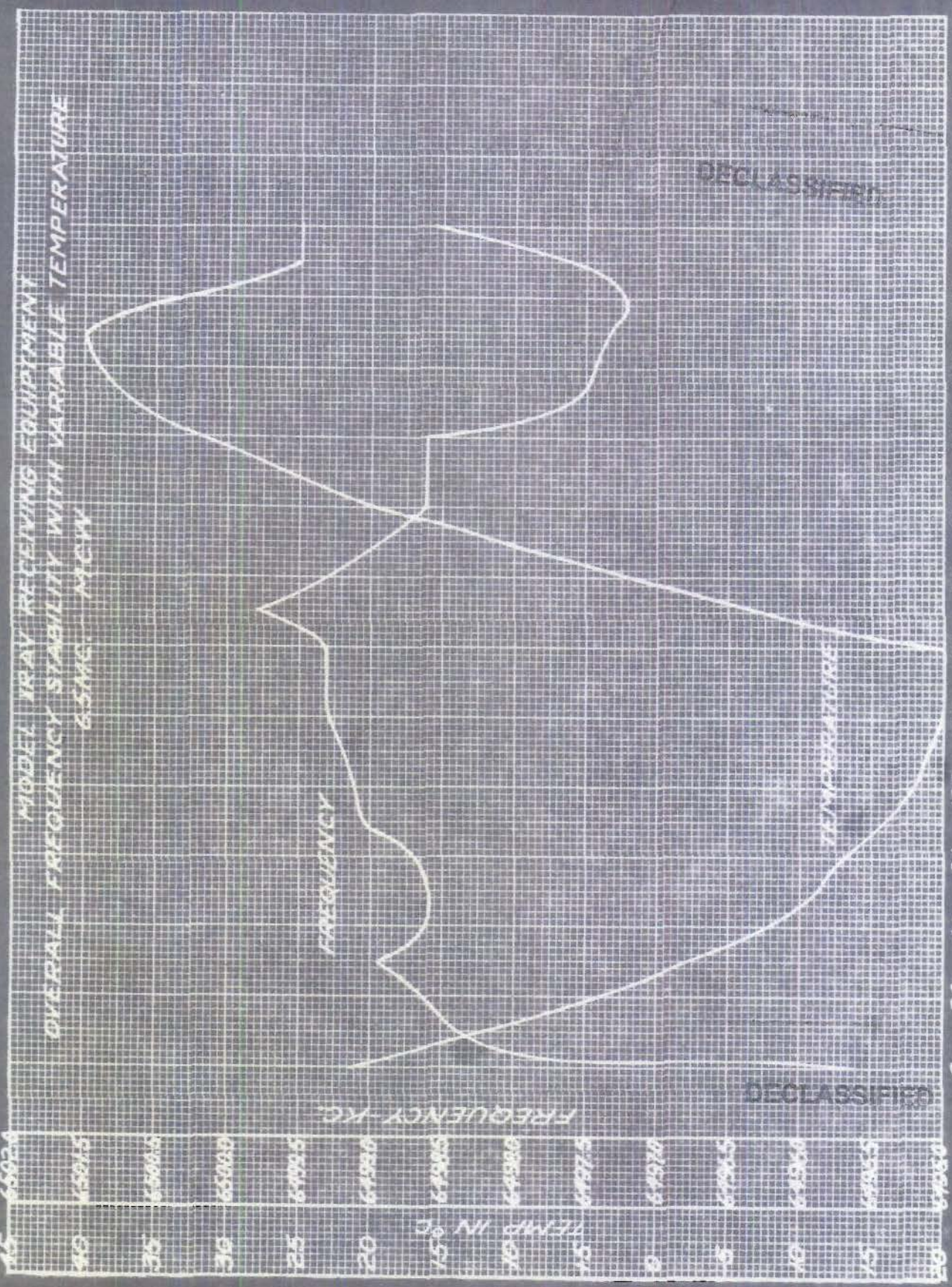
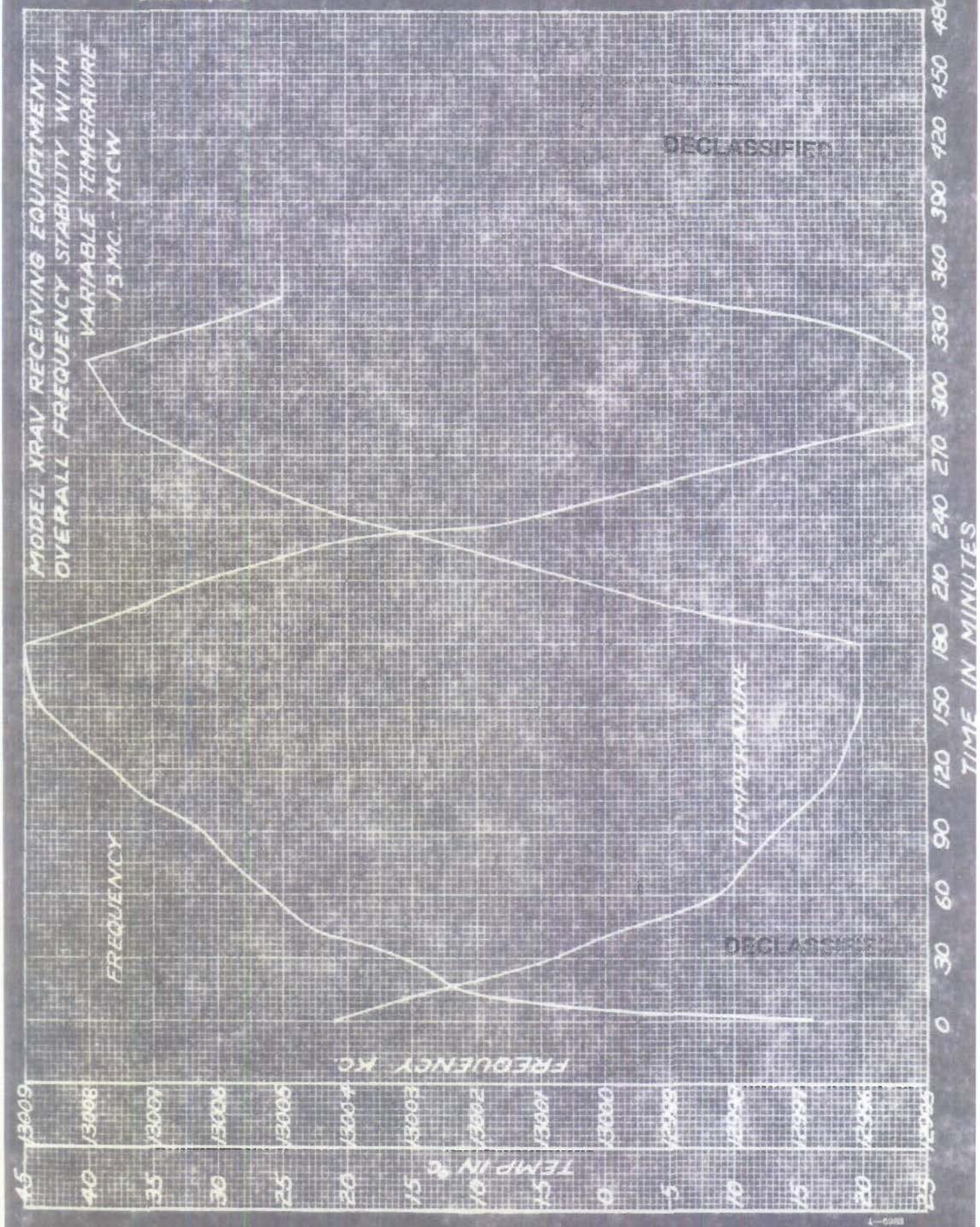


PLATE 71

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE



SHEET

PLATE 72

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

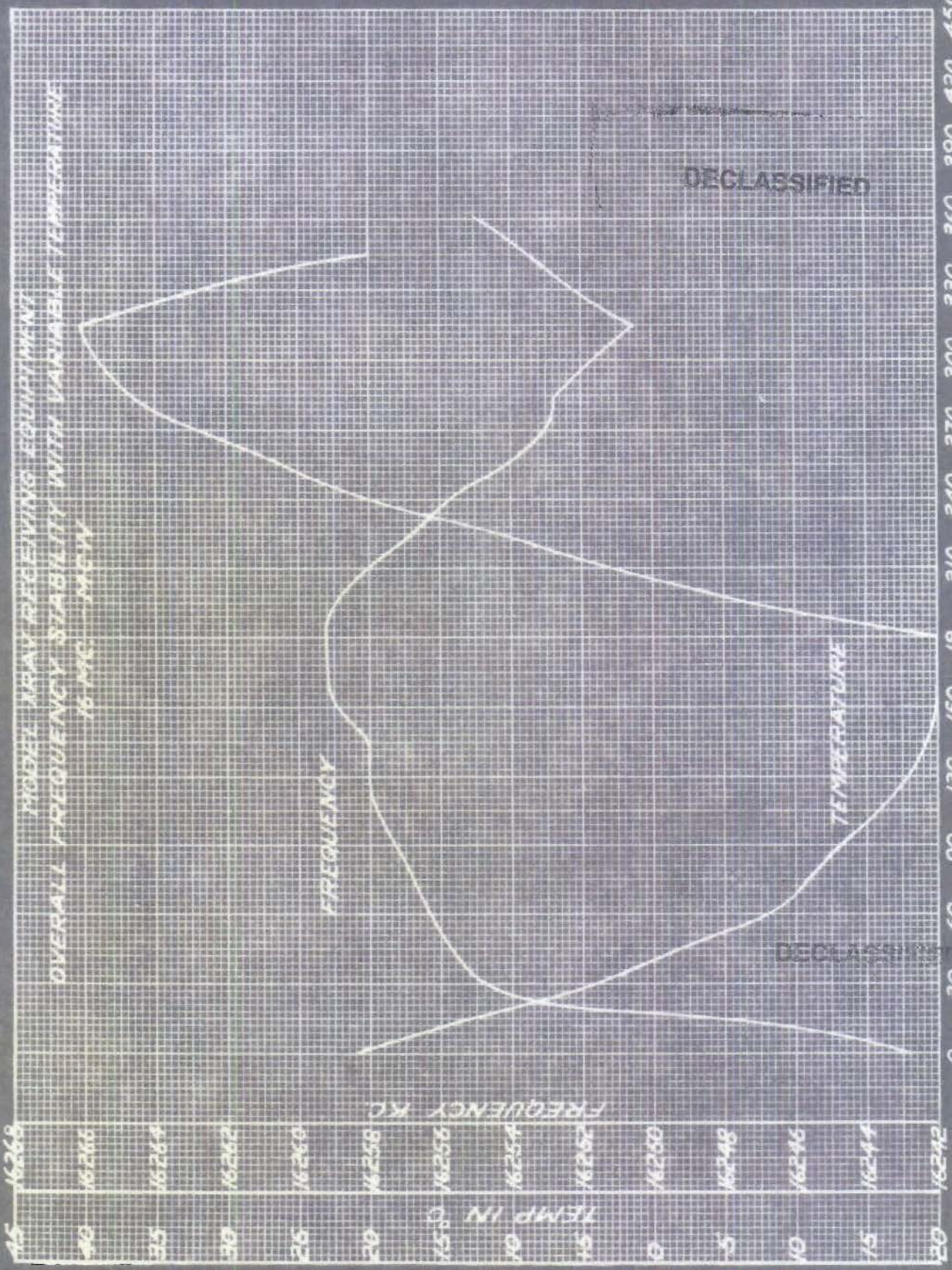
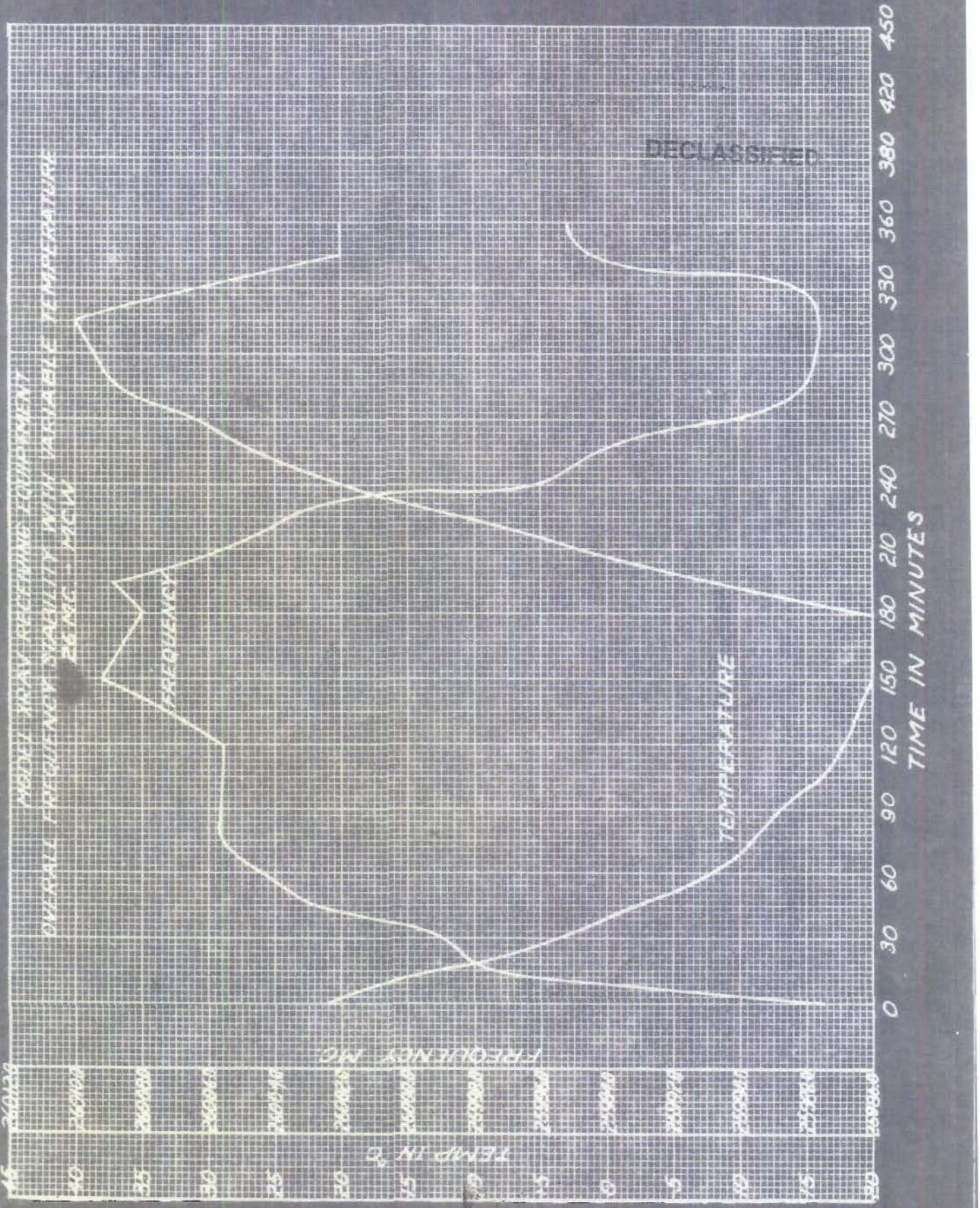


PLATE 73

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

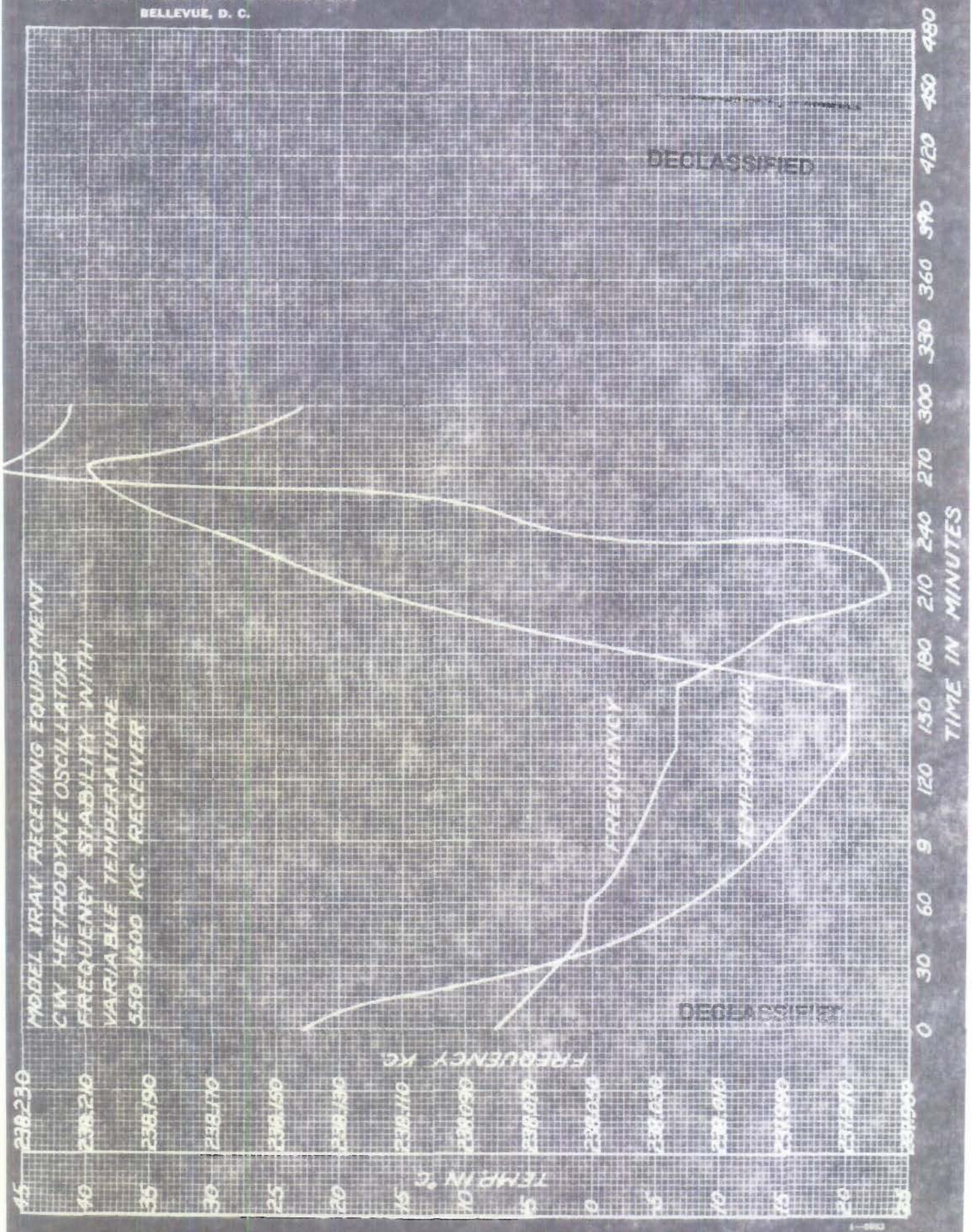
DATE



DECLASSIFIED PLATE 74

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

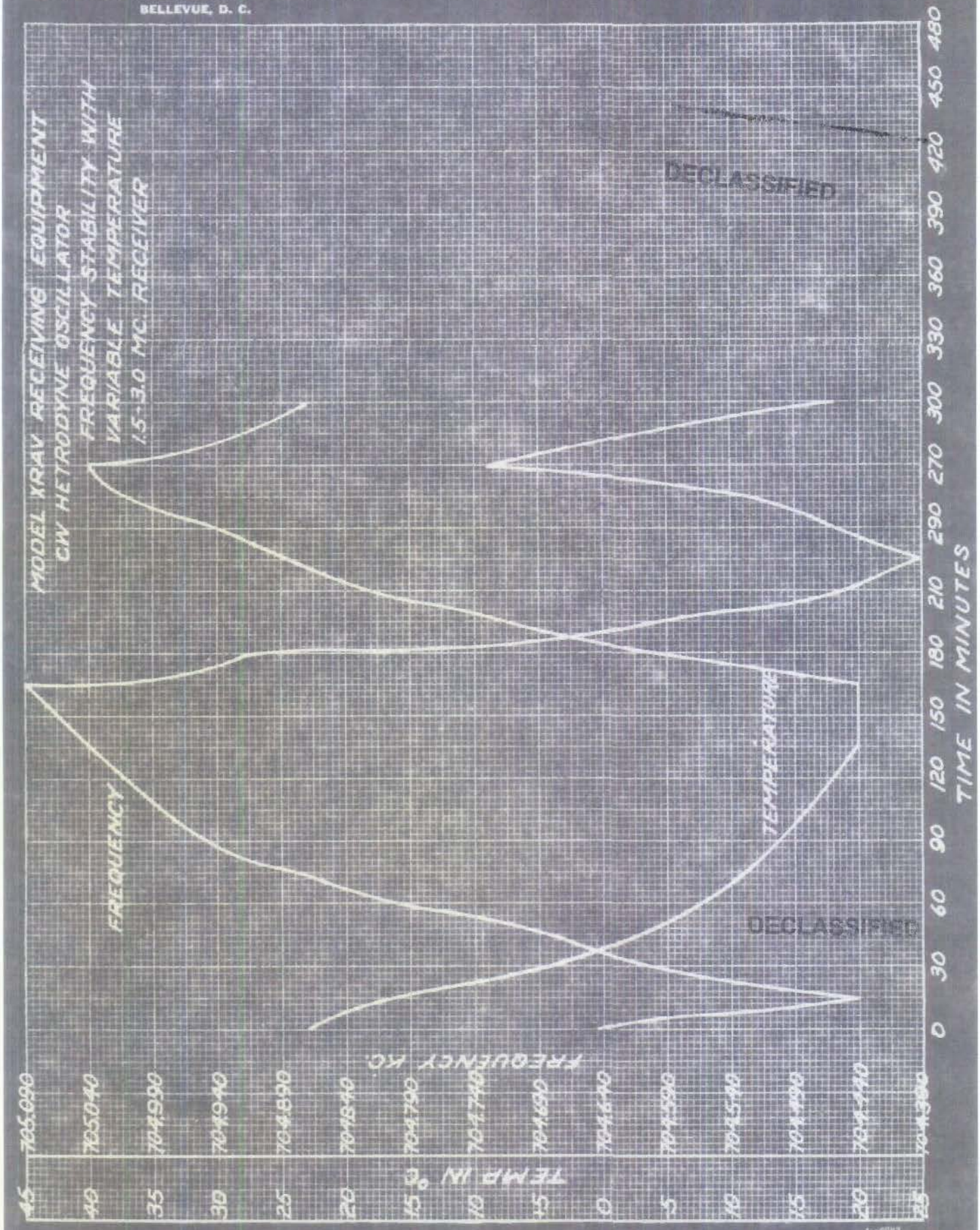


SHEET

PLATE 75

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE



SHEET

PLATE 76

DECLASSIFIED

PLATE 77

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

DECLASSIFIED

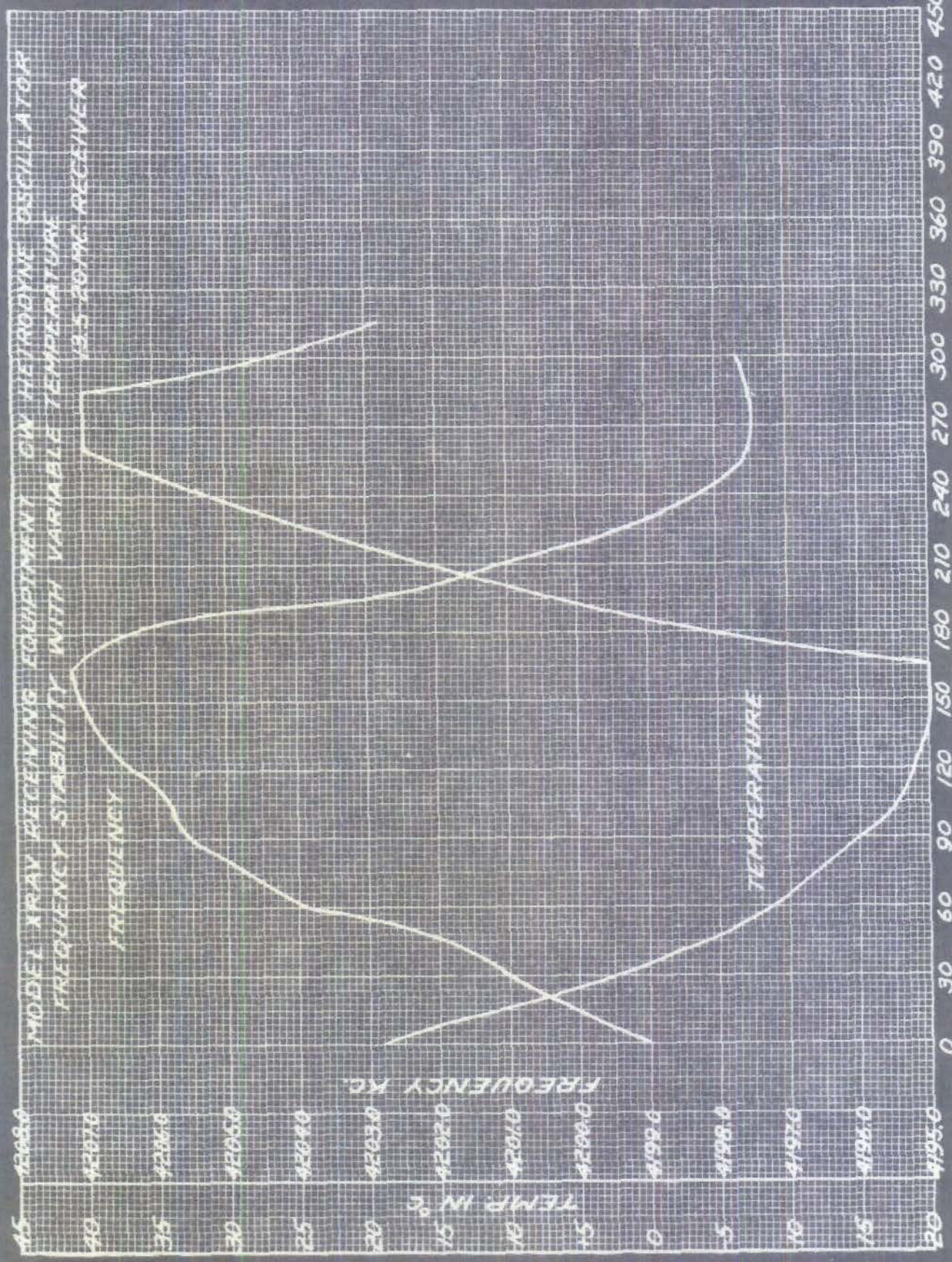
PLATE 78

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.
DATE
DECLASSIFIED

PLATE 79

DECLASSIFIED

DECLASSIFIED



DECLASSIFIED

PLATE 80

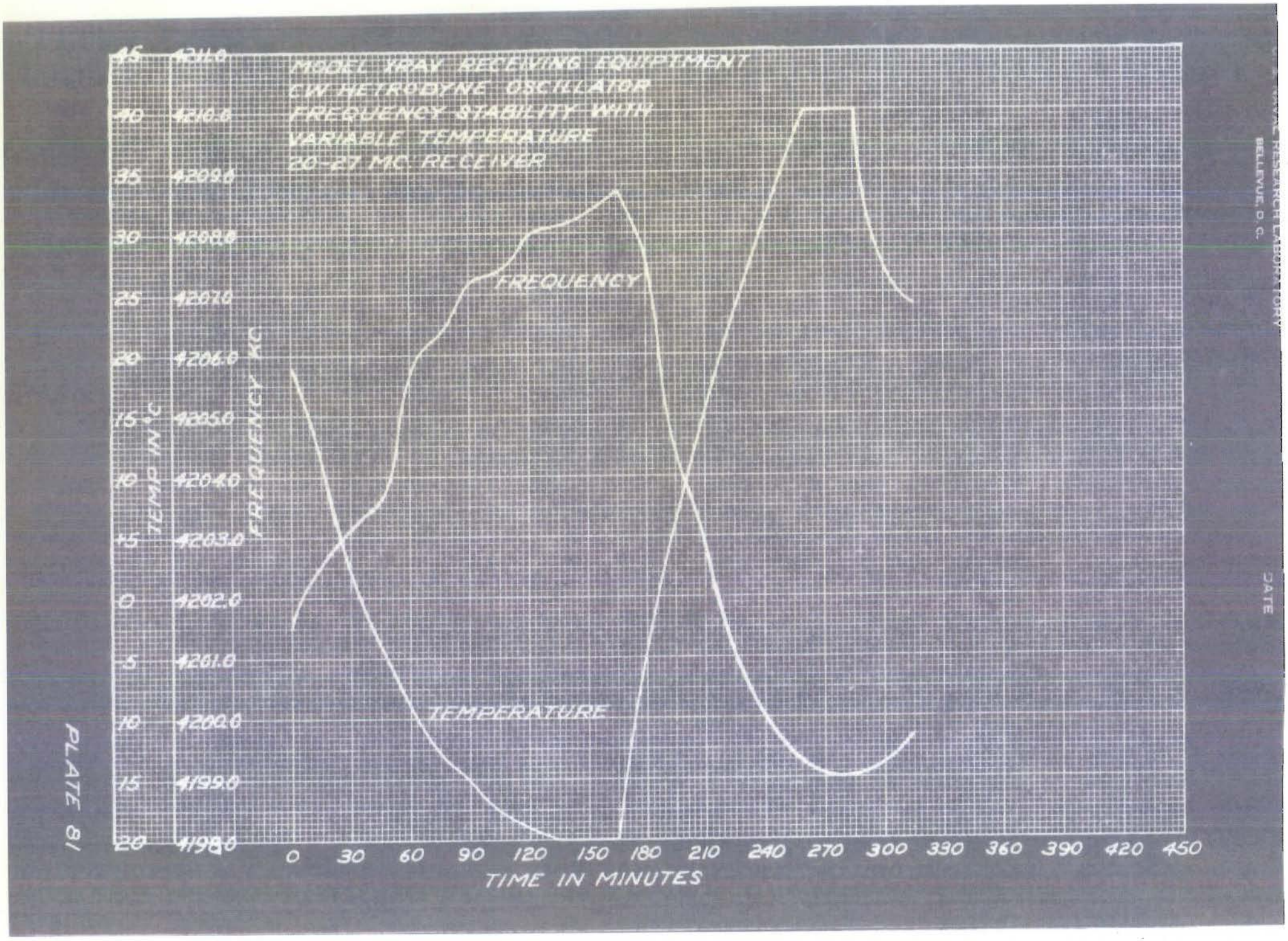


PLATE 81

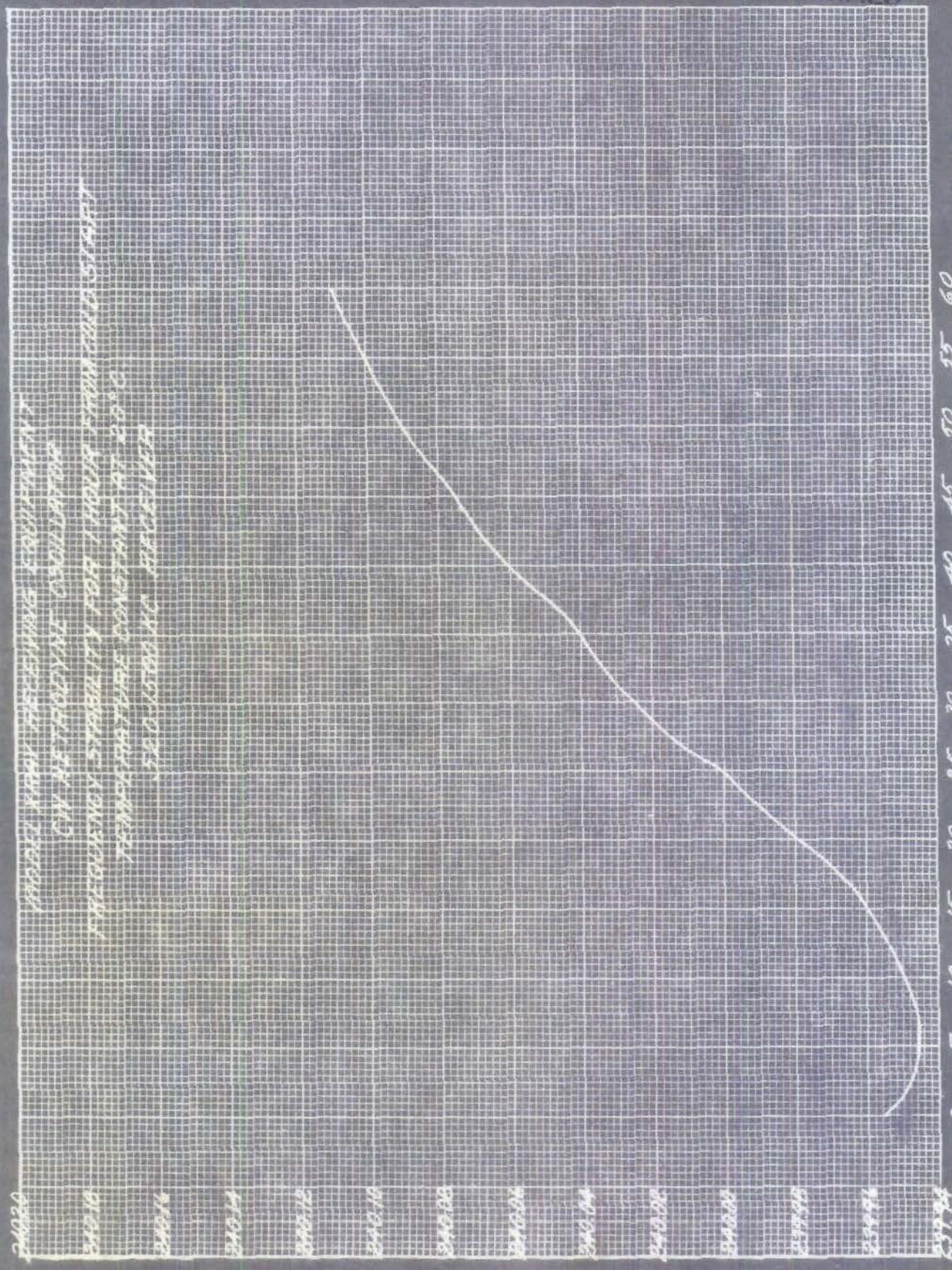
BELLEVUE, D. C.

DATE

BELLEVUE, D. C.

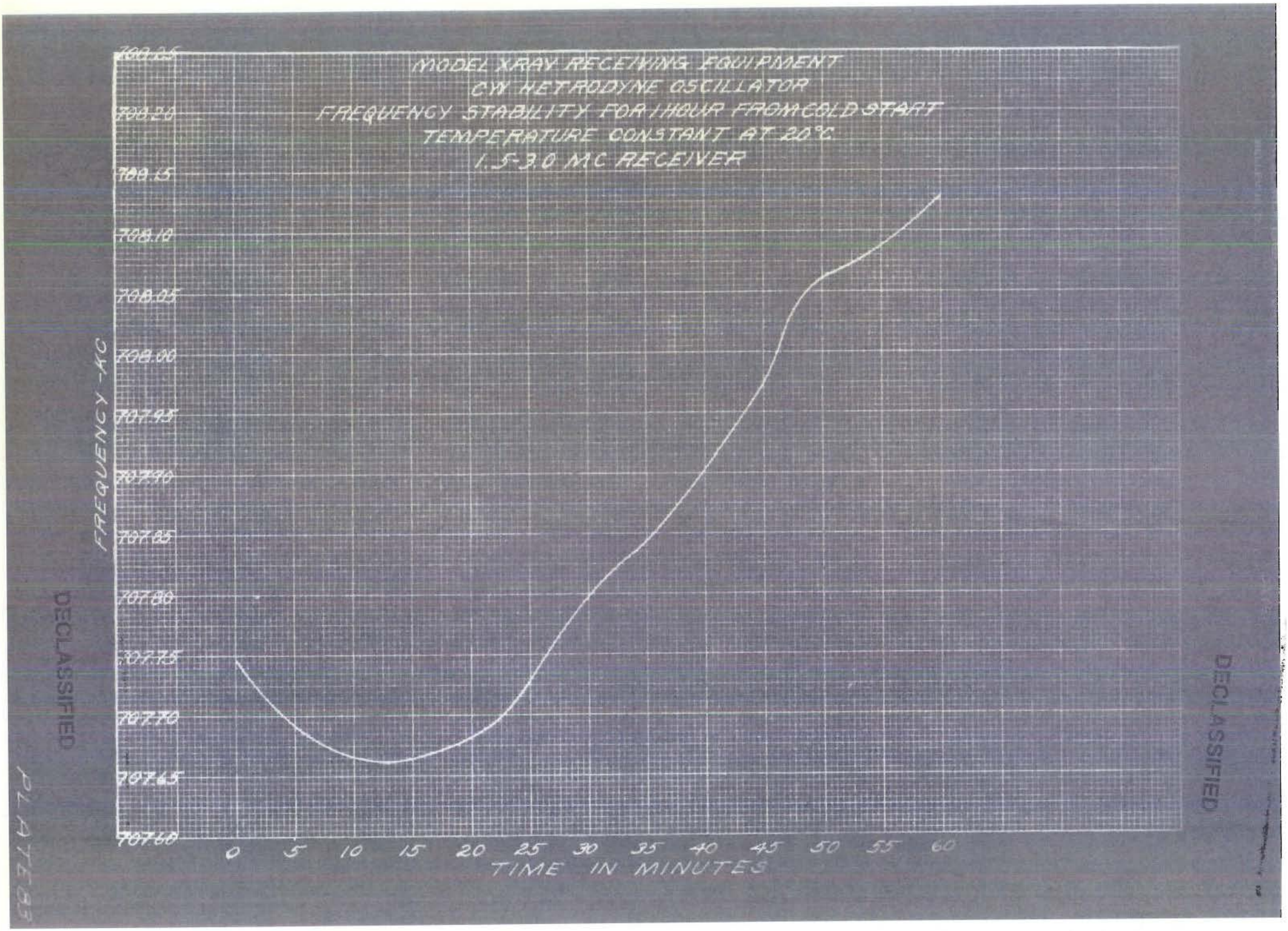
DATE

DECLASSIFIED

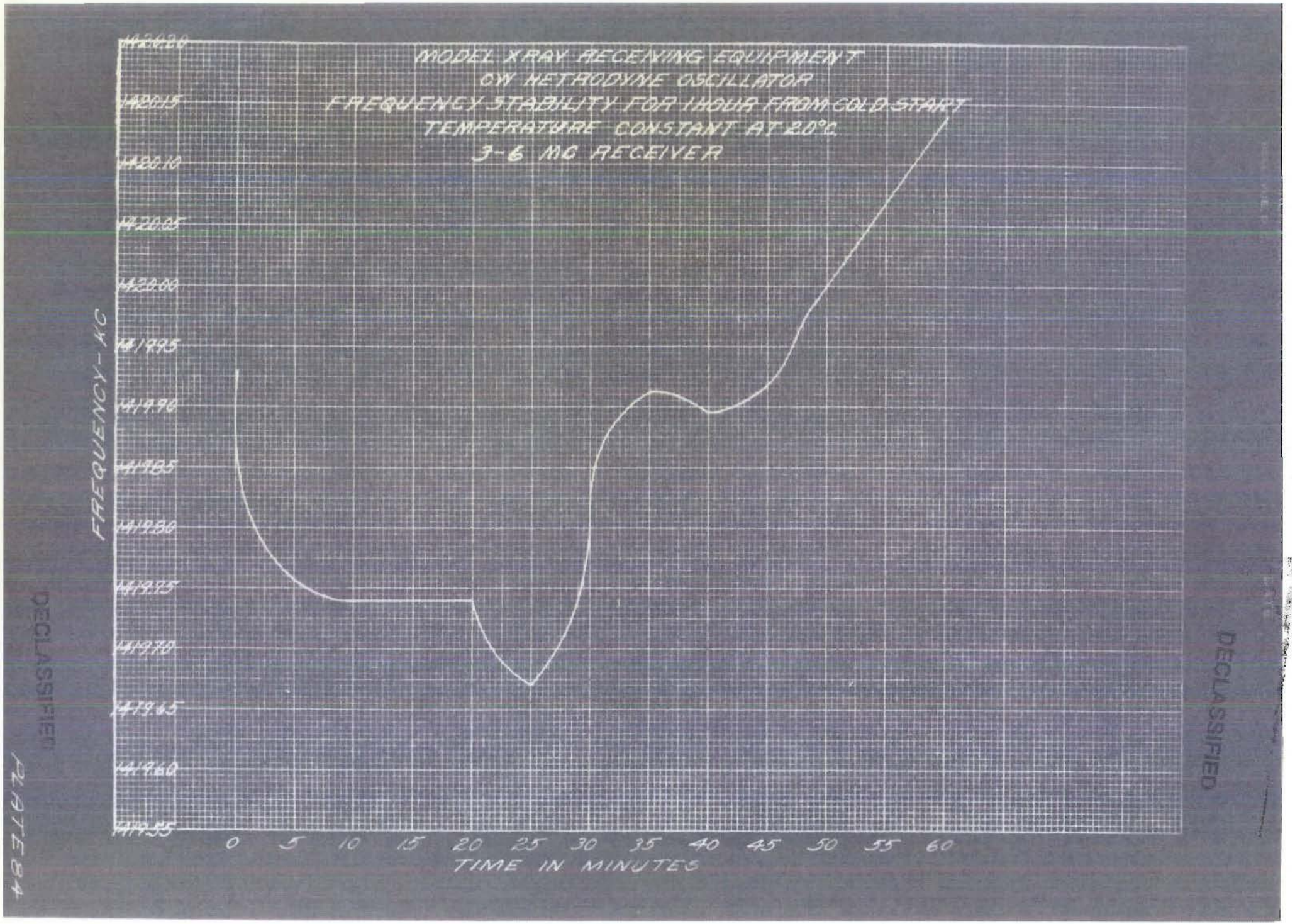


DECLASSIFIED

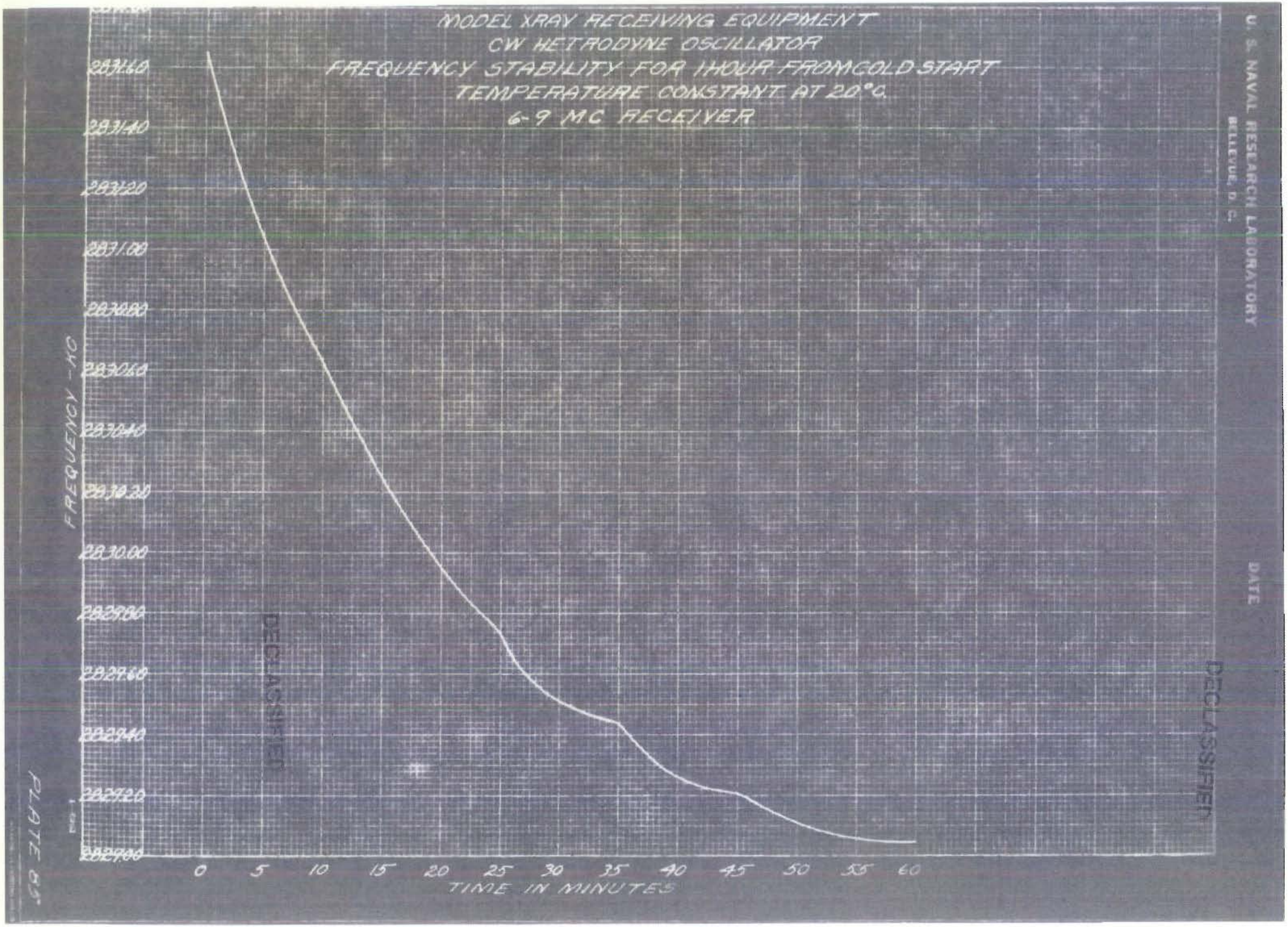
PLATE 82

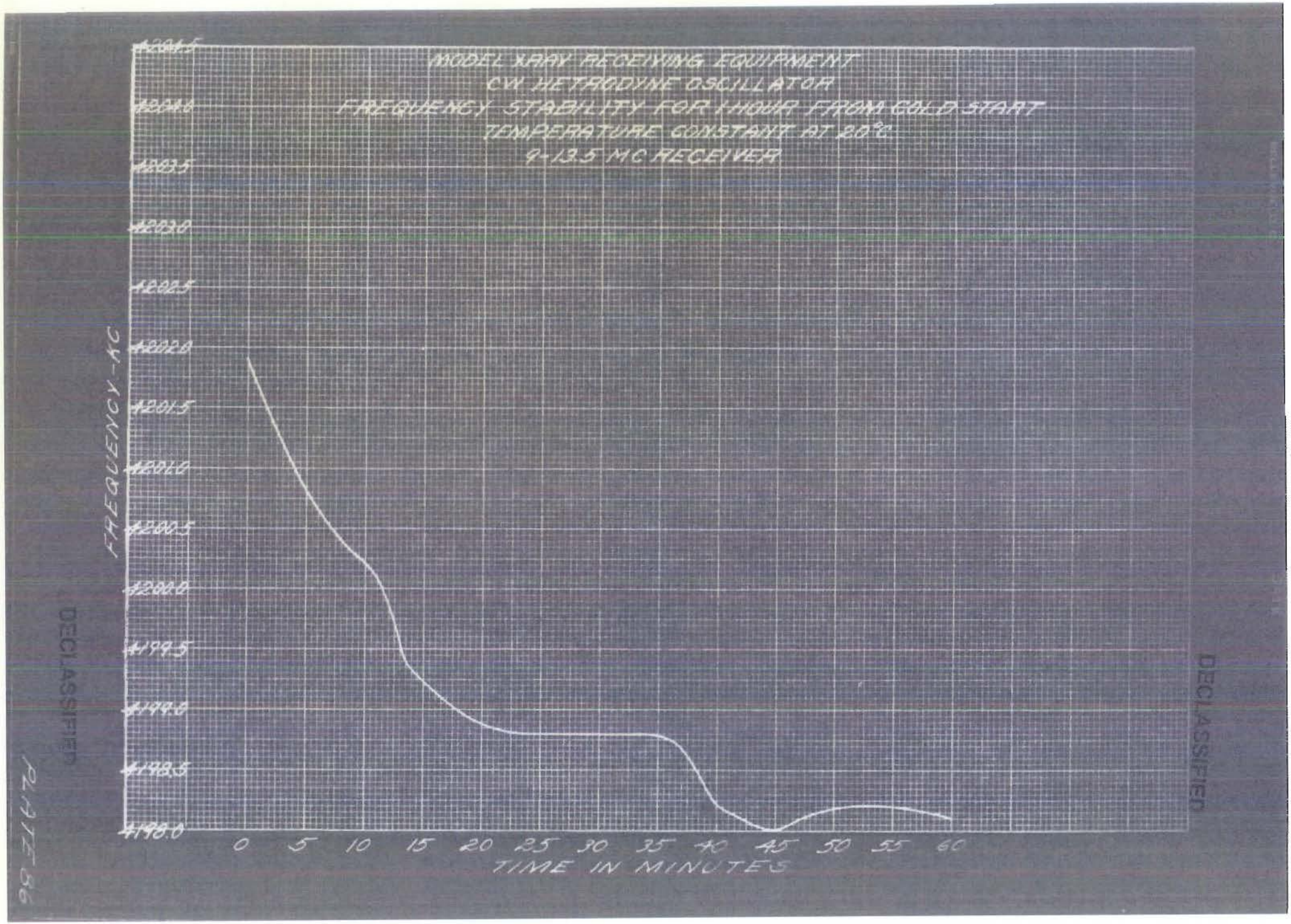


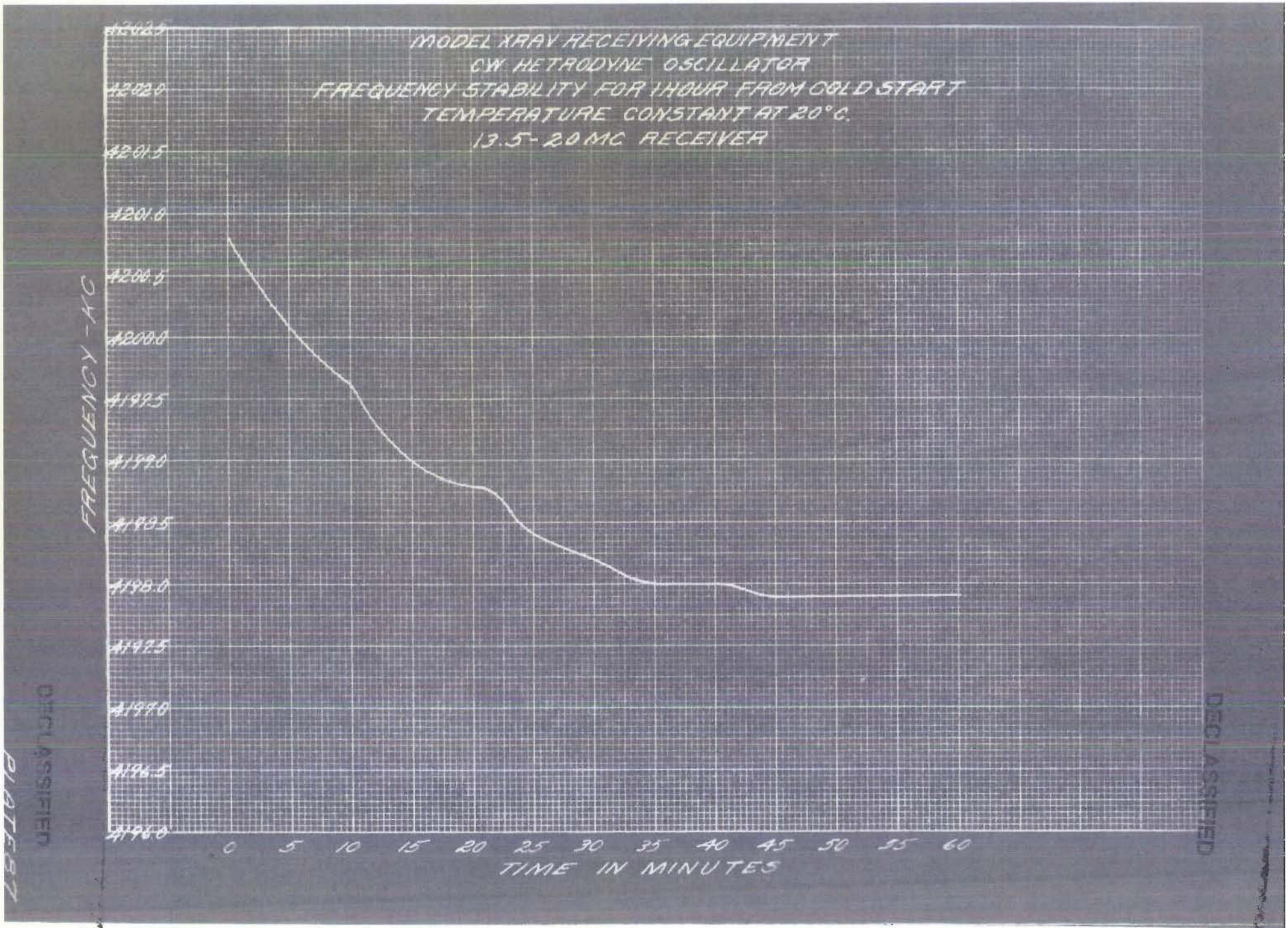
DECLASSIFIED
DECLASSIFIED
PLATE 23



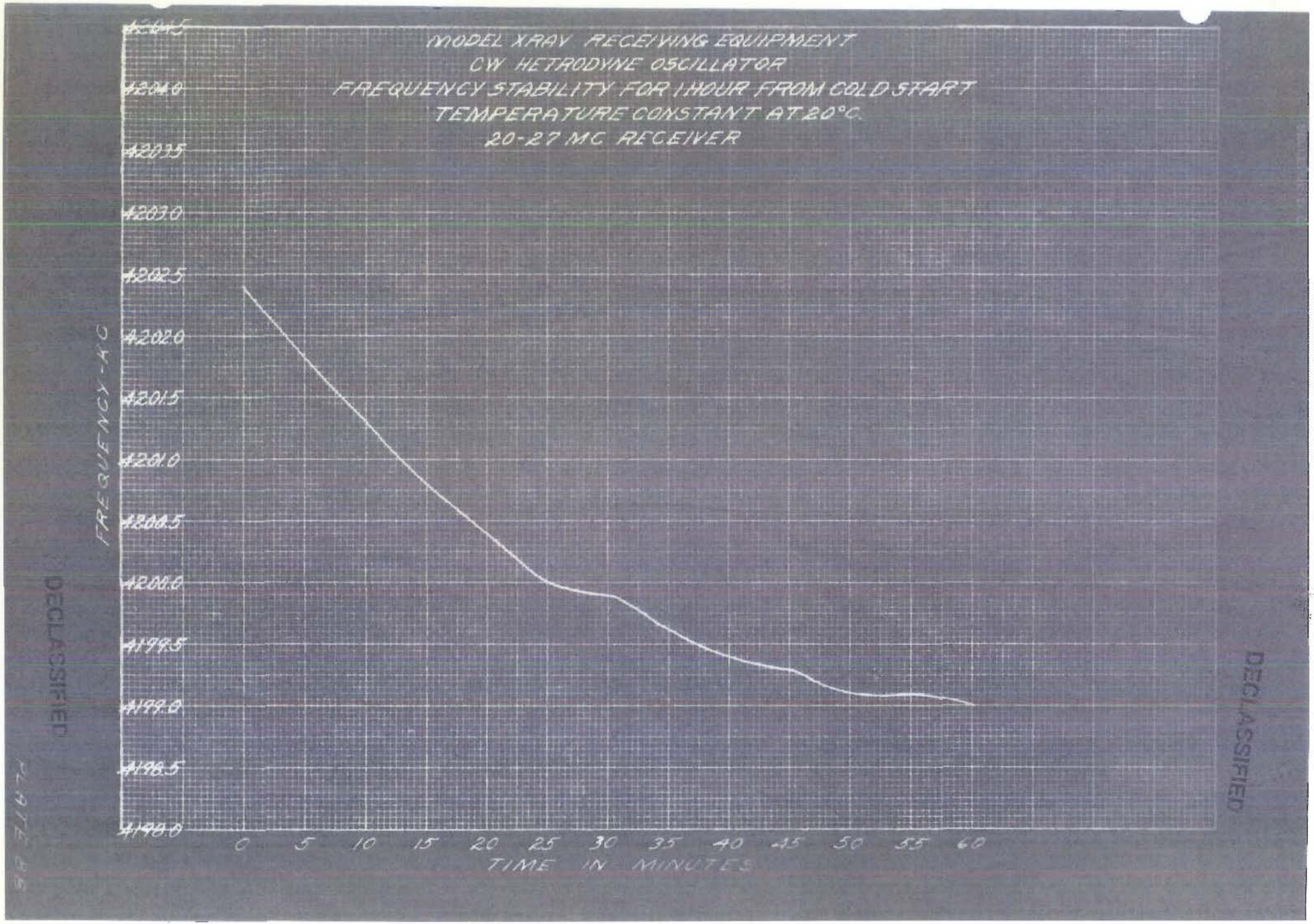
DECLASSIFIED
DECLASSIFIED
PLATE 84


MODEL XRAY RECEIVING EQUIPMENT
CW HETRODYNE OSCILLATOR
FREQUENCY STABILITY FOR 1 HOUR FROM COLD START
TEMPERATURE CONSTANT AT 20°C.
6-9 MC RECEIVER
FREQUENCY - KC
TIME IN MINUTES
0 5 10 15 20 25 30 35 40 45 50 55 60
U. S. NAVAL RESEARCH LABORATORY
DATE
DECLASSIFIED
DECLASSIFIED
PLATE 69.


MODEL XRAY RECEIVING EQUIPMENT
CW HETRODYNE OSCILLATOR
FREQUENCY STABILITY FOR 1 HOUR FROM COLD START
TEMPERATURE CONSTANT AT 20°C.
9-13.5 MC RECEIVER
FREQUENCY - KC
4203.5
4203.0
4202.5
4202.0
4201.5
4201.0
4200.5
4200.0
4199.5
4199.0
4198.5
4198.0
0 5 10 15 20 25 30 35 40 45 50 55 60
TIME IN MINUTES
DECLASSIFIED
DECLASSIFIED
PLATE 86



DECLASSIFIED
DECLASSIFIED
PLATE 27


MODEL XRAV RECEIVING EQUIPMENT
CW HETRODYNE OSCILLATOR
FREQUENCY STABILITY FOR 1 HOUR FROM COLD START
TEMPERATURE CONSTANT AT 20°C.
20-27 MC RECEIVER
FREQUENCY - KC
4205
4204.0
4203.5
4203.0
4202.5
4202.0
4201.5
4201.0
4200.5
4200.0
4199.5
4199.0
4198.5
4198.0
0
5
10
15
20
25
30
35
40
45
50
55
60
TIME IN MINUTES
DECLASSIFIED
DECLASSIFIED

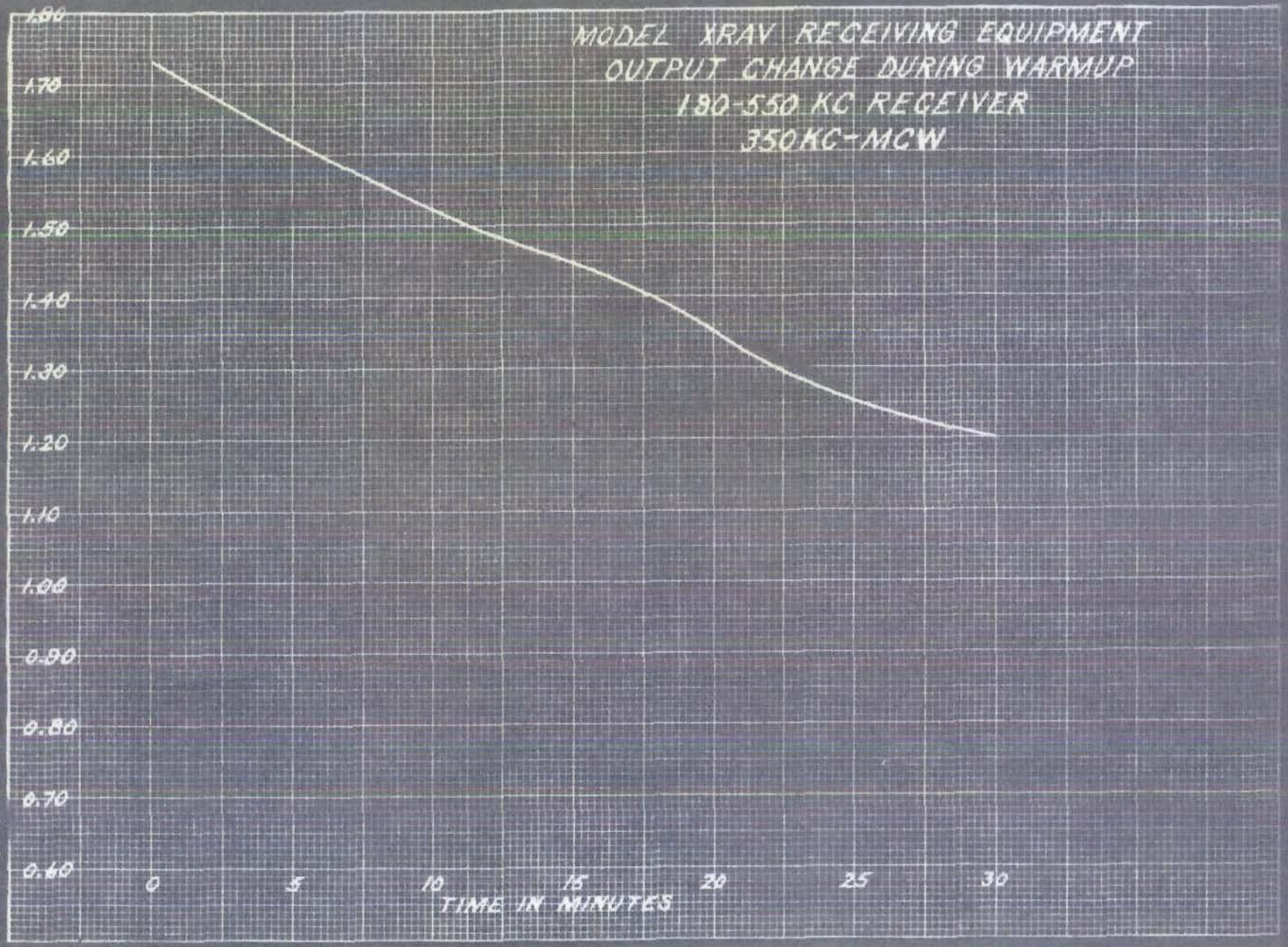


PLATE 89

DECLASSIFIED

DECLASSIFIED

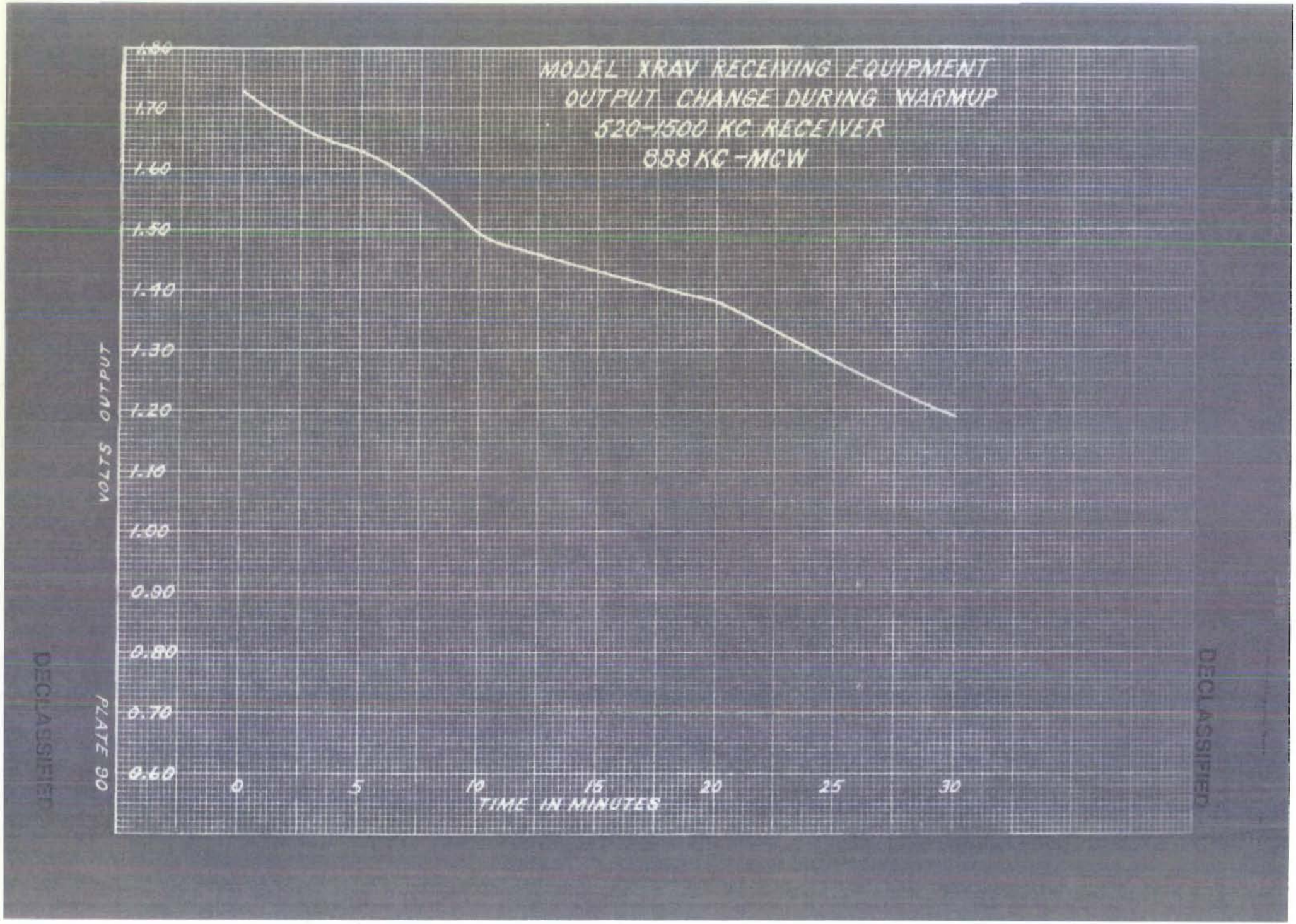
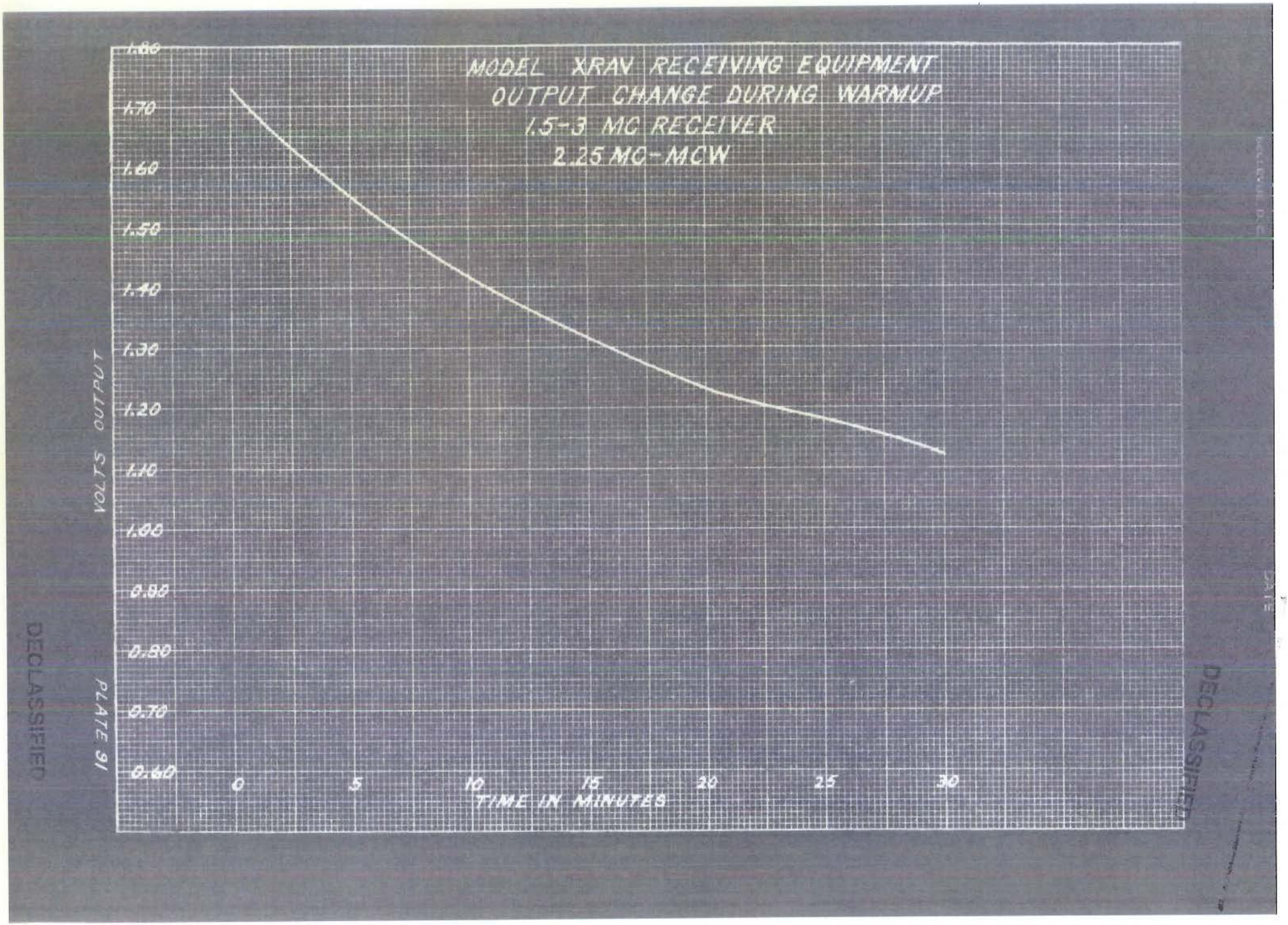


PLATE 90

DECLASSIFIED

DECLASSIFIED



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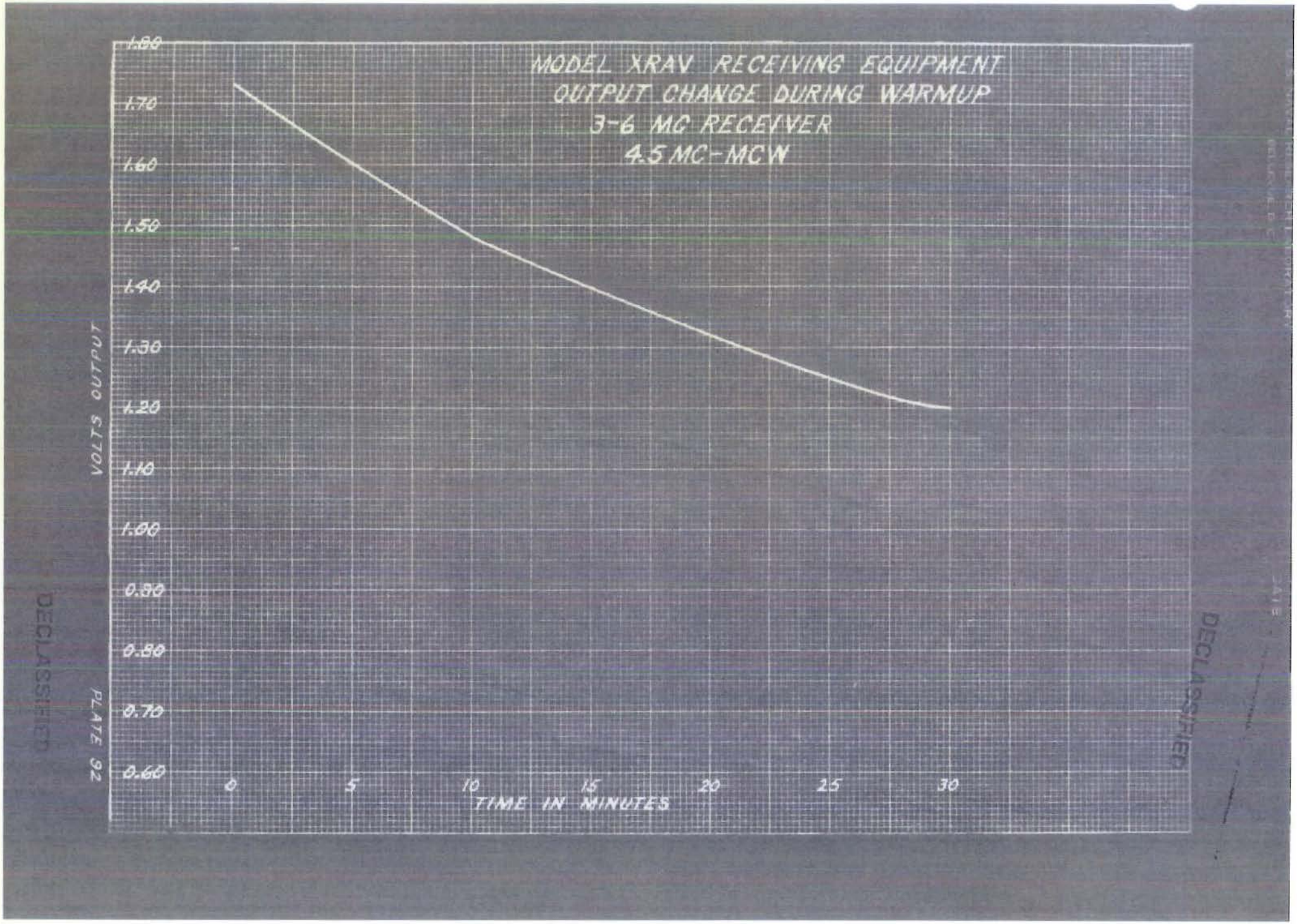

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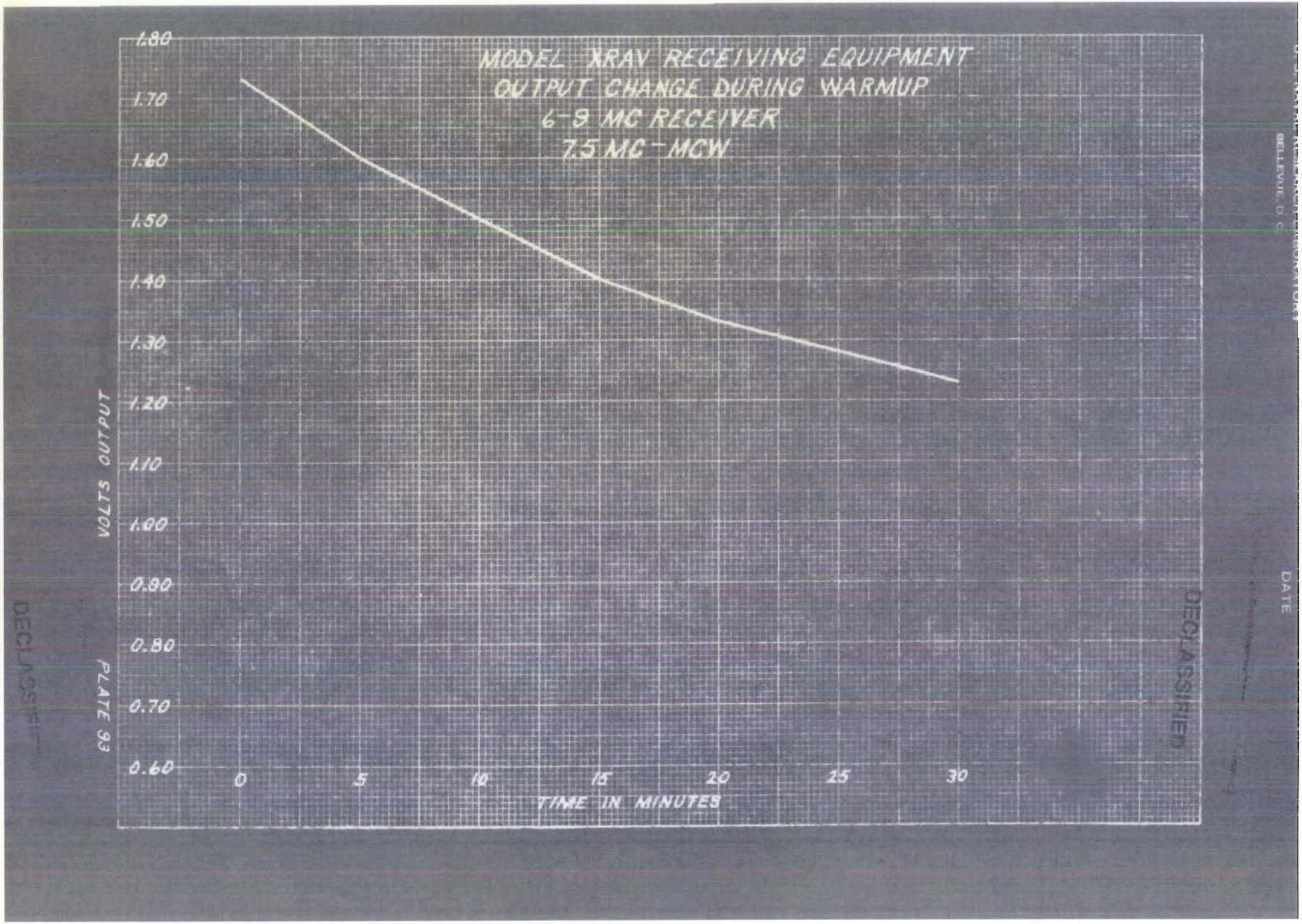

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PLATE 93

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MODEL XRAV RECEIVING EQUIPMENT
OUTPUT CHANGE DURING WARMUP
9-13.5 MC RECEIVER
11 MC-MCW

TIME IN MINUTES

0 5 10 15 20 25 30

VOLTS OUTPUT

0.60 0.70 0.80 0.90 1.00 1.10 1.20 1.30 1.40 1.50 1.60 1.70 1.80

PLATE 94

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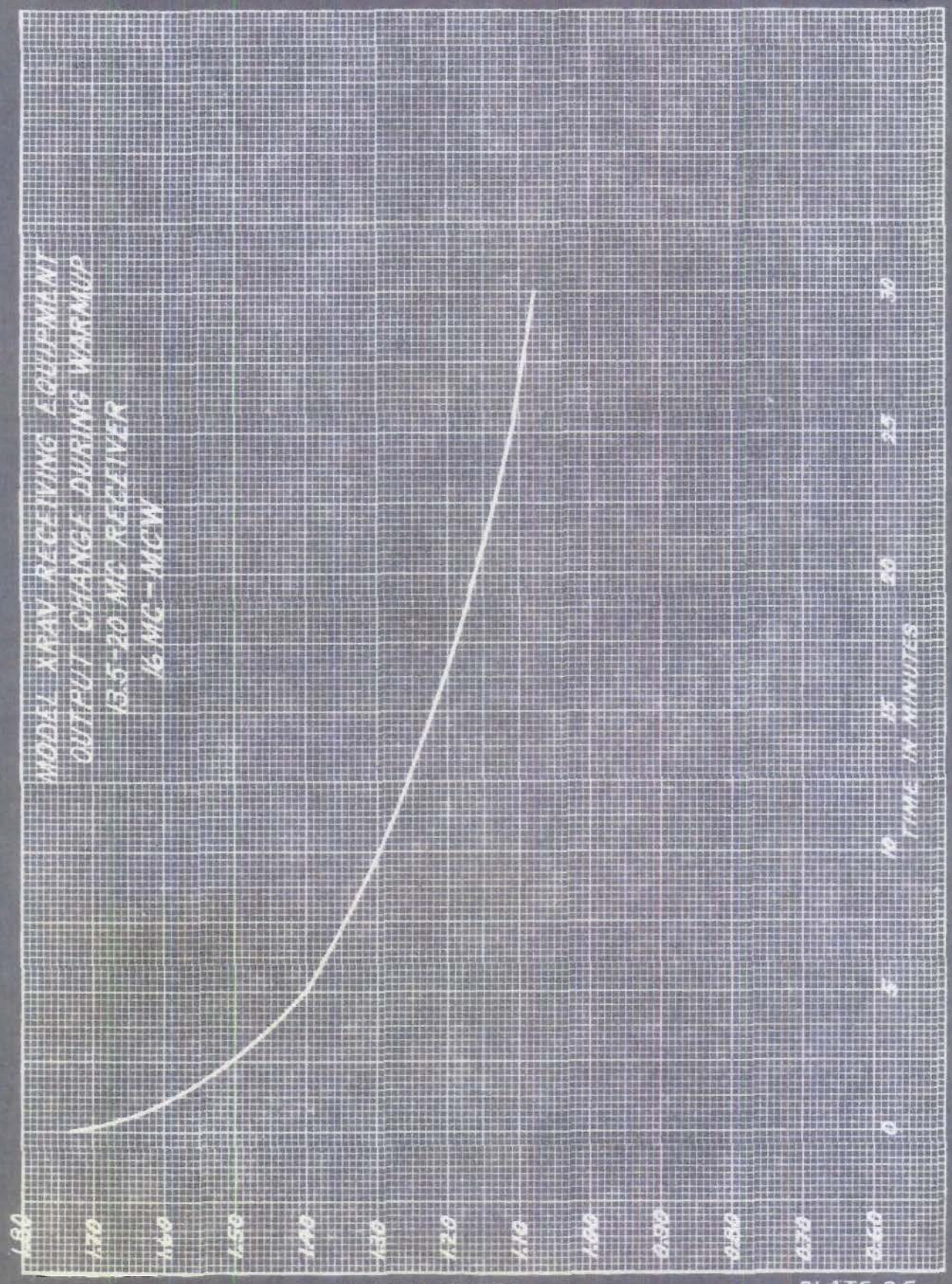

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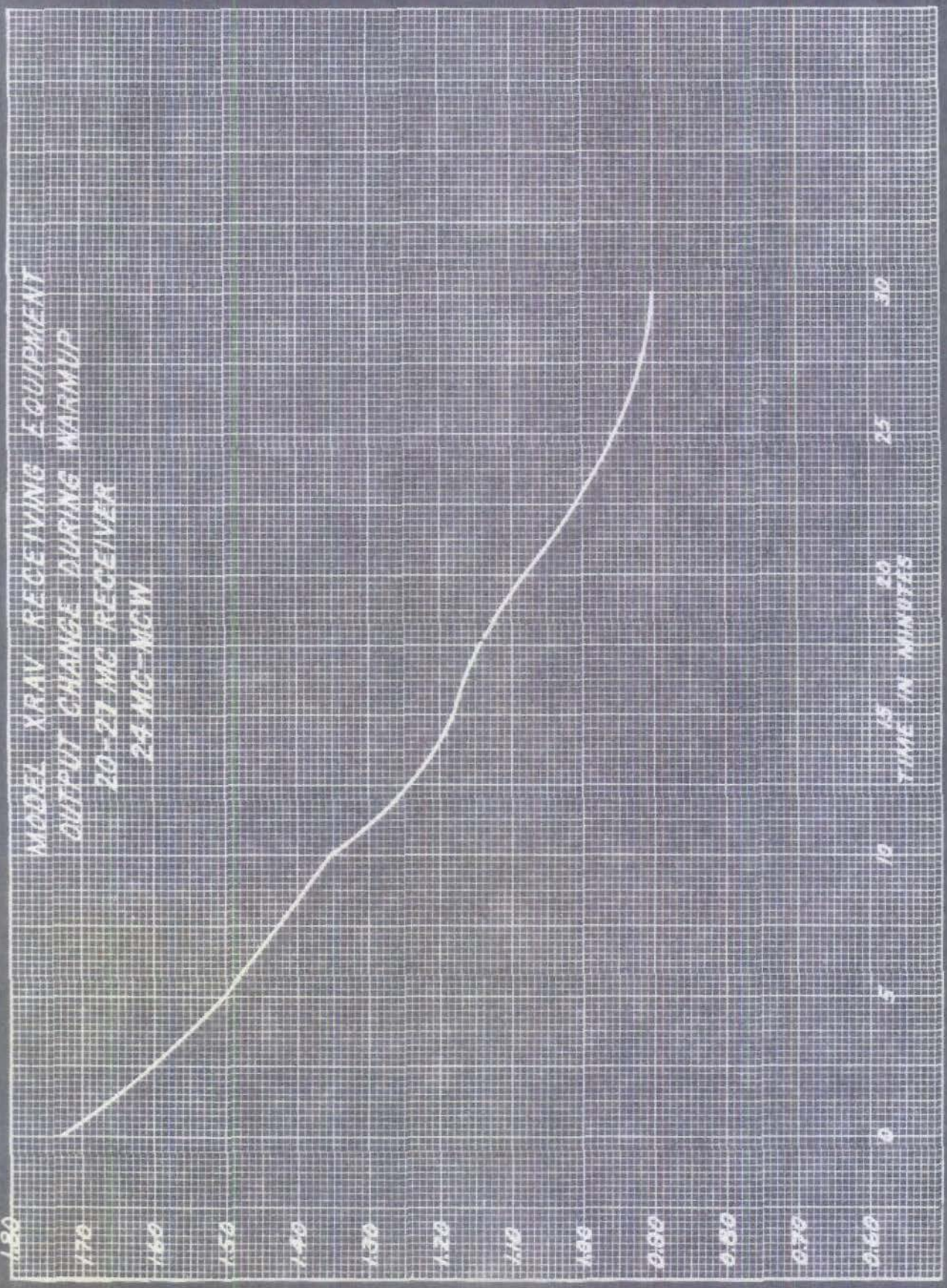

PLATE 96

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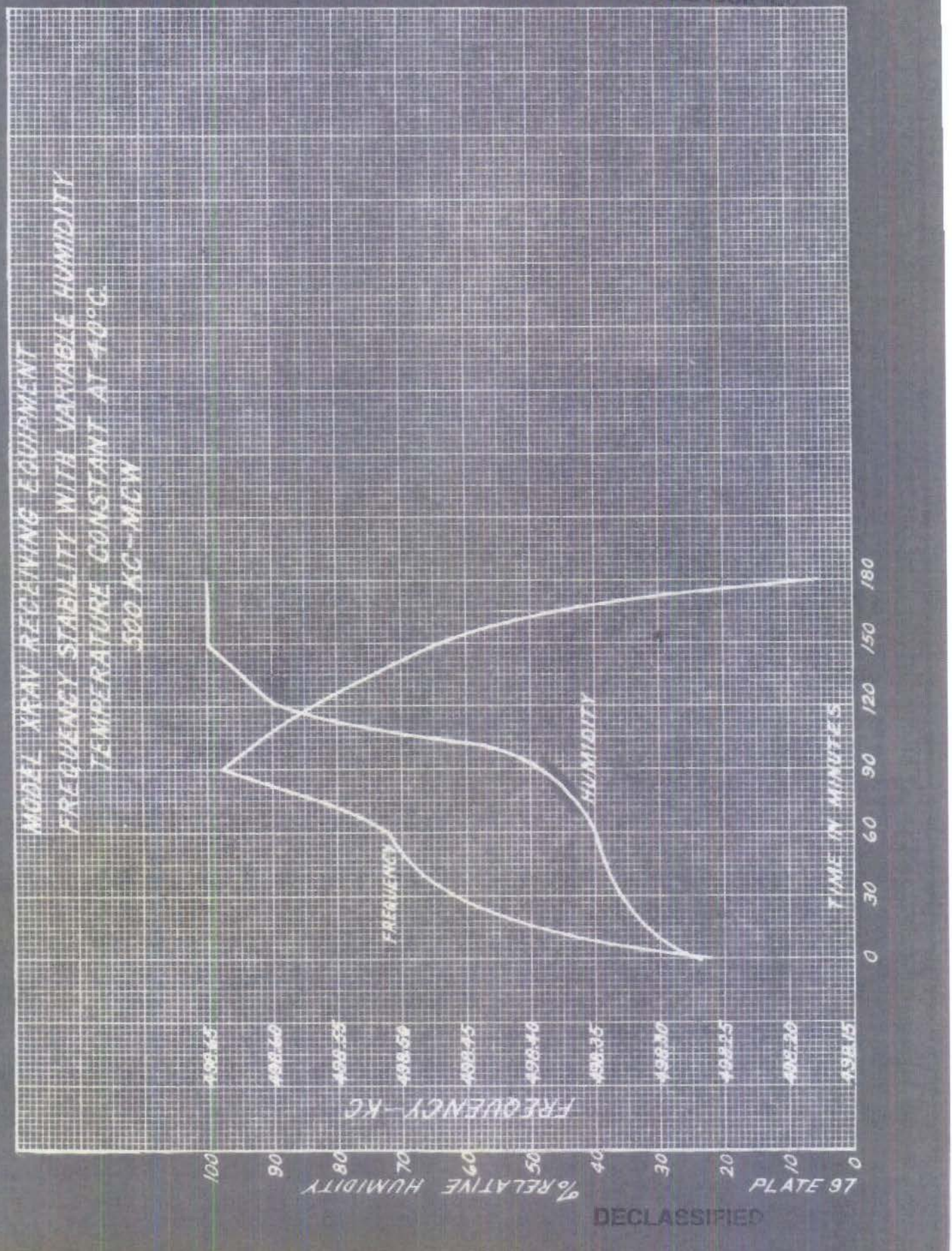

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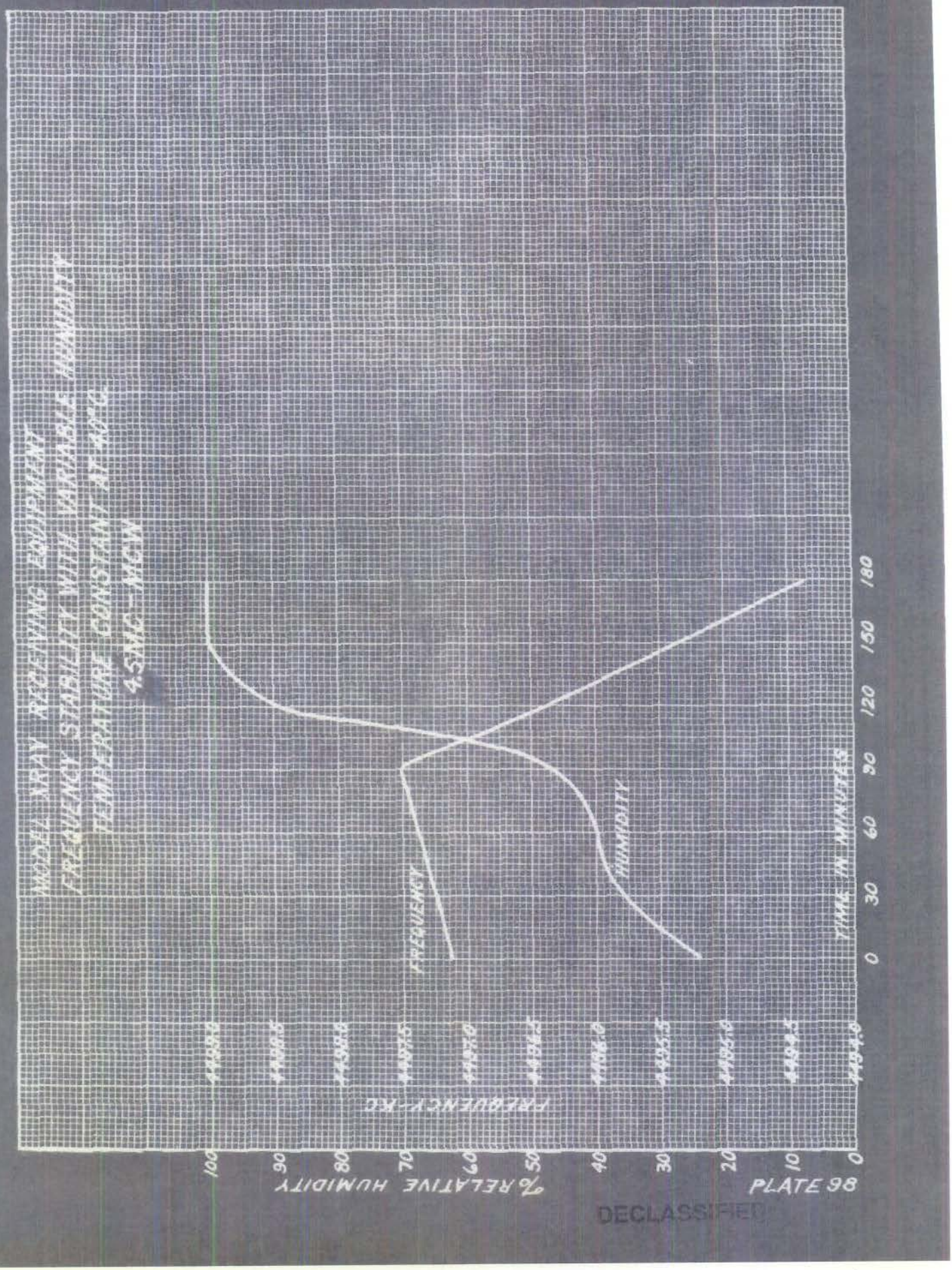

PLATE 98

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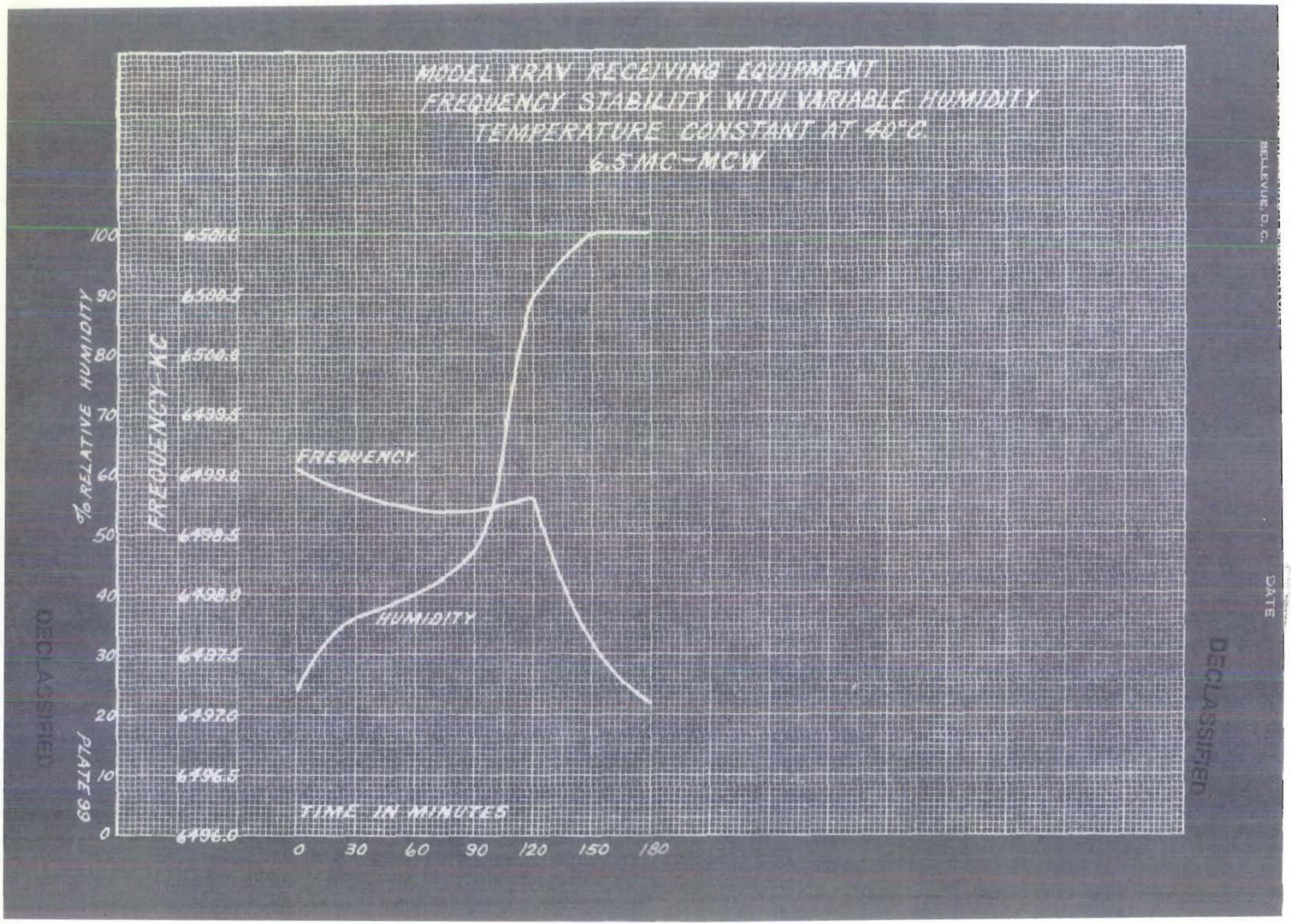
MODEL XRAY RECEIVING EQUIPMENT
FREQUENCY STABILITY WITH VARIABLE HUMIDITY
TEMPERATURE CONSTANT AT 40°C.
6.5 MC.—MCW
% RELATIVE HUMIDITY
FREQUENCY-KC
6501.0
6500.5
6500.0
6499.5
6499.0
6498.5
6498.0
6497.5
6497.0
6496.5
6496.0
100
90
80
70
60
50
40
30
20
10
0
FREQUENCY
HUMIDITY
TIME IN MINUTES
0
30
60
90
120
150
180
PLATE 99
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BELLEVUE, D. C.
DATE

U. S. NAVAL RESEARCH LABORATORY
BELLEVUE, D. C.

DATE

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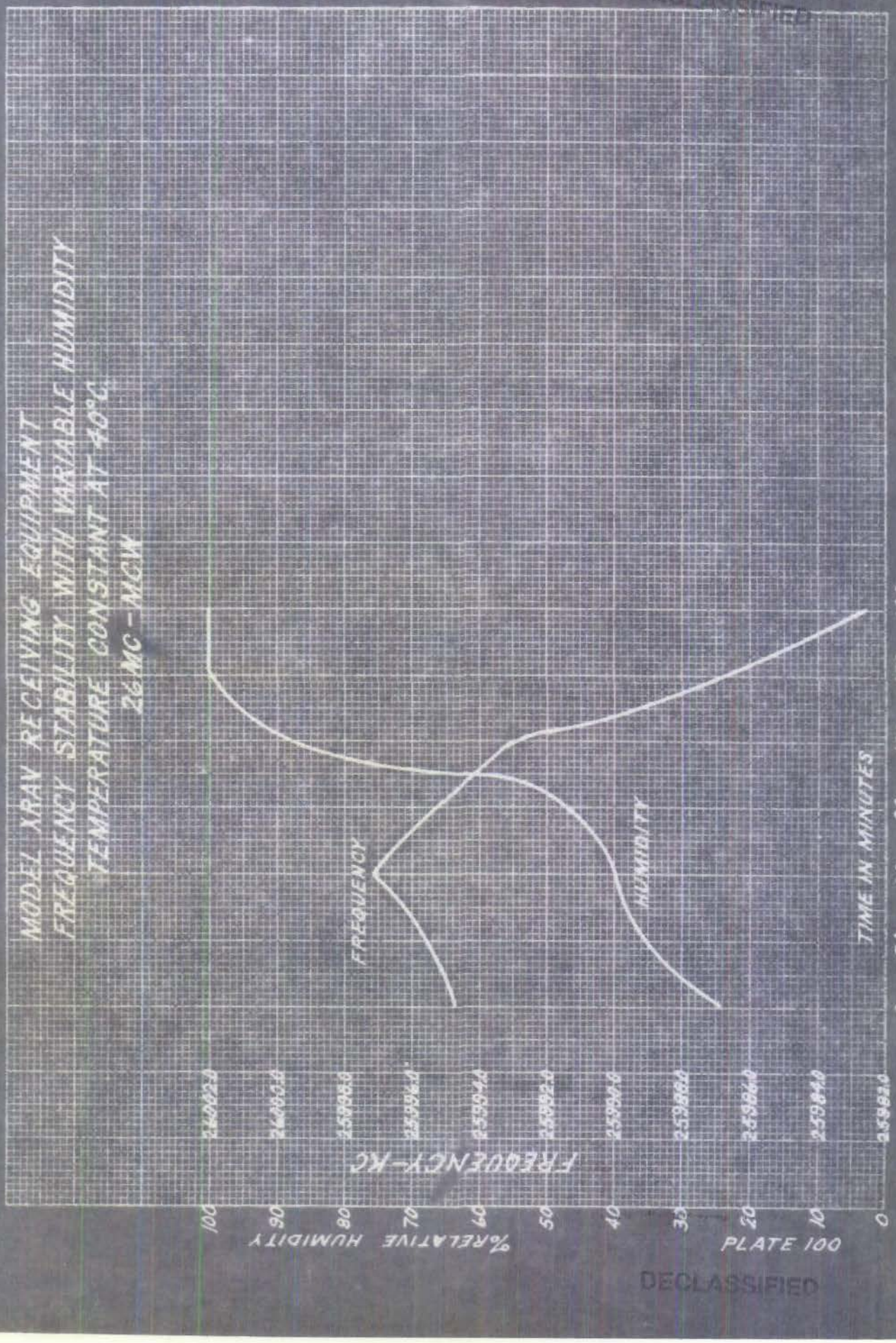

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U. S. NAVAL AIR STATION
Anacostia, D. C.

F42-1/46(2)/NA6 JCL/cc
(440)
Serial 40166 7 DEC 1940

CONFIDENTIAL

From: Commanding Officer.
To: Director, Naval Research Laboratory.

Subject: Aircraft Radio - Confidential Contract C-NOs72445 with Aircraft Radio Corp. for Model RAV Patrol Plane Receiving Equipment - Report on Flight Tests of Preliminary Models.

Reference: (a) BuShips let. C-NOs72445 (9-12-DR1) of September 17, 1940.

Enclosure: (A) Photograph AN-56287 - Model XRAV Patrol Plane Receiving Equipment - Complete Equipment.
(B) Photograph AN-56289 - Model XRAV Equipment - Bank of Four Receivers - Side and Rear View.
(C) Photograph AN-56293 - Model XRAV Equipment - Mounting Plate and Mounting Rack.
(D) Photograph AN-56292 - Top View and Bottom View of Individual Receiver Unit.

1. This letter is the report of flight tests made on the model XRAV patrol plane receiving equipment as directed by reference (a).

2. The subject equipment consists of eight individual receiver units mounted in two banks of four units each. The total frequency range of the eight units extends from 0.2 megacycles to 27.0 megacycles. The equipment is designed so that it can be adapted to either local or remote operation but the linkages and remote control units necessary for remote operation were not provided with this equipment. The model RAV receivers operate from a 24 volt DC power source.

3. The subject equipment arrived at this station on October 29. It was tested briefly in the laboratory and then installed in JO-2 airplane #1048. Six flights were made including one to an altitude of 20,000 feet. Tests were completed on November 27. One bank of four receivers is now being used as accessory equipment in the flight tests of the model GO-7 transmitter.

4. Tube Lineup.

Each receiver unit employs the following tubes:

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Subject: Aircraft Radio - Confidential Contract C-NOs72445 with Aircraft Radio Corp. for Model RAV Patrol Plane Receiving Equipment - Report on Flight Tests of Preliminary Models

- -

No.	Type
3	12SK7
1	12SR7
1	12A6
1	12K8

5. Weights and overall Dimensions.

Unit	Weight	Height	Width	Length
190 - 550 kc Receiver	9.6	5 5/8"	4 3/4"	12 3/8"
520 - 1500 kc Receiver	9.5	5 5/8"	4 3/4"	12 3/8"
1.5 - 3.0 mc Receiver	9.3	5 5/8"	4 3/4"	12"
3.0 - 6.0 mc Receiver	9.2	5 5/8"	4 3/4"	12"
6.0 - 9.0 mc Receiver	9.1	5 5/8"	4 3/4"	12"
9.0 - 13.5 mc Receiver	9.1	5 5/8"	4 3/4"	12"
13.5 - 20.0 mc Receiver	9.1	5 5/8"	4 3/4"	12"
20.0 - 27.0 mc Receiver	9.0	5 5/8"	4 3/4"	12"
Mounting Rack	5.3	4 5/8"	21"	13 1/8"
Mounting Base	1.1	1 7/8"	21 1/2"	10 3/4"
Mounting Rack and base together	6.4	5 1/8"	21 1/2"	13 1/8"
Power Cable	1.5			115"
Interconnecting Cable	1.0			61"
Bank of Four Receivers, 190 kc to 6.0 mc. with mounting facilities but no cables.	44	7 3/8"	21 1/2"	14 1/8"
Bank of Four Receivers, 6.0-27.0 mc with mounting facilities but no cables.	42.7	7 3/8"	21 1/2"	13 3/4"

Weight of complete operative installation consisting of eight receivers, necessary mounting facilities, one interconnecting cable and one power cable was 89.2 pounds. One additional power cable weighing 1.5 pounds was provided but no slip covers were furnished. The additional 3/8" on the length of the 190 - 550 kc and 520 - 1500 kc receiver is due to the projection of the ant-loop switch.

6. The following are the more important flight tests made on the subject equipment:

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F42-1/46(2)/NA6
(440)
Serial 40166

CONFIDENTIAL

Subject: Aircraft Radio - Confidential Contract C-NOs72445 with Aircraft Radio Corp. for Model RAV Patrol Plane Receiving Equipment - Report on Flight Tests of Preliminary Models.

- -

(a) Coordination with accessory equipment.
(b) CW and voice operation throughout the bands.
(c) Check of spurious responses.
(d) Operation of receivers in parallel.
(e) Altitude flight.

7. Satisfactory coordination with accessory radio equipment was obtained throughout. The accessory equipment consisted of a model GO-3 transmitter, a model LM frequency meter, and a model RL-2 interphone. A model GF series transmitter was used to supply the necessary power for operating the model LM frequency meter during tests.

8. CW and voice operation was satisfactory throughout the range of the equipment.

9. The most serious spurious responses observed during flight tests occurred when any particular receiver unit was tuned to the frequency of the conversion oscillator of the next lower unit. These responses become more intense at the higher frequency end of the band but even at the lower frequencies the spurious responses were strong enough to produce full receiver output. The above of course presumes operation on a common antenna with maximum setting of the volume control. Another type of spurious response was observed whenever any particular receiver unit was tuned to a harmonic - usually the third - of its own CW oscillator. These responses are far less intense than those mentioned above and from a practical standpoint, no difficulty is anticipated.

10. Operation in parallel was feasible, even with the large number of receiver units involved. A slight amount of dynamotor ripple was noticed in the telephones when operating on the ground but this was not audible in flight. Slight indications of cross-talk between the A Tel line and B Tel line were also observed on the ground but not in the air. This cross-talk occurred when a strong signal was fed into B Tel and the phones plugged into A Tel or vice versa.

11. Operation at an altitude of 20,000 feet was satisfactory.

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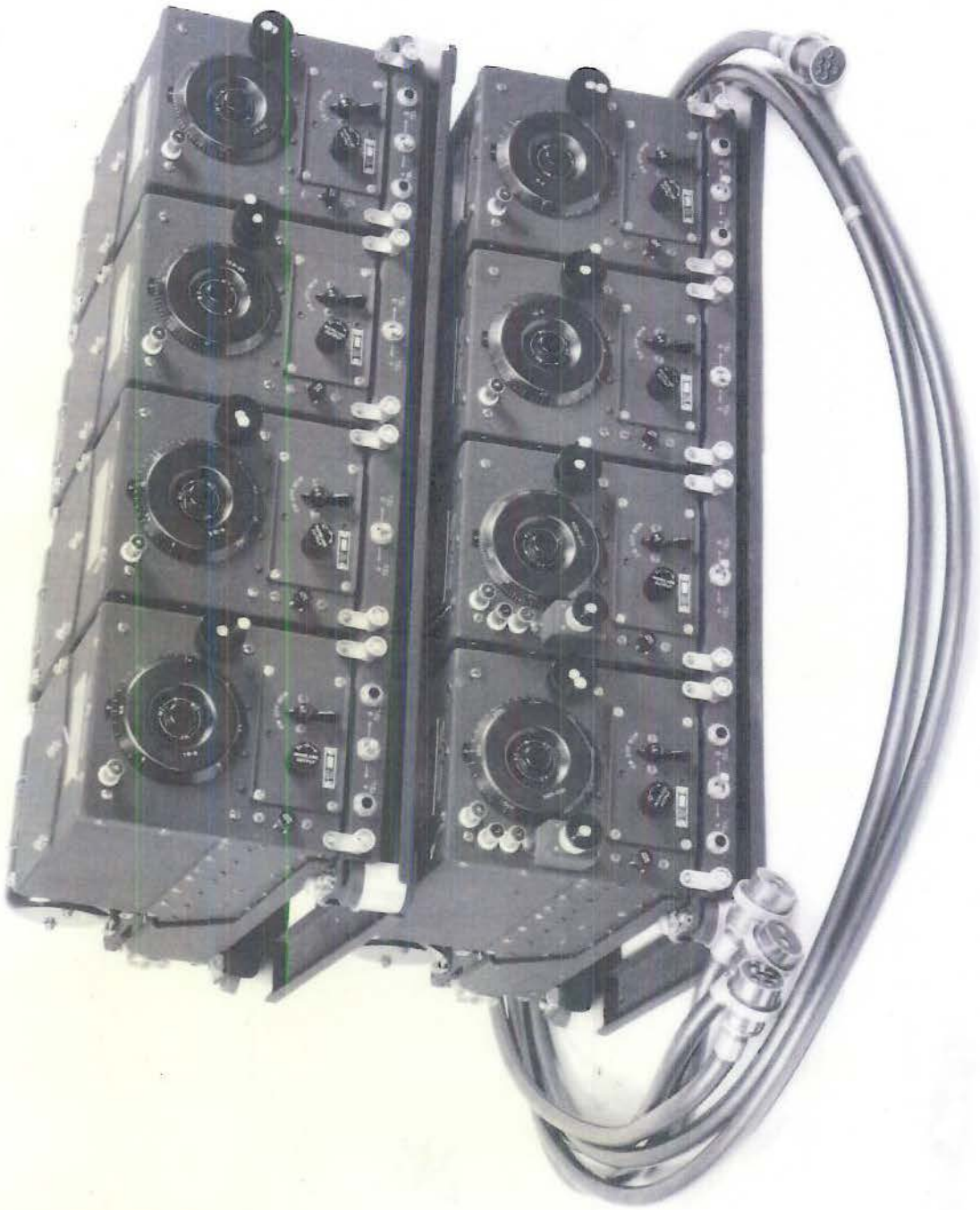

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Encl. A

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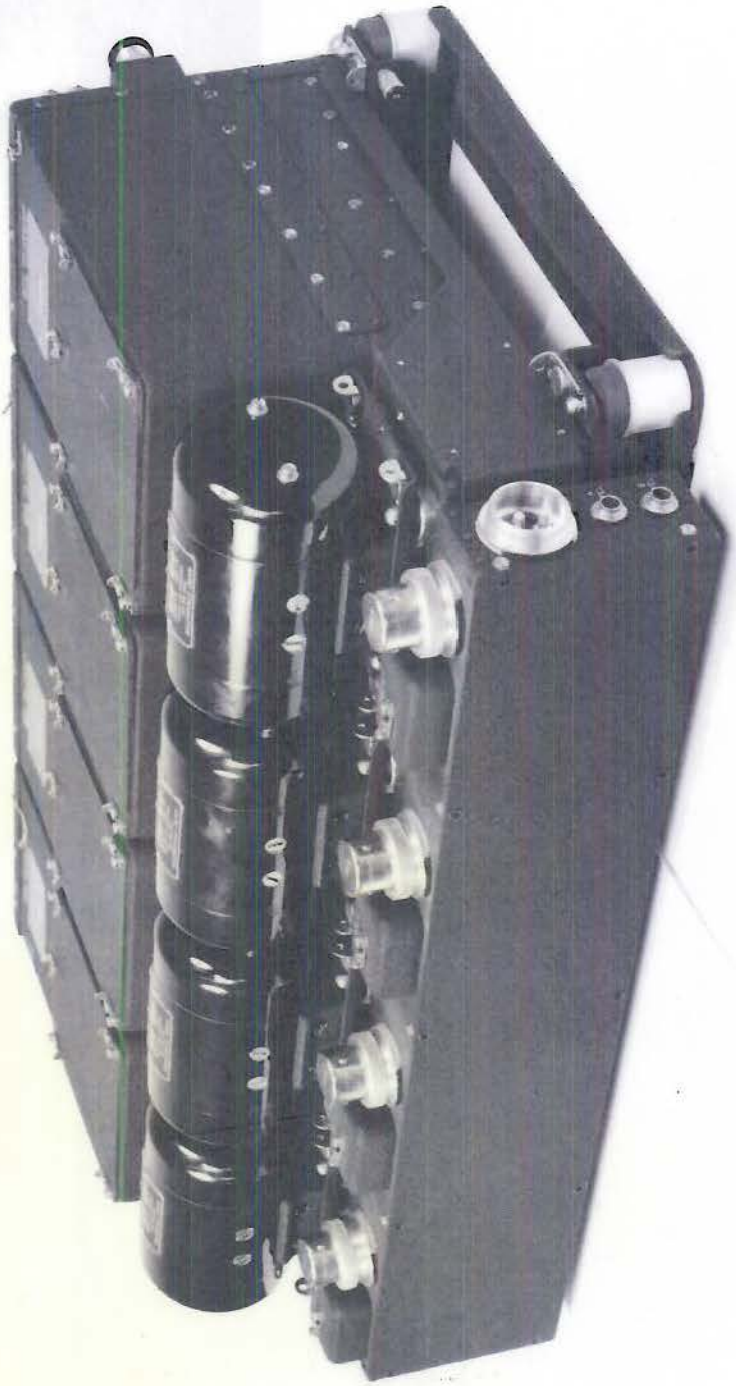

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Encl. B

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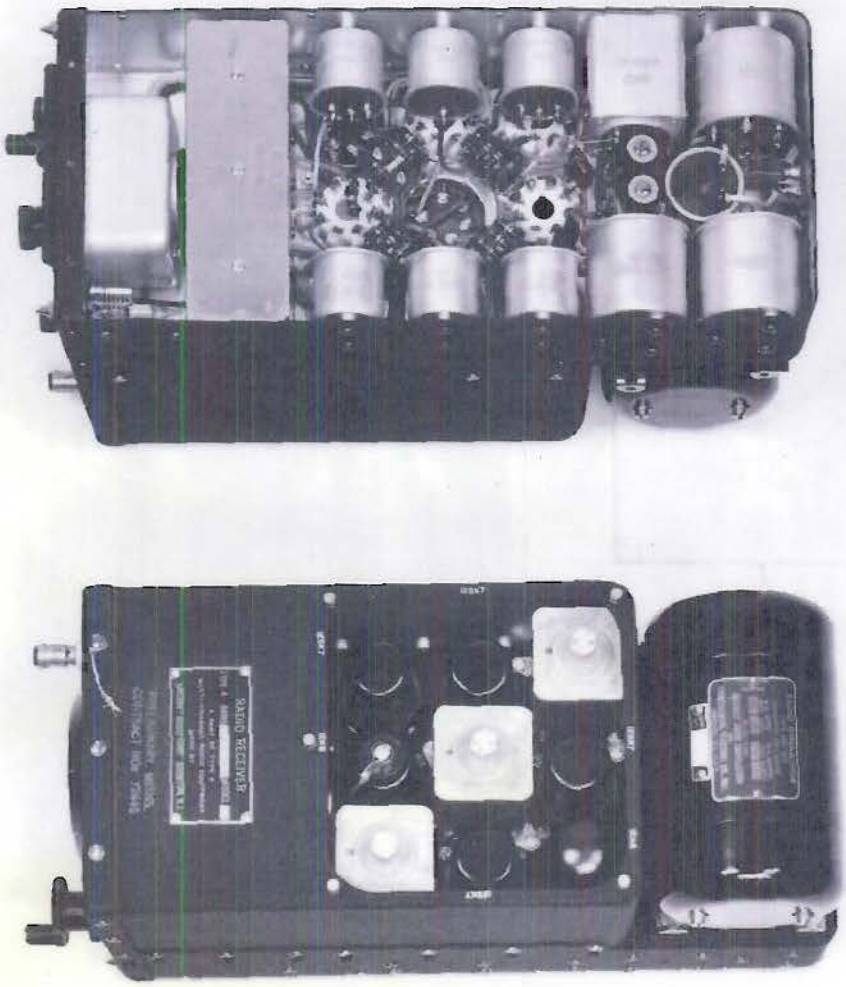

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Encl. D