[redacted]

28 May 1945

Serial No. [redacted]

UNCLASSIFIED

DECLASSIFIED

NAVAL RESEARCH LABORATORY
WASHINGTON 20, D. C.

DECLASSIFIED by NRL Contract
Declassification Team
Date: 9 SEP 2016
Reviewer's name(s): H. DO, P. HANNA

Declassification authority: NAVY DECLASS MANUAL, 11 DEC 2012, 08 SERIES

TEST OF MODEL TEA RADIO TRANSMITTING EQUIPMENT

BY

George O. Newcomb, Ensign, USNR

Radio Division - Special Development

FR-2533

Report R-2533 - Problem S482.2T-C

[redacted]

UNCLASSIFIED

DECLASSIFIED: By authority of 5000A January 1958
Entered by: E. Bliss Code 2027

DISTRIBUTION STATEMENT A APPLIES
Further distribution authorized by UNLIMITED only.

Approved by
E. A. Speakman
Head, Special Development Section

Dr. A. Hoyt Taylor
Superintendent, Radio Division

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

Title Page ....1 sheet
Abstract ....1 sheet
Table of Contents ......1 sheet
Text ....28 sheets
Plates ....5 sheets

DECLASSIFIED

[redacted]

28 May 1945

Serial No. [redacted]

NAVAL RESEARCH LABORATORY
WASHINGTON 20, D. C.

FR-2533

TEST OF MODEL TBA RADIO TRANSMITTING EQUIPMENT

BY

George O. Newcomb, Ensign, USNR

Radio Division - Special Development
Report R-2533 - Problem #488,2T-C

[redacted]

Approved by
E. A. Speakman
Head, Special Development Section

Dr. A. Hoyt Taylor
Superintendent, Radio Division

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

Title Page ....1 sheet
Abstract ....1 sheet
Table of Contents ....1 sheet
Text ....26 sheets
Plates ....5 sheets

- a -

Report No R- 2533

ABSTRACT

This report covers the type approval tests of a production model of the low frequency unit of the Model TEA Radio Transmitting Equipment. The complete Model TEA is a guided missile countermeasures and communications jamming transmitter with a 15-125 Mc range and a nominal power output of 1 Kw. Built in three rectangular racks bolted one on top of the other, the equipment houses two radio-frequency units with their modulators and modulation generators and the common power supply unit that is used to operate either of the r-f units. The H.F. unit, the Type CAOW-35ABO Power Oscillator, was not tested. The Type CAOW-35ABN L.F. Power Oscillator, operating with the Type CAOW-20ADB, Rectifier Power Unit, uses plug-in tank coils to cover the 15-55 Mc range in three bands. The L.F. transmitter and its associated units were given electrical performance, temperature, humidity, inclination, vibration and shock tests. The power output, frequency coverage, and general circuit operation was satisfactory. The major fault of the equipment was that the plug-in tank coils and coupling loop arced under vibration and shock, stopping transmission. This Laboratory recommends improving the shock-resistance of the coil assemblies and making certain other changes listed in Paragraphs 43 through 63 inclusive.

[redacted]

TABLE OF CONTENTS

PLATES

Distribution

BuShips, 938	(8)
CNO, Op-25-A2	(1)
EFSG, NRL Anacostia	(1)
JEIA	(1)
USN R&SL, San Diego	(1)

INTRODUCTION

1. This report is an account of an investigation of the performance of the low frequency unit of the Navy Model TEA radio transmitter, a jamming transmitter intended for use on naval vessels. Results of this investigation, already reported verbally to representatives of the Bureau of Ships, have led to certain modifications in the design of the equipment (Reference 8).

2. The Model TEA jamming transmitter is composed of three rectangular units assembled on top of each other to form a complete assembly measuring approximately 72 inches high, 48 inches wide, and 24 inches deep. The bottom unit contains the high-voltage rectifier filter and control circuits for both the low and high frequency transmitters. Primary power is obtained from a three-phase, 440 volt, 60 cycle, 9 ampere supply, and auxiliary power is obtained from a three-phase, 110 volt, 60 cycle, 7 ampere source. The middle unit houses the CAOW-35ABN oscillator and modulator. This oscillator employs 833-A tubes in a push-pull tuned plate, self-excited oscillator circuit, and covers the 15-55 kc. range in three bands by means of plug-in coils. The top unit contains the CAOW-35ABO oscillator and modulator circuits providing frequency coverage in the 40 to 125 megacycle range. The HF transmitter is not included as part of this report. The modulator circuits for the two oscillators are identical and interchangeable. Modulation is obtained by means of square wave grid keying. Further details are given in Reference 7.

3. The BuShips letter of Reference 1 requested this Laboratory to make complete mechanical and electrical "type approval" tests on the following preproduction units of the Model TEA equipment:

- (a) Type CAOW-35ABN, L.F. Power Oscillator
- (b) Type CAOW-50AFC Modulator
- (c) Type CAOW-35ABP Modulation Generator (Variable tone and noise)
- (d) Type CAOW-35ABQ Modulation Generator (Fixed frequency tone)
- (e) Type CAOW-20ADB Rectifier Power Unit
- (f) Type CAOW-10 AET Dummy load

Due to the unsatisfactory performance of the preproduction unit the Bureau requested an investigation by letter of Reference 3 to determine necessary changes and resultant maximum performance. The troubles with the equipment are discussed in Reference 5. Design changes to overcome these difficulties made it impractical to consider the equipment a true preproduction model, and following its completion, a second equipment designated production Serial No. 1 was received. This report covers tests on the Model TEA production units of the types listed. The equipment was tested to check compliance with Reference 6 and the Navy specification RE-13A554E, as authorized by NRL Problem S482.2 T-C in accordance with letters of References 1 and 2. References pertinent to this report are contained in a list at the end of the text.

[redacted]

4. The mechanical and electrical tests of the transmitter were made by the Special Development Section of the Radio Division of this Laboratory. The Type CAOW-10AET dummy load mechanical tests were made by the Shock and Vibration Division of the Laboratory, and the electrical tests of the unit by the Communication Security Section of the Radio Division of this Laboratory.

TESTS ON THE LF TEA TRANSMITTER AND ASSOCIATED UNITS

5. Power Output Tests: Power output was determined by loading the transmitter into a short length of 50 ohm cable, Type RG-18/U, connected to a water cooled 50 ohm resistor. At each frequency the load was tuned with a series capacitance to obtain the minimum standing wave ratio. The limiting factors on power output were, singly or concurrently, the maximum grid current of 200 M.a. maximum plate current of 900 M.a., maximum coupling, an approximate limit of plate color, and maximum available plate voltage. Power outputs limited by one or more of these factors were considered maximum. The plug-in tank coils were adjusted to give the minimum specified output (see Reference 6) at two different times. The first adjustment was made at the beginning of the power output tests (the data for which are in Part 1 of Appendix A) in order to meet the output specifications. This readjustment may have been necessitated because of misalignment caused by bending of the coil assemblies during packing or shipping. During the shock and vibration tests the coils were deliberately bent out of shape to eliminate arcing in order to test for possible further faults. When it was deemed advisable to make further tests of modulated output, it was necessary to readjust the coils. They were again adjusted to give specified output, but not to the extent that the maximum cw output was identical to that in the first tests made. Consequently, two separate curves of maximum cw power output are given on Plates 1 and 2.

6. Power output under modulation was measured under three different types of conditions:

(a) Adjusting oscillator to nominal cw output and then switching to modulation.
(b) Applying modulation and adjusting oscillator controls to obtain maximum modulated power output.
(c) Adjusting oscillator to maximum cw output and then switching to modulation.

The data from the tests under conditions a, b, and c are given in Parts 1, 2, and 3 of Appendix A respectively. Data from tests under condition b are plotted in Plates 3 and 4 with the maximum cw power output for the given coil adjustment given on Plate 2. The gain in modulated output resulting from operation in condition b is indicated on Plate 5 which gives output with 1000 cycle modulation using methods b and c.

[redacted]

7. As shown on Plate 1, the LF transmitter cw output (with the coils as first adjusted by this Laboratory) was 1500 to 2250 watts from 15 to 50 Mc. dropping to 700 watts at a top frequency of 54 Mc. With the second adjustment, cw output was 1500 to 2250 watts from 15 to 42 Mc. and 1000 watts or more from 42 to 55 Mc. Maximum audio tone modulated output varied in general from 1000 watts at 14.5 Mc. to 1700 watts at 36 Mc. then down to 700 watts at 55 Mc. (see Plate 3).

8. Frequency Range - The frequency limits of the three bands, also dependent upon the tank coil adjustment, were as follows:

Coil	1st Adjustment	2nd Adjustment
1	14.82 - 26.80 Mc.	14.63 - 25.88 Mc.
2	22.70 - 41.40 Mc.	22.74 - 43.32 Mc.
3	38.60 - 54.00 Mc.	39.54 - 55.46 Mc.

9. Variation in Ambient Temperature -

(a) The units were subjected to ambient temperature variations between 0° C. and + 60° C., the limits given in BuShips specification RE-13A-554E. The assembled equipment was energized at room temperature and the operation checked before lowering the ambient temperature to 0° C. This temperature was held until the RF oscillator stabilized, the ambient temperature was increased successively to + 25° C., + 50° C., and + 60° C. after reaching stable operation. The relative humidity was held between 25 and 30%. The 35ABQ unit was tested separately under similar conditions.

(b) The data from the test of varying ambient temperatures, given in tabular form in Part 4 of Appendix A, may be summarized as follows:

1. The carrier frequency dropped from 48.486 to 48.417 Mc., a change of 69 Kc. or 0.147%, with the 60° C. rise in ambient temperature.
2. The variable tone generator, set at 1136 cycles, dropped to 973 cycles when the ambient was brought from 0° C to + 60° C. This was a change of 14.4%.
3. The fixed frequency tone was affected as follows by ambient temperature changes: The 8 and 12 Kc. tones dropped in frequency 1.2 and 2.52% respectively when the temperature was increased from 0° to + 60° C.

10. Variations in Relative Humidity - The LF transmitter, was subjected to the following humidity variations:

(a) Stabilization at + 40° C. and 33 to 35% relative humidity.
(b) Following condition (a) two hours at + 40° C. and 95 to 97% relative humidity.
(c) Following condition (b) two hours at + 40° C. and 30 to 33% relative humidity.

[redacted]

11. From the tests on the assembled transmitter, the following results were obtained:

(a) The carrier frequency varied 0.02% during the humidity test; the power output increased from 1250 to 1400 watts when the humidity was raised.

(b) The tone generator in the 35ABP modulation generator varied from 977.5 to 960 cycles, a change of 1.78 percent, when the humidity was increased.

(c) The tones of the 35ABQ generator held frequency within the 1% limit. However, the 8000 and 12000 cycle tones rarely stabilized. These tone frequencies would approach stabilization at one frequency, then jump to a different frequency and approach stabilization again at a new point. The instability amounted to about 20 cycles in the 8000 cycle tone and 4 to 60 cycles in the 12000 cycle tone. These data are presented in tabular form in Part 5 of Appendix A.

12. Wet-Start Test - The un-energized equipment was placed in an enclosed chamber for 16 hours and the temperature and relative humidity held at approximately + 40°C. and 97%. Upon energizing the equipment a power supply failure occurred due to shorting of a.c. and d.c. leads in the low voltage supply distribution cable. The leads had been worn by abrasion against the steel framework, and the moisture from the high humidity allowed the wires to arc to each other and to the framework.

13. Since no time was available for further humidity tests, an inspection was made to check the equipment for corrosion.

(a) The Allen head screws and pins in the various drive assemblies were rusted, as were the Allen wrenches.

(b) The panel-holding thumb screws and the countersunk holes in the power supply framework were also rusted.

(c) The metal type and model nameplates were corroded through the paint; with further exposure to high humidity they would soon become illegible.

14. Shock Test - The assembled low frequency transmitter and power supply was bolted to a test platform to simulate a shipboard installation. Approximately 50 shocks were applied to the test platform in three directions, toward the back, and left and right sides of the equipment. Approximately twenty of the shocks imparted momentary peak acceleration of 280G to the test platform, the rest were mostly 90G shocks, with a few of 31G.

[redacted]

15. The following faults were disclosed by application of shock:

(a) The power oscillator tank coils and coupling loop momentarily arced between turns and/or to each other under shock, tripping the overload relay and stopping transmission.

(b) One 833-A power oscillator tube developed a permanent filament to grid short. Similar shocks did not cause further 833-A failures when new tubes were used.

(c) The main power circuit breaker tripped several times under shocks of approximately 280 G, with 833-A plate voltage set at zero before shock was applied.

16. Vibration - The transmitter was vibrated on its test platform for approximately two hours. Preliminary checks were made by cycling over the vibration range of 600 to 1900 revolutions per minute, 10 to 31.7 cycles per second. Then the equipment was vibrated at the frequency determined by observation to be most likely to cause failure of the equipment. In the case of this equipment, with only the power supply and the low frequency transmitter being vibrated, the frequency most likely to cause failure was approximately 16 cycles per second.

17. The faults disclosed by vibration were as follows:

(a) Arcing between turns of coupling loop.

(b) Tuning condenser shifts position slightly under vibration.

(c) Frequency excursion under vibration 300 Kc. at 49 Mc., approximately 0.61%.

18. Inclination Test - The transmitter was bolted to a test table and inclined in two planes to 45° each side of vertical for approximately two hours at a 5 cycle per minute rate. No evidences of malfunction were noted in the equipment. The maximum frequency excursion was about 5 Kc.

19. Line Voltage Variation Tests - The maximum frequency change in the fixed frequency generator under line voltage variation of plus and minus 10% was 4.5 cycles, a drift of 0.037%, in the 12000 cycle tone. With one set of tubes, the voltage regulators did not operate at normal line voltage. This was probably due to the regulator characteristic and not the circuit. The variable tone generator in the CAOW 35ABP unit had less than 1% drift for tone frequencies between 500 cycles and 100 kilocycles. Tabulated data are given in part 6 of Appendix A.

20. Variable Tone Generator Frequency Calibration - The calibration of the variable tone generator in the CAOW-35ABP modulation generator, Serial 1, was in error from - 3.0 to +.68 percent over a frequency range of 100 to 220,000 cycles. Data are tabulated in Part 7 of Appendix A.

21. Variable Tone Generator Reset - Re-setability of the variable tone generator was checked by setting the tone generator accurately to given frequencies, then attempting to reset with clockwise or counterclockwise rotation, though backlash was negligible. In 14 attempts the average error was 1.90%. Test data are tabulated in Part 8 of Appendix A.

22. Fixed Tone Generator Adjustment - The available ranges of adjustment of the 1000 and 1500 cycle frequencies, 1.1 and 1.7% respectively, are unsatisfactory in view of the 3% value specified in Reference 6. The adjustment at 8 Kc. is 8.8% and at 12 Kc. is 9.9%. Results are tabulated in Part 10 of Appendix A.

23. Variation of Tone Modulation Frequency with R.F. Power Output - This test was run by setting the transmitter at approximately 50 Mc. carrier varying the power output from 0 to maximum under modulation, and measuring the modulation frequency. The results are approximate because the transmitter was loaded into a dummy load with an indeterminate amount of stray r.f. The maximum drift noted in the variable tone generator was 1.42%, and the average drift was 0.54%. The maximum drift of the fixed frequency tone generator was 0.32%. Data are tabulated in Part 9 of Appendix A.

24. Tests of External Modulation - The Navy Model LO-2 audio oscillator was connected to the external modulation jack and used as a modulation source. By varying the output voltage of the LO-2, the duty cycle of the r.f. output as observed on an oscilloscope may be varied from approximately 10% to 90%. The higher output voltages give the lower duty cycles, due to the inversion in the modulator. The following data was taken on 50% duty cycle operation, with duty cycle checked on an oscilloscope picture of the r.f. envelope.

R.F. (mc)	Tone Freq. (Kc)	Duty Cycle (%)	Tone Gen. Output (volts)	Position Output Control
50	15	50	4.1	7.9
43.5	15	50	4.4	7.9
39	15	50	5.2	8.1
39	10	50	5.0	8.1

25. CAKW-10AET Dummy Load Tests - The mechanical and electrical tests on the dummy load indicated that it would work satisfactorily as a load for the l.f. transmitter, although not flat over the range. Mechanically, the load was quite satisfactory, with no faults resulting from the standard vibration and shock tests given in Navy specification RE-13A554E. The load has no provision for indicating the amount of power output.

26. RF Frequency Stability with Modulation - According to Reference 6, the limit of r.f. drift from look-through to tone modulation should not exceed 20 Kc. This limit was based on the assumption that it was possible to set the transmitter accurately on the signal to be jammed by means of look-through. Therefore, tests were made to check accuracy of setting as well as drift after

[redacted]

DECLASSIFIED

switching to tone modulation. The accuracy of "setting on" was very bad in the first tests made due to "pulling" or shift of the apparent frequency into the receiver by r.f. radiation from the unshielded tuned load. When the CAOW-10AET load was used the pulling was eliminated and the transmitter could be set to the enemy signal by means of look-through interruption of cw, or with the carrier also modulated by tone frequencies up to 8 Kc., within two or three kilocycles. The drift after switching off the look-through sometimes ran as high as 40 kilocycles, but this can be corrected by returning to look-through for a brief moment and readjusting the tuning condenser. One very important factor in setting the jammer to the enemy signal was found to be the sweep bandwidth. Final adjustments should be made with the narrowest bandwidth sweep practical, so that an error of a few Kc. is most noticeable. Otherwise, errors of 20 to 30 Kc. will probably result.

27. Output Indicator - The output indicator failed during the first electrical tests. Upon inspection it was found to have an insecurely mounted dropping resistor in too small a box to allow proper clearance. The resistor had broken due to its poor mounting and r.f. arcing to the box had discolored the metal near the resistor. The shielding box was so attached to the cabinet that the top panel had to be removed before it was possible to open the box, even to replace the tube.

28. Mechanical Inspection - Many of the power cables inside the equipment were insufficiently secured. Sufficient abrasion resulted that one cable failed, as noted in the wet-start test, before the vibration test was made.

29. The output coupling loop drive was sufficiently spring loaded to prevent its changing position under vibration, but the freezing of the brass shaft at the insulated end of the coupling loop in its brass bearing resulted in very unsatisfactory coupling control.

30. The stop preventing the coupling loop from striking the tank coils was unsatisfactory. The bracket supporting it was weak and bent under pressure.

31. The stops designed to hold the access doors open were left unfinished, incorrectly assembled, and not strong enough. Consequently, the stops were unsatisfactory.

32. The tapped holes in the aluminum framework of the L.F. power oscillator to receive the thumb screws in the plug-in modulator and modulation generator units became partially stripped due to misalignment.

33. The RG-8/U cables conneeted to the front of the CAOW-50 AFC modulator hang down over the modulation generator controls and hinder operation and removal of the generator.

34. Various r.f. bypass condensers inthe L.F. power oscillator unit were not securely mounted as prescribed in specification RE13A554E.

35. In assembling the units for shock and vibration tests the bolts used to hold the power oscillator unit to the power supply were those supplied by TEMCo.

[redacted]

Of the seven 3/8" bolts, only five could be used. One elastic stop nut was misaligned, and another bolting position required a shorter bolt, or a bolt with greater thread length.

36. The coupling loop drive mechanism was mounted with through bolts that would prevent disassembling the unit unless the high-frequency transmitter were not bolted on top of the low-frequency unit.

37. A two piece bakelite clamp intended to hold in place the cables from the power supply to the two upper units did not open sufficiently to permit easy cable installation. In attempting to force the cables through the clamp some of the glass insulation on the cable wires was torn. Finally the clamp was removed and discarded during all tests.

38. Tube Life - With the exception of the 833-A failure due to shock, the only tube re-placements required were in the 807 keyer circuit. When the equipment was set up for preliminary tests, look through would not operate until shocked into operation by the momentary application of tone or noise modulation. When V-203 was replaced with a new 807, with slightly higher gm, normal look through operation resulted. A check on circuit constants and characteristics of the tubes removed, showed the circuit to be the same as that successfully used in previous equipments and that the tubes passed Navy minimum requirements. It is possible that V-203 was biased more than for class B operation, so that slight variations of gm encountered in acceptable tubes were sufficient to prevent the positive pulses from cutting off V-203 during the times required by look through operation.

39. Spurious Radiation at 60 Mc. - When the receiver-panoramic adapter combination was tuned to approximately 60 Mc., with no plate voltage on the power oscillator, a signal was received that simulated the transmitter signal. When certain modulation control positions were set the signal was modulated and appeared as a transmitter signal. The signal was traced to an oscillation in V-216, the cathode follower output tube in the modulation generator. The oscillatory circuit was the lead from the cathode follower to the modulator unit. The oscillations were choked out by introducing an Ohmite z-1 r-f choke in the lead just before the jack for the modulator at terminal No 8 of jack 202.

40. CONCLUSIONS

The equipment in general is much improved over the preproduction model. However, mechanical and electrical improvements will be necessary before the equipment will meet Navy general specifications and the TEA low frequency unit performance specifications.

41. The equipment tested failed to meet the following performance specifications, Reference 6. All such specifications not listed below were met.

(a) Coil range: Coil #1 - The 14.5-28 Mc. ± 0.5 Mc. range was not met with the two separate coil adjustments used in power output tests (see Paragraph 8 of this report).

[redacted]

(b) R.F. Frequency Stability: The equipment failed to meet the maximum drift specification of 20 Kc, under variations in type of modulation. This difficulty may be overcome by operating technique; see Paragraph 26 of this report.

(c) Modulation:
1. Type CAOW-35ABP Generator:
Tone - Resetability error of the variable tone generator in the 35ABP unit was worse than 1%; see Paragraph 21 in this report.
Noise - The noise bandwidth control was not stable; during the greater part of the tests no control of bandwidth was possible.
2. Type CAOW-35ABQ Generator:
Stability - The fixed frequencies did not stay within 1% variation under an ambient temperature change of 0 to 50° C.
Adjustment - Each frequency did not have an initial adjustment range of plus and minus 3% (see Part 10 of Appendix A).

42. The following faults are listed because they either are not in accordance with Navy specification RE 13A554E or limit the use of the subject equipment.

(a) The variable tone generator in the CAOW 35ABP modulation is extremely unstable with varying ambient temperature, the 1000 cycle tone changed 14% with an ambient temperature change from 0° to + 50° C.
(b) Frequent replacements of V-203 were necessary to maintain proper look-through operation.
(c) The mechanical faults listed in Paragraph 28 of this report are of such a nature that satisfactory operation cannot result.

43. Recommendations: The following recommendations of this Laboratory are directly the result of the equipment faults listed in this report.

44. The tone generator in the CAOW-35ABP modulation generator should be used until the development of a replacement unit is completed by the RCS section of this Laboratory.

45. The noise bandwidth control circuit should have R-206 changed from 82 K to 50 K ohms. This allows an external bias range of approx. -5 to -12 volts, and does not allow V-213 grid current to determine the bias.

46. The stability and initial adjustment range of the CAOW-35ABQ, four frequency generator should be improved to meet the equipment performance specifications.

47. The output indicator dropping resistor R-284 should be securely mounted in a shielded compartment of sufficient size to eliminate r.f. arcing to ground.

[redacted]

Spacing should be such as to allow for high voltage peaks resulting from standing waves on the antenna feed line. The opening to remove tubes and service the indicator should face the front of the unit.

48. All cables and wires should be securely clamped to give the maximum practical protection from abrasion.

49. The bracket for the coupling loop stop should be made strong enough to withstand the loop pressure without bending.

50. The metal nameplates should be refinished to meet Navy finish specifications.

51. The screwheads in the countersunk holes in the completed power supply frameworks should be painted with a Navy approved paint to eliminate the rusting. All pins and set screws in the gear and shaft assemblies should be stainless steel, or should be otherwise protected by a Navy approved finish.

52. The stops on the access doors should be reassembled to perform the function for which they were intended.

53. Inserts of stronger metal are recommended to replace the tapped holes in the aluminum framework to eliminate stripping of threads because of minor misalignments of plug-in unit thumb screws.

54. The door to the spare coil compartment should be removed or divided to prevent RG-8/U cable leading from the modulators from interfering with operation.

55. The rf bypass condensers in the power oscillator section should be mounted according to specification RE13A554E.

56. The elastic stop nuts for the 3/8" bolts intended to hold the TEA main units together should be correctly aligned. Short bolts should be provided for the locations requiring them.

57. The tank coil and coupling loop assemblies should be re-designed to prevent arcing under shock and vibration.

58. The use of a bakelite clamp of the type described in Paragraph 37 is desirable. It should, however, be so designed as to allow easy installation of interconnecting cables and should not have sharp edges that will injure the glass covered wire.

59. The main power circuit breaker in the power supply should be replaced or shock mounted to prevent tripping under shock.

60. All components in the power oscillator compartment should be mounted to allow their removal without disassembling the main units.

61. A complete tuning condenser and tank coil assembly and a coupling loop assembly, except for the drive shaft and revolution counter, should be given shock and vibration tests after being redesigned by TEMCo.

[redacted]

62. Several units should be thoroughly checked at TMCo. to ascertain whether or not frequent V-203 replacements are necessary in other units as well as Serial No. 1. If such is the case, the cause must be found and corrected.

63. The spurious 60 Mc, radiation described in Paragraph 39 as being set up in the modulation input lead to the modulator should be corrected by inserting an R-F choke in the lead, perhaps as done by this laboratory at jack 202.

REFERENCES:

1. BuShips ltr. C-S67/1/68 (920 Ag) C-920-6668 to NRL of 9 August 1944 (Requesting test of preprod.)
2. NRL ltr. C-F42-1/84/RCM Serial 700-4212 to BuShips of 11 August 1944 (S482.2 assigned)
3. BuShips ltr. C-S67-1/68 (920-Ag) C920-6861 to NRL of 18 October 1944 (req. inf. as to max, practical performance.)
4. BuShips ltr. C-S67-1/68 (920-Ag) C-920-6705 to NRL (tentative perf. specs.)
5. NRL ltr. C-F42-1/84 RCM (321) Serial No. C-320-950
6. Performance Specs. L.F. unit of Model TEA
7. NRL report No. R-2330
8. NRL ltr. C-S67/5 - RCM (365-2) Serial No. C-360-25/45 to BuShips of 28 February 1945.

[redacted]

PART 1 — APPENDIX A

Power Output Tests: Maximum cw and Normal modulated outputs.

COIL 1

Freq. Mc.	Mod. Gen.	Mod.	Ig ma	Ip ma	Ep Kv	Po K Watts	Out. Ind.	Ant. Coup.	% CW Po	RF Wave Shape Es.Sq.	Peak Value ok
14.82	35ABP	CW	79	760	3.90	1.90	0.91	162			
		CW	52	540	2.90	1.00	0.68	162	100		
		(F.R.W. Noise)	45	400	3.0	0.65	0.62	162	65		
		L.T.	44	400	3.1	0.70	0.50	162	70	X	
		100c	35	240	3.0	0.50	0.34	162	50	X	
		1 Kc	35	260	3.0	0.50	0.51	162	50	X	
		25 Kc	34	320	3.0	0.45	0.58	162	45	X	
		50 Kc	35	320	3.0	0.45	0.58	162	45	X	
		100 Kc	40	335	3.0	0.50	0.57	162	50		X
		200 Kc	45	430	3.0	0.70	0.60	162	70		X
	35ABQ	1 Kc	40	310	3.0	0.60	0.56	162	60	X	
		1.5 Kc	40	340	3.0	0.60	0.60	162	60	X	
		8 Kc	36	320	3.0	0.53	0.61	162	53	X	
		12 Kc	34	310	3.0	0.46	0.58	162	46	X	
18.2		CW	75	780	3.45	1.90	0.66	162			
22.5		CW	180	720	3.90	2.25	0.25	162			
26.8		CW	200	580	3.00	1.30	0.07	162			

COIL 1 — MODULATION TESTS

Freq. Mc.	Mod. Gen.	Mod.	Ig ma	Ip ma	Ep Kv	Po K Watts	Out. Ind.	Ant. Coup.	% CW Po	RF Wave Shape Es.Sq.	Peak Value ok
18.02		CW	120	530	2.50	1.0	0.58	162	100		
	35ABP	(F.R.W. Noise)	74	340	2.55	0.6	0.48	162	60		
		L.T.	86	360	2.60	0.7	0.40	162	70	X	
		100c	65	230	2.60	0.5	0.29	162	50	X	
		1 Kc	67	250	2.60	0.5	0.44	162	50	X	
		25 Kc	61	270	2.60	0.5	0.51	162	50	X	
		50 Kc	60	270	2.56	0.5	0.51	162	50	X	
		100 Kc	54	260	2.55	0.4	0.48	162	40		X
		200 Kc	60	340	2.55	0.55	0.47	162	55		X
	35ABQ	CW	117	530	2.50	1.00	0.58	162	100		
		1 Kc	80	310	2.60	0.60	0.46	162	60	X	
		1.5 Kc	85	340	2.60	0.70	0.51	162	70	X	
		8 Kc	74	300	2.60	0.60	0.52	162	60	X	
		12 Kc	65	260	2.60	0.50	0.51	162	50	X	

[redacted]

PART 1

Coil #1

Freq. (Mc)	M.G. Unit	Mod.	Ig (ma)	Ip (ma)	Ep Kv	Po K Watts	Po Indi-cator	Ant. Coup.	% CW Po	RF Wave Square	Peak R.F. value ok
22.2	35ABP	CW	120	600	2.0	1.0	0.40	162	100		
		100c	66	270	2.1	0.6	0.20	162	60	X	
		1 Kc	70	290	2.1	0.5	0.28	162	50	X	
		25 Kc	66	300	2.1	0.5	0.25	162	50	X	
		50 Kc	65	300	2.1	0.45	0.20	162	45	X	
		100 Kc	59	280	2.1	0.40	0.16	162	40	X	X
		200 Kc	61	320	2.1	0.45	0.18	162	45		X
	35ABQ	CW	122	610	2.05	1.0	0.28	162	100		
		1 Kc	82	360	2.1	0.65	0.22	162	65	X	
		1.5 Kc	90	395	2.1	0.65	0.24	162	65	X	
		8 Kc	79	340	2.15	0.55	0.25	162	55	X	
		12 Kc	70	300	2.15	0.50	0.23	162	50	X	

Coil #2

Freq. (Mc)	M.G. Unit	Mod.	Ig (ma)	Ip (ma)	Ep Kv	Po K Watts	Po Indi-cator	Ant. Coup.	% CW Po	RF Wave Square	Peak R.F. value ok
22.70		CW	100	810	3.85	1.50	0.20	142.5			
		CW	75	650	3.15	1.00	0.14	142.5	100		
	35ABP	F.B.W. Noise	55	480	3.20	0.65	0.13	142.5	65		
		L.T.	48	460	3.35	0.72	0.12	142.5	72	X	
		100c	45	290	3.25	0.52	0.08	142.5	52	X	
		1 Kc	48	310	3.25	0.50	0.11	142.5	50	X	
		25 Kc	44	360	3.20	0.50	0.13	142.5	30	X	
		50 Kc	45	370	3.20	0.50	0.13	142.5	50	X	
		100 Kc	45	395	3.20	0.50	0.13	142.5	50		X
		200 Kc	55	500	3.15	0.675	0.14	142.5	67.5		X
	35ABQ	CW	76	640	3.15	1.00	0.17	142.5	100		
		1 Kc	55	380	3.25	0.70	0.14	142.5	70	X	
		1.5 Kc	56	420	3.25	0.68	0.16	142.5	68	X	
		8 Kc	50	400	3.25	0.60	0.14	142.5	60	X	
		12 Kc	44	380	3.25	0.47	0.14	142.5	47	X	

[redacted]

PART 1

COIL #2

Freq. Mc.	Mod. Gen.	Mod.	Ig ma	Ip ma	Ep Kv	Po K Watts	Po Indicator	Ant. Coup.	% CW Po	R.F. Wave Square	Peak R.F. Value ok
27.3	35ABP	CW	105	850	3.81	2.0	0.08	144.5			
		CW	69	600	2.75	1.2	0.06	144.5	100		
		Noise	64	570	2.80	0.95	0.06	144.5	79		
		7.5c L.T.	54	440	3.0	0.75	0.05	144.5	62.5	X	
		15c L.T.	52	420	3.0	0.70	0.05	144.5	58.5	X	
		100c	45	270	2.9	0.525	0.04	144.5	43.5	X	
		1 Kc	45	280	2.95	0.500	0.04	144.5	41.5	X	
		25 Kc	40	250	2.90	0.440	0.05	144.5	36.5	X	
		50 Kc	43	350	2.90	0.470	0.05	144.5	39	X	
		100 Kc	45	340	2.90	0.50	0.05	144.5	41.5		X
		200 Kc	51	440	2.85	0.62	0.06	144.5	51.5		X
	35ABC	CW	69	600	2.75	1.0	0.06	144.5	100		
		1 Kc	50	350	2.85	0.60	0.05	144.5	60	X	
		1.5 Kc	50	380	2.81	0.65	0.06	144.5	65	X	
		8 Kc	46	340	2.83	0.55	0.05	144.5	55	X	
		12 Kc	41	310	2.85	0.475	0.05	144.5	47.5	X	
	35ABP	F.B.W. Noise	41	380	2.85	0.550	0.05	144.5	55		

COIL #2

Freq. Mc.	Mod. Gen.	Mod.	Ig ma	Ip ma	Ep Kv	Po K Watts	Po Indicator	Ant. Coup.	% CW Po	R.F. Wave Square	Peak R.F. Value ok
32.4	35ABP	CW	130	880	3.9	2.0	0.12	138.5			
		CW	84	620	2.85	1.05	0.09	138.5	100		
		W.B. Noise	50	380	2.88	0.52	0.07	138.5	49.5		
		100c	50	280	2.90	0.50	0.04	138.5	47.6	X	
		1 Kc	50	290	2.90	0.46	0.05	138.5	43.9	X	
		25 Kc	48	340	2.85	0.50	0.05	138.5	47.6	X	
		50 Kc	49	360	2.90	0.50	0.05	138.5	47.6	X	
		100 Kc	45	345	2.90	0.50	0.05	138.5	47.6		X
		200 Kc	52	400	2.85	0.58	0.05	138.5	55.3		X
	35ABC	CW	89	635	2.85	1.10	0.09	138.5	100		
		1 Kc	60	380	2.95	0.60	0.07	138.5	54.5	X	
		1.5 Kc	64	410	2.95	0.70	0.075	138.5	63.5	X	
		8 Kc	64	360	2.95	0.60	0.07	138.5	54.5	X	
		12 Kc	50	320	2.95	0.50	0.06	138.5	45.5	X	

[redacted]

PART 1

COIL #2

Freq. Mc.	Mod. Gen.	Mod.	Ig ma	Ip ma	Ep Kv	Po K Watts	Po Indi-cator	Ant. Coup.	% CW Po	R.F. Wave Square	Peak R.F. Value ok
41.4	35ABP	CW	190	860	3.20	1.90	0.10	147			
		CW	131	650	2.4	1.05	0.08	147			
		Wide Noise	70	380	2.5	0.55	0.08	147			
		7.5c L.T.	91	440	2.55	0.70	0.06	147			
		15c L.T.	91	440	2.55	0.70	0.06	147			
		CW	129	640	2.35	1.0	0.075	147	100		
		1 Kc	70	300	2.45	0.50	0.06	147	50	X	
		25 Kc	65	320	2.45	0.50	0.06	147	50	X	
		50 Kc	65	340	2.45	0.50	0.06	147	50	X	
		100 Kc	55	320	2.45	0.45	0.06	147	45		X
		200 Kc	45	280	2.50	0.40	0.06	147	40		X
	35ABC	CW	130	640	2.35	1.0	0.07	147	100		
		1 Kc	85	370	2.45	0.68	0.06	147	68	X	
		1.5 Kc	90	410	2.45	0.65	0.07	147	65	X	
		8 Kc	79	355	2.45	0.60	0.07	147	60	X	
		12 Kc	70	320	2.50	0.55	0.07	147	55	X	

COIL #3

Freq. Mc.	Mod. Gen.	Mod.	Ig ma	Ip ma	Ep Kv	Po K Watts	Po Indi-cator	Ant. Coup.	% CW Po	R.F. Wave Square	Peak R.F. Value ok
38.6		CW	80	730	3.42	0.66	0.06	125			
41.3		CW	115	860	3.85	1.60	0.04	136.5			
		CW	85	680	3.05	1.00	Not	136.5	100		
		Wide Noise	50	440	3.16	0.50	Oper-ating	136.5	50		
		CW	89	680	3.05	1.00	"	136.5	100		
		15c L.T.	40	470	3.22	0.70	"	136.5	70		
		7.5c L.T.	40	480	3.25	0.70	"	136.5	70		
		100c	50	320	3.20	0.50	"	136.5	50	X	
		1 Kc	45	270	3.20	0.40	"	136.5	40	X	
		25 Kc	43	400	3.15	0.40	"	136.5	40	X	
		50 Kc	45	405	3.12	0.40	"	136.5	40	X	
		100 Kc	42	380	3.12	0.40	"	136.5	40		X
		200 Kc	49	450	3.10	0.50	"	136.5	50		X
	35ABC	CW	89	680	3.10	1.0	"	136.5	100		
		1 Kc	59	400	3.16	0.6	"	136.5	60	X	
		1.5 Kc	59	440	3.15	0.6	"	136.5	60	X	
		8 Kc	54	680	3.2	0.55	"	136.5	55	X	
		12 Kc	45	360	3.2	0.57	"	136.5	57	X	

[redacted]

PART 1 [redacted]

Freq. Mc.	Mod. Gen.	Mod.	Ig ma	Ip ma	Ep Kv	Po K Watts	Po Ind.	Ant. Coup.	% CW Po	R.F. Wave Square	Peak R.F. Value ok
45.0	35ABP	CW	163	840	3.85	1.60		143.5			
		CW	118	650	3.0	1.00		143.5	100		
		100c	67	310	3.12	0.50		143.5	50	X	
		1 Kc	61	270	3.15	0.40		143.5	40	X	
		25 Kc	60	390	3.10	0.45		143.5	45	X	
		50 Kc	60	395	3.10	0.50		143.5	50	X	
		100 Kc	53	360	3.10	0.46		143.5	46		X
		200 Kc	53	400	3.10	0.48		143.5	48		X
	35ABQ	CW	118	660	3.0	1.00		143.5	100		
		1 Kc	75	380	3.1	0.62		143.5	62	X	
		1.5 Kc	81	400	3.1	0.64		143.5	64	X	
		8 Kc	62	320	3.12	0.50		143.5	50	X	
		12 Kc	55	300	3.15	0.40		143.5	40	X	
49.3		CW	197	900	3.25	1.61		147.5			
		CW	143	710	2.60	1.00		147.5	100		
		100c	79	330	2.75	0.48		147.5	48	X	
		1 Kc	79	340	2.75	0.50		147.5	50	X	
		25 Kc	67	400	2.75	0.46		147.5	46	X	
		50 Kc	59	415	2.70	0.41		147.5	41	X	
		100 Kc	43	260	2.72	0.30		147.5	30		X
		200 Kc	35	310	2.75	0.26		147.5	26		X
		CW	145	700	2.60	1.00		147.5	100		
		1 Kc	94	410	2.70	0.60		147.5	60	X	
		1.5 Kc	100	450	2.70	0.70		147.5	70	X	
		8 Kc	84	400	2.70	0.52		147.5	52	X	
		12 Kc	73	360	2.75	0.47		147.5	47	X	

[redacted]

PART 1

COIL #3

Freq, Mc.	Mod. Gen.	Mod.	Ig ma	Ip ma	Ep Kv	Po K Watts	Po Ind.	Ant. Coup.	% CW Po	R.F. Wave Square	Peak R.F. Value ok
52	35ABP	CW	200	870	2.65	1.00		151.5	100		
		Wide Noise	92	560	2.75	0.46		151.5	46		
		100c	98	490	2.85	0.50		151.5	50	X	
		1 Kc	103	410	2.85	0.51		151.5	51	X	
		25 Kc	90	500	2.80	0.49		151.5	49	X	
		50 Kc	76	540	2.80	0.40		151.5	40	X	
		100 Kc	61	470	2.80	0.35		141.5	35		X
		200 Kc	56	410	2.80	0.40		151.5	40		X
		L.T.	(V-203 going bad - replaced)								
	35ABQ	CW	185	820	2.5	0.82		151.5	100		
		1 Kc	117	480	2.65	0.54		151.5	66	X	
		1.5 Kc	122	520	2.62	0.60		151.5	73	X	
		8 Kc	103	460	2.62	0.50		151.5	61	X	
		12 Kc	101	460	2.65	0.50		151.5	61	X	
		L.T.	120	540	2.75	0.60		151.5	73	X	
54	35.ABP	CW	205	880	2.40	0.72		151			
		Wide Noise	100	590	2.50	0.30		151			
		L.T.	130	580	2.70	0.40		151			
		CW	207	880	2.45	0.55		151	100		
		100c	110	400	2.65	0.30		151	54.5	X	
		1 Kc	85	320	2.65	0.20		151	36.4	X	
		8 Kc	106	470	2.60	0.30		151	54.5	X	
		25 Kc	80	500	2.60	0.26		151	47.3	X	
		50 Kc	75	550	2.56	0.24		151	43.7		X
		100 Kc	erratic			0.32					
		200 Kc	erratic			0.50					

[redacted]

PART 2

COIL #1

MAXIMUM POWER OUTPUT WITH MODULATION

Freq. Mc.	Mod. Unit	Type Mod.	Tone Freq	Ig. ma.	Ip ma	Ant. Coup.	Ep Kv	Po K Watts
14.73	35ABQ	Tone	1.0 Kc	60	530	179	4.0	1.100
			1.5 Kc	75	580	179	4.0	1.300
			8 Kc	55	540	179	4.0	1.000
			12 Kc	49	500	179	4.0	0.800
	35ABP	Noise	Full B.	105	810	171	3.9	1.100
			Min. B.	60	570	178.5	4.0	1.000
18.33	35ABQ	Tone	1.0 Kc	80	500	178	4.0	1.350
			1.5 Kc	85	560	178	4.0	1.500
			8 Kc	75	500	178	4.0	1.250
			12 Kc	65	450	178	4.0	1.050
	35ABP	Noise	Full B.	74	560	178	4.0	1.250
			Min. B.	75	510	178	4.0	1.250
22.16	35ABQ	Tone	1.0 Kc.	165	580	178	4.0	1.750
			1.5 Kc	170	550	178	4.0	1.760
			8 Kc	155	600	178	4.0	1.900
			12 Kc	160	600	178	4.0	1.900
	35ABP	Noise	Full B.	170	600	178	4.0	1.850
			Min. B.	172	550	178	4.0	1.750
25.8	35ABQ	Tone	1.0 Kc	115	760	175.5	3.9	1.820
			1.5 Kc	125	860	175.5	3.9	2.050
			8.0 Kc	100	650	175.5	3.9	1.570
			12 Kc	97	620	175.5	4.0	1.510
	35ABP	Noise	Full B.	105	730	175.5	4.0	1.700
			Min. B.	85	580	175.5	4.0	1.450

COIL # 2

Freq. Mc.	Mod. Unit	Type Mod.	Tone Freq	Ig. ma.	Ip ma	Ant. Coup.	Ep Kv	Po K Watts
22.76	35ABQ	Tone	1.0 Kc	50	620	171	4.0	1.300
			1.5 Kc	64	620	169	3.95	1.350
			8 Kc	55	580	169	3.95	1.150
			12 Kc	49	540	169	3.95	0.900
	35ABP	Noise	Full B.	58	660	169	3.95	1.100
			Min. B.	56	620	169	3.95	1.050
29.80	35ABQ	Tone	1 Kc	70	680	172	3.90	1.450
			1.5 Kc	71	720	172	3.90	1.550
			8 Kc	61	640	172	3.90	1.350
			12 Kc	55	570	172	3.90	1.200
	35ABP	Noise	Full B.	65	760	172	3.90	1.350
			Min.B.	65	670	172	3.90	1.300
36.0	35ABQ	Tone	1 Kc	80	800	174.5	3.9	1.850
			1.5 Kc	90	850	174.5	3.9	2.050
			8 Kc	75	770	174.5	3.9	1.700
			12 Kc	65	680	174.5	3.95	1.550
	35ABP	Noise	Full B.	80	830	173.5	3.95	1.750
			Min. B.	89	740	173.5	3.95	1.800
43.05	35ABQ	Tone	1 Kc	200	670	177	3.4	1.200
			1.5 Kc	204	680	177	3.4	1.250
			8 Kc	195	660	177	3.4	1.200
			12 Kc	200	690	177	3.5	1.350
	35ABP	Noise	Full B.	200	670	177	3.4	1.100
			Min. B.	200	670	177	3.4	1.100

[redacted]

[redacted]

DECLASSIFIED

PART 2 [redacted]

Freq. Mc.	Mod. Unit	Type Mod.	Tone Freq.	Ig ma	Ip ma	Ant. Comp.	Ep Kv	Po Kw
41.04	35ABQ	Tone	1 Kc	30	700	180	4.0	1.000
			1.5 Kc	30	700	180	3.7	0.900
			8 Kc	25	700	180	4.0	0.700
			12 Kc	20	660	180	4.0	0.550
	35ABP	Noise	Full B.	45	700	174	4.0	0.820
			Min. B.	40	530	174	4.0	0.770
45.40	35ABQ	Tone	1 Kc	50	780	179	4.0	1.000
			1.5 Kc	69	780	176.5	4.0	1.000
			8 Kc	50	770	178.5	4.0	0.850
			12 Kc	40	700	178.5	4.0	0.750
	35ABP	Noise	Full B	65	780	175	4.0	0.950
			Min.B.	65	640	175	4.0	0.900
49.5	35ABQ	Tone	1 Kc	125	810	172	4.0	0.750
			1.5 Kc	135	870	172	4.0	0.720
			8 Kc	111	760	172	4.0	0.700
			12 Kc	95	670	172	4.0	0.530
	35ABP	Noise	Full B.	200	800	160	3.5	0.560
			Min. B	185	760	160	3.5	0.460
55.2	35ABQ	Tone	1 Kc	151	780	177	2.6	0.750
			1.5 Kc	150	760	177	2.65	0.600
			8 Kc	140	790	174.5	2.40	0.650
			12 Kc	95	800	177.5	2.60	0.500
	35ABP	Noise	Full B.	200	680	171.5	2.0	0.420
			Min.B.	200	680	171.5	2.0	0.350

[redacted]

PART 3

COIL #1

MODULATED POWER OUTPUT - POWER OSCILLATOR ADJUSTED FOR MAXIMUM CW OUTPUT

Freq. Mc.	Mod. Unit	Type Mod.	Tone Freq.	Ig ma	Ip ma	Ant. Coup.	Ep Kv	Po K Watts
14.63	35ABQ	Tone	CW	120	820	170.5	3.9	1.950
			L.T.	90	600	170.5	4.2	1.500
			1 Kc	75	480	170.5	4.0	1.300
			1.5 Kc	80	520	170.5	4.0	1.350
			8 Kc	77	480	170.5	4.0	1.100
			12 Kc	58	450	170.5	4.0	.950
	35ABP	Noise	Full B.	70	560	170.5	4.0	1.200
			Min. B.	75	510	170.5	4.0	1.200
18.25	35ABQ	Tone	CW	135	780	177	3.9	2.050
			L.T.	100	530	177	4.3	1.400
			1 Kc	80	420	177	4.0	1.250
			1.5 Kc	90	480	177	4.0	1.300
			8 Kc	80	450	177	4.0	1.200
			12 Kc	70	400	177	4.0	1.000
	35ABP	Noise	Full B.	80	530	177	4.0	1.250
			Min. B.	90	480	177	4.0	1.250
22.58	35ABQ	Tone	CW	200	570	179	3.7	1.600
			L.T.	145	400	179	3.9	1.100
			1 Kc	120	320	179	3.8	.950
			1.5 Kc	132	350	179	3.8	1.000
			8 Kc	95	270	179	3.8	.700
			12 Kc	100	300	179	4.0	.800
	35ABP	Noise	Full B.	156	520	179	4.0	.550
			Min. B.	92	460	179	4.0	.400
25.88	35ABQ	Tone	CW	200	860	173.5	3.15	1.550
			L.T.	140	560	173.5	3.50	.850
			1 Kc	135	510	173.5	3.3	.850
			1.5 Kc	142	540	173.5	3.3	.970
			8 Kc	120	460	173.5	3.3	.800
			12 Kc	109	400	173.5	3.3	.700
	35ABP	Noise	Full B.	200	880	173.5	3.85	1.500
			Min. B.	180	840	173.5	3.85	1.550

[redacted]

PART 3 COIL #2

Freq. Mc	Mod. Unit	Type Mod.	Tone Freq.	Ig ma	Ip ma	Ant. Coup.	Ep Kv	Po K Watts
22.74	35ABQ	Tone	CW	100	700	165.5	3.8	2.120
			L.T.	73	480	165.5	4.1	1.770
			1 Kc	61	390	165.5	3.9	1.650
			1.5 Kc	69	440	165.5	3.9	1.750
			8 Kc	59	440	165.5	3.9	1.650
			12 Kc	50	400	165.5	3.9	1.560
	35ABP	Noise	Full B.	70	570	165.5	3.9	1.850
			Min. B.	65	470	16515	4.0	1.750
28.58	35ABQ	Tone	CW	109	850	166.5	3.85	1.760
			L.T.	75	460	166.5	4.2	1.140
			1 Kc	66	460	166.5	4.0	1.050
			1.5 Kc	80	560	166.5	4.0	1.200
			8 Kc	50	350	166.5	4.0	.700
			12 Kc	55	430	166.5	4.0	.850
	35ABP	Noise	Full B.	72	610	166.5	3.9	1.160
			Min. B.	60	460	166.5	4.0	.970
36.62	35ABQ	Tone	CW	150	900	174	3.8	2.250
			L.T.	109	630	174	3.8	1.350
			1 Kc	103	550	174	3.8	1.400
			1.5 Kc	109	600	174	4.0	1.520
			8 Kc	95	530	174	4.0	1.400
			12 Kc	80	470	174	4.0	1.200
	35ABP	Noise	Full B.	90	600	174	4.0	1.320
			Min B.	105	600	174	4.0	1.500
43.32	35ABQ	Tone	CW	200	670	179	3.15	1.200
			L.T.	145	500	179	3.3	.850
			1 Kc	125	400	179	3.2	.700
			1.5 Kc	140	440	179	3.23	.830
			8 Kc	112	370	179	3.25	.700
			12 Kc	105	350	179	3.25	.620
	35ABP	Noise	Full B.	200	710	179	3.6	1.520
			Min. B.	190	710	179	3.65	1.500

[redacted]

PART 3

COIL #3

Freq. Mc	Mod. Unit	Type Mod.	Tone Freq.	Ig ma	Ip ma	Ant. Coup.	Ep kv	Po K Watts
39.54	35ABQ	Tone	CW	100	710	162	4.0	1.200
			L.T.	76	530	162	4.1	0.910
			1 Kc	65	410	162	4.0	0.600
			1.5 Kc	80	450	162	4.0	0.700
			8 Kc	60	410	162	4.0	0.550
			12 Kc	50	380	162	4.0	0.470
	35ABP	Noise	Full B.	70	520	162	4.0	0.650
			Min. B.	60	430	162	4.0	0.550
45.52	35ABQ	Tone	CW	130	820	173	3.9	1.450
			L.T.	85	520	173	3.5	0.800
			1 Kc	86	480	173	4.0	0.900
			1.5 Kc	95	540	173	4.0	1.000
			8 Kc	80	490	173	4.0	0.800
			12 Kc	70	450	173	4.0	0.700
	35ABP	Noise	Full B.	75	560	173	4.0	0.900
			Min. B.	85	520	173	4.0	0.730
49.44	35ABQ	Tone	CW	184	880	173	3.5	1.290
			L.T.	124	580	173	3.3	0.700
			1.0 Kc	120	530	173	3.65	0.720
			1.5 Kc	129	580	173	3.65	0.800
			8 Kc	109	510	173	3.65	0.700
			12 Kc	94	460	173	3.7	0.640
	35ABP	Noise	Full B.	125	720	173	4.0	1.000
			Min. B.	119	600	173	4.0	0.900
55.46	35ABQ	Tone	CW	180	900	176	2.15	1.000
			L.T.	120	600	176	2.65	0.600
			1 Kc	121	590	176	2.35	0.650
			1.5 Kc	125	610	176	2.35	0.700
			8 Kc	107	550	176	2.40	0.600
			12 Kc	92	490	176	2.40	0.525
	35ABP	Noise	Full B.	36	610	176	2.40	0.150
			Min. B.	55	470	176	2.40	0.300

[redacted]

PART 4

[redacted]

VARIATIONS IN AMBIENT TEMPERATURE

(a) Carrier frequency drift with varying ambient temperature.

Temp. °C.	Freq. Mc.	% change
0	48.186	0
25	48.165	0.0434
50	48.126	0.124
60	48.117	0.147

(b) Tone generator (35A[illegible]) drift with varying ambient temperature.

0	1136 c.p.s.	0
25	1041	8.36
50	979	13.80
60	973	14.40

(c) Fixed frequency tone generator (35A[illegible]) drift with varying ambient temperature.

Temp. °C.	R.H.	Freq. Cycles	% change
31	36	999	
		1409	
		8064	
		12256	
0		1002	0.00
		1494	0.00
		8104	0.00
		12294	0.00
+ 60	18	995.5	- 0.65
		1403	- 0.75
		8008	- 1.20
		11988	- 2.52
+ 30	23	999	- 0.30
		1409	- 0.35
		8068	- 0.45
		12174	- 1.13
0		1001	- 0.10
		1494	0
		8104	0
		12300	+ 0.06

[redacted]

PART 5 [redacted]

(a) R.F. Stability under varying relative humidity.

Temp °C.	Relative Humidity %	Stable RF Mc.	Po Watts	Drift %	Freq.Changes during Stab.
+ 40	33	48.425	1250	0	17 Kc/90 Min.
+ 40	96	48.420	1400	0.0103	9 Kc/45 Min.
+ 40	33	48.435	1300	0.0206	6 Kc/15 Min.

(b) Tone Frequency Stability in 35ABP modulation generator.

Rel. Humidity %	Tone Freq. Cycles	Change %
33	977.5	0
96	960.0	1.78
33	980.0	0.26

(c) Tone Frequency Stability of 35ABQ modulation generator.

Rel. Humidity %	Tone Freq. Cycles	Change %
26-30	998	0
	1487	0
	8032 to 8055	
	12062 to 12126	
97	997.5	0.10
	1486.5	0
	8012	0.25 to 0.53
	12027	0.29 to 0.82
30	998	0
	1487.5	0
	8034-8052	0
	12057	0

(Test repeated with different tubes)

Rel. Humidity %	Tone Freq. Cycles	Change %
29	998.5	0
	1487	0
	8028	0
	12048-12054	0
95	997.5	0.10
	1487	0
	8006	0.25
	12001.5	0.39 to 0.44
29	998	0
	1487.5	0
	8028	0
	12048-12054	0

[redacted]

[redacted]

LINE VOLTAGE CHANGE

(a) CAOW - 35ABQ Tone Generator.

Line Voltage (Volts)	Frequency (Cycles)	% Frequency Change
115	1000	0
103.5	1000	0
126.5	1000.5	0.05
115	1500	0
103.5	1500	0
126.5	1500	0
115	8000	0
103.5	8002	0.025
126.5	8001	0.0125
115	12000	0
103.5	12000	0
126.5	12004.5	0.0375

(b) CAOW - 35ABP Modulation Generator.

Freq. @ E = 115v (Cycles)	Drift @ 120.5v %	Drift @ 126.5 v %	Drift @ 104.5 v %
97	- 1.550	- 1.550	- 2.060
497	0.0	- 0.200	- 0.200
975	- 0.109	- 0.050	+ 0.308
4954	- 0.071	- 0.121	+ 0.121
7862	- 0.382	- 0.178	+ 0.178
15108	+ 0.112	+ 0.159	- 0.178
40344	+ 0.020	+ 0.056	- 0.550
59136	0.0	+ 0.041	+ 0.405
97840	+ 0.348	+ 0.654	- 0.756
148750	- 0.309	+ 0.067	+ 1.850
220176	+ 0.520	- 0.776	- 1.730

[redacted]

PART 7

APPENDIX A

CALIBRATION ACCURACY OF TONE GENERATOR

Freq. Accdg. to Calibration (Cycles	Measured Frequency (Cycles)	Variation from Calibrated Freq. (%)
100	97	- 3.00
500	498	- 0.40 ± 0.1
1000	974	- 0.60 ± 0.1
5000	4941	- 1.18 ± 0.02
8000	7834	- 2.08 ± 0.025
15000	15102	+ 0.68 ± 0.02
40000	40140	+ 0.35 ± 0.02
60000	59172	- 1.38 ± 0.02
100000	98580	- 1.42 ± 0.02
150000	146340	- 2.44 ± 0.02
220000	214280	- 2.60 ± 0.02

PART 8

APPENDIX A

RESET OF TONE GENERATOR FREQUENCY

Orig. Setting Tone Freq. (cycles)	Dial Setting	Clockwise Resetting Freq.	Clockwise Resetting % Error	C. Clockwise Resetting Freq.(Cycles)	C. Clockwise Resetting % Error
100	76.4	99	1.0	99.5	0.5
500	36.4	508	1.6	502	0.4
1000	78.1	917	8.3	920	8.0
5000	34.9	4952	1.0	4948	1.0
8000	6.0	8008	0.1	7982	0.2
15000	58.0	15185	1.2	14870	0.9
40000	35.0	40800	2.0	39830	0.4

[redacted]

MODULATION FREQUENCY SHIFT WITH RF POWER CHANGE

R.F. Power (Watts)	Mod. Gen. Type	Tone Freq. (Kc)	% Drift
1300	35 ABP	CW	
0		0.097	
340		0.097	0
700		0.097	0
0		0.4985	
400		0.5005	0.41
740		0.503	0.93
0		0.980	
400		0.987	0.72
700		0.992	1.22
0		4.939	
400		4.956	0.34
700		4.968	0.59
0		7.958	
380		7.962	0.05
700		7.968	0.13
0		15.190	
300		15.315	0.82
600		15.405	1.42
0		51.200	
250		51.210	0.02
530		51.238	0.07
0		75.300	
200		75.150	0.20
450		75.000	0.40
0		100.000	
		99.966	0.03
		99.876	0.12
0	35 ABQ	0.999	
395		0.999	0
760		0.999	0
0		1.491	
390		1.490	0
760		1.491	0
0		8.083	
350		8.099	0.20
650		8.109	0.32
0		12.2235	
320		12.228	0.04
600		12.2295	0.05

[redacted]

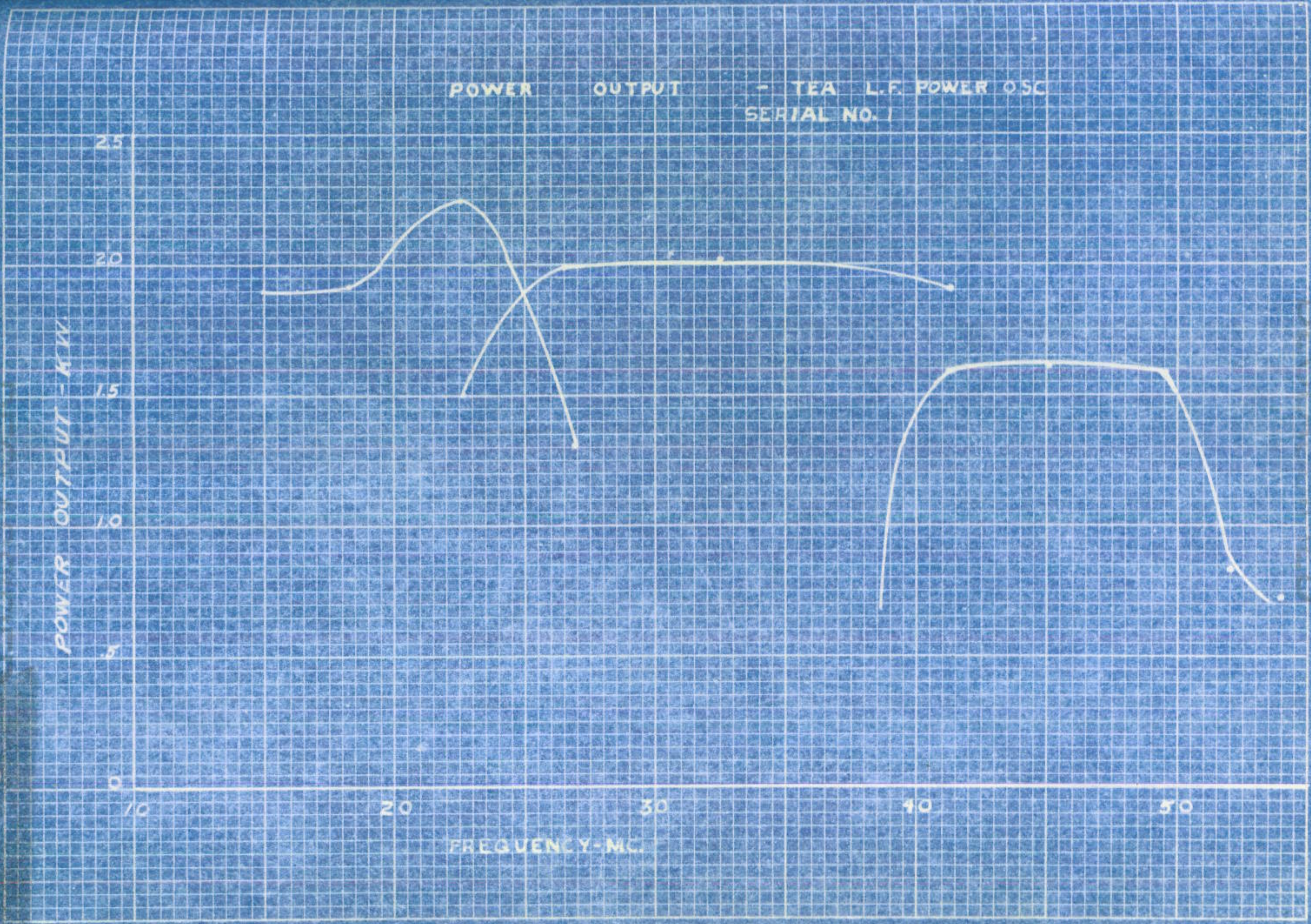

POWER OUTPUT - TEA L.F. POWER OSC
SERIAL NO. 1
POWER OUTPUT - KW.
2.5
2.0
1.5
1.0
.5
0
10
20
30
40
50
FREQUENCY-MC.

PLATE I

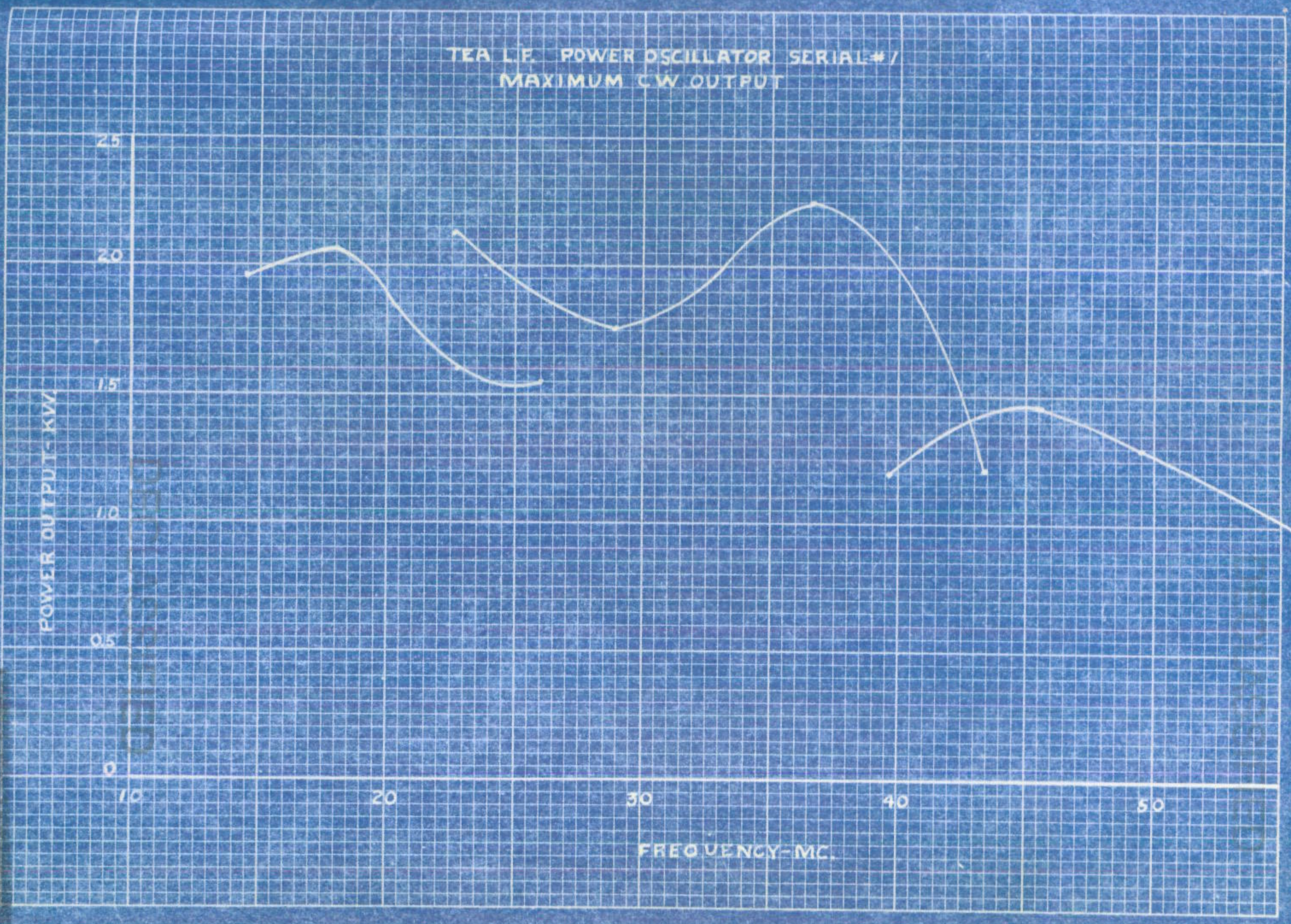


PLATE 2

DECLASSIFIED

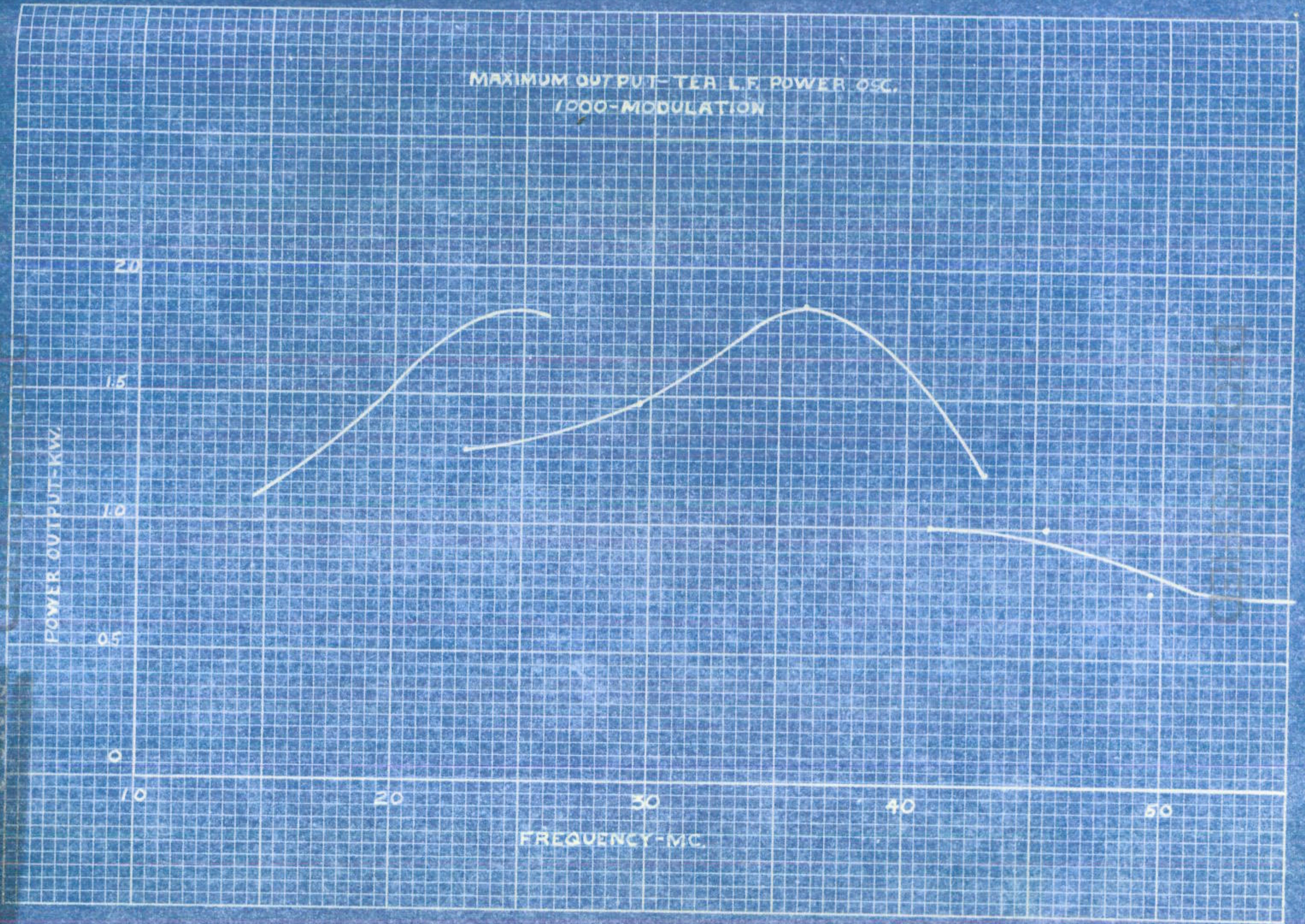
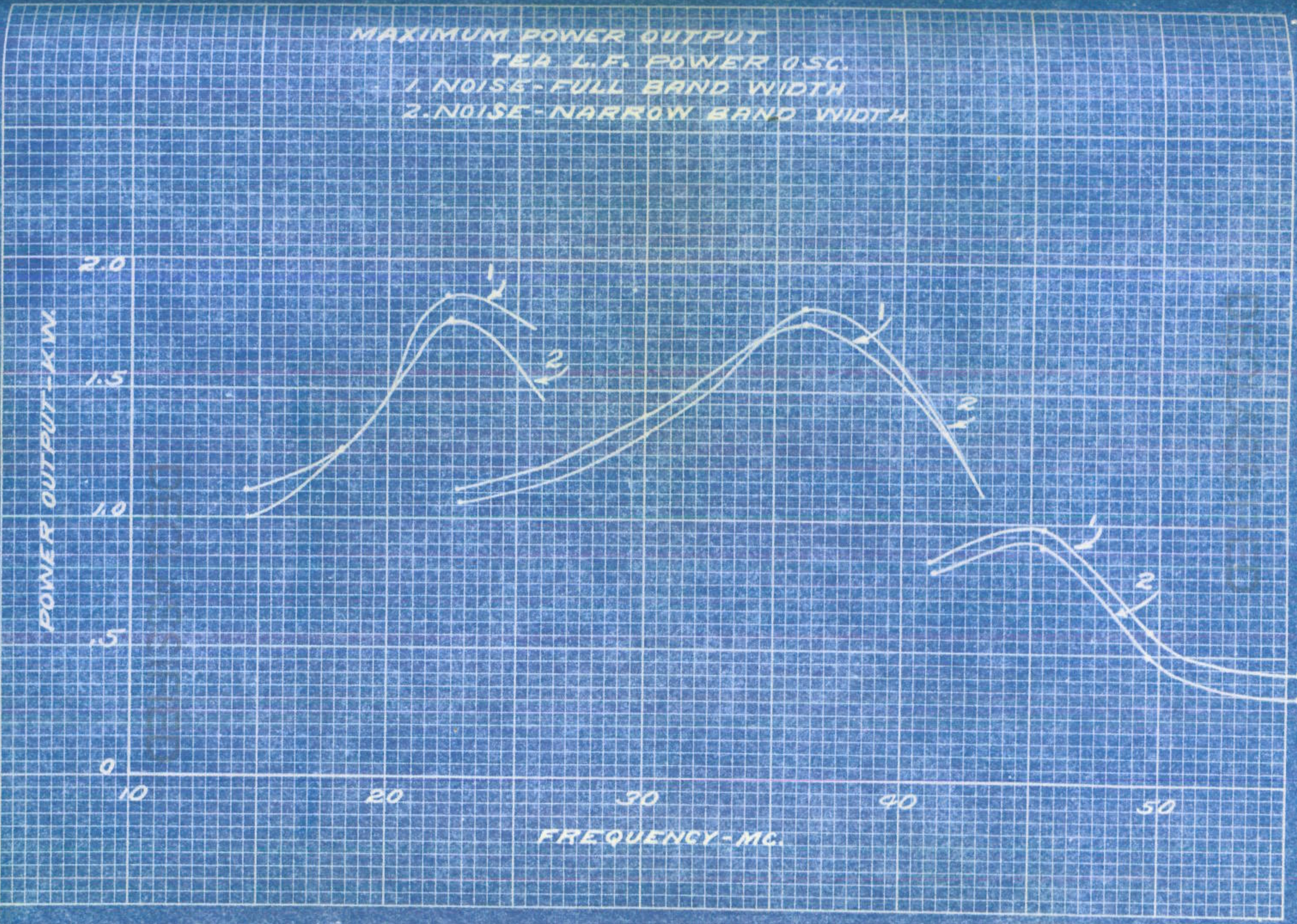

MAXIMUM OUTPUT-TEA L.F. POWER OSC.
1000-MODULATION
POWER OUTPUT-KW.
2.0
1.5
1.0
0.5
0
10
20
30
40
50
FREQUENCY-MC.

PLATE 3



MAXIMUM POWER OUTPUT
TEA L.F. POWER OSC.
1. NOISE-FULL BAND WIDTH
2. NOISE-NARROW BAND WIDTH
POWER OUTPUT-K.W.
2.0
1.5
1.0
.5
0
10
20
30
40
50
FREQUENCY-MC.
1
2

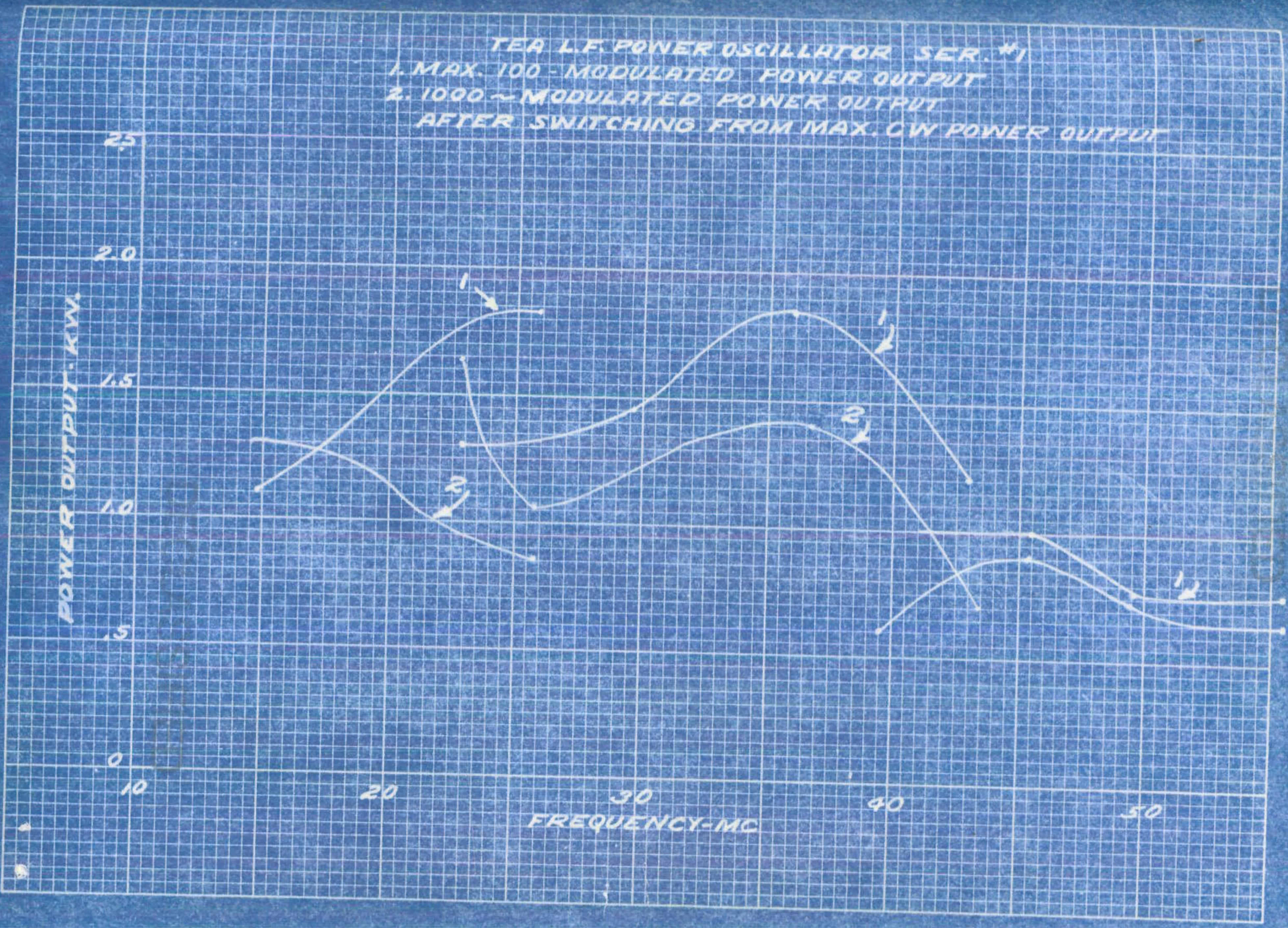

TEA L.F. POWER OSCILLATOR SER. #1
1. MAX. 100 - MODULATED POWER OUTPUT
2. 1000 ~ MODULATED POWER OUTPUT
AFTER SWITCHING FROM MAX. CW POWER OUTPUT
POWER OUTPUT - K.W.
2.5
2.0
1.5
1.0
.5
0
10
20
30
40
50
FREQUENCY - MC
1
2

PLATE 5