[redacted]

RL-51

DECLASSIFIED

REPORT NO. R-1960

DATE 26 November 1942

FR-1960

SUBJECT

Classification changed from CONFIDENTIAL
To UNCLASSIFIED
By authority of Class. Info. Bulletin No 1.
File No. Dated

Report on

Test of Model TBK-12 Radio Transmitting Equipment

MASTER FILE COPY

NOT ISSUED

DECLASSIFIED by NRL Contractor
Declassification Team
Date: 11 Jun 2014
Reviewer's name(s): H. DO, P. HANNA

Declassification authority: NAVY DECLASS MANUAL, 11 DEC 2012, 04 SERIES

NAVAL RESEARCH LABORATORY

BELLEVUE, D. C.

DISTRIBUTION STATEMENT A APPLIES
Further distribution authorized by
UNLIMITED only.

U. S. GOVERNMENT PRINTING OFFICE 16—21900

DECLASSIFIED

N. R. L. 66

REPLY IN DUPLICATE AND REFERENCE TO C-S67/52(380-CBD) WILL BE APPRECIATED

CONFIDENTIAL

CONFIDENTIAL

NAVAL RESEARCH LABORATORY

ANACOSTIA STATION

WASHINGTON, D. C.

sdt

DEC 8 1942

From: Naval Research Laboratory.
To: Bureau of Ships.

Subject: Radio - Test of Model TBK-12 Transmitting Equipment - RCA Manufacturing Co., Camden, N.J., Contractor - BuShips Problem T-49C.

Reference: (a) BuShips ltr C-NOs-80750(480-H) of August 3, 1942 to NRL.
(b) NRL Report No. R-1567.
(c) NRL Report No. R-1960.

Enclosure: (A) Ten copies of NRL Report No. 1960.
(hw)

1. In accordance with reference (a), the production Model TBK-12 Transmitting Equipment, Serial No. 76, was subjected to tests at the Naval Research Laboratory. Tests were conducted to determine operating characteristics and to obtain data on changes necessary to enable the equipment to comply with the requirements set forth by the basic specifications. In general, tests followed the procedure outlined in specification RE 13A 442G as amended by the Contract Notes. However, since Section V of RE 13A 442G has been largely superseded by RE 13A 592C, the latter specification was followed in investigating control circuits. The results of these investigations are reported in enclosure (A). The following paragraphs contain a comparison of the TBK-12 equipment and the XTBK-8 equipment previously tested at the Laboratory as reported in NRL Report No. R-1567.

2. In general, steps have been taken by the Contractor to correct each of the deficiencies pointed out in NRL Report No. R-1567 on the XTBK-8 transmitting equipment. A comparison of the recommendations made in references (b) and (c) will show that the following defects noted in the XTBK-8 are also present in the TBK-12.

(a) (Recommendation (k) of ref. (b) and recommendation (r) of ref. (c)). The filament voltage cannot be adjusted to normal when the line voltage varies over the limits of plus and minus 10 per cent.

(b) (Recommendation (o) of ref. (b) and recommendation (x) of ref. (c)). A constant temperature in the m-o compartment is not maintained over the required ranges of ambient temperature and humidity.

(c) (Recommendation (p) of ref. (b) and recommendation (x) of ref. (c)). Change of humidity causes a variation in output frequency in excess of specification limitations.

3. The frequency stabilities of the XTBK-8 and the TBK-12 are compared in the following table, abstracted from data contained in the reports on the two equipments. In each case the frequency deviation is expressed as a percentage of the limit set by specification RE 13A 442G. It will be noted that the frequency stability of the TBK-12 is somewhat less than that of the TBK-8 at both 2000 and 4500 kc. The XTBK-8 transmitter exceeded the specified limits a total of two tests while the TBK-12 exceeded the limits in six tests. Frequency deviations listed for the humidity and temperature tests of the TBK-12 may have been increased by the failure of the temperature regulating system to maintain a constant temperature at extremes of temperature and humidity. This matter is discussed in appropriate paragraphs of enclosure (A).

Test	Per Cent Frequency Variation of Specification Allowance			
	2000 Kc		4500 Kc	
	XTBK-8	TBK-12	XTBK-8	TBK-12
Reset (Ave.)	9	21	10	20
(Max.)	11	24	8	22
Backlash (Ave.)	10	7	37	4
(Max.)	8	13	26	5
Adjust-Tune-Operate Switch	50	65	33	58
Detuning of Circuits	38	10	22	13
Power Output Control	50	150	20	24
Change of Tubes (M.O.)	79	47	67	46
(Other)	40	24	24	40
Variation of Line Voltage	33	59	28	37
Variation of Temperature	40	92	60	128
Variation of Humidity	77	130	153	245
Locked Key (5 Min.)	125	25	47	17
(2 Hours)	64	28	27	80
Key Locked to Intermittent (a)	48	24	58	50
(b)	40	20	26	20
Cont. to Intermittently Keyed	50	75	89	35
Inclination	70	125	100	34
Vibration	0	10	12	146
Shock	5	45	13	49
Average	42	49.7	43	53.6

[redacted]

4. The power output obtained from the TBK-12 equipment is compared to that from the XTBK-8 in the tabulation below. In addition, the power-amplifier grid current is shown for each frequency. A 500-watt, 110-volt lamp-load was employed in all measurements. It will be noted that the power output of the TBK-12 transmitter is less than the specified 300 watts at 18000 kilocycles. It was found that this difficulty was caused by insufficient power-amplifier grid drive. As explained in enclosure (A), the Contractor attempted to eliminate the trouble by carefully cleaning all r-f joints in the power-amplifier and intermediate-amplifier stages and by selecting vacuum tubes for each position. Although it was then possible to attain full power-amplifier loading and the power output was increased, the extent of the improvement is not considered sufficient to eliminate low efficiency power-amplifier operation and consequent overload of the type 861 vacuum tube. In addition, the necessity for using selected tubes is very objectionable in the Naval service. It is pointed out that in practice an operator is unable to judge the efficiency of operation and can detect overload of the p-a tube only by observing the plate color. Therefore, it is suggested that the Contractor be requested to take such corrective steps as may be necessary to eliminate the trouble and insure satisfactory operation with any tubes having characteristics as specified by Naval specifications.

	Power Output (Watts)		P-A Ig (Ma)	
Frequency	XTBK-8	TBK-12	XTBK-8	TBK-12
2000	606	560	54	52
3000	600	552	45	46
4000	560	*510	37	*35
5000	558	500	33	33
6000	540	486	34	30
7000	516	470	32	28
8000	500	460	31	27
9000	480	440	28	22
10000	450	432	24	24
12000	446	400	27	19
14000	400	360	24	16
16000	350	330	22	14
18000	300	240	18	8

* 4500 Kc.

[redacted]

5. Other factors which could be compared are shown in the following table. It is pointed out that carrier and generator ripples are less in the TBK-12 than in the XTBK-8, all values for the TBK-12 being within the limits specified for these tests.

Test		XTBK-8	TBK-12
Carrier Ripple - 2000 Kc (%)		0.2	0.033
- 4500 Kc (%)		0.54	0.13
- 18100 Kc (%)		0.9	0.54
M-O Dial Overlap - min. (%)		3.2	3.73
Var. of Freq. per Division (M.O.)	min. (%)	0.0003	0.0007
	max. (%)	0.0057	0.0042
R-F Voltage Available for Calibration,	min. (mv)	61.	36.
	max. (mv)	100+.....	69.
Generator Regulation (Main Plate)	(%)	1.15	0.
(Mid-tap)	(%)	0.98	0.
(Aux. Plate)	(%)	2.8	1.15
(Bias)	(%)	0.	2.17
Generator Ripple (Main Plate)	(%)	0.53	0.17
(Mid-tap)	(%)	0.48	0.24
(Aux. Plate)	(%)	0.3	0.11
(Bias)	(%)	0.48	0.04

6. Attention is invited to the fact that the motor starter was not delivered to the Laboratory with the rest of the equipment for test. If it is the Bureau's intention to permit the equipment to remain at the Laboratory, it is requested that the Bureau take steps to locate the starter and forward it to the Laboratory. The apparatus was received from the Norfolk Navy Yard and it is probable that the starter is in storage at that point.

7. It is pointed out that many of the defects and recommendations included in enclosure (A) have been transmitted to the Bureau of Ships by telephone.

W. B. Goulett

W. B. Goulett,
By direction.

[redacted]

26 November 1942

NRL Report No. R-1960
BuShips Prob. T-49C

[redacted]

NAVY DEPARTMENT

Report on Test of Model TBK-12 Radio Transmitting Equipment

Contractor:
RCA Manufacturing Company

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

Number of Pages: Text - 40 Tables - 46 Plates - 35

Authorization: BuShips ltr C-NOs-80750(480H) of August 3, 1942.

Date of Tests: May 25, 1942 to August 15, 1942.

Tests conducted by:
E. L. Hurd, Contract Employee

T. D. Hobart, Contract Employee

Report prepared by:
C. B. Davis, Radio Engineer

Reviewed by:
R. B. Meyer, Principal Radio Engineer
Chief of Section

A. Hoyt Taylor, Head Physicist
Superintendent, Radio Division

Approved by:
W. B. Gould
By direction

Distribution: BuShips (10)

adt

TABLE OF CONTENTS

	Page
Authorization of Test.	1
Object of Test	1
Abstract of Tests.	1
Conclusions	2a
Recommendations	2b
Material under Test.	3
Method of Test	3
Data Recorded.	4
Results of Tests	5
Specifications RE 13A 442G	
Section I.	5
Section II	5
Section III.	18
Section V.	31
Section VI	33
Section IX	37
Summary of Defects	38

APPENDICES

	Table
Check of Resistors Used in Equipment.	1
Investigation of Fuses.	2
Effect of Failure of Fuses.	3
Calibration and Range of Adjustment of Overload Relays	4
Antenna Short Circuited and Open Circuited.	5
Potentials Applied to Electrodes of Vacuum Tubes - 2000 Kc.	6
Potentials Applied to Electrodes of Vacuum Tubes - 18000 Kc	7
List of Controls and Meters	8
List of Nameplates.	9
Weights and Dimensions.	10
Determination of Power Output	11
Operation into a 90-Foot Vertical Antenna	12
Operation into a 33-Foot Vertical Antenna	13
Measurement of Carrier Ripple	14
Accuracy of Reset to Previously Calibrated Frequencies	15
Test for Lost Motion, Backlash, and Torque Lash . . .	16
Operation of Adjust-Tune-Operate Control.	17
Detuning of Circuits.	18
Operation of Power Output Control	19
Change of Tubes - M.O..	20
Change of Tubes - 1st I.A..	21

(Continued)

	Table
Change of Tubes - 2nd I.A.	22
Change of Tubes - P.A.	23
Variation of Supply Line Voltage	24
Variation in Ambient Temperature - 2000 Kc	25
Variation in Ambient Temperature - 18000 Kc	26
Variation in Humidity - 2000 Kc	27
Variation in Humidity - 18000 Kc	28
Locked Key Test - 2000 Kc	29
Locked Key Test - 4500 Kc	30
Change from Key-Locked to Intermittently-Keyed Condition	31
Change from Continuously-Keyed to Intermittently-Keyed Condition	32
Inclination Test - Front to Back	33
Inclination Test - Side to Side	34
Vibration Test	35
Shock Test	36
Summary of Frequency Stability Tests	37
Determination of Limiting Frequencies to which Transmitter Can Be Tuned	38
Variation of Resonant Frequency of Master Oscillator per Division of Dial Marking	39
Effect of Dial Locks	40
Frequency Range of M-O Calibrator	41
Voltage Regulation of Filament Circuits	42
R-F Voltage Output of Frequency Meter Coupling Circuit	43
Power Required from Supply Line	44
Regulation of Generators	45
Measurement of Generator Ripple	46

	Plate
Oblique View of Transmitter	1
Front View of Transmitter - Doors Closed	2
Front View of Transmitter - Doors Open	3
Front View of Transmitter - M.O. Compartment Removed	4
Oblique View of Transmitter - Shields in Place	5
Rear View of Transmitter - Shields Removed	6
Left Side View of Transmitter	7
Right Side View of Transmitter	8
Sectional View, Top Rear	9
Sectional View, Lower Rear	10
Sectional View, Top Left Side	11
Sectional View, Top Right Side	12
Sectional View, Lower Left Side	13
Sectional View, Lower Left Side	14

(Continued)

	Plate
Sectional View, Lower Right Side.	15
Front View of Oscillator Compartment.	16
Rear View of Oscillator Compartment	17
Left Side of Oscillator Compartment	18
Right Side of Oscillator Compartment, Shields in Place.	19
Right Side of Oscillator Compartment, Shields Removed	20
Interior of Constant Temperature Compartment.	21
Front View of Motor-Generator	22
Rear View of Motor-Generator.	23
Detail View of Transmitter Control, Showing Interlock	24
Variation in Temperature - 2000 Kc.	25
Variation in Temperature - 4500 Kc.	26
Frequency Drift from Cold Start - 4500 Kc	27
Variation in Humidity - 2000 Kc	28
Variation in Humidity - 4500 Kc	29
Inclination, Side to Side - 2000 Kc	30
Inclination, Side to Side - 18000 Kc.	31
Inclination, Front to Back - 2000 Kc.	32
Inclination, Front to Back - 18000 Kc	33
Vibration - 2000 Kc	34
Vibration - 4500 Kc	35

AUTHORIZATION OF TEST.

1. The tests herein reported were originally authorized by reference (a). Other pertinent data are listed as references (b) to (d).

Reference: (a) BuShips ltr C-NOs-80750(480-H) of August 3, 1942.
(b) BuShips specification RE 13A 442G.
(c) Contract Notes applying to Specification RE 13A 442G and Contractor's Informative Descriptive Specification AS-5326A-G.
(d) Contractor's Informative Descriptive Specification AS-5326A-G.

OBJECT OF TESTS.

2. The object of the tests was:

(a) To determine the extent to which the equipment complies with contractual requirements and basic specifications and modifications thereto.

(b) To obtain sufficient data to permit the submission of recommendations regarding desirable changes to increase the suitability of the equipment and for use in revision of basic specifications required in the purchase of additional equipment.

ABSTRACT OF TESTS.

3. The tests herein reported were conducted to determine the degree of compliance of the Model TBK-12 Transmitting Equipment (Serial No. 29) with the mechanical and electrical requirements set forth in the governing contract and specifications.

4. Specifically, tests were conducted to determine the following:

(a) Ability of the equipment to withstand shipment and movement from one location to another.

(b) Check of mechanical and physical construction and assembly, general workmanship, materials employed, corrosion resisting measures used, and the adequacy of electrical circuits to withstand operation under Naval Service conditions.

(c) Power output, power input, overall efficiency, and flexibility of antenna coupling circuits.

[redacted]

(d) Quality of emitted signals, lilt, and undesirable modulation.

(e) Check of dimensions and weights of the various component units.

(f) Determination of frequency overlap, limiting frequencies of various circuits, and cycles per division of the master oscillator controls.

(g) Check of the protective circuits employed in the equipment.

(h) Frequency stability and accuracy under the following conditions:

(1) Accuracy of reset.
(2) Lost motion and backlash.
(3) Operation of adjust-tune-operate control.
(4) Detuning of circuits.
(5) Operation of power output control.
(6) Change of tubes.
(7) Variation of supply line voltage.
(8) Variation in ambient temperature.
(9) Variation in humidity.
(10) Locked key operation for two hours.
(11) Locked key to intermittently keyed.
(12) Continuously keyed to intermittently keyed.
(13) Inclination.
(14) Vibration.
(15) Shock.

5. The operation of the calibration facilities provided were checked and the r-f voltages available for calibration purposes were measured.

6. The operation of the four-wire and six-wire control circuits was investigated to determine their operation under a variety of conditions.

7. The power equipment supplied was tested to determine voltage regulation, voltage ripple, and general performance under various conditions of operation.

[redacted]

CONCLUSIONS

(a) In general, components employed in the Model TBK-12 Equipment are of standard construction and have received Navy Type Approval. However, voltmeter multiplier resistors are of the hermetically sealed sectional type which has caused trouble in service.

(b) The mechanical design and construction of the equipment are good and wiring is in most cases of satisfactory quality. In a few instances ferrous materials have not been adequately protected from corrosion; in others, deficiencies of workmanship and inspection were noticeable. The equipment demonstrated its ability to withstand vibration and severe shock without serious damage. The only breakage or damage occurring during these tests was minor.

(c) The use of a removable master-oscillator unit provides good accessibility to all parts included in the transmitter. A few improvements can still be made, however, particularly in the location of resistors now contained in the oscillator cabinet.

(d) The number of controls in the TBK-12 has been held to the practicable minimum. Controls and meters are well arranged and frequency changes can be accomplished easily and quickly with a minimum of effort.

(e) The output of the transmitter is unsatisfactory at 18000 kilocycles. This difficulty is caused by insufficient grid drive to the power-amplifier stage. Improvements involving better grounding and special selection of tubes were made by the Contractor during the tests. However, the resulting gain is not considered sufficient to insure satisfactory performance in service. The low grid drive results in decreased efficiency and causes overload of the power-amplifier tube. This condition should be corrected in all production equipments.

(f) Frequency variations in excess of those permitted by the specifications were recorded in tests of operation of power output control, variation of ambient temperature, variation of humidity, inclination, and vibration. Difficulties with the operation of the temperature control associated with the oscillator compartment were encountered during humidity and temperature tests.

(g) After suitable corrections, mentioned herein, have been made, the TBK-12 equipment should be capable of meeting the rigorous requirements of the Naval Service.

[redacted]

RECOMMENDATIONS

It is recommended:

(a) That final inspections of production equipments at the factory be made just previous to shipment in order to prevent the release of equipment containing misaligned or damaged components. (Par. 22)

(b) That the necessary remedial action be applied to the items enumerated in paragraph 31.

(c) That all exposed steel in the motor-generator set be adequately protected against corrosion. (Par. 33)

(d) That the use of iron and steel in the transmitter be held to a minimum and that measures be taken to protect the ferrous materials against corrosion where their employment is necessary. (Par. 34)

(e) That separate bleeders be employed for the 1500 and 3000-volt supplies. (Par. 37)

(f) That the inadequate protection afforded the p-a tube when the antenna is shorted or open circuited be considered acceptable, since no satisfactory method of protection has yet been developed. (Par. 43)

(g) That necessary circuit changes be made to insure operation of all vacuum tubes within the limitations set by the specifications. (Par. 44)

(h) That the quality of castings included in the construction be carefully controlled to preclude the possibility of failure under shock; that master starting relay K-101 be modified to improve its resistance to shock; that cabled leads be braced rigidly to prevent movement; that protective bushings be used in the motor generator to prevent damage to insulation; and that the use of solder to provide mechanical strength be avoided. (Par. 47)

(j) That the shaft of resistor R-137 be provided with a slot to facilitate adjustment. (Par. 49)

(k) That care be taken to prevent the protrusion of set screws and taper pins used to secure control knobs. (Par. 52)

(l) That the cover glass of the r-f ammeter be equipped with a hole to permit zero adjustment of the meter. (Par. 54)

(m) That voltmeter multiplier resistors be of the standard Navy hermetically-sealed type. (Par. 55)

(n) That care be taken to employ assembly bolts of the correct lengths. (Par. 59)

(o) That the design of the m-o unit limit catches be improved; that resistors R-103 and R-121 be mounted outside the constant-temperature compartment; and that a more suitable gasket material be used on the m-o cover plate or the durability of the present gasket increased. (Par. 64 and 107)

(p) That symbol numbers be corrected and symbol number tags be affixed adjacent to all components. (Par. 69)

(q) That the method of securing the p-a Lord mounts be changed to facilitate replacement. (Par. 71)

(r) That the range of the filament rheostat be increased to permit readjustment to normal voltage with line voltages 10 per cent lower and higher than normal. (Par. 72)

(s) That thumbscrews and locks be provided with a black-nickel finish unless the Contractor can show that the present dull-finish coating provides equivalent durability. (Par. 76)

(t) That care be taken to omit or remove the protective finish applied to metal parts wherever its presence might prevent proper electrical bonding; and that the Contractor investigate the possibility of employing a conductive finish for protection against corrosion. (Par. 77)

(u) That the grid drive to the power amplifier be increased to prevent overloading the tube and to assure rated output over the entire frequency range. (Par. 86)

(v) That the effect on the output frequency of varying the power output by manipulation of the plate voltage rheostat be reduced to the specified value. (Par. 95)

(w) That the effect of variation in the ambient temperature on the output frequency be reduced. (Par. 98)

(x) That the Contractor determine whether difficulties with the operation of the master-oscillator constant-temperature compartment under high-humidity conditions are present in production equipments; and that the effect of high humidity on the output frequency be reduced to comply with the specifications. (Par. 99 and 107)

[redacted]

(y) That care be taken in the design to avoid the use of interlocks, switches, and relays which may open under conditions which set up strains in the component or its support and thus cause defective operation. (Par. 103)

(z) That the frequency stability with respect to vibration be improved. (Par. 104)

(aa) That the operation of the master-oscillator constant-temperature compartment be improved (Par. 107); that an improved type of protective thermostat be employed (Par. 108)

(bb) That care be taken to adequately protect the lead covering of wires where the wires pass over sharp metal edges. (Par. 131)

(cc) That the transmitter ground post be relocated. (Par. 138)

(dd) That terminals capable of supplying 110 volts, 150 milliamperes to receiver protective relays be provided on the main terminal board. (Par. 163)

(ee) That the Bureau determine whether the dimensions of the motor generator and transmitter, which exceed the specified values, will cause difficulties in contemplated installations. (Par. 128 and 184)

(ff) That connection studs and links be provided in the driving motor connection box. (Par. 192)

(gg) That errors in the instruction book be corrected. (Par. 196).

[redacted]

MATERIAL UNDER TEST.

8. The material under test consisted of one Model TBK-12 Transmitting Equipment, Serial No. 29, which included the following major parts:

1 - Radio Transmitter Unit
Type CRV-52105,
Frequency Range - 2000 to 18100 kc.
440/220-volt, 3-phase, 60-cycle supply.

1 - Motor-Generator Unit
Type CBP-21332A.

9. The Model TBK-12 Transmitting Equipment, Serial No. 76, was originally received at the Naval Research Laboratory on May 25, 1942 from the Norfolk Navy Yard. The magnetic controller, which originally formed a unit of the complete equipment, was not delivered to the Laboratory, and, therefore, was not available for tests. The equipment was manufactured by the R.C.A. Manufacturing Company, Camden, N. J., under contract NOs-80750, and was delivered to the Naval Research Laboratory by motor truck transportation.

10. The following vacuum tubes were provided with the TBK-12 transmitting equipment:

1 - type CRC-38161 tube (Serial no. 287).
3 - type CRC-38160 tubes (Serial nos. 801, 834, and 835).

11. A complete set of spare parts accompanied the equipment.

METHOD OF TEST.

12. The equipment, when received, was examined carefully to determine whether any damage had been incurred during the process of shipment.

13. Power output measurements were made through the use of a photronic cell, a 115-volt, 500-watt lamp being used as a dummy load. Capacity losses in the lamps were minimized by removal of bases. In order to insure maximum accuracy, the lamp and photronic cell were rigidly anchored so that the spacing between them would remain constant throughout the test. The transmitter was adjusted for optimum output and the reading of the microammeter noted after all parts of the system had reached equilibrium, care being exercised at all times to prevent undue heating of the photronic cell. The lamp was then switched from the transmitter to a 60-cycle calibrating

source, and this 60-cycle supply was adjusted to give exactly the same photronic cell response as had been obtained previously from the transmitter. The power required to give this response was measured by means of an accurate wattmeter.

14. Frequency changes and drifts were checked by means of Model LK Frequency Indicators. The transmitter was operated at full power whenever the governing specifications required this method of operation.

15. The transmitting equipment, including motor generator and starter, was placed within the Laboratory test chamber and subjected to variations in ambient temperature between the limits of zero and plus 50°C and variations in relative humidity between the limits of approximately 30% and 95%. Output frequency and power output were kept under constant observation during these tests, and additional data relative to transmitter currents and potentials, m-o cabinet temperatures, and line voltage conditions were also recorded.

16. Frecuency range, overlap and end tolerances were determined by means of a Model LM Frequency Meter. The r-f potentials available for calibrating purposes were determined by means of a Model OF Interference Locator and in conjunction with a standard signal generator. The voltage was measured across a 70-ohm resistor at the end of a 10-foot length of shielded line.

17. Measurements of ripple voltage present in the outputs of the various generators were made by means of a high impedance Ballantine voltmeter.

18. The ability of the equipment to withstand vibration and the roll and pitch of a vessel was determined by mounting the entire equipment on the Laboratory test stand, which is capable of producing the necessary conditions.

19. Shock tests were conducted by imparting a momentary, horizontal acceleration of high value to the supporting platform by means of a pneumatic device.

20. The degree of amplitude modulation present in the cw output was determined through the medium of a suitable rectifier, blocking capacitor, and voltmeter.

DATA RECORDED.

21. Complete data were recorded during all tests conducted, and this information is appended hereto as Tables 1 to 46 and Plates 1 to 35, inclusive.

[redacted]

RESULTS OF TESTS.

22. The Model TBK-12 Equipment, Serial No. 2 , was received at the Naval Research Laboratory on May 25, 1942. The apparatus was carefully examined to determine wh ther any damage had been incurred in transit. It was noted t at the plates of power-amplifier tank capacitor C-146 were ot lined up, although the retaining nut which secures the pla es was tight. Also, the plates of the intermediate-amplifi r tank capacitor were loose and it was necessary to realign the capacitor and tighten the retaining nut before opera ion could be accomplished. It is not considered possibl that the misalignment of capacitor C-146 could be due to andling or treatment during shipment. It is therefore sugge ted that each equipment be rigorously inspected before r leasing the apparatus for shipment from the factory.

23. In the following paragraphs of this repo t, reference is made to the governing specifications RE 13A 442G. Specifications RE 13A 592C are also referred to in connecti n with the investigation of the control circuits employed i the equipment.

Specifications RE 13A 442G, Section I

24. The general construction and design of t e TBK-12 equipment conforms with this introductory section of the governing specifications. The transmitter covers th range from 2000 to 18100 kilocycles and provides cw emissi n throughout the operating range. The succeeding paragraphs f this report discuss in detail the construction and operat ng characteristics of the equipment.

Specifications RE 13A 442G, Section II

25. The components which go to make up the c mplete assembly were examined to the extent possible witho resorting to complete disassembly or destruction of the variou parts.

26. Par. 2-2.

(a) The vacuum tubes employed in the TBK-12 quipment have received Navy type approval. Types 860 and 861 tubes are used.

(b) All resistors used in TBK-12 equipment a e listed in Table 1, together with their working conditions m asured at 18000 kilocycles. Except in the case of R-146, the ower dissipated by each resistor in the equipment was sub tantially less than the power rating. Resistor R-146 is momen arily subjected to the overload shown in the table when th "stop"

button is depressed with six-wire control. It is overloaded only during the very short interval while the master starting relay is opening. Under normal running conditions the power dissipated by this resistor is less than 0.2 watt. The measured resistance in every case was well within 5 per cent of the value marked on the ferrule as required by Navy specifications RE 13A 372G.

(c) Numerous units of standard design are used in the TBK-12 equipment. Special design is resorted to only where necessary to provide satisfactory performance and to meet the requirements of the governing specifications.

(d) Various other component parts used in the equipment, and which are covered by the reference specifications of paragraph 2-2(4) of reference (b) are treated in detail in appropriate paragraphs of this report.

27. Par. 2-3. In general, the materials employed in the construction of this equipment are of types suitable for the particular applications in which they are used. However, steel has been used in some instances where additional protection is required or other materials should be substituted. These cases are discussed individually in paragraph 4.

28. Par. 2-3-1. No trouble of any kind was experienced during tests which could be attributed to faulty contact design. Investigation at the conclusion of the tests revealed no undue pitting of contacts.

29. Par. 2-3-2. All multicontact switches are of the positive self-positioning type. Self-cleaning contacts are employed throughout.

30. Par. 2-3-3. All variable resistors furnished are of the wire-wound type and performed satisfactorily during the test period. The working conditions are shown in Table 1. It will be noted that each unit is rated considerably in excess of the power actually dissipated while in operation.

31. Par. 2-4. The following items were noted as not being of the best workmanship and should be corrected by the Manufacturer.

(a) The power-amplifier milliammeter failed during the tests. An inspection revealed that the internal series resistor had not been properly soldered in place during manufacture.

(b) A few r-f leads were found to be considerably longer than necessary. The lead from L109 to C135, visible in Plate 12, can be made shorter by connecting to the lower rather than to the top terminal of C135. The same plate also shows that C137 can be relocated to reduce the length of lead to L111. Care should be taken in the design to keep r-f leads as short as possible.

(c) Coil L106 was not shipped in place in the transmitter. Taper pins required for installation of the coil were not furnished.

(d) Contacts on S107 and S108 do not center correctly, causing a considerable part of the contact area to be ineffective. More care should be taken in adjusting these contacts before shipment.

(e) Engraved index marks on all controls were not satisfactorily filled with wax or paint.

(f) End ties on some solenoid-type r-f choke coils were broken, allowing the last turn to loosen.

(g) Many machined parts had not been cleaned before assembly, and filings and metal chips were found clinging to the units. Since these metallic particles might cause short circuits under service conditions involving vibration and shock, it is recommended that all parts be adequately cleaned before incorporation in the equipment.

(h) The interlock boss on the adjust-tune-operate switch failed because of a defect in the casting.

32. Par. 2-5. The equipment was subjected to temperatures ranging from zero to 50°C and humidity up to 95% at a temperature of 40°C. No overheating or operational failures were noted during either test. The master-oscillator heater unit was found to be inadequate at low temperatures. This defect is discussed in paragraph 107.

33. Par. 2-6. In general, all parts of the equipment were found to be suitably protected from corrosion by the use of paint or plating. Rust was observed forming on the motor-generator set armature shafts. It is suggested that a protective finish be applied to all exposed steel in the motor-generator unit.

[redacted]

34. Par. 2-7. Iron and steel have been used to some extent in the construction of the TBK-12 equipment. In some of these applications ferrous materials have been used because they afford definite mechanical advantages. In a few of the applications listed below, protection against corrosion is absent or inadequate.

(a) Universal joints of C148.
(b) Case and support brackets of R119.
(c) Support and bolts securing blower motor.
(d) Set screws and taper pins in all control.
(e) All variable capacitor shafts.
(f) Brackets and screws on R152.
(g) Parts of R117, R118, and R137.
(h) Through bolts and brackets on T101 and T103.
(i) Case of C171.
(j) Clamping brackets of C153, C152, and C15.
(k) Parts of all relays.
(l) Cover chains on the motor-generator set.
(m) Springs on interlock assemblies.
(n) Pins that align all decks in the frame.
(o) Nuts on indicator light housings.

35. Par. 2-8. High quality insulation of the Isolantite or Micalex type is utilized throughout the equipment. The use of phenolic insulation has been restricted to such employment as does not violate the governing specifications.

36. Par. 2-9. Wood has not been used as an electrical insulator in this equipment.

37. Par. 2-10-1 and 2-10-2. Fuses provided in the equipment are listed in Table 2. The rating and operating conditions of each fuse are listed and it will be noted that adequate circuit protection is provided in each case. All fuses rated at 250 volts are of the renewable-link cartridge type, while high-voltage supply fuses are non-renewable. Barriers have been employed between fuses in the generator connection boxes as shown in Plate 22 and the interior walls and covers of the boxes are equipped with a layer of insulating material to prevent arc-over to ground. Table 3 presents data on the effects produced by opening the various fused circuits. It is pointed out that fuses F205 and F206, in the 1500 and 3000-volt output lines, respectively, are not effective in entirely removing voltage from the fused lines. As shown in the table, sufficient power feeds through the common bleeder resistor, R138 and R139, to give an appreciable r-f output. Moreover, a ground on the 1500-volt circuit will cause F205 to open but will simultaneously place 3000 volts across the bleeder. This will result in 150 watts dissipation for each

[redacted]

bleeder resistor and will result in their destruction if the motor generator is operated while a search is made for the trouble. It is suggested that separate bleeders be employed for the 1500 and 3000-volt supplies to effect the elimination of these difficulties.

38. Par. 2-10-3. The range of adjustment and the accuracy of calibration of overload relays K106 and K107 was determined as shown in Table 4. Both relays are adjustable over the required range from full load to 125 per cent of full load. These relays employ oil-filled dash-pots and directions for filling the cylinders are given on nameplates attached to the bodies of the relays.

39. Par. 2-12. Outside cases and frames are at ground potential when the transmitter is in operation. Suitable interlocks have been provided to reduce, as much as possible, danger of coming in contact with high voltages.

40. Par. 2-13. Suitable ventilation has been provided by means of perforated side, rear, and top shields. In addition, the access doors to the tube compartments are perforated as shown in Plate 1 to provide additional ventilation.

41. Par. 2-14. During extensive tests on the equipment, no signs of softening or flowing of any compound were noted. No cracking of insulation was evident during low temperature tests.

42. Par. 2-15. Various locked key tests from two to seven hours in length were made, under various conditions of temperature and humidity. The transmitter was operated at full power output during these tests and no signs of overheating or other detrimental effects were noted. Keying was accomplished at various rates of speed up to 100 words per minute without trouble from brush discharge, arcing, or corona.

43. Par. 2-16. Table 5 shows the results of open circuiting and short circuiting the antenna of the TBK-12 while operating with full power output at 2000 and 18100 kilocycles. It will be noted that severe overloads of the power-amplifier tube occur under these conditions. This difficulty is usually present in high-frequency transmitters and up to the present time no effective remedy has been found. It is therefore recommended that the requirements of this paragraph of the specifications be waived.

44. Par. 2-17. Tables 6 and 7 list potentials applied to the electrodes of the vacuum tubes under various conditions of operation. It may be noted that the master-oscillator screen grid voltage exceeds the specified limit of 500 volts in all

[redacted]

cases. The excess is particularly serious when the key is open, since the applied voltage rises to over 1000 volts. This condition is undesirable, since it may result in breakdown or arc-overs inside the tube. It is recommended that necessary circuit changes be accomplished to eliminate the difficulty. All other vacuum tubes are operated within the voltage limits specified for the particular tube type. As pointed out in paragraph 86, insufficient grid drive causes overload of the power-amplifier tube at 18 mc.

45. Par. 2-18. All items considered as unsatisfactory are taken up separately in appropriate paragraphs.

46. Par. 2-19. The equipment was subjected to the inclination tests specified in this paragraph. No mechanical failures were brought about as a result of these tests. Variations in frequency during inclination are covered under paragraph 103 of this report.

47. Par. 2-20. The entire equipment was subjected to vibration and shock tests as outlined in Tables 35 and 36. Shocks were administered by means of a pneumatic testing device which imparts a high, momentary, horizontal acceleration to the platform supporting the equipment. Various difficulties noted during the test are listed below, together with other points affecting the reliability of the equipment under such conditions.

(a) The dial lock on control J failed during the first set of five shocks. This failure was due to a defective dial cover casting. The lock is cast integral with the dial cover and replacement of the entire dial cover assembly was necessary. A very close control over the quality of these castings should be maintained or the lock should be fabricated as a separate unit to facilitate replacement.

(b) Master starting relay K-101 opened during shock. It is suggested that the armature be lightened if possible and that the hold-in force developed by the coil be increased. It is pointed out that this relay is not shock mounted and is therefore subjected to considerable force during shock.

(c) The group of wires to T-101 are not rigidly braced and consequently vibrate with considerable amplitude when subjected to vibration and shock.

[redacted]

(d) Leads entering the driving motor of the motor-generator set are not protected against abrasion where they pass through holes in the motor frame. It is recommended that fiber bushings be used to prevent damage to the insulation at these points.

(e) Solder is depended on for mechanical strength in connections to transformer terminals.

48. Par. 2-21. All vacuum tubes are adequately protected against the effects of vibration and shock. The master-oscillator tube depends on the shock mounting of the entire master-oscillator unit for this protection, while all other tubes included in the design are individually shock mounted. The keying relay is mounted rigidly on the transmitter frame but no detrimental effects were noted during vibration and shock tests.

49. Par. 2-22. In general, the design and control of the circuits in the TBK-12 equipment are considered to be as simple as possible within the requirements of the specifications. However, no safe and convenient means is provided for the adjustment of R-137. Although normally it will not be necessary to adjust this resistor in service, it is suggested that a slot be provided in the resistor shaft to permit adjustment with a screwdriver.

50. Par. 2-23-1. All controls, meter, and indicators are located on the front panel and are arranged as symmetrically as space will permit. Panel controls and meters are listed in Table 8, while Plate 2 shows their appearance and arrangement.

51. Par. 2-23-2. A suitable, reverse-etched nameplate has been affixed adjacent to each panel control and indicator light to describe its function. Nameplate markings are listed in Table 9. All markings are easily readable at a distance of 24 inches under normal operating conditions.

52. Par. 2-24. All control shafts and bushings in the TBK-12 are grounded. Insulated handles are employed on all controls. However, set screws and taper pins on several controls were found to protrude considerably beyond the surface of the control knob. It is recommended that set screws be recessed to prevent accidental r-f burns.

53. Par. 2-25. All meters used in this equipment are of the 3.5-inch diameter, flush type and are provided with anti-glare glass.

[redacted]

54. Par. 2-25-1. The antenna ammeter is of the self-contained type and is connected in the high-potential side of the antenna tuning circuit as required by the specifications. The meter is located behind the front panel and is covered by a glass window. The window is not provided with a screwdriver hole to facilitate adjusting the zero setting of the meter. It is suggested that such an access hole be provided to permit adjustment.

55. Par. 2-25-2. All panels are drilled and adjacent equipment suitably mounted to permit the substitution of meters of the same nominal size but having the maximum dimensions permitted by specification 17-I-12C. All d-c voltmeters have a sensitivity of 1000 ohms per volt. Hermetically sealed multipliers are employed for plate voltmeters M-111 and M-112, as required by reference (c). However, these resistors are of the sectional type and are therefore not in accordance with specification RE 13A 590A. Five separate sections, joined by axial 10-32 screws, are used to make up each multiplier resistor. The dimensions of the assembly are as follows:

Overall length	- 9-3/4 inches.
Length over ferrule spacer rings	- 8-3/4 inches.
Diameter of ferrule rings	- 1-3/8 inches.

It is pointed out that these dimensions correspond to those of the style MFA resistor as outlined on sheet 14A of RE 13A 590A. It is recommended that standard Navy type resistors be substituted for those now employed in all production equipments. With the exception of the r-f ammeter, all meters may be removed from the front. Meters are secured by means of RH 6-32 screws tapped into the front panel and the length of connecting leads allows removal of meters through the front panel openings.

56. Par. 2-26. Appropriate nameplates, listed in Table 9, are attached to all major units. Plates are of metal and are reverse-etched with a black background.

57. Par. 2-27. Assembled separate items such as the motor starter, motors, generators, and transformers are marked with nameplates bearing the rating such as operating voltage, current, frequency, and Navy type number. The nameplate markings of many of these units are listed in Table [illegible].

58. Par. 2-28. The interchangeability of spare parts with components employed in the construction of the equipment was not checked completely. However, occasion arose during the test period to replace several parts and no difficulty was experienced. All parts are marked with ratings, Navy type number, and symbol number to facilitate replacement.

59. Par. 2-29. The requirements of this paragraph of the basic specifications were not checked. To do so would require complete disassembly of the equipment. It is assumed that these inspections have been conducted at the point of manufacture. Elastic stop nuts permitted by specification RE 13A 554D have been employed to some extent in the construction but not in locations where their frequent removal will be required in service. In a few cases bolts of insufficient length are employed and advantage is not taken of the full thread of the associated nuts. Care should be taken in assembly to use bolts of the required length as specified by paragraph 2-29-9 of the basic specification.

60. Par. 2-30-1. All dials and controls employed in the Model TBK-12 Equipment are so designed that clockwise rotation of the control knob results in an increase in the numerical reading and in the final controlled effect.

61. Par. 2-30-2. All dials and verniers are marked with evenly spaced divisions and numbering is such that continuity is provided throughout the dial ranges. The marking and mounting of all dial scales assures visibility of at least two significant figures at all times. The width of any single division on the dials is not less than the minimum of 0.05-inch permitted by the specifications. On controls B, D, E, F, and J the divisions are 3/32-inch wide and on controls C, G, and I, 1/16-inch wide.

62. Par. 2-30-3. In general, all controls and mechanical drives are of sufficient strength and suitable design to provide satisfactory service. Each control knob is secured to its shaft by means of a taper pin and a set screw. Rheostat knobs employ two set screws in addition to the taper pin. Pins have also been employed to secure couplings and driven devices--friction alone has not been depended on in any case. End stops of satisfactory design have been provided on all controls.

63. Par. 2-31-1. The design and construction of the equipment permit replacement of components such as vacuum tubes or resistors of the limiting dimensions and characteristics permitted by Naval specifications.

64. Par. 2-31-2. The accessibility of components in the TBK-12 is greatly improved by the inclusion of a removable m-o unit. This unit may be withdrawn from the transmitter frame after loosening the retaining thumbscrews visible in Plate 16. Stops are provided to prevent the unit from accidentally sliding completely out and falling to the deck. These stops consist of spring actuated plungers, near the front of the m-o unit guide rails, which engage the frame of the m-o

unit at its extreme limit of travel. It is normally necessary to release these catches before the unit can be entirely removed. However, the plunger springs became so distorted before the end of the test period that the plungers were no longer effective in preventing accidental loss of the unit. Since these catches may be subjected to severe strains in case the unit is partially withdrawn for service while subjected to pitch and roll, it is important that they operate effectively at all times. It therefore is suggested that the design of the catches be modified to prevent the actuating springs from becoming distorted when releasing them. The design of the transmitter permits the replacement of any parts subject to failure in service without extensive disassembly. With the exception of a few components on the lower shelf, replacements can be readily accomplished from the sides of the transmitter. Parts mounted within the master-oscillator compartment are completely accessible when the covers are removed from the cabinet as shown in Plates 20 and 21. It may be observed that resistors R-103 and R-121, the master-oscillator grid resistors, are mounted inside the constant temperature chamber. It is therefore necessary to remove the side cover in order to replace these components. To avoid this difficulty it is suggested that the resistors be relocated in the ground side of the grid circuit and that they be mounted outside the m-o cabinet. As pointed out in paragraph 107, this change is desirable for other considerations also. During the course of the tests it was necessary to remove the cover on the constant temperature compartment of the master-oscillator unit several times. It was found that the gasket used between cover and frame stuck to each so that removal of the cover without destroying the gasket became increasingly difficult. It is recommended that a more suitable gasket material be used or that some method be applied to prevent adhesion of the gasket to the frame.

65. Par. 2-31-3. All toggle and push-button switches employed in the transmitter are mounted on removable plates in such a manner that they may be removed and replaced without access to the rear of the front panel. Leads to the switches have sufficient length and flexibility to permit this operation without difficulty.

66. Par. 2-32. The total weight of the equipment is 1821 pounds. The weights of the individual units are listed in Table 10. It is pointed out that the motor starter is not included in the weight, since this unit was not furnished for test.

67. Par. 2-33. The dimensions of each unit comprising the equipment are shown in Table 10. It may be noted that either unit will pass through doors or hatches of the specified

[redacted]

dimensions. The motor starter was not available for tests to determine its degree of compliance with this paragraph of the specifications.

68. Par. 2-34. Tests were conducted in which the supply line voltage was varied from 5 per cent below normal to 5 per cent above in periods of one minute and five minutes. Similar tests were made with 10 per cent variations from normal. The results of these tests are contained in Table 24. No damage to tubes or equipment occurred at any time during the tests.

69. Par. 2-35-1. Each component in the equipment is identified by a round paper tag secured adjacent to it. The surface of the tags is protected by a clear coat of lacquer or glyptal. The following errors in markings were noted:

(a) Resistor R-115 is incorrectly labelled R 135.

(b) Transformer T-101 is not provided with a identification tag.

(c) Fuses in the motor-generator set are not identified by symbol numbers.

(d) Resistor R-123 is marked CHD-63022E, whereas the instruction book lists the resistor as CHD-63022D.

(e) Resistor R-128 is marked CHD-63205E, whereas the instruction book lists the resistor as CHD-63205E.

70. Par. 2-35-2. Resistor mountings are marked with round paper tags bearing the Navy type number and the resistance required for each mounting. Tube positions are similarly marked with the type tube required for each socket.

71. Par. 2-36. The three Lord mounts supporting the master-oscillator compartment can be replaced easily after the unit is removed from the transmitter frame. The intermediate-amplifier tubes are each shock mounted by means of a rubber pad which supports the tube sockets. These pads may be replaced without extensive disassembly. The Lord mounts supporting the power-amplifier tube cradle may be replaced without difficulty but the cradle must be removed in the process. It is suggested that the mounts be inserted from outside the p-a shield to eliminate the necessity for removing the cradle during the process.

72. Par. 2-37. As stated in paragraph 68, the supply line voltage to the equipment was varied from 10 per cent below normal to 10 per cent above in periods of one minute and five

minutes without damage to tubes or equipment. During these tests voltage controls were not readjusted. For line voltage variations in excess of 10 per cent readjustment of controls to the correct voltages is permitted. Table 42 shows the range of adjustment provided by the filament rheostat. It will be noted that it is impossible to maintain normal voltage when the line voltage is 10 per cent higher than normal. It is recommended that the range of the filament rheostat be increased to permit adjustment of the filament voltage to the correct value at either extreme of line voltage.

73. Par. 2-38. Lifting eyes have been provided at the top corners of the transmitter frame. The eye bolts slide down into the corner gussets when not in use and are held in that position by wing-nut clamps to prevent rattling. Each eyebolt has an opening 1-1/4 by 1-3/8 inches which is of adequate size to permit the use of a rope one inch in diameter without difficulty. Nameplates, visible in Plates 11 and 12, are affixed to the top frame member to indicate that shackles are to be used for lifting the equipment. The motor-generator set is not provided with eye-bolts suitable for hoisting the entire assembly but four 1-1/4-inch diameter holes in the bed-plate are provided for that purpose.

74. Par. 2-39-1. A black wrinkle finish has been applied to the front panel and all external shields including the top shield. The motor generator is finished with flat gray paint.

75. Par. 2-39-2. There are no exposed unprotected surfaces of aluminum or aluminum alloy on the external portion of the equipment. The shields and frame have been protected as described in the preceding paragraph.

76. Par. 2-39-3. Thumbscrews and locks which are manipulated in normal installation and service are provided with an adherent dull-black coating. Unless it can be shown that this coating is equal or superior to black nickel in service, it is recommended that a black nickel finish be applied to these parts as required by the specifications.

77. Par. 2-39-4. All interior surfaces of aluminum or aluminum alloy are suitably protected from corrosion by means of a lacquer finish. On parts where it is not practicable to use this finish, a coat of black enamel has been applied. Sufficient care had not been taken to thoroughly remove the protective lacquer coating where connections to the shield structure were made. In an attempt to increase the grid drive to the power amplifier at 18 mc, the Contractor's representative removed, cleaned, and reconnected many of the joints and connections to the shielding in the power-amplifier compartment.

This action resulted in an increase in the available drive, although the final value obtained is not considered to be satisfactory, as pointed out in paragraph 86. It is recommended that care be taken to omit or remove the protective finish applied to metal parts wherever its presence prevents proper electrical bonding as required for shielding or connections. It is also suggested that the manufacturer investigate the possibility of using a conducting protective finish such as the Nasat or Supersat coatings employed successfully in other Naval transmitting equipments.

78. Par. 2-40-1. All indicating lamps are Navy type TS-51 rated at 18 volts and 0.11 ampere.

79. Par. 2-40-2. Each indicator lamp is mounted as a part of a combined receptacle, resistor lamp assembly. The housing of the lamp and socket is of aluminum, the visible portions being finished in dull black. The portion of the housing which protrudes through the panel is provided with a rolled edge to form a bezel around the lamp. The maximum dimensions of the various indicator lamp assemblies are as follows:

Maximum extension behind panel	- 1-1/2 inches.
Diameter of bezel	- 1-5/16 inches.
Extension of glass globe beyond bezel	- 1-1/16 inches.

80. Par. 2-40-3. The colors of the indicator lamp globes furnished are listed in Table 8. Globes are of colored glass and are inside etched.

81. Par. 2-41. No electrolytic capacitors are used in the TBK-12 equipment.

82. Par. 2-42 to 2-49. These paragraphs of the specifications cover type tests of components. No separate components were provided with the transmitting equipment and it is assumed that such tests have been made at the point of manufacture.

83. Par. 2-50. Filament voltage is applied to all tubes whenever the master starting relay K-101 is closed. Therefore, plate and screen potentials cannot be applied to vacuum tubes in the aosence of filament excitation. Voltage to energize the keying relay K-102 is derived from the bias generator. When starting the equipment, keying may be accomplished as soon as the bias voltage has risen high enough to actuate the keying relay. This occurs within a few seconds after the master start switch is closed. Therefore, it is possible to apply electrode voltages to the tubes before the

filaments have attained full operating temperature. However, it was observed that no spurious oscillations resulted from this type of operation and that no detrimental effect on tube life occurred. In view of this, no corrective action is recommended.

Specifications RE 13A 442G, Section III

84. Par. 3-1. The design of the Model TBK-1 Equipment is such that it functions over the frequency range of 2000 to 18100 kilocycles with a nominal output of 500 watts. The requirement that it be capable of operation as a 75-watt transmitter over the same frequency range was eliminated by reference (c) and has, therefore, been omitted from the design. The following listing shows the circuits involved in the transmitter.

Stage	Circuit	Type Vacuum Tube	Freq. Range (Kc)	No. of Bands
Oscillator	Electron Coupled Colpitts	860	1000-2261.5	6
Osc. Plate	Doubler	---	2000-4522	1
1st I.A.	Class "C" Amplifier Doubler	860	2000-4522 4525-9050	1
2nd I.A.	Class "C" Amplifier Doubler	860	2000-9050 9050-18100	1
P.A.	Class "C" Amplifier	861	2000-18100	1
Ant. Tuning	Voltage or Current Feed	---	2000-18100	1

85. Par. 3-2. A flexible antenna coupling and tuning system is provided which permits operation with antennas of widely different characteristics. Provision is made for either current or voltage feed as described in paragraph 87. Operation with two typical antenna systems is shown in Tables 12 and 13. Although it was not possible to make tests with all the various combinations of antennas and trunk sizes listed in this paragraph, sufficient tests were made to insure that no difficulty should be experienced in operation into antenna systems within the physical dimensions specified.

86. Par. 3-3-2. The power output from the transmitter was measured at various frequencies throughout the range as shown in Table 11. It will be noted that the power output exceeded the specification limit at all frequencies except at 18100 kilocycles. In this case the power output of 2.0 watts

was considerably below the specified value of 300 watts. It was found that this difficulty was caused by insufficient grid drive to the power-amplifier tube. As shown in the table, the p-a grid current steadily decreases as the frequency is increased until at 18100 kilocycles the current is only 8 ma. Selected tubes could be loaded up to full power input with this low value of grid current, but only at a reduced efficiency which caused excessive plate losses. Tube specifications state that 40 milliamperes of grid current is the normal value although considerable variation from this value may occur. In an effort to increase the available drive, the Contractor's representative disconnected, sanded, cleaned, and reconnected the following:

(a) Grid socket connections and straps.

(b) Ground connections to the power-amplifier tube cradle.

(c) Ground connections on lower screen by-pass capacitor.

(d) Back brace and mounting plate upon which the 2nd i-a plate capacitor is mounted.

(e) Ground connections to the p-a grid by-pass capacitor.

(f) Ground connections to the m-o tube compartment.

These steps resulted in an increase in grid current to 14 ma, which was still insufficient to obtain full p-a loading. By selecting tubes for the master-oscillator and amplifier stages, this value was increased to 22 milliamperes and the power output from the transmitter to a value slightly in excess of specification requirements. It is pointed out that extremely careful tuning was necessary to obtain the maximum values of grid current stated above and that even slight detuning, such as may be expected in service, resulted in a considerable decrease in p-a grid current and a large drop in power output. Even at the maximum value of grid current obtainable a border-line condition exists which may result in shortening the life of the power-amplifier tube, since full amplifier loading is possible only at the expense of reduced efficiency. This condition and the necessity for selecting tubes are considered very undesirable. Therefore, it is recommended that the Manufacturer investigate the difficulty and apply proper corrective measures to all production equipments.

87. Par. 3-4. The equipment has provision for both voltage and current feed into the antenna system. Transfer from one to the other is made by means of a switch (Control H) on the front panel.

88. Par. 3-5-1. The transmitter was keyed at speeds up to 100 words per minute and no signs of key click or lilt were noticed. The harmonic content of the transmitter output was not determined.

89. Par. 3-5-2. The amount of amplitude modulation caused by hum or ripple was measured at three frequencies with the results shown in Table 14. It may be noted that the percentage modulation present is well within the 2 per cent limit imposed by the specifications.

90. Par. 3-6. The design of the transmitting equipment permits its adjustment to any frequency within the specified band by means of controls located on the front panel. The number of controls is the minimum consistent with the specified performance.

91. Par. 3-7-1. Accuracy of Reset to Previously Calibrated Frequencies. The results of the reset test are shown in Table 15. Both maximum and average values came well within limits imposed by the specifications. Although in some cases the time required to reset was in excess of that specified, the excess was not great, and speed could certainly be increased with practice on the part of the operator.

92. Par. 3-7-2. Lost Motion, Backlash, and Torque Lash. The results of tests conducted to determine the amount of backlash present in the master-oscillator dial assembly are shown in Table 16. It will be noted that the deviations in all cases are within the specified limit.

93. Par. 3-7-3. Operation of Adjust-Tune-Operate Control. Table 17 contains the results of tests made to determine the change in frequency resulting from operation of the adjust-tune-operate control. The frequency changes at both test frequencies were within the requirement of 0.001 per cent.

94. Par. 3-7-4. Detuning of Circuits. Each tuned circuit following the master oscillator was detuned each side of resonance to such a degree as to cause the plate current of any affected tube to vary 25 per cent from its normal value. The effect on the output frequency was observed with the results shown in Table 18. All frequency variations were within the 0.003 per cent limit set by the basic specification.

95. Par. 3-7-5. Operation of Power Output Control. The variation in frequency resulting from manipulation of the power output control is shown in Table 19. A reduction of power from full value to 85 per cent full power is shown to result in a variation of frequency of 0.00145 per cent, and the reduction to 68.5 per cent caused 0.00150 per cent variation,

both of which are outside the limit of 0.001 per cent stated in the specifications. Steps should be taken to increase the stability in this respect.

96. Par. 3-7-6. Change of Tubes. Tables 20, 21, 22, and 23 contain the results obtained from tests made to determine the influence on the emitted frequency of changing tubes in the various stages. Tests were made at two frequencies, 2000 kc and 4500 kc. As may be observed, the average variation in frequency caused by changing tubes in each stage is well below the specified limit in every case.

97. Par. 3-7-7. Variation of Line Voltage. The TBK-12 equipment submitted for test was designed for operation from a 440-volt, 60-cycle, a-c line. Therefore, under the requirements of this paragraph, the line voltage was varied ±5 per cent of normal value to determine the effect on the output frequency. This test was made at two frequencies, 2000 kc and 4500 kc. At each frequency, the voltage was varied from the minimum to the maximum in one minute, and additionally in a period of five minutes. In all four cases the frequency changes were within specification limits. Although not required under this paragraph, an additional test was made in which the line voltage was varied from 10 per cent below to 10 per cent above the rated value. At 4500 kc the frequency variation was still within the limits for the ±5 per cent test, while at 2000 kc these limits were exceeded.

98. Par. 3-7-8. Variation of Ambient Temperature. The results of tests conducted to determine the effect of the emitted frequency caused by changes in the ambient temperature are given in Tables 25 and 26 and are presented graphically in Plates 25 and 26. A summary of the results is appended to each table. Reference to these summaries will show that the variations in frequency at 2000 kilocycles were within the specified limit of 0.00025 per cent, whereas at 4500 kilocycles the observed variation was in excess of this value in the range from 20 to 10 degrees C. It is recommended that the cause of the difficulty be sought and that the matter be corrected. It is suggested that temperature gradients existing inside the master-oscillator compartment, as pointed out in paragraph 107, may be a factor in producing the effect.

99. Par. 3-7-9. Variation of Humidity. The effects of humidity variations during the specified test are shown in Tables 27 and 28, and Plates 28 and 29. Tests were conducted at 2000 and 18000 kilocycles, but in the latter case frequency measurements were made at the m-o output frequency of 4500 kc. In both cases, as noted in the tables, the m-o compartment heater ceased regulating at a humidity of about 97 per cent and resumed regulation after the humidity was

decreased to 93 per cent. Although the heater remained off during this period, it will be observed from the table that the cabinet temperature increased. Time did not permit a thorough investigation of this phenomenon and no explanation of the effect can be advanced. It is suggested that the Manufacturer make the necessary tests to determine whether the difficulty exists in other production equipments and if so, that the cause be found and corrective measures applied. It is pointed out that simultaneous changes in the output frequency were in each case in excess of the variation permitted by the basic specifications.

100. Par. 3-7-10. Locked Key Operation for Two Hours. The results of two-hour locked key tests at full power, conducted at 2000 and 4500 kc, are presented in Tables 29 and 30. The frequency variations which occurred during each test were well within the limits required by the governing specifications.

101. Par. 3-7-11. Change from Key-Locked to Intermittently-Keyed Condition. Table 31 lists the results of tests made in compliance with this paragraph of the specifications. It will be noted that the frequency variations permitted by the specifications were not exceeded under conditions where the master-oscillator tube filament was lighted or unlighted.

102. Par. 3-7-12. Change from Continuously-Keyed to Intermittently-Keyed Condition. The TBK-12 equipment satisfactorily meets the requirements set forth by this paragraph of the specifications. Data obtained during the course of the test are shown in Table 32.

103. Par. 3-7-13. Inclination Due to Roll and Pitch of Ship. The entire TBK-12 equipment, including the motor generator, was secured to the test platform and subjected to an inclination of 45 degrees at five cycles per minute in fore-and-aft and side-to-side directions. Tables 33 and 34 cover the results of these tests. These data are also presented in graphical form in Plates 30 to 33, inclusive. It is pointed out that the variation in frequency during any single cycle of inclination was considerably less than the 0.001 per cent limit set by the specifications. Variations calculated from the initial or final frequencies existing just previous to or immediately after application of inclination are also included in these tables. It may be noted that these values are considerably higher than those obtained during any single cycle of inclination, since frequency drift occurring during the test periods is also included. On two occasions during the inclination, the carrier was interrupted when the equipment reached the extreme angle of inclination and resumed only upon returning to the normal, vertical position. The cause of this difficulty could not be determined. However, it is probable

that strains set up in the frame and tuning device were sufficient to cause switch interlocks to open. Care should be taken in the design to avoid types of interlocks, switches, or relays which may open under conditions which set up strains in the component or its support and cause minute distortion of the device.

104. Par. 3-7-14. Vibration. Data obtained during vibration tests conducted in accordance with this paragraph of the specifications are contained in Table 35, while the same information is presented graphically in Plates 34 and 35. It will be noted that the set in frequency at 4500 kilocycles exceeds the specified limit of 0.0005 per cent. It is recommended that necessary changes be made to improve the performance of the equipment in this respect.

105. Par. 3-7-15. Shock. The TBK-12 equipment was subjected to shock by a pneumatic testing device which imparts to the test platform a horizontal acceleration of high magnitude but of short duration. The results of these tests are given in Table 36. The percentage variation in frequency caused by each shock was well below the limit of 0.01 per cent imposed by the specifications. Mechanical difficulties resulting from the shock are discussed in paragraph 47.

106. Par. 3-7. General. The results of the various frequency stability tests called for by paragraph 3-7 are summarized in Table 37. The frequency variations listed for each test are the maximum values obtained during that test. The totals listed for the columns are the arithmetical sums, no account being taken of whether the variations were plus or minus. The columns headed "Per cent frequency variation of specification allowance" give the percentage values of the actual test results as compared with the values permitted by the specifications. Thus, a value of 100 per cent indicates that the test and specification values are in exact agreement. A test value of 10 per cent indicates that the frequency variation observed during the test was only 10 per cent of the value permitted by the specifications. A test value in excess of 100 per cent indicates that the specification value was exceeded.

107. Par. 3-8. The temperature of the master-oscillator compartment is controlled by an electric heater. Plate 27 shows the results of a test conducted at ordinary ambient temperature to determine the length of time required to reach the normal operating temperature of 60°C. It will be noted that the cabinet temperature levels off in approximately 50 minutes. However, as shown by the curve of "heater on," full temperature stability was not attained until some time later. During the temperature tests described in paragraph 98 a check was made of the length

[redacted]

of time the m-o compartment heater was on after sta lity had been reached at each temperature. Results were as llows:

Amb. Temp. (°C)	Per Cent of Time Heater Was Energized		M-O Compa ment Indicated T p. °C	
	2000 Kc	4500 Kc	2000 Kc	4500 Kc
50	6.9	4.8	60.1	60.0
40	13.9	14.3	60.1	60.0
30	24.5	24.5	60.1	60.2
20	40.5	42.3	60.3	60.3
10	81.5	80.8	60.5	60.8
0	100.	100.	61.0	61.0

It will be observed that the compartment heater was n continuously at an ambient temperature of 0°C. This f t indicates that the insulation of the compartment is inadequat or that the amount of heat available is insufficient. It i pointed out that the temperature of the compartment, as ind ated by the panel thermometer, steadily increased as the am ent temperature was reduced. The bulb of the thermometer located directly in front of the blower exhaust opening and herefore tends to indicate the temperature of the air passin over the heaters rather than the true temperature of the com rtment. It is suggested that a more suitable location for t thermometer be sought in new designs of the equipment. D ficulty was experienced during tests at high humidity as po ted out in paragraph 99. Under these conditions the cabine temperature increased above normal even though the heater mained unenergized. In this case the loss in the circuits ontained in the compartment is sufficient to cause the cabin temperature to rise. In an attempt to alleviate this condi ion, it is suggested that m-o grid bias resistors R-121 and -103 be connected in the ground side of the grid tank ci uit and that they be located outside the cabinet.

108. Par. 3-9. A thermostatic cut-out devic is incorporated in the m-o cabinet to protect the equipment a inst damage caused by excessive temperature. It was found that he cut-out operates to open the heater circuit when the cabine temperature reaches 75°C and closes the circuit when the t perature drops to 72°C. It is recommended that a type of pr ective thermostat be substituted which will prevent tempera ures above the maximum of 70°C set by the specifications nd which will not restore the circuit until the temperature s dropped to approximately 55°C.

109. Par. 3-10. A "filament standby" toggle witch is provided on the front panel. When in the "stand- y position, the filament of the master-oscillator tube is energi ed even though the motor-generator set is shut down. This accomplished

[redacted]

by shorting out the contacts on master starting rela K-101 which normally open the circuit to the primary of th master-oscillator filament transformer when the equipment i shut down. When the switch is in the "off" position, the filament is energized only when the K-101 is closed and the m tor generator is running.

110. Par. 3-11. Necessary neutralization for satisfactory operation of the TBK-12 equipment is provide by the use of screen grid type tubes in all amplifier stage .

111. Par. 3-12. By means of a voltage divide deriving its voltage from the 1500-volt m-o plate supply, a h gh positive voltage is applied between filaments of all tubes ar ground when the key is open. This voltage effectively bias s the grids of all tubes beyond cut-off and prevents oscillation under this condition. However, as pointed out in paragra 44, this method causes excessive voltages to be applied to th screen-grid of the oscillator tube. The section of the pot ntiometer which supplies the bias voltage is shorted out by th keying relay when the key is closed. Keying was accomplish d at various frequencies and at various rates of speed up to 100 words per minute without difficulty of any sort.

112. Par. 3-13.

(a) The master-oscillator grid tuning circui is adjusted by means of a six-point range switch (Control A) whi h varies both inductance and capacitance. Continuous tuning s provided in the form of a copper slug which may be moved in a d out of the grid coil. Table 39 contains the results of a t st conducted to determine the continuity of tuning over the six-f equency band ranges. It may be noted from this table that i every case the overlap between ranges exceeds 3 per cent, s required by the specifications. Upper and lower frequency en tolerances are also in excess of 3 per cent. In the first and econd intermediate and power amplifier-stages the tuning is con inuous over the entire band from 2000 to 18100 kc. End tol rances for the entire transmitter are indicated in Table 38. T e oscillator plate tuning circuit limited both high and low frequencies. However, the end tolerances were in excess of speci cations on both extremes of the required frequency range.

(b) The "Tune-Operate" and "Antenna Feed" sw tches are equipped with interlocks which open the keying circu t when the switches are manipulated. "Oscillator Range Swi ch," Control A, is not provided with an interlock, but an examination at the conclusion of the test period revealed no pit ng of the contacts.

[redacted]

113. Par. 3-14. The transmitter is capable, by means of a minimum number of control dials on the front panel, of adjustment to any frequency within the specified band.

114. Par. 3-15. Each panel control has, on or adjacent to it, a suitable reverse-etched nameplate indicating its function. In addition, each tuning control is identified by a designating letter from A to J, inclusive.

115. Par. 3-16. A calibration card suitable for recording reset data for 14 frequencies has been provided in suitable mount on the front panel as shown in Plate 1. The transparent cover, however, is made of a plastic which is inflammable. It is recommended that this cover be made of non-inflammable substance. The holder is equipped with four spare cards mounted behind the active card.

116. Par. 3-17. Verniers are provided by means of positive gearing on all except step-by-step controls. Table 39 gives the change in frequency in per cent per division of the master-oscillator vernier from 1875.5 to 4679 kc. The per cent variation fell between the limits of 0.001 and 0.01 per cent set by the specifications except at the high frequency ends of taps 3, 4, and 6 of Control "A." Since these portions of the tuning control range are not utilized in normal operation, no corrective measures are recommended.

117. Par. 3-18. Suitable locking devices have been provided on all dials capable of continuous rotation. Table 40 shows the effect on the output frequency of locking the master-oscillator dials. At the two frequencies at which the tests were made, the change was so small as to be negligible.

118. Par. 3-19. A small trimmer capacitor in the m-o grid tank circuit permits adjustment to compensate for small changes in circuit capacitance such as that caused by replacing the m-o tube. The setting of the trimmer capacitor may be varied by means of a screwdriver after first removing the plug which is located in the front panel. Table 41 shows the range of adjustment provided in this manner. It may be noted that, at either end of the oscillator frequency range, the variation obtained considerably exceeds the minimum of 0.03 per cent set by the specifications.

119. Par. 3-20. It is possible in the TBK-1 equipment to shift from one frequency to another without the necessity of readjusting filament, plate, or bias voltages.

120. Par. 3-21. A three-position switch is used in the transmitter to facilitate frequency shifting with safety

and minimum interference. The switch is marked "Tu ng Step 1," "Tuning Step 2," and "Operate." The voltages appli to the various tubes at each switch position are listed in ables 6 and 7. It will be noted that plate potential is ap ied only to the master-oscillator tube on "Tuning Step 1"; t t full voltage is applied to the master-oscillator and red ed voltage to the intermediate and power-amplifier tubes on "T ing Step 2"; and that full voltage is applied to all tubes on St 3 "Operate."

121. Par. 3-22. A cam-lever test key has be provided on the front panel as shown in Plate 11. Switch po tions are: down - "momentary on," center - "off," up - "locked n." The switch operated satisfactorily throughout the test riod.

122. Par. 3-23. The transmitting equipment so designed that with the key up, all stages are inoperative an incoming signals may be heard.

123. Par. 3-24. No electrical interference s noticed as a result of the blower motor operation, even wit a receiver installed in the immediate vicinity of the transmit r.

124. Par. 3-25. The power output from the t nsmitter may be controlled from the front panel by manipulat n of the plate voltage rheostat. The range of adjustment ava lable is shown in Table 19. It will be observed that the po r could be reduced to 20 per cent of full output at 2000 ki cycles, whereas at 18000 kilocycles a reduction to 5.7 per nt was possible. The extreme reduction obtainable at 1800 kilocycles is due to the drop in power-amplifier grid drive as he voltage is decreased. As pointed out in paragraph 86, insu icient grid drive is supplied the power amplifier at this equency and a small decrease in the drive is sufficient to use a very large drop in the power output. At 2000 kiloc les the efficiency of the p-a stage drops from 60 per ce t at normal plate voltage to 41 per cent at minimum volta e, whereas at 18000 kilocycles the efficiency drops from 35.7 r cent to 5.7 per cent under the same conditions.

125. Par. 3-26. Five indicator lamps are pro ided on the front panel in compliance with specification re irements. The function of each light and the color of the glob are listed in Table 8.

126. Par. 3-27. A list of the indicating ins ruments provided is included in Table 8. It may be noted th t meters are furnished to indicate filament, bias, and plate oltages and plate currents of the various stages. The anten a ammeter is located in the high potential side of the circuit and is mounted behind a clear glass window in the front pan l.

127. Par. 3-28. A suitable tube life meter i included in the design. This meter is connected across the f ament supply to the power-amplifier tube and hence operate only when this circuit is energized.

128. Par. 3-29. Table 10 lists the various d ensions of the transmitter and motor-generator units. It is ointed out that the height of the transmitter is slightly i excess of the specification limit of 72 inches.

129. Par. 3-30. The dimensions of the transm ter and motor-generator are slightly greater than permitted para-graphs 3-29 and 6-19 of the basic specifications. E her unit will pass through the doors and hatches specified by aragraph 2-33.

130. Par. 3-31. Included, integral with the ransmitter, are all vacuum tubes, radio-frequency circuits, mete , filament transformers, relays, filter unit and controls neces ry for its operation.

131. Par. 3-32. Each radio-frequency circuit n the TBK-12 equipment is completely shielded from the oth s, and the whole unit is shielded externally on all six sid . Lead covered wires employed in the assembly have been pro cted from damage by felt pads where they pass over sharp metal hield or frame edges. In one or two instances additional pro ction is desirable. In particular, felt padding should be pplied to wires going through the second deck partition fro the first to the second intermediate amplifiers to preve abrasion of insulation.

132. Par. 3-33. All electrical meters and vo meter multipliers except the antenna current meter are sui bly bypassed for protection against stray radio-frequenc currents. Meter by-pass capacitors are 0.02 µf, whereas multip er by-pass units are 0.002 µf.

133. Par. 3-34. The filament of the m-o tube s ener-gized by filament transformer T-102, while all other vacuum tube filaments are supplied from transformer T-101. Both of these transformers are equipped with primaries which ay be connected for operation from 100 or 200 volts a.c. l secon-dary windings are center-tapped. Power to operate t filament transformers is derived from distribution transforme T-103, which may be connected for either 440 or 220-volt li input. The secondary is also provided with links which may changed to furnish 115 or 230 volts output.

[redacted]

134. Par. 3-35. Transformers included in the quipment are compact and air-cooled. No difficulty was exper nced with overheating of any of these units. Each transformer s equipped with a suitable bakelite terminal board and engraved umbers are located adjacent to each terminal. Ratings and e method of connection are summarized on metal nameplates att hed to the case or laminations of the transformers.

135. Par. 3-36. Table 42 gives the results o a test conducted to determine the voltage regulation of the ilament circuits. As will be noted in the table, the regula on of all filament supplies is less than 2.1 per cent. As ointed out in paragraph 72, insufficient range is provided the filament rheostat to permit adjustment to normal val at line voltages 10 per cent above normal.

136. Par. 3-37-1. The transmitter is so desi ed as to enable it to be mounted with its back flush against bulkhead.

137. Par. 3-37-2. The two alloy channels whi comprise the foundation pedestal of the transmitter may be se red to the deck by four 9/16-inch bolts. Adequate strength s obtained in this manner and the equipment successfully withst d incli-nation, vibration, and shock tests to which it was s jected. The rear channel is provided with six holes, as show in Plate 6, to accommodate external connection cables. Cables m also be brought in at the sides. It is pointed out that cab guards which were used in the TBK-8 equipment to prevent da ge to internal wiring when installing foundation hold-down olts have been omitted from the present design.

138. Par. 3-37-3. All external cable connect ns are effected at the main terminal board located just ins e the lower access door as shown in Plate 3. The arrangem t of terminals is such that the connection of external le s is facilitated; external soldering lugs are provided. e terminal board differs slightly from that employed in the Mod TBK-8 Equipment in that high voltage terminals are located ertically, one above the other, rather than horizontally as in e earlier design. This change is not considered disadvantageo , although somewhat more care must be employed during installat n to preclude the possibility of short circuits to adjace cable or cable shielding. The ground post is located at t left side of the main terminal board as shown in Plate 3. This position makes it difficult to connect the ground st p to the terminal in such a manner as to avoid interferen with the renewal of the adjacent control circuit fuses. ring installation, considerable care must be taken to pre nt short circuits also. It is recommended that the ground po be relocated on the bottom frame brace near its present osition in order to avoid these difficulties. The lower edg of the

terminal board is 4-1/8 inches above the deck. Howe r, the clearance present underneath the lower deck is consi erably less because of the fore-and-aft frame members. The inimum clearance beneath the lower shelf is 2-1/2 inches.

139. Par. 3-37-4. Access doors in the front nel provide a means of renewing vacuum tubes and adjusting lays. The doors are described in greater detail in paragra s 143 and 144.

140. Par. 3-37-5. The keying relay is mounte on the front panel as shown in Plate 3. A cast metal cover s provided which is secured by means of two captive thumb rews. An unbreakable transparent window in the cover permi the operation of the relay contacts to be observed at al times.

141. Par. 3-37-6. A 4-1/2-inch diameter hole n the top shield provides an entry for the external antenn lead.

142. Par. 3-38. Side, top, and back shields re perforated with 3/8-inch holes with 430 perforations pe square foot to provide ventilation and partial visibility o the interior. The top shield is secured with round-head achine screws, whereas side and rear shields are secured by eans of captive knurled-head thumbscrews locked to the shiel s. The maximum length of any shield is 32-3/4 inches.

143. Par. 3-39. All access doors are provide with brass piano hinges and stops to prevent hinge strain nd to hold the doors in the open position.

144. Par. 3-40. All access doors are of the verlapping type and are of sufficient size to permit the conven nt replacement of tubes by service personnel. Tube acc ss doors are perforated as shown in Plate 2 to permit observa on of the vacuum tubes during operation. The clear openin available when each door is open is listed below.

Access Door	Dimensions of Clear Opening Height (Inches)	Width (Inche
Power Amplifier	17	7-1/
Intermediate Amplifier	7-1/2	8-1/
Master Oscillator	8	11-1/
Terminal and Relay	8-1/2	25

145. Par. 3-41. Insulated hand rails are att ched to the front panel and are of the following dimensions:

Top of rail to deck	- 55-7/8 inches.
Clearance, rail to panel	- 1-1/2 inches.
Diameter	- 1 inch.
Overall length	- 25 inches.

These hand rails are secured by means of large machi screws which pass through the transmitter frame and are thre ded into the ends of the rails.

146. Par. 3-42. Protection from d-c voltages eing applied to the antenna system as a result of failure f the coupling system has been obtained by the insertion of C-147, a 0.002 µf, 5000-volt fixed condenser in series with he antenna coupler.

147. Par. 3-43-1. Suitable coupling and termi ating facilities have been provided in the equipment to per it the use of standard frequency measuring equipment.

148. Par. 3-43-2. R.F. pickup is provided by eans of a small, single-plate air capacitor, located near the master-oscillator plate circuit. The pickup is carried to t e terminal board of the transmitter by means of shielde leads, one of which is at ground potential.

149. Par. 3-43-3. Table 43 gives the results f a test conducted to determine the voltage output of the coup ing system. It will be noted that, for various frequencie , the voltage output ranged from 36 to 69 millivolts.

150. Par. 3-43-4. The output phone jack is lo ated approximately at mid-panel height and near the left s ie of the front panel. This jack permits the use of the Na y type 49001 and 49034 shielded plugs.

151. Par. 3-43-5. The output phone jack is ma ked, "Frequency Meter Audio Output," as required by the ba ic specifications. The coupling terminals on the main t rminal board are marked "Freq. Meter 13AF, AF 14, RF 15, RF 6."

Specification RE 13A 442G, Section V

152. Since Section V of Specification RE 13A 4 2G has been extensively amended and largely superseded by RE 13A 592C, the latter specification is followed in the following paragraphs.

153. Par. 2-1 of RE 13A 592C. The following c vers the use of four-wire and six-wire control systems in the BK-12 transmitting equipment.

154. Par. 2-3 of RE 13A 592C. The four and s[illegible]-wire circuits used in the equipment are essentially those [illegible]hown on page 10C of the specifications.

155. Par. 2-4 of RE 13A 592C. The maximum st[illegible]dy-state current flowing in the start-stop remote control cir[illegible]its is 588 ma. The maximum peak current occurs when the st[illegible] button is depressed when employing six-wire control. The p[illegible]k current of 1.15 amperes is well within the specified limit o[illegible]2.5 amperes.

156. Par. 2-5 of RE 13A 592C. The terminals [illegible] the remote control lines are numbered 1y through 6y and [illegible]rrespond to those numbered 1 through 6 in the diagram on page [illegible]0C of the specifications.

157. Par. 2-6 of RE 13A 592C. Remote indicat[illegible] lamps in remote control units operate simultaneously with [illegible]cal indicator lamps after the control transfer switch is [illegible]laced in the "remote" position.

158. Par. 2-7 of RE 13A 592C. Suitable termi[illegible]ls and links are provided for changing from four to six-wir[illegible] control circuit operation. Two sets of terminals are locate[illegible] on the sides of the power-amplifier compartment shields as [illegible]own in Plates 7 and 8, while the third is visible in Plate [illegible] adjacent to the high voltage terminals on the main terminal b[illegible]rd.

159. Par. 2-8 of RE 13A 592C. The Model TBK-[illegible] Equipment was delivered wired for six-wire control. A maintai[illegible]ng-contact switch mounted on a nameplate was furnished for use [illegible] case four-wire control is to be employed. The two switch[illegible] may be interchanged easily and necessary circuit changes ca[illegible] be accomplished readily. The type of remote control ci[illegible]uit may be selected and the transmitter modified at the poin[illegible] of installation.

160. Par. 2-9 of RE 13A 592C. Keying potenti[illegible] is derived from the 230-volt d-c exciter generator. A [illegible]tentiometer consisting of two 1500-ohm resistors in series is em[illegible]oyed to drop this voltage to 115 volts as required by the sp[illegible]ifications.

161. Par. 2-10 of RE 13A 592C. The measured [illegible]ltage across the open key was 115 volts.

162. Par. 2-11-1 of RE 13A 592C. Suitable ad[illegible]stable contacts are provided on the keying relay for the op[illegible]ation of receiver protective relays. Operation equivalent[illegible]o a SPDT switch is afforded and the contacts are wired to ter[illegible]nals on the main terminal board.

[redacted]

163. Par. 2-11-2 of RE 13A 592C. No connections have been brought out to the terminal board from the bias supply for operation of receiver protective relays. It is recommended that terminals capable of supplying 110 volts and 0.150 ampere d.c. to an external load be provided on the main terminal board.

Six-Wire Remote Control.

164. Par. 2-12-1 of RE 13A 592C. A two-button momentary contact switch for starting and stopping the motor generator is located on the front panel. This switch is operative in both positions of the "Local-Remote" switch.

165. Par. 2-12-2 of RE 13A 592C. The equipment is capable of being started, stopped, and keyed from any connected remote unit after the control transfer switch has been placed in the "Remote" position.

Four-Wire Remote Control.

166. Par. 2-13-1 of RE 13A 592C. The equipment is capable of being started or stopped locally by means of a maintaining-contact switch when the transfer switch is in the "Local" position. The equipment may be stopped locally when the switch is in the "Remote" position or started locally if the transfer switch is in the "Remote" position and the remote starting switch is in the "on" position.

167. Par. 2-13-2 of RE 13A 592C. The TBK-12 equipment is capable of being started, stopped and keyed from a remote unit after the local start switch is placed in the "On" position and the control transfer switch is placed in the "Remote" position.

Specifications RE 13A 442G, Section VI

168. Par. 6-1. The following paragraphs summarize the characteristics of the TBK-12 power supply.

169. Par. 6-2. The motor generator unit received for test was capable of operation from either 440 or 220 volts, 60 cycles a.c. A 440-volt supply was employed during the various tests covered by this report.

170. Par. 6-3. The equipment functioned satisfactorily under conditions involving gradual and sudden changes of supply line voltage of ±5 per cent and ±10 per cent of rated value. Results of these tests are shown in Table 24.

171. Par. 6-4. The transmitter was subjected to two-hour locked key tests (Tables 29 and 30) and no undue heating of the motor-generator set was noticed.

172. Par. 6-5. Table 44 gives the power input from the line for various units under various conditions. It will be noted that total power input under key locked, full power output conditions is 3.1 kw, which is well under the specification limit of 4.5 kw.

173. Par. 6-6. The filament transformer primaries are supplied with 115 volts by the secondary of transformer T-103. The primary of T-103 is connected to the 440-volt, a-c line.

174. Par. 6-7. The plate, screen grid, and bias power are obtained from a motor-generator unit.

175. Par. 6-8. The d-c power for excitation of the generators is obtained from the bias generator.

176. Par. 6-9. The motor-generator equipment used with the TBK-12 transmitter includes: (1) a suitable driving motor; (2) a suitable high-voltage generator of the double commutator type, one circuit of which supplies power to the power-amplifier plate, and the other of which supplies power to the intermediate-amplifier plates and all amplifier screen grids; and (3) a suitable low-voltage generator of the double commutator type, one circuit of which supplies power to the master-oscillator plate and screen grid and the other of which supplies bias power to all tubes and excitation to both generators. All units are mounted on a common bedplate.

177. Par. 6-10. The motor-generator equipment is of the three-unit, six-bearing type as defined by this paragraph of the specifications.

178. Par. 6-11. The longest armature assembly used in the motor generator is 32-1/2 inches long. The specification limit of 36 inches has, therefore, not been exceeded.

179. Par. 6-14. The design of the equipment does not require the connection of generators in series to obtain necessary high voltages.

180. Par. 6-15. Flexible couplings between units of the motor-generator set are of the leather disc type. The construction of the couplings provides sufficient strength to enable successful operation under the conditions of intermittent stress imposed by keying the transmitter as well as stresses experienced in normal service. Heavy sheet metal guards are employed to shield each coupling as illustrated in Plates 22 and 23.

181. Par. 6-16. The motor and generator unit are mounted on a heavy cast bedplate. Each unit is so mounted as to permit replacement without disturbing the others. Each individual unit is fastened to the bedplate by four cap screws and two square-head dowel pins located in the corners for positioning. Shims are used under the high voltage unit to secure alignment. No shims are used under the motor or low voltage generator units. Four 7/8-inch diameter holes are drilled in the bedplate for securing the motor-generator set to the deck.

182. Par. 6-17. Motor and generator frames are grounded to the bedplate. Metal cover plates for terminal boxes are securely mounted and grounded to the frames. Terminal boxes are of strong, rigid construction and will stand a weight of 250 pounds without deformation.

183. Par. 6-18. A nameplate is mounted near the eye bolt on each machine reading, "This Eye Bolt Must Not Be Used When Hoisting The Entire Motor-Generator Set. Use Only For Hoisting This Individual Unit." Four 1-1/4-inch diameter holes in the bedplate, shown in Plate 22, afford a means for lifting the entire assembly.

184. Par. 6-19. The dimensions of the motor-generator unit are given in Table 10. It may be noted that the height (23-1/4 inches) exceeds the specification limit of 22 inches. It is suggested that the Bureau determine whether this small excess will cause difficulty in contemplated installations.

185. Par. 6-20. Ball bearings are used in all motors and generators. The equipment was not disassembled to permit an inspection of the bearings.

186. Par. 6-21. Suitable nameplates, listed in Table 9, are mounted on each unit, giving the type of lubricant to be used and the period of time between lubrications.

187. Par. 6-22. The motor-generator shafts accessible for inspection are marked "TBK-12."

188. Par. 6-23. Suitable fuses are provided in the generator connection boxes to protect the generators against damage caused by failure of any part of the equipment including short circuits in the high voltage cable. Barriers of laminated phenolic material are mounted between fuses to prevent flashover between terminals. The fuses provide adequate protection to prevent damage to the generators in case of failure of any part of the equipment or short circuits in the high voltage cables. However, as pointed out in paragraph 37, the connection of bleeder resistors between the high-voltage terminals may result

in the destruction of these components if fuse F-205 is disrupted by a short circuit in the 1500-volt output line.

189. Par. 6-24. The short circuit tests were not conducted at the Laboratory.

190. Par. 6-30. Such data as could be obtained to determine compliance with this paragraph of the specifications, without disassembling the equipment, are listed below.

M.O. AND BIAS GENERATOR

(1) Prime Mover: 4.5 h.p., 440/220 volts, 60 cycles, 3-phase motor.
(2) Degree of enclosure: semi-enclosed, drip proof.
(3) Method of cooling: self-ventilated, fan-cooled.
(4) Rated voltage: 1500/250.
(5) Class of insulation: not determined.
(6) Kilowatt capacity: 0.195/0.100.
(7) Time rating: continuous.
(8) Service application: use with radio transmitter.
(9) Ambient temperature of reference: Nameplate indicates 40°C temperature rise, out no ambient temperature of reference is given.
(10) Overload capacity: not determined.
(11) Bearings: ball, type unknown.

HIGH-VOLTAGE GENERATOR

(1) Prime mover: 4.5 h.p., 440/220 volts, 60 cycles, 3-phase motor.
(2) Degree of enclosure: semi-enclosed, drip proof.
(3) Method of cooling: self-ventilated, fan-cooled.
(4) Rated voltage: 3000/1500.
(5) Class of insulation: not determined.
(6) Kilowatt capacity: 1.5/0.6.
(7) Time rating: continuous.
(8) Service application: use with radio transmitters.
(9) Nameplate indicates 40°C temperature rise, out no ambient temperature of reference is given.
(10) Overload capacity: not determined.
(11) Bearings: ball, type unknown.

191. Par. 6-31. The voltage regulation of the generators is given in Table 45. It will be noted that, in all cases, the regulation was well below the specification limit of 5 per cent. Data on the amount of ripple present in the output of each generator are given in Table 46. In this case the equipment also complied with the specifications.

[redacted]

192. Par. 6-33. Data which could be obtained without disassembly of the driving motor are listed below.

(1) Ambient temperature of reference: Not stated.
(2) Class of insulation: Not determined.
(3) Degree of enclosure: Semi-enclosed, drip-proof.
(4) Method of cooling: Natural ventilation.
(5) Speed classification: Constant.
(6) Duty classification: Continuous.
(7) Frequency: 60 cycles.
(8) Voltage: 440/220, 3-phase.
(9) Classification: Squirrel cage induction motor.
(10) Sub-classification, squirrel cage induction motors: Not determined.
(11) Bearings: Ball, type unknown.
(12) Rated speed: 1750 r.p.m.
(13) Horse Power: 4.5.

Connections to the driving motor are made directly to wires which are brought from the machine. Also, the transfer from 440 to 220-volt operation is accomplished by reconnecting wires. It is recommended that connection studs be provided to facilitate the connection of external leads and that links be furnished in the connection box so that the motor can be altered for operation on either of the two voltages with less difficulty.

193. Par. 6-34. A magnetic controller was not received with the Model TBK-12 Transmitting Equipment.

194. Par. 6-35. The filter on this equipment consists only of capacitors and is contained within the transmitter unit.

195. Par. 6-36. No starter was supplied with this equipment, but photographs in the instruction book show the starter box doors mounted on hinges with removable pins fastened to the box with small chains as specified.

Specifications RE 13A 442G, Section IX

196. Tracings, Manufacturing Drawings, and Instruction Books A preliminary instruction book including drawings, diagrams, and photographs was included with the equipment. The following inconsistencies were noted and should be corrected in the final instruction book.

(a) The Navy type number of R-123 was given as CHD-63022D in the instruction book, while the marking on the resistor ferrule was CHD-63022E.

(b) The Navy type number of R-128 was given as CHD-63205E in the instruction book, but was marked CAO-63205D on the resistor, itself.

(c) Paragraph 3.16, page 12, in the instruction book states that a type 861 vacuum tube is used in the second intermediate amplifier. Actually, a type 860 tube is used.

197. A summary of the defects noted in the Model TBK-12 Equipment and such items as do not comply with the requirements of the governing specifications are listed below.

(a) The plates of capacitors C-146 and C-135 were misaligned when the equipment was received (Par. 22).

(b) The p-a plate milliammeter failed; r-f lead lengths are excessive; taper pins for the assembly of coil L-106 were not furnished; contacts of S-107 and S-108 are misaligned; filling material for dial index marks is unsatisfactory; end ties of r-f chokes were broken; filings and metal chips were not cleaned from machined parts; interlock of the adjust-tune-operate switch failed (Par. 31).

(c) The motor-generator armature shafts corroded (Par. 33).

(d) Ferrous materials are extensively employed and in some cases the protection against corrosion is inadequate (Par. 34).

(e) The arrangement of high-voltage bleeder resistors is unsatisfactory (Par. 37).

(f) The p-a tube is not protected against severe overload under conditions where the antenna may be short circuited or open circuited (Par. 43).

(g) The master-oscillator screen grid is supplied with voltages higher than permitted by Naval specifications (Par. 44).

(h) The casting comprising the dial lock on control J failed under shock; master starting relay K-101 opened under shock; wires to T-101 are not adequately braced; leads entering the motor frame are not protected against abrasion; solder is depended on for mechanical strength (Par. 47).

[redacted]

(j) Rheostat R-137 is not provided with a sa[illegible] and satisfactory means for control (Par. 49).

(k) Set screws and taper pins protrude beyon[illegible] the insulated surface of some control knobs ([illegible]ar. 52).

(l) No method for adjusting the r-f ammeter i[illegible] provided (Par. 54).

(m) Voltmeter multiplier resistors are not a [illegible]tandard Navy type (Par. 55).

(n) Bolts of insufficient length are employe[illegible]at some points in the assembly (Par. 59).

(o) Master-oscillator unit limit catches are [illegible]ot effective; resistors R-103 and R-121 are [illegible]ot easily accessible; the master-oscillator [illegible]over-plate gasket tears easily when the cover [illegible]s removed (Par. 64).

(p) Errors were noted in symbol numbers and [illegible]sistor identification numbers (Par. 69).

(q) The filament voltage cannot be readjuste[illegible]to normal when the line voltage is 10 per cent hig[illegible](Par. 72).

(r) Thumbscrews are not finished in black ni[illegible]el as specified (Par. 76).

(s) The protective coating applied to shield[illegible]had not been adequately removed at points where e[illegible]ectrical bonding was essential (Par. 77).

(t) The power output is less than the specifi[illegible]d minimum at 18000 kc; the power-amplifier tube is [illegible]verloaded at this frequency (Par. 86).

(u) Operation of the power output control pr[illegible]uces frequency variations in excess of specifi[illegible]ation requirements (Par. 95).

(v) At 4500 kc, changes in the ambient temper[illegible]ture produce frequency variations in excess o[illegible]speci-fication limitations (Par. 98).

(w) Variation in the relative humidity produc[illegible]s fre-quency variations in excess of specificat[illegible]on limitations (Par. 99).

(x) The power output was interrupted momentarily during inclination tests (Par. 103).

(y) Vibration produced a set in frequency at 500 kc in excess of the limits set by the specifications (Par. 104).

(z) The temperature of the master-oscillator cabinet is not maintained at a constant level under all conditions of ambient temperature (Par. 107).

(aa) The protective thermostat in the m-o compartment does not operate at the correct temperatures (Par. 108).

(bb) Lead-covered wire is not properly protected against mechanical damage (Par. 131).

(cc) The transmitter ground post is located so as to facilitate proper external connection (Par. 138).

(dd) A source of direct current for the supply of external receiver attenuator relays is not provided in the transmitter (Par. 163).

(ee) The dimensions of the motor-generator and transmitter slightly exceed those permitted by the specifications (Par. 128 and 184).

(ff) Terminals are not provided in the connection box of the driving motor to facilitate the connection of external leads (Par. 192).

(gg) Certain errors exist in the instruction book (Par. 196).

[redacted]

Table 1

Model TBK-12 Transmitting Equipment

CHECK OF RESISTORS USED IN EQUIPMENT

Test as per paragraph 2-2 of Specifications RE 1[illegible] 442G

Res. No.	Rated Ohms	Style	Type No.	Permitted by Specs Watts	Volts	Max. Res.	Measured Watts	V[illegible]ts	Res.
R103	20000	C	CHD-63485E	28	775	25000	0.08	0.	19920.
R104	35000	A	CHD-63221E	80	1650	75000	4.93	5	34900.
R105	20000	B	CHD-63159E	60	1200	50000	19.1	0	19450.
R106	6000	C	CHD-63797E	28	775	25000	Neg.	5.3	6020.
R107	8000	C	CHD-63798E	28	775	25000	12.8	0	7970.
R108	16000	C	CHD-63030E	28	775	25000	12.8	2	15930.
R109	1000	C	CHD-63777E	28	775	25000	0.17	3	988.
R112	2000	C	CHD-63362E	28	775	25000	1.90	8.0	1957.
R113	60	E	CHD-63309E	10	350	6000	---	0.	60.47
R115*	2000	A	CHD-63205D	80	1650	75000	47.0	8.	2019.
R116	1500	A	CHD-63204E	80	1650	75000	26.9	9.	1470.
R120	5000	C	CHD-63026E	28	775	25000	3.32	7.	4866.
R121	20000	C	CHD-63485E	28	775	25000	0.08	0.	19540.
R123	1500	C	CHD-63022E	28	775	25000	21.7	0.	1489.
R125	15000	A	CHD-63218E	80	1650	25000	31.6	0.	14630.
R126	8000	C	CHD-63798E	28	775	25000	10.3	0.	8160.
R127	2000	B	CHD-63143E	60	1200	50000	42.6	8.	1953.
R128	2000	A	CAO-63205D	80	1650	75000	40.6	7.	2029.
R129	3.5 Meg.	A	CAY-63775				2.57	3 0.	3.5 Meg.
R130	4000	C	CHD-63760E	28	775	25000	2.87	8.	4060.
R131	800	C	CHD-63793E	28	775	25000	3.64	4.	801.
R132	8000	B	CHD-63152E	60	1200	50000	3.64	0.	7856.
R133	35000	A	CHD-63221E	80	1650	75000	4.87	2.	34850.
R134	2000	A	CHD-63205D	80	1650	75000	47.4	8.	1998.
R135	2000	A	CHD-63205D	80	1650	75000	49.70	0.	2060.
R136	15000	A	CHD-63218E	80	1650	75000	31.80	0.	15400.
R138	15000	A	CHD-63218E	80	1650	75000	35.3	7.	14570.
R139	15000	A	CHD-63218E	80	1650	75000	40.20	2.	15230.
R142	800	C	CHD-63793E	28	775	25000	3.48	9.	802.
R143	3.5 Meg.	A	CAY-63775				0.52	1 0.	3.5 Meg.
R145							4.77	9.6	19.27
R146	100	C	CHD-63791D	28	775	25000	133.	5.	99.7
R151	1500	A	CHD-63204E	80	1650	75000	27.2	0.	1469.
R153	300	B	CHD-63131E	60	1200	50000	52.4	9.	290.5
R154	1500	C	CHD-63022E	28	775	25000	8.88	5.	1490.

* This resistor is marked R135 in the transmitter.

[redacted] (Continued)

Table 1 (Cont'd)

Indicator Lamp Assemblies

Resistor	Ohms Rated	Ohms Meas.	Measured Volts	Measured Watts	Extension of Cap Beyond Front Panel (In.)	Extension of Cap Beyond Bezel (In.)	Overall Length (In.)
Heater Pilot Light	1200	1189	98	8.08	1-3/16	1-1/16	6-7/8
Plate Voltage Indicator Light	2600	2616	228	19.88	1-1/8	1	7-9/32
Bias Indicator Light	2600	2660	226	19.21	1-1/8	1	7-9/32
Starter Indicator	1200	1213	98	7.92	1-1/8	1	6-15/16
Osc. Fil. Indicator (No series resistor employed)					1-1/8	1	4-5/8

Variable Resistors

Rheostat	Ohms Rated	Ohms Meas.	Measured Volts	Measured Watts	Ext. Behind Panel (In.)	Max. Diam. (In.)	Manufacturer and Type No.	Rated Watts
R118 (Max.)	750	752	90	10.78	1-3/4	4		
R118 at point of operation.	-	557	85	12.96				
R119 (Max.)	2500	2477	203	20.3	3-3/16	7-1/2	Ohmite 0542	150
R119 at point of operation.	-	250	90	32.4				
R137 (Max.)	50	52	22.5	9.75	1-1/4	3-1/8	Ohmite 0449	100
R137 at point of operation.	-	52	22.5	9.75				
R117 (Max.)	10	10.4	25.0	60.0	1-1/2	4	Ohmite 0530	150
R117 at point of operation.	-	8.9	20.5	47.3				

[redacted]

Table 2

Model TBK-12 Transmitting Equipment

INVESTIGATION OF FUSES

Test as per paragraphs 2-10 and 6-23 of Specifications [illegible] 13A 442G

Part No.	Circuit	Manufacturer and Type No.	Fuse Rating (Amps.)	Fuse Rating (Volts)	Measured (Amps)	Measured (Volts)
		Transmitter Unit				
F-102	Control	G.E. 1020	6.	250	2.95	115
F-103	Control	G.E. 1020	6.	250	2.95	115
F-107	Heater	G.E. 1022	10.	250	*5.38	
					2.85	
					2.92	115
F-108	Heater	G.E. 1022	10.	250	*5.38	
					2.85	
					2.92	115
		Low-Voltage Generator				
F-201	Bias	Chase-Shawmut AD-7	2.	250	0.78	230
F-204	M-O Plate	Littelfuse Special	0.33	2500	0.08	1350
		High-Voltage Generator				
F-205	Screen	Littelfuse 2108	0.75	2500	0.25	1500
F-206	P-A Plate	Littelfuse 3024A	0.75	5000	0.35	3000

Note: *(1) 5.38. Both heaters and motor going.
2.85. Aux. and motor.
2.92. Main heater and motor.

(2) Heater motor takes 0.250 amp.

[redacted]

Table 3

Model TBK-12 Transmitting Equipment

EFFECT OF FAILURE OF FUSES

Test as per paragraphs 2-10 and 6-23 of Specifications R 13A 442G

Symbol No. of Device Removed	Effect on Operation
	(Motor Generator Initially Running)
F-102	Motor Generator shuts down. M.O. heater continues to operate.
F-103	Motor Generator shuts down. M.O. heater continues to operate.
F-107	Stops M.O. heater and blower.
F-108	Stops M.O. heater and blower.
F-201	Field excitation to all generators interrupted, removing power from tubes. Motor Generator continues to run.
F-204	Removes plate and screen voltage from the Master Oscillator.
F-205	Removes plate voltage from I.P.A. Also removes screen voltages from I.P.A. and P.A. stages. Power output still noticeable. Circuit connected to P.A. plate circuit through resistors R-138 and R-139. The following conditions were found to exist: 1st I.P.A. Ip: 13 mils 2nd I.P.A. Ip: 20 mils P.A. Ig : 7 mils P.A. Ip : 100 mils Ant. Cur. : 1.6 amps.
F-206	Plate voltage on the power-amplifier stage drops to 130 volts. This voltage is derived from the I.P.A. 1500-volt supply through resistors R-138 and R-139.

(Continued)

Table 3 (Cont'd)

Symbol No. of Device Removed	Effect on Operation
F-206 and R-138	P-A I_p goes to zero. Other stages opera normally. Drive is still applied to P-A grid.
F-205 and R-138	I-A and P-A I_p go to zero.

Tests made at 2000 kc.

[redacted]

Table 4

Model TBK-12 Transmitting Equipment

CALIBRATION AND RANGE OF ADJUSTMENT OF OVERLOAD RELAYS

Test as per par. 2-10(3) of Specifications RE 13A 442G

Relay	Calibration Markings	Actual Current (Amps.)
K106	Minimum	0.430
	0.31	0.440
	0.45	0.460*
	0.48	0.500
	0.62	0.670
	Maximum	0.735
K107	Minimum	0.180
	0.17	0.185
	0.23	0.255*
	0.25	0.280
	0.34	0.385
	Maximum	0.400

Relay	Voltage	Coil Resistance (Ohms)	Coil Current (Ma)	Watts
K102	115		88	10.12**
K105	230		220	50.6
K104	115	185	387	
K101	110	187	588	

Note: * This calibration marking was the operating point and could only be estimated.

** This is also the key voltage and current.

[redacted]

Table 5

Model TBK-12 Transmitting Equipment

ANTENNA SHORT CIRCUITED AND OPEN CIRCUITED

Antenna: 115-Volt, 500-Watt Lamp

Test as per paragraph 2-16 of Specifications RE 13A 442G

Frequency (Kc)	Antenna Condition	Antenna Current (Amps.)	Plate Current (Ma)	Plate Voltage (Volts)	Output (Watts)
2000	Normal	4.5	300	3000	535
2000	Open	0.	40	3000	0
2000	Shorted	Off Scale	Off Scale	3000	-
18100	Normal	2.5	230	3000	165
18100	Open	0.	290	3000	0
18100	Shorted	1.4	290	3000	0

[redacted]

Table 6

Model TBK-12 Transmitting Equipment

POTENTIALS APPLIED TO ELECTRODES OF VACUUM TUBES - 00 KC

Test as per Paragraph 2-17 of Specifications RE 13 442G

Element	Spec. Ratings	Tune (1) Key Up	Tune (1) Key Down	Tune (2) Key Up	Tune (2) Key Down	Operate Key Up	Operate Key Down
Master Oscillator 38160							
Plate	3000	1060	750	1060	750	106	750
Screen	500	1010	525	1010	525	101	530
Grid	-800	-290	-80	-290	-80	-29	-80
Filament	10	9.8	9.6	9.8	9.6	8	9.6
1st Intermediate Power Amplifier 38160							
Plate	3000	0	0	1210	1280	121	1500
Screen	500	-15	190	-20	250	-2	240
Grid	-800	-392	-120	-392	-110	-39	-100
Filament	10	9.9	9.85	9.9	9.85	9	9.85
2nd Intermediate Power Amplifier 38160							
Plate	3000	0	0	1210	1500	121	1500
Screen	500	-15	250	-15	225	-1	270
Grid	-800	-520	-230	-530	-440	-53	-475
Filament	10	9.9	9.85	9.9	9.85	9	9.85
Power Amplifier 38161							
Plate	3500	0	0	1210	1500	271	3000
Screen	750	370	640	380	375	38	460
Grid	-1000	-530	-240	-530	-490	-53	-575
Filament	11	10.95	10.9	10.95	10.9	1 95	10.9

[redacted]

Table 7

Model TBK-12 Transmitting Equipment

POTENTIALS APPLIED TO ELECTRODES OF VACUUM TUBES - 18 00 KC

Test as per paragraph 2-17 of Specifications RE 13A 42G
Ratings Taken from Specifications RE 13A 600D

Element	Spec. Limit	Tune (1) Key Up	Tune (1) Key Down	Tune (2) Key Up	Tune (2) Key Down	erate Key U	erate Key Down
Master Oscillator 38160							
Plate	3000	1090	675	1090	675	1090	675
Screen	500	1035	550	1035	550	1035	550
Grid	-800	-290	-70	-290	-70	-290	-70
Filament	10	9.8	9.6	9.8	9.6	9.	9.6
1st Intermediate Power Amplifier 38160							
Plate	3000	0	0	1210	1300	1210	1500
Screen	500	-20	150	-20	290	-20	350
Grid	-800	-398	-120	-398	-110	-398	-110
Filament	10	9.9	9.85	9.9	9.85	9.	9.85
2nd Intermediate Power Amplifier 38160							
Plate	3000	0	0	1210	1300	1210	1500
Screen	500	-20	250	-20	265	-20	310
Grid	-800	-520	-230	-520	-365	-520	-400
Filament	10	9.9	9.85	9.9	9.85	9.	9.85
Power Amplifier 38161							
Plate	3500	0	0	1210	1500	2710	3000
Screen	750	385	650	370	525	360	670
Grid	-1000	-520	-230	-520	-270	-520	-290
Filament	11	10.95	10.90	10.95	10.90	10.	10.90

[redacted]

Table 8

Model TBK-12 Transmitting Equipment

LIST OF CONTROLS AND METERS

Data as per paragraph 2-23 of Specifications RE 13A -42G

Control Designation	Nameplate	Divisions
A	Oscillator Switch	6 P nts
B	Oscillator Tuning	7,12 Div.
C	Oscillator Plate Tuning	9 Div.
D	1st Amp. Tuning	3,00 Div.
E	2nd Amp. Tuning	2,85 Div.
F	Power Amplifier Tuning	2,85 Div.
G	Antenna Coupling	9 Div.
H	Antenna Feed Switch	2 P nts
I	Antenna Capacitor	9 Div.
J	Antenna Inductor	2,85 Div.

M--O Compensator (Screwdriver adjustment).
Tuning Step One, Tuning Step Two, Operate (3 point switch)
Filament Voltage (arrow shows rotation to increase).
Plate Voltage (arrow shows rotation to increase).
Bias Voltage (arrow shows rotation to increase).
Frequency Meter Audio Output (jack).
Start Stop (two-button, six-wire control).
Test Key (toggle type, lock--up, open--center, momentary-- own).
Emergency Stop Switch (two-button switch).marked "Stop--On
Local--Remote Switch (local--down, remote--up).
Overload Reset. (push button, m-o and i-a).
Overload Reset (push button, p-a).
M-O Cabinet Thermometer (58°C-62°C).
Tuning Chart (14 frecuencies).
Keying Relay.
Oscillator Filament Standby Switch, "Off-On."
Oscillator Filament Rheostat (screwdriver adjustment).

Indicator Lights

M-O Heater Circuit ---Amber
Meter Solenoid ---Red
Plate Voltage ---Red
Bias Voltage ---Green
Master Oscillator Filament---Clear

[redacted] (Contin d)

Table 8 (Cont'd)

Meters

Nameplate	Range	Navy Type
Oscillator Plate Current	150 ma d.c.	AY-22061
Oscillator Screen Current	50 ma d.c.	AY-22056
1st Amp. Plate Current	150 ma d.c.	AY-22061
2nd Amp. Plate Current	150 ma d.c.	AY-22061
P-A Grid Current	150 ma d.c.	AY-22061
P-A Plate Current	500 ma d.c.	AY-22067
Antenna Current	8 amps. r.f.	CV-22030
Auxiliary Plate Voltage	3.5 kv d.c.	AY-22311
External Multiplier		AY-63775
Bias Voltage	350 volts d.c.	AY-22143
Filament Voltage	15 volts a.c.	AY-22080
P-A Plate Voltage	3.5 kv d.c.	AY-22311
External Multiplier		AY-63775
Tube Hour Meter	10,000 hours	AY-22148-B

Interlocked Access Doors

M-O Compartment
Relay Compartment
1st and 2nd Amplifier Compartment
P-A Tube Compartment

Nameplates

Equipment Nameplate
Transmitter Unit Nameplate
Date of Acceptance Nameplate

[redacted]

Table 9

Model TBK-12 Transmitting Equipment

LIST OF NAMEPLATES

Test as per paragraphs 2-26 and 2-27 of Specifications [illegible] 13A 442G

1. (Size: 4 by 4-1/2 inches) - Transmitter.

RADIO TRANSMITTING EQUIPMENT

Model TBK-12 Serial 76

Frequency Range: 2000 to 18100 Kc.

Output: 500 Watts Supply: 440V, 60 ~, [illegible] PH.

Equipment consists of following units:
CRV-52105 Transmitter
CAE-21336 Magnetic Controller
CBP-21332 Motor Generator

See License Notice Inside

N A V Y D E P A R T M E N T
BUREAU OF SHIPS

- -

Contractor:
RCA Manufacturing Co. Inc.
Camden, N.J., U.S.A.

Contract NOs-80750 Contract Date: 14 J[illegible]. 1941

- -

2. (Size: 2 by 3 inches) - Transmitter

BEFORE REMOVING
OSCILLATOR UNIT
DISCONNECT
FIRST AMPLIFIER
GRID LEAD AND
OPEN LOWER DOOR

- -

[redacted] (Continued)

DECLASSIFIED

Table 9 (Cont'd)

3. (Size: 2 by 3 inches) - Transmitter.

Radio Transmitter Unit
Type CRV-52105
Frequency: 2000 to 18100 Kc
Supply: 440/220V, 60 ~

Weight: 655 Lbs. Serial 29

A Unit of Model TBK-12 Equipment

Manufactured for
Navy Department - Bureau of Ships
By
RCA Manufacturing Co., Inc.
Camden, N.J., U.S.A.

Contract NOs-80750 Contract Date: 14 Jan 1941

- -

4. (Size: 5/8 by 4 inches) - Transmitter.

DATE ACCEPTED BY THE GOV. ____
DATE PLACED IN SERVICE ____
SEE INSTRUCTION BOOK REGARDING GUARANTEE

- -

5. (Size: 2-3/8 by 3-1/2 inches) - Motor Generator Set
L.V. Generator.

ELECTRIC SPECIALTY CO.
Stamford, Conn., U.S.A.

D.C. Generator Serial No. 94334
Type F51 Volts 250-1500 P.
Phase ____ Cyc. ____ H.P. ____ Amps. -.13
RPM 1750 Wind'g. Comp. Duty Cont.
Contract NOs-80750 CB 21329A

Accepted
By S.J.S. Date 1942

- -

[redacted] (Continued)

DECLASSIFIED

Table 9 (Cont'd)

6. (Size: 1-1/16 by 3 inches) - Motor Generator Set - V. Generator

LUBRICATE EVERY SIX MONTHS
WITH GRADE A GREASE. REMOVE DRAIN
PLUGS BEFORE GREASING. SPIN
SHAFT DURING AND AFTER
GREASING AND BEFORE REPLACING
DRAIN AND REFILLING PLUGS.

- -

7. (Size: 13/16 by 3 inches) - Motor Generator Set - V. Generator.

THIS EYEBOLT MUST NOT BE USED
WHEN HOISTING THE ENTIRE
MOTOR-GENERATOR SET.
USE ONLY FOR HOISTING
THIS INDIVIDUAL UNIT.

- -

8. (Size: 1 by 2-1/8 inches) - Motor Generator Set - V. Generator.

CAUTION
HIGH VOLTAGE

- -

9. (Size: 7/8 by 3 inches) - Motor Generator Set - L. Generator.

ROTATION
(Arrow)

- -

[redacted]

(Continued)

Table 9 (Cont'd)

10. (Size: 2-3/8 by 3-1/2 inches) - Motor Generator Set H.V. Generator.

ELECTRIC SPECIALTY CO.
Stamford, Conn., U.S.A.

D.C. Generator — Serial No. 302462
Type P53 — Volts 3000-1500 — P. ____
Phase ____ — Cyc. ____ — H.P. ____ — Amp. .5-.4
RPM 1750 — Wind'g. Comp. — Duty Cont.
Contract NOs-80750 — C-21328A

Accepted
By S.J.S. Date 1942

- -

11. (Size: 1-1/16 by 3 inches) - Motor Generator Set - H.V. Generator.

LUBRICATE BEARINGS EVERY SIX MONTHS
WITH GRADE A GREASE. REMOVE DRAIN
PLUGS BEFORE GREASING. SPIN
SHAFT DURING AND AFTER
GREASING AND BEFORE REPLACING
DRAIN AND REFILLING PLUGS.

- -

12. (Size: 13/16 by 3 inches) - Motor Generator Set - H.V. Generator.

THIS EYEBOLT MUST NOT BE USED
WHEN HOISTING THE ENTIRE
MOTOR-GENERATOR SET.
USE ONLY FOR HOISTING
THIS INDIVIDUAL UNIT.

- -

[redacted] (Continued)

Table 9 (Cont'd)

13. (Size: 9/16 by 3 inches) - Motor Generator Set - H.V. Generator.

LUB. SPEC. 14L3

- -

14. (Size: 1 by 2-1/8 inches) - Motor Generator Set - H.V. Generator.

CAUTION
HIGH VOLTAGE

- -

15. (Size: 7/8 by 3 inches) - Motor Generator Set - H.V. Generator.

ROTATION
(Arrow)

- -

16. (Size: 2-3/8 by 3-1/2 inches) - Motor Generator Set - Motor.

ELECTRIC SPECIALTY CO.
Stamford, Conn., U.S.A.

A.C. Motor
Type BY54
Phase 3
RPM 1750
Contract NOs-80750

Volts 220-440
Cyc. 60 H.P. 4.5
Wind'g. ____

Serial No. 94333
Frame No. ____
Amps. 12-6
Duty Cont.
Cat. No. 21327A

Accepted
By S.J.S. Date 1942

- -

(Continued)

Table 9 (Cont'd)

17. (Size: 1-1/16 by 3 inches) - Motor Generator Set - M[illegible]or.

LUBRICATE BEARINGS EVERY SIX MONTHS
WITH GRADE A GREASE. REMOVE DRAIN
PLUGS BEFORE GREASING. SPIN
SHAFT DURING AND AFTER
GREASING AND BEFORE REPLACING
DRAIN AND FILLING PLUGS.

- -

18. (Size: 13/16 by 3 inches) - Motor Generator Set - Mo[illegible]r.

THIS EYEBOLT MUST NOT BE USED
WHEN HOISTING THE ENTIRE
MOTOR-GENERATOR SET.
USE ONLY FOR HOISTING
THIS INDIVIDUAL UNIT.

- -

19. (Size: 1-9/16 by 2-9/16 inches) - Motor Generator Se[illegible] - Motor.

(Bears connection diagram for 220 and 440 volt lines.

- -

20. (Size: 7/8 by 3 inches) - Motor Generator Set - Moto[illegible]

ROTATION
(Arrow)

- -

[redacted] (Co[illegible]nued)

Table 9 (Cont'd)

21. (Size: 2 by 3 inches) - Motor Generator Set.

Motor-Generator Unit
Type CBP-21332A
Consisting of Bed Plates and Types
CBP-21327A, CBP-21328A, CBP-21329A.
Supply: 220, 440, 3 PH, 60 CY
Weight 1150 Serial No. 29
A Unit of Model TBK-12 Equipment
Manufactured For
Navy Department - Bureau of Ships
By
Electric Specialty Company
Stamford, Conn., U.S.A.
Contract NOs-80750 Contract Date 1-14-4

- -

22. (Size: 1-3/8 by 2-3/4 inches) - Transmitter - Blower Motor.

BODINE ELECTRIC COMPANY
CHICAGO
U.S.A.

TYPE NC1-12		CONTRACT ____
VOLTS 110 A.C.	PHASE 1, CY 60	SHIP NO. ____
AMPS. .25	WINDING ____	TEMP. RISE 40
RPM 2850	INTER H.P.	TIME ____
NO. 609197	CONT. H.P. 1/70	DUTY CONT.
DATE MFD. 1941		

FOR ____________

- -

[redacted]

Table 10

Model TBK-12 Transmitting Equipment

WEIGHTS AND DIMENSIONS

Test as per paragraphs 2-32, 3-29, and 6-19 of Specifications RE 13A 442G

Transmitter

		Specification Requirements
Height	72-1/8"	72"
Width	31-7/8"	32"
Depth	24-1/2"	24-7/8"
Weight	652 Lbs.	

Motor-Generator Set

		Specification Requirements
Length	71-1/4"	75"
Height	23-1/4"	23"
Width	19"	19"
Weight	1196 Lbs.	

Total Weight (Two Units) - 1821 Lbs.
Specification Limits - 2100 Los.

[redacted]

Table 11

Model TBK-12 Transmitting Equipment

DETERMINATION OF POWER OUTPUT

Antenna: 115-Volt, 500-Watt Lamp

Test as per paragraph 3-3(2) of Specifications RE 13 442G

Control or Meter	2000 Kc	3000 Kc	4500 Kc	5000 Kc
A	1	4	6	3
B	2828	3179	4752	1683
C	10	60	83	43
D	487	1351	1900	2007
E	352	1309	1846	1950
F	231	1110	1694	1812
G	45	30	32	33
H	C	C	C	C
I	64	90	90	90
J	0	582	1744	1939
M.O. I_p	30	34	36	34
M.O. I_{sg}	11.5	11.5	11.5	11.5
1st I.A. I_p	41.0	36.0	26.0	51.0
2nd I.A. I_p	100.0	70.0	58.0	56.0
P.A. I_g	52	46.0	35.0	33.0
P.A. I_p	300	300	300	300
Aux. E_p	1350	1350	1350	1350
Plate E_p	3000	3000	3000	3000
Bias Voltage	230	230	230	230
Fil. Volts	11	11	11	11
Line Volts	444	445	446	448
Watts Output	560	552	510	500
Spec. Requirements	500	500	450	450

[redacted] (Continued)

Table 11 (Cont'd)

Control or Meter	6000 Kc	7000 Kc	8000 Kc	9000 Kc
A	4	5	6	6
B	3179	3834	2565	4752
C	60	72	78	83
D	2177	2398	2394	2457
E	2112	2230	2323	2380
F	1990	2120	2220	2280
G	35	38	41	47
H	C	C	C	C
I	90	90	90	90
J	2212	2422	2595	2705
M.O. I_p	34	34	34	35
M.O. I_{sg}	11.5	11.5	11.5	11.5
1st I.A. I_p	54	62	60.0	49
2nd I.A. I_p	58	58	60	61
P.A. I_g	30	28	27	22
P.A. I_p	300	300	300	300
Aux. E_p	1350	1350	1350	1350
Plate E_p	3000	3000	3000	3000
Bias Voltage	230	230	230	230
Fil. Volts	11	11	11	11
Line Volts	448	448	448	448
Watts Output	486	470	460	440
Spec. Requirements	450	400	375	375

[redacted] (Continued)

Table 11 (Cont'd)

Control or Meter	10000 Kc	12000 Kc	14000 Kc	1600 Kc	18100 Kc
A	3	4	5	6	6
B	1683	3179	3834	2565	4855
C	43	60	72	78	83
D	2008	2177	2298	2395	2479
E	2456	2552	2626	2684	2741
F	2368	2458	2530	2587	2642
G	45	49	90	50	33
H	V	V	V	V	V
I	90	90	90	90	90
J	0	1800	2345	2600	2714
M.O. I_p	34	33	33	34	35
M.O. I_{sg}	11.5	11.5	11.5	11	11.5
1st I.A. I_p	56	60	61	62	45
2nd I.A. I_p	88	92	92	90	73
P.A. I_g	24	19	16	14	8
P.A. I_p	300	300	285	275	230
Aux. E_p	1350	1350	1350	1350	1350
Plate E_p	3000	3000	3000	3000	3000
Bias Voltage	230	230	230	230	230
Fil. Volts	11	11	11	11	11
Line Volts	445	444	445	446	444
Watts Output	432	400	360	330	240
Spec. Requirements	360	360	325	325	300

Table 12

Model TBK-12 Transmitting Equipment

OPERATION INTO AN ACTUAL ANTENNA

Antenna: 90' Vertical
20' Lead-in

Test as per paragraph 3-2 of Specifications RE 1[illegible] 442G

ontrol or Meter	2000 Kc	3000 Kc	4500 Kc	5000 Kc
A	1	4	6	3
B	2828	3179	4752	1683
C	10.5	60	83	43
D	500	1353	1903	1909
E	350	1306	1846	1952
F	233	1145	1708	1820
G	45	73	63	45
H	C	V	C	C
I	55	63	90	90
J	0	0	1070	1511
.O. Ip (Ma)	30	34	34	34
.O. I_{sg} (Ma)	11	12	11	11
st I.A. Ip (Ma)	50	37	37	52
nd I.A. Ip (Ma)	103	69	58	58
.A. I_g (Ma)	53	45	35	35
.A. Ip (Ma)	300	300	300	300
nt. Cur. (Amps.)	5.1	2.3	2.[illegible]	2.7
ux. E_p	1350	1350	1350	1350
late E_p	3000	3000	3000	3000
ias Voltage	230	230	230	230
il. Volts	11.0	11.0	11.[illegible]	11.0
ine Volts	440	440	440	440

[redacted]

(Continued)

Table 12 (Cont'd)

Control or Meter	6000 Kc	7000 Kc	8000 Kc	9000 Kc
A	4	5	6	6
B	3179	3834	2565	4752
C	60	72	78	83
D	2176	2300	2396	2475
E	2110	2231	2320	2397
F	1994	2122	2215	2291
G	53	40	23	34
H	C	V	V	V
I	90	90	90	90
J	2244	1718	2290	2548
M.O. Ip (Ma)	33	33	33	34
M.O. Isg (Ma)	11	11	11	11
1st I.A. Ip (Ma)	60	65	68	50
2nd I.A. Ip (Ma)	59	61	61	60
P.A. Ig (Ma)	32	30	28	20
P.A. Ip (Ma)	300	300	300	300
Ant. Cur. (Amps.)	3.0	2.3	1.0	1.3
Aux. Ep	1350	1350	1350	1350
Plate Ep	3000	3000	3000	3000
Bias Voltage	230	230	230	230
Fil. Volts	11.0	11.0	11.0	11.0
Line Volts	440	440	440	440

(Continued)

Table 12 (Cont'd)

Control or Meter	10000 Kc	12000 Kc	14000 Kc	1600 Kc	18100 Kc
A	3	4	5	6	6
B	1683	3179	3834	2565	4855
C	43	60	72	78	84
D	1906	3176	2300	2395	2478
E	2455	2552	2626	2684	2741
F	2370	2458	2540	2593	2648
G	60	19	55	15	30
H	V	V	C	V	C
I	90	90	90	90	90
J	2472	2632	2522	2808	2642
M.O. Ip (Ma)	34	34	33	33	35
M.O. Isg (Ma)	11	11	11	11	11
1st I.A. Ip (Ma)	58	64	68	68	50
2nd I.A. Ip (Ma)	87	94	95	94	74
P.A. Ig (Ma)	23	20	18	15	7
P.A. Ip (Ma)	300	300	300	300	240
Ant. Cur. (Amps.)	1.8	0	1.8	1	1.5
Aux. Ep	1350	1350	1350	1350	1350
Plate Ep	3000	3000	3000	3000	3000
Bias Voltage	230	230	230	230	230
Fil. Volts	11.0	11.0	11.0	11	11.0
Line Volts	440	440	440	440	440

Table 13

Model TBK-12 Transmitting Equipment

OPERATION INTO AN ACTUAL ANTENNA
Antenna: 33' Vertical
16' Trunk
20' Lead-In
Test as per paragraph 3-2 of Specifications RE 13 442G

Control or Meter	2000 Kc	3000 Kc	4500 Kc	5000 Kc
A	1	4	6	3
B	2128	3179	4752	1683
C	10.5	60	83	43
D	500	1353	1903	1909
E	350	1306	1846	1952
F	232	1145	1708	1820
G	57	37	46	38
H	C	C	V	V
I	45	90	90	90
J	0	912	991	1636
M.O. I_p (Ma)	30	34	34	34
M.O. I_{sg} (Ma)	11	12	11	11
1st I.A. I_p (Ma)	50	37	37	52
2nd I.A. I_p (Ma)	103	69	58	58
P.A. I_g (Ma)	53	45	35	35
P.A. I_p (Ma)	300	300	300	300
Ant. Cur. (Amps.)	4.7	3.7	1.7	1.1
Aux. E_p	1350	1350	1350	1350
Plate E_p	3000	3000	3000	3000
Bias Voltage	230	230	230	230
Fil. Volts	11.0	11.0	11.0	11.0
Line Volts	440	440	440	440

[redacted] ontinued)

Table 13 (Cont'd)

Control or Meter	6000 Kc	7000 Kc	8000 Kc	9000 Kc
A	4	5	6	6
B	3179	3635	2565	4752
C	60	72	78	83
D	2176	2300	2396	2475
E	2110	2231	2320	2397
F	1994	2122	2215	2296
G	40	70	70	50
H	V	V	V	V
I	90	90	90	90
J	2297	2442	2400	2408
M.O. I_p (Ma)	33	33	33	34
M.O. I_{sg} (Ma)	11	11	11	11
1st I.A. I_p (Ma)	60	65	68	50
2nd I.A. I_p (Ma)	59	61	61	60
P.A. I_g (Ma)	32	30	28	20
P.A. I_p (Ma)	300	300	300	300
Ant. Cur. (Amps.)	1.0	1.7	1.5	1.2
Aux. E_p	1350	1350	1350	1350
Plate E_p	3000	3000	3000	3000
Bias Voltage	230	230	230	230
Fil. Volts	11.0	11.0	11.0	11.0
Line Volts	440	440	440	440

[redacted]

(Continued)

Table 13 (Cont'd)

Control or Meter	10000 Kc	12000 Kc	14000 Kc	1600 Kc	18100 Kc
A	3	4	5	6	6
B	1683	3179	3834	2565	4855
C	43	60	72	78	84
D	1906	2176	2300	2395	2478
E	2455	2552	2626	2684	2741
F	2370	2458	2540	2593	2648
G	32	27	76	90	33
H	V	V	C	C	C
I	90	90	90	90	90
J	2516	2690	2526	2511	2617
I.O. I_p (Ma)	34	34	33	33	35
I.O. I_{sg} (Ma)	11	11	11	11	11
1st I.A. I_p (Ma)	58	64	68	68	50
2nd I.A. I_p (Ma)	87	94	95	94	74
P.A. I_g (Ma)	23	20	18	1[illegible]	7
P.A. I_p (Ma)	300	300	300	300	240
Ant. Cur. (Amps.)	1.0	1.2	1.6	[illegible]	1.4
Aux. E_p	1350	1350	1350	1350	1350
Plate E_p	3000	3000	3000	3000	3000
Bias Voltage	230	230	230	230	230
Fil. Volts	11.0	11.0	11.0	11[illegible]	11.0
Line Volts	440	440	440	440	440

Table 14

Model TBK-12 Transmitting Equipment

MEASUREMENT OF CARRIER RIPPLE

Test as per paragraph 3-5-(2) of Specifications RE [illegible]A 442G

Frequency (Kc)	Rectified Carrier Voltage (Volts)	R-M-S Ripple Voltage (Volts)	[illegible]r Cent Ripple
2000	330	0.1	[illegible].033
4500	660	0.9	[illegible].13
18100	130	0.7	[illegible].54

Note: (1) Specification Requirements: 2 per cent [illegible] less.

[redacted]

Table 15

Model TBK-12 Transmitting Equipment

ACCURACY OF RESET TO PREVIOUSLY CALIBRATED FREQUENCY

Test as per paragraph 3-7-(1) of Specifications RE 3A 442G

Trial No.	Frequency (Kc)	Time (Sec.)	Deviation in Cycles	Frequency Per Cent
Original	2000.464			
1	2000.470	60	6	.00029
2	2000.478	65	14	.00069
3	2000.470	61	6	.00029
4	2000.490	63	26	.0012
5	2000.450	70	14	.00069
			Average:	.000632
Original	4500.600			
1	4500.570	64	30	.00067
2	4500.550	70	50	.00111
3	4500.596	63	4	.00009
4	4500.560	53	40	.00089
5	4500.590	54	10	.00022
			Average:	.00060

Specification Requirements:

Average of five trials: 0.003 per cent.
No one trial to exceed 0.005 per cent.

Table 16

Model TBK-12 Transmitting Equipment

TEST FOR LOST MOTION, BACKLASH, AND TORQUE LA

Test as per paragraph 3-7-(2) of Specifications RE A 442G

Trial No.	Frequency When Approached From Clockwise Direction	Frequency When Approached From Counterclockwise Direction	Backl Cycles	Per Cent
1	2000.442	2000.435	7	00035
2	2000.439	2000.440	1	00005
3	2000.438	2000.434	4	00020
4	2000.445	2000.425	20	00100
5	2000.440	2000.435	5	00025
		Average:		00037
		Maximum Departure:		001
		Permitted by Spec. (Max.):		008
		Average Permitted by Spec.:		005
1	4500.538	4500.535	3	00007
2	4500.550	4500.550	0	00000
3	4500.562	4500.554	8	00018
4	4500.571	4500.554	17	00038
5	4500.568	4500.552	16	00036
		Average:		00020
		Maximum Departure:		00038
		Permitted by Spec. (Max.):		008
		Average Permitted by Spec.:		005

Table 17

Model TBK-12 Transmitting Equipment

OPERATION OF ADJUST-TUNE-OPERATE CONTROL

Test as per paragraph 3-7-(3) of Specifications RE [illegible] 442G

Step One (Adjust)	Step Two (Tune)	Step Three (Operate)	Maximu Frequency Cycles	nge Cent
4500.516	4500.500	4500.490	26	0058
2000.493	2000.482	2000.480	13	0065

Specification Requirements: 01

[redacted]

Table 18

Model TBK-12 Transmitting Equipment

DETUNING OF CIRCUITS

Test as per paragraph 3-7-(4) of Specifications RE A 442G

Circuit Detuned	Frequency (Kc)	Change in Frequency Cycles	Per Cent
Normal	2000.475		
C (C)	2000.473	2	00010
C (CC)	2000.474	1	00005
D (C)	2000.472	3	00015
D (CC)	2000.470	5	00025
E (C)	2000.470	5	00025
E (CC)	2000.470	5	00025
F (C)	2000.470	5	00025
F (CC)	2000.470	5	00025
G (C)	2000.471	4	00020
G (CC)	2000.470	5	00025
H (C)	2000.470	5	00025
I (C)	2000.469	6	00030
I (CC)	2000.469	6	00030
J (CC)	2000.470	5	00025
Normal	4500.400		
C (C)	4500.398	2	00004
C (CC)	4500.411	11	00024
D (C)	4500.416	16	00036
D (CC)	4500.417	17	00038
E (C)	4500.418	18	00040
E (CC)	4500.417	17	00038
F (C)	4500.416	16	00036
F (CC)	4500.416	16	00036
G (C)	4500.413	13	00029
G (CC)	4500.413	13	00029
H (C)	4500.415	15	00033
I (C)	4500.413	13	00029
J (C)	4500.413	13	00029
J (CC)	4500.412	12	00027
	Specification Requirements:		003

Note: (1) "C" denotes control detuned clockwise.
"CC" denotes control detuned counterclockwise.

(2) Each circuit was detuned sufficiently to cause 25% change in the plate current of an affected tube.

[redacted]

Table 19

Model TBK-12 Transmitting Equipment

OPERATION OF POWER OUTPUT CONTROL

Antenna: 115-Volt, 500-Watt Lamp

Test as per paragraphs 3-7(5) and 3-25 of Specifications [illegible]13A 442G

Frequency (Kc)	Frequency Change		Power Amp.		Output (Watts)	Pow (%	Voltage (%)
	Cycles	Per Cent	Ep	Ip			
2000.445			3000	300	540		
2000.474	29	0.00145	2750	280	460	85.	91.8
2000.475	30	0.00150	2500	255	370	68.	83.4
2000.450	5	0.00025	2250	240	288	53.	75.0
2000.450	5	0.00025	2000	210	212	39.	66.7
2000.450	5	0.00025	1750	180	160	29.	58.4
2000.450	5	0.00025	1650	160	108	20.	55.5
+500.379			3000	230	246		
+500.376	3	0.00007	2750	195	180	73.	91.8
+500.375	4	0.00009	2500	150	110	44.	83.4
+500.390	11	0.00024	2250	110	14	5.	75.0

Specification Requirement: Frequency change not to exceed [illegible]001%.

Note: Measurements shown above for 4500 kc were obtained [illegible]h a transmitter output frequency of 18000 kc.

[redacted]

Table 20

Model TBK-12 Transmitting Equipment

CHANGE OF TUBES - M.O.

Test as per paragraph 3-7(6) of Specifications RE 1 442G

Manufacturer and Serial No. of Tube		Frequency (Kc)	Deviation fr Cycles	Mean Freq. Per Cent
R.C.A. 22935		2000.180	216	0.01070
R.C.A. 23120		2000.417	21	0.00105
R.C.A. 22922		2000.411	15	0.00075
R.C.A. 23113		2000.420	24	0.00120
R.C.A. 23125		2000.322	74	0.00370
R.C.A. 22917		2000.465	69	0.00345
R.C.A. 30158		2000.324	72	0.00360
R.C.A. 30116		2000.657	261	0.01305
R.C.A. 23020		2000.470	74	0.00370
R.C.A. 42786		2000.290	106	0.00530
	Mean:	2000.396	93.2	0.00465
R.C.A. 22935		4500.540	179	0.0039
R.C.A. 23120		4500.550	189	0.0042
R.C.A. 22922		4500.236	125	0.0027
R.C.A. 23113		4500.101	260	0.0057
R.C.A. 23125		4500.560	199	0.0044
R.C.A. 22917		4500.411	50	0.0011
R.C.A. 30158		4500.310	51	0.0011
R.C.A. 30116		4500.795	434	0.0096
R.C.A. 23020		4500.000	361	0.0080
R.C.A. 42786		4500.107	254	0.0056
	Mean:	4500.361	210	0.0046

Specification Requirements: 0.01 per cent.

Table 21

Model TBK-12 Transmitting Equipment

CHANGE OF TUBES - 1st I.A.

Test as per paragraph 3-7(6) of Specifications RE 13 ,42G

Manufacturer and Serial No. of Tube		Frequency (Kc)	Deviation fro Cycles	Mean Freq. Per Cent
R.C.A. 22935		2000.505	6	0.00030
R.C.A. 23120		2000.510	1	0.00005
R.C.A. 22922		2000.514	3	0.00015
R.C.A. 23113		2000.512	1	0.00005
R.C.A. 23125		2000.513	2	0.00010
R.C.A. 22917		2000.511	0	0.
R.C.A. 30158		2000.514	3	0.00015
R.C.A. 30116		2000.515	4	0.00020
R.C.A. 23020		2000.510	1	0.00005
R.C.A. 42786		2000.509	2	0.00010
	Mean:	2000.511	2.3	0.00012
R.C.A. 22935		4500.258	6	0.00013
R.C.A. 23120		4500.250	14	0.00031
R.C.A. 22922		4500.272	8	0.00017
R.C.A. 23113		4500.265	1	0.00002
R.C.A. 23125		4500.251	13	0.00028
R.C.A. 22917		4500.253	11	0.00024
R.C.A. 30158		4500.284	20	0.00044
R.C.A. 30116		4500.276	12	0.00026
R.C.A. 23020		4500.263	1	0.00002
R.C.A. 42786		4500.270	6	0.00013
	Mean:	4500.264	9.2	0.00020

Specification Requirements: 0.0005 per cent.

Table 22

Model TBK-12 Transmitting Equipment

CHANGE OF TUBES - 2nd I.A.

Test as per paragraph 3-7(6) of Specifications RE 13 442G

Manufacturer and Serial No. of Tube		Frequency (Kc)	Deviation fr Cycles	Mean Freq. Per Cent
R.C.A. 23113		2000.505	4	0.00020
R.C.A. 22922		2000.503	2	0.00010
R.C.A. 23120		2000.502	1	0.00005
R.C.A. 22935		2000.501	0	0.
R.C.A. 23125		2000.500	1	0.00005
R.C.A. 22917		2000.501	0	0.
R.C.A. 30158		2000.500	1	0.00005
R.C.A. 30116		2000.499	2	0.00010
R.C.A. 23020		2000.500	1	0.00005
R.C.A. 42786		2000.498	3	0.00015
	Mean:	2000.501	1.5	0.00008
R.C.A. 22935		4500.513	12	0.00026
R.C.A. 23120		4500.508	7	0.00015
R.C.A. 22922		4500.503	2	0.00004
R.C.A. 23113		4500.495	6	0.00013
R.C.A. 23125		4500.500	1	0.00002
R.C.A. 22917		4500.492	9	0.00020
R.C.A. 30158		4500.501	0	0.
R.C.A. 30116		4500.502	1	0.00002
R.C.A. 23020		4500.504	3	0.00007
R.C.A. 42786		4500.494	7	0.00015
	Mean:	4500.501	4.8	0.00010

Specification Requirements: 0.0005 per cent.

Table 23

Model TBK-12 Transmitting Equipment

CHANGE OF TUBES - P.A.

Test as per paragraph 3-7(6) of Specifications RE 1 442G

Manufacturer and Serial No. of Tube		Frequency (Kc)	Deviation fr Cycles	Mean Freq. Per Cent
WEMCO 27455		2000.498	1	0.00005
WEMCO 28318		2000.500	1	0.00005
WEMCO 28359		2000.497	2	0.00010
WEMCO 27479		2000.499	0	0.
WEMCO 26515		2000.500	1	0.00005
	Mean:	2000.499	1.0	0.00005
WEMCO 27455		4500.511	2	0.00004
WEMCO 28318		4500.520	11	0.00024
WEMCO 28359		4500.510	1	0.00002
WEMCO 27479		4500.490	19	0.00042
WEMCO 26515		4500.512	3	0.00007
	Mean:	4500.509	3.6	0.00016

Specification Requirements: 0.0005 per cent.

[redacted]

Table 24

Model TBK-12 Transmitting Equipment

VARIATION OF SUPPLY LINE VOLTAGE

Test as per paragraph 3-7-(7) of Specifications RE 3A 442G

Line (Volts)	Fil. (Volts)	P-A E_p (Volts)	Output (Watts)	Frequency (Kc)	Frequency Change Cycles	Per Cent
			Minus to Plus 5% in One Minute			
418	10.5	3000	456	2000.432		
440	11.0	3000	564	2000.435		
462	13.1	3020	560	2000.450	1	0.00089
418	10.5	3000	250	4500.525		
440	11.0	3000	266	4500.510		
462	11.6	3000	274	4500.500	2	0.00056
			Minus to Plus 5% in Five Minutes			
418	10.5	3000	540	2000.430		
440	11.0	3000	550	2000.434		
462	11.6	3010	553	2000.440	1	0.00049
418	10.5	3000	250	4500.517		
440	11.0	3000	260	4500.500		
462	11.6	3000	266	4500.492	2	0.00055
			Minus to Plus 10% in One Minute			
396	9.8	3000	540	2000.385		
440	11.0	3000	550	2000.498		
484	12.3	3010	562	2000.502	11	0.0058
396	9.8	3000	216	4500.520		
440	11.0	3000	260	4500.496		
484	12.3	3000	274	4500.481	3	0.00086

[redacted]

(Continued)

Table 24 (Cont'd)

Line (Volts)	Fil. (Volts)	P-A Ep (Volts)	Output (Watts)	Frequency (Kc)	Frequency Change Cycles	Per Cent
			Minus to Plus 10% in Five Minutes			
396	9.8	3000	540	2000.478		
440	11.0	3000	532	2000.490		
484	12.3	3010	560	2000.500	2	0.0019
396	10.0	3000	258	4500.521		
440	11.0	3000	260	4500.498		
484	12.3	3000	270	4500.482	3	0.00086

Note: (1) Specification Requirements: 0.0015 per cent.

Table 25

Model TBK-12 Transmitting Equipment

VARIATION IN AMBIENT TEMPERATURE - 2000 KC

Test as per paragraph 3-7(8) of Specifications RE 1 442G

ne	Amb. Temp. (°C)	Rel. Hum. (%)	Frequency (Kc)	M.O. Cabinet Temp. (°C)	Power Am Ep		Output (Watts)
30	52.0	18	2000.514	60.1	3000	3	480
+5	51.5	13	2000.513	60.1	3000	3	480
00	51.5	10	2000.514	60.0	3000	3	480
L5	51.5	10	2000.514	60.1	3000	3	480
30	51.7	10	2000.514	60.1	3000	3	470
+5	42.0	11	2000.514	60.1	3000	3	480
00	41.0	13	2000.512	60.1	2960	3	480
L5	41.0	13	2000.509	60.1	2960	3	480
30	40.0	15	2000.507	60.1	2960	3	488
+5	41.5	13	2000.505	60.1	2960	3	492
00	34.0	16	2000.503	60.1	2960	3	494
L5	30.5	12	2000.500	60.1	2960	3	504
30	30.0	12	2000.498	60.1	2960	3	508
.5	30.0	12	2000.497	60.1	2960	3	508
00	30.2	16	2000.494	60.1	2960	3	512
5	22.0	21	2000.488	60.3	3000	3	520
0	21.5	19	2000.485	60.3	3000	3	520
5	21.0	19	2000.484	60.3	3000	3	520
0	21.0	23	2000.482	60.3	3000	3	524
5	22.2	23	2000.481	60.3	2950	3	520
0	13.5	24	2000.472	60.4	2960	3	540
5	12.0	24	2000.468	60.5	2950	3	560
0	11.5	27	2000.479	60.5	2920	3	570
5	11.5	24	2000.470	60.5	2920	3	580
0	11.5	27	2000.470	60.5	2920	3	580
	2.0	--	2000.451	60.7	2950	3	585
	1.0	--	2000.436	61.0	3000	3	590
	1.0	--	2000.425	61.0	3000	3	595
	1.0	--	2000.425	61.0	3000	3	597
	0.5	--	2000.425	61.0	3000	3	600

Continued)

Table 25 (Cont'd)

Summary

Temperature Change (°C)	Cycles Change	Per C Chan Per
50 to 40	9	0.000
40 to 30	11	0.000
30 to 20	13	0.000
20 to 10	11	0.000
10 to 0	45	0.000

Specification Requirements: Frequency change n to exceed 0.00025% per 1°C.

Table 26

Model TBK-12 Transmitting Equipment

VARIATION IN AMBIENT TEMPERATURE - 18000 KC

Test as per paragraph 3-7(8) of Specifications RE 1[illegible] 442G

Time	Amb. Temp. (°C)	Rel. Hum. (%)	Frequency (Kc)	M.O. Cabinet Temp. (°C)	Power Am Ep	[illegible]	Output (Watts)
0830	51.0	6	4500.645	60.1	3000	2[illegible]	200
0845	52.0	6	4500.655	60.0	3000	2[illegible]	192
0900	51.5	5	4500.658	60.0	3000	2[illegible]	184
0915	51.5	7	4500.663	60.0	3000	2[illegible]	184
0930	52.0	7	4500.670	60.0	3000	2[illegible]	184
0945	41.5	11	4500.668	60.1	3000	2[illegible]	184
1000	41.0	11	4500.660	60.1	3000	2[illegible]	196
1015	41.5	10	4500.652	60.0	3000	2[illegible]	196
1030	42.0	10	4500.645	60.1	3000	2[illegible]	200
1045	42.0	10	4500.640	60.0	3000	2[illegible]	200
1100	32.0	14	4500.637	60.13	3000	2[illegible]	206
1115	30.2	14	4500.622	60.15	3000	2[illegible]	214
1130	33.5	11.6	4500.613	60.18	3000	2[illegible]	214
1145	30.5	14	4500.604	60.2	3000	2[illegible]	220
1200	31.0	14	4500.600	60.2	3000	2[illegible]	224
1215	22.0	25	4500.570	60.3	3000	2[illegible]	234
1230	22.0	16	4500.555	60.3	3000	2[illegible]	234
1245	23.0	12	4500.555	60.3	3000	2[illegible]	234
1300	21.0	17	4500.550	60.3	3000	2[illegible]	240
1315	23.0	18	4500.548	60.3	3000	2[illegible]	240
1330	11.0	27	4500.548	60.55	3000	2[illegible]	250
1345	10.5	--	4500.435	60.67	3000	2[illegible]	260
1400	11.0	--	4500.402	60.72	3000	2[illegible]	264
1415	11.0	--	4500.400	60.75	3000	2[illegible]	266
1430	10.5	--	4500.405	60.8	3000	2[illegible]	266
1445	1.0	--	4500.360	61.0	3000	2[illegible]	270
1500	1.0	--	4500.305	61.0	3000	2[illegible]	276
1515	1.0	--	4500.310	61.0	3000	2[illegible]	276
1530	0.0	--	4500.311	61.0	3000	2[illegible]	276
1545	0.0	--	4500.352	61.0	3000	2[illegible]	280

([illegible]ntinued)

Table 26 (Cont'd)

Summary

Temperature Change (°C)	Cycles Change	Per Ce Chang Per °
50 to 40	30	0.0000
40 to 30	40	0.0000
30 to 20	52	0.0001
20 to 10	143	0.0003
10 to 0	53	0.0001

Specification Requirements: Frequency change no to exceed 0.00025% per 1°C.

Note: Frequency measurements were made at the m output frequency of 4500 kc.

[redacted]

Table 27

Model TBK-12 Transmitting Equipment

VARIATION IN HUMIDITY - 2000 KC

Test as per paragraph 3-7(9) of Specifications RE 13 .42G

Time	Amb. Temp. (°C)	Rel. Hum. (%)	Frequency (Kc)	Power Amp. Ep	Power Amp. Ip	Outpu (Watts	M-O Cabinet Temp. (°C)
)945	38.5	18	2000.500	3000	300	502	60.1
.000	41.5	14	2000.500	3000	300	502	60.1
015	42.0	14	2000.500	3000	300	502	60.1
.030	41.5	14	2000.500	3000	300	494	60.1
.045	41.0	90	2000.485	3000	300	494	60.1
.100	42.0	97	2000.440*	3000	300	490	60.8
.115	43.0	93	2000.422	3000	295	490	60.85
.130	43.0	93	2000.452**	3000	295	490	60.2
.145	44.0	90	2000.470	3000	295	490	60.2
200	42.0	31	2000.498	3000	297	490	60.1
215	42.0	23	2000.500	3000	297	490	60.1
230	41.0	21	2000.500	3000	297	490	60.1
245	42.0	21	2000.500	3000	298	490	60.1
300	41.5	21	2000.495	3000	295	490	60.1

* Heater has stopped regulating.
* Heater resumed regulation.

requency at end of first test period - 2000.500 kc
requency of maximum departure thereafter - 2000.422 kc
Difference: 78 cycles, 0.0039 per cent.
Specification Requirements: Not to exceed 0.003 per cen

ower output at end of first test period - 494 watts
aximum power decrease thereafter - 490 watts
Difference: 4 watts, 0.81 per cent.
Specification requirements: Not to exceed 5 per cent.

ntenna: 115-volt, 500-watt lamp.

[redacted]

Table 28

Model TBK-12 Transmitting Equipment

VARIATION IN HUMIDITY - 18000 KC

Test as per paragraph 3-7(9) of Specifications RE 13 442G

Time	Amb. Temp. (°C)	Rel. Hum. (%)	Frequency (Kc)	Power Amp. E_p	Power Amp. I_p	Outp (Watt	M-O Cabinet Temp. (°C)
1400	41	27	4500.520	3000	230	250	60.1
1415	41	29	4500.525	3000	230	250	60.1
1430	41	30	4500.530	3000	230	250	60.1
1445	42	83	4500.460	3000	230	244	60.15
1500	45	97	4500.200*	3000	230	240	61.4
1515	42	93	4500.215**	3000	230	244	61.2
1530	43	93	4500.270	3000	230	244	60.7
1545	43	93	4500.331	3000	230	244	60.3
1600	42	43	4500.450	3000	230	244	60.1
1615	42	28	4500.462	3000	230	248	60.1
1630	43	27	4500.480	3000	230	250	60.1

* Heater stopped regulating.
** Heater resumed regulation.

Note: (1) Antenna - 115-volt, 500-watt lamp.
(2) Output frequency: 18000 kc. Frequency measur ents were made at the m-o output frequency of 4500 kc.

requency at end of first test period - 4500.530 kc.
requency of maximum departure thereafter - 4500.200 kc.
Difference: 330 cycles, 0.00734 per cent.
pecification requirements: Not to exceed 0.003 per cent.

ower output at end of first test period - 250 watts.
aximum power decrease thereafter - 240 watts.
Difference: 10 watts, 4.0 per cent.
pecification requirements: Not to exceed 5 per cent.

[redacted]

Table 29

Model TBK-12 Transmitting Equipment

LOCKED KEY TEST - 2000 KC

Test as per paragraph 3-7-(10) of Specifications RE A 442G

Time	Frequency (Kc)	Power (Watts)	P-A Ip (Ma)	P-A Ep (Volts)	Line (Volts)	abinet Temp. (°C)
0810	2000.430					
0815	2000.425	560	300	3000	440	60.1
0820	2000.428	556	300	3000	440	60.1
0825	2000.427	568	300	3000	440	60.1
0830	2000.428	558	300	3000	435	60.1
0835	2000.427	556	300	3000	436	60.1
0840	2000.429	554	300	3000	435	60.1
0845	2000.430	550	300	3000	432	60.08
0850	2000.433	546	300	3000	436	60.1
0855	2000.432	542	300	3000	435	60.1
0900	2000.430	542	300	3000	433	60.1
0905	2000.431	540	300	3000	435	60.1
0910	2000.432	540	300	3000	436	60.1
0915	2000.430	540	300	3000	434	60.1
0920	2000.432	540	300	3000	432	60.1
0925	2000.432	540	300	3000	432	60.1
0930	2000.434	540	299	3000	435	60.1
0935	2000.437	540	299	3000	435	60.1
0940	2000.436	544	299	3000	434	60.1
0945	2000.438	542	299	3000	434	60.1
0950	2000.439	542	299	3000	434	60.1
0955	2000.436	542	299	3000	434	60.1
1000	2000.436	542	299	3000	435	60.1
1005	2000.435	544	299	3000	433	60.1
1010	2000.435	544	299	3000	432	60.1

Note: (1) Change in frequency during first five min es:
5 cycles; 0.00025 per cent.
Specification Requirements: Not over 0.0 per cent.

(2) Change in frequency during remainder of t t:
14 cycles; 0.0007 per cent.
Specification Requirements: Not over 0.0 5 per cent.

(3) Ambient temperature varied from 23°C to 2 C.

[redacted]

Table 30

Model TBK-12 Transmitting Equipment

LOCKED KEY TEST - 4500 KC

Tests as per paragraph 2-7-(10) of Specifications RF 3A 442G

Time	Frequency (Kc)	Power (Watts)	P-A Ip (Ma)	P-A Ep (Volts)	Line (Volts)	abinet Temp. (°C)
0815	4500.330	274	260	3000	438	60.15
0820	4500.338	272	255	3000	440	60.10
0825	4500.370	266	255	3000	440	60.10
0830	4500.381	260	250	3000	438	60.10
0835	4500.396	258	250	3000	435	60.10
0840	4500.400	258	249	3000	435	60.10
0845	4500.407	258	250	3000	438	60.10
0850	4500.409	260	250	3000	435	60.10
0855	4500.411	258	249	2990	436	60.10
0900	4500.413	258	249	2990	436	60.10
0905	4500.416	258	249	2990	434	60.10
0910	4500.420	258	249	2990	435	60.10
0915	4500.422	256	249	2990	436	60.10
0920	4500.420	252	248	2980	434	60.10
0925	4500.421	250	247	2980	434	60.10
0930	4500.425	252	247	2980	438	60.10
0935	4500.424	252	247	2980	436	60.10
0940	4500.423	252	246	2980	437	60.10
0945	4500.427	252	246	2980	437	60.10
0950	4500.425	252	246	2980	437	60.10
0955	4500.428	252	245	2980	437	60.10
1000	4500.428	250	245	2970	435	60.10
1005	4500.423	250	245	2970	437	60.10
1010	4500.429	250	245	2970	438	60.10
1015	4500.427	250	245	2970	435	60.10

Note: (1) Change in frequency during first five min s:
8 cycles; 0.00017 per cent.
Specification Requirements: Not over 0.0 per cent.

(2) Change in frequency during remainder of t :
91 cycles; 0.002 per cent.
Specification Requirements: Not over 0.0 per cent.

(3) Ambient temperature varied from 26°C to 2 .

[redacted]

Table 31

Model TBK-12 Transmitting Equipment

CHANGE FROM KEY-LOCKED TO
INTERMITTENTLY-KEYED CONDITION

Test as per paragraph 3-7-(11) of Specifications RE A 442G

Test Condition	Frequency at End of 10-Minute Key-Locked Period	Frequency at End of 10-Second Dash 20 Minutes Later	Change in Freq. Cycles	Per Cent
All fil. lighted	2000.480	2000.491		0.00055
M-0 fil. lighted	2000.480	2000.492		0.00060
Fil. not lighted	2000.480	2000.500		0.00100
All fil. lighted	4500.500	4500.465		0.00078
M-0 fil. lighted	4500.520	4500.464		0.00124
Fil. not lighted	4500.530	4500.575		0.00100

Specification Requirements:

With M-0 Fil. lighted, not to exceed:	0.0025
With M-0 Fil. not lighted, not to exceed:	0.005

[redacted]

Table 32

Model TBK-12 Transmitting Equipment

CHANGE FROM CONTINUOUSLY KEYED CONDITION
TO INTERMITTENTLY KEYED CONDITION

Test as per paragraph 3-7-(12) of Specifications RE A 442G

Frequency at End of 30 Minutes of Continuous Keying (Kc)	Frequency at End of 10-Second Dash after 20-Minute Pause (Kc)	Change in F uency Cycles	r Cent
2000.500	2000.515	15	00075
4500.533	4500.517	16	00035

Note: (1) Specification Requirements: 0.001 pe ent.

[redacted]

Table 33

Model TBK-12 Transmitting Equipment

INCLINATION TEST - FRONT TO BACK

Test as per paragraph 3-7(13) of Specifications RE [illegible] 442G

Time	Maximum Frequency (Kc)	Difference (Cycles)	Minimum Frequency (Kc)	Test Condition
1158	2000.515			Stationary
1200	2000.540	5	2000.535	Inclination
1205	2000.536	6	2000.530	Inclination
1210	2000.540	6	2000.534	Inclination
1215	2000.534	4	2000.530	Inclination
1220	2000.531	6	2000.525	Inclination
1225	2000.530	5	2000.525	Inclination
1230	2000.531	6	2000.525	Inclination
1231	2000.525			Stationary

Maximum frequency change from stationary condition at start of test: 25 cycles; 0.00125 per cent.

Maximum frequency change from stationary condition at end of test: 15 cycles; 0.00075 per cent.

Maximum frequency change noted during test, minimum maximum: 6 cycles; 0.00035 per cent.

1120	18000.590			Stationary
1121	18000.620	42	18000.578	Inclination
1125	18000.635	35	18000.600	Inclination
1130	18000.640	28	18000.612	Inclination
1135	18000.638	33	18000.604	Inclination
1140	18000.635	31	18000.610	Inclination
1145	18000.639	29	18000.610	Inclination
1150	18000.640	30	18000.610	Inclination
1151	18000.613			Stationary

Maximum frequency change from stationary condition at start of test: 50 cycles; 0.00028 per cent.
Maximum frequency change from stationary condition at end of test: 35 cycles; 0.00019 per cent.
Maximum frequency change noted during test, minimum maximum: 42 cycles; 0.00023 per cent.

Specification Requirements: Not to exceed 0.001 per cent

[redacted]

Table 34

Model TBK-12 Transmitting Equipment

INCLINATION TEST - SIDE TO SIDE

Test as per paragraph 3-7(13) of Specifications RE 1 442G

Time	Maximum Frequency (Kc)	Difference (Cycles)	Minimum Frequency (Kc)	Test Condition
1327	2000.527			Stationary
1328	2000.531	6	2000.525	Inclination
1330	2000.527	7	2000.520	Inclination
1335	2000.527	7	2000.520	Inclination
1340	2000.526	6	2000.520	Inclination
1345	2000.530	9	2000.521	Inclination
1350	2000.522	5	2000.517	Inclination
1355	2000.525	8	2000.517	Inclination
1356	2000.521			Stationary

Maximum frequency change from stationary condition a start of test: 10 cycles; 0.0005 per cent.
Maximum frequency change from stationary conditions end of test: 10 cycles; 0.0005 per cent.
Maximum frequency change noted during test, minimum maximum: 9 cycles; 0.00045 per cent.

.403	18000.533			Stationary
.404	18000.590	40	18000.550	Inclination
.410	18000.585	35	18000.550	Inclination
.415	18000.582	27	18000.555	Inclination
.420	18000.591	31	18000.560	Inclination
.425	18000.595	44	18000.551	Inclination
.430	18000.590	30	18000.560	Inclination
.431	18000.580			Stationary

Maximum frequency change from stationary condition a start of test: 62 cycles; 0.00034 per cent.
Maximum frequency change from stationary condition a end of test: 30 cycles; 0.00017 per cent.
Maximum frecuency change noted during test, minimum maximum: 44 cycles; 0.00024 per cent.

pecification Requirements: Not to exceed 0.001 per cent

[redacted]

Table 35

Model TBK-12 Transmitting Equipment

VIBRATION TEST

Test as per paragraph 3-7(14) of Specifications RE 1[illegible] 442G

Time	Frequency (Kc)	Antenna Current (Amps.)	P.A. Ip (Ma)	P.A. Ep (Volts)	Fil. Volts	Test Condition
1525	2000.520	4.4	300	3000	11	Stationary
1530	2000.520	4.4	300	3000	11	Vibration
1535	2000.519	4.4	300	3000	11	Vibration
1540	2000.519	4.4	300	3000	11	Vibration
1545	2000.519	4.4	300	3000	11	Vibration
1550	2000.519	4.4	300	3000	11	Vibration
1555	2000.519	4.4	300	3000	11	Vibration
1556	2000.519	4.4	300	3000	11	Stationary

Maximum set in frequency: 1 cycle; 0.00005 per cen[illegible]
Maximum variation in frequency: 1 cycle; 0.00005 p[illegible] cent.
Specification requirements: Maximum set in frequen[illegible] not to exceed 0.0005 per c[illegible].

1600	4500.530	2.5	235	3000	11	Stationary
1601	4500.570	2.5	220	3000	11	Vibration
1605	4500.565	2.5	220	3000	11	Vibration
1610	4500.563	2.5	220	3000	11	Vibration
1615	4500.562	2.45	215	3000	11	Vibration
1620	4500.562	2.45	215	3000	11	Vibration
1625	4500.562	2.45	215	3000	11	Vibration
1630	4500.563	2.45	215	3000	11	Vibration

Maximum set in frequency: 33 cycles; 0.00073 per c[illegible].
Maximum variation in frequency: 40 cycles; 0.00089 [illegible]r cent.
Specification requirements: Maximum set in frequen[illegible] not to exceed 0.0005 per c[illegible].

[redacted]

Table 36

Model TBK-12 Transmitting Equipment

SHOCK TEST

Test as per paragraph 3-7(15) of Specifications RE [illegible] 442G

Shock Applied To	Frequency before Shock	Frequency after Shock	Frequen Cycles	Difference Per Cent
Front	2000.510	2000.512	2	0.00010
	2000.510	2000.509	1	0.00005
	2000.506	2000.506	0	0.
	2000.500	2000.499	1	0.00005
	2000.506	2000.510	4	0.00020
Left Side	2000.497	2000.506	9	0.00045
	2000.505	2000.508	3	0.00015
	2000.509	2000.510	1	0.00005
	2000.508	2000.509	1	0.00005.
	2000.509	2000.510	1	0.00005
	2000.510	2000.512	2	0.00010
Front	4500.592	4500.600	8	0.00018
	4500.600	4500.593	7	0.00016
	4500.592	4500.593	1	0.00002
	4500.599	4500.605	6	0.00013
	4500.610	4500.605	5	0.00011
	4500.604	4500.596	8	0.00018
Left Side	4500.530	4500.552	22	0.00049
	4500.550	4500.543	7	0.00016
	4500.536	4500.547	11	0.00024
	4500.548	4500.550	2	0.00004
	4500.545	4500.547	2	0.00004
	4500.547	4500.551	4	0.00009

Specification Requirements: Not to exceed 0.001 per cent

Note: (1) Dial lock mechanism of Control J failed during [illegible]hock from the front.
(2) Relay K101 opened during shock and it was nece[illegible]ary to block the relay.
(3) With approximately 250 g applied to the suppor[illegible]ng platform, the acceleration near the top of the transmitt[illegible] was found to range from 18 to 36 g.

Table 37

Model TBK-12 Transmitting Equipment

SUMMARY OF FREQUENCY STABILITY TESTS

Tests as per paragraph 3-7(1 to 15) of Specifications [illegible] 13A 442G

Test No.	Maximum Frequency Variation Per Cent 2000 Kc	Maximum Frequency Variation Per Cent 4500 Kc	Per Cent Frequency Variation of Spec. Allowance 2000 Kc	Per Cent Frequency Variation of Spec. Allowance 4500 Kc	Spec. Limits
3-7-1(a)	0.00063	0.00060	21	20	0.003
(b)	0.00120	0.00111	24	22	0.005
3-7-2(a)	0.00037	0.00020	7	4	0.005
(b)	0.00100	0.00038	13	5	0.008
3-7-3	0.00065	0.00058	65	58	0.001
3-7-4	0.00030	0.00040	10	13	0.003
3-7-5	0.00150	0.00024	150	24	0.001
3-7-6(a)	0.00465	0.00460	47	46	0.01
(b)	0.0012	0.00020	24	40	0.0005
3-7-7	0.00089	0.00055	59	37	0.0015
3-7-8	0.00023	0.00032	92	128	0.00025
3-7-9	0.00390	0.00734	130	245	0.003
3-7-10(a)	0.00025	0.00017	25	17	0.001
(b)	0.00050	0.00220	20	88	0.0025
3-7-11(a)	0.00060	0.00124	24	50	0.0025
(b)	0.00100	0.00100	20	20	0.005
3-7-12	0.00075	0.00035	75	35	0.001
3-7-13	0.00125	0.00034	125	34	0.001
3-7-14	0.00005	0.00073	10	146	0.0005
3-7-15	0.00045	0.00044	45	49	0.001
Total:	0.02051	0.02286	Mean: 49.7	53.[illegible]	Total 0.05575

[redacted]

Table 38

Model TBK-12 Transmitting Equipment

DETERMINATION OF LIMITING FREQUENCIES
TO WHICH TRANSMITTER CAN BE TUNED AND LOADE

Antenna: 115-Volt, 500-Watt Lamp.

Test as per paragraph 3-13 of Specifications RE 13 442G

	Low	High
Output Frequency	1,919.0	,788.0
Specified Frequency	2,000.0	,100.0
Overlap Kilocycles	81.0	688.0
Mean Frequency	1,959.5	,444.0
Per Cent Overlap	4.13	3.73
Limiting Circuit	Osc. Plate Tuning	M.O.

ntrol:	A	B	C	D	E	F	G	H	I	J
,919 Kc	1	1,591	0	383	195	124	50	C	60	0
,778 Kc	6	6,510	85	2,502	2,761	2,651	25	V	76	2,855
ter	M-O I_p	1st I-A I_p		2nd I-A I_p		P-A I_g		P-A I_p		
,919 Kc	26	34		91		43		300		
,788 Kc	40	37		64		9		300		

te: (1) Specification Requirements: 3 per cent overl .

[redacted]

Table 39

Model TBK-12 Transmitting Equipment

VARIATION OF RESONANT FREQUENCY OF MASTER OSCILLATOR PER DIVISION OF DIAL MARKING

Test as per paragraph 3-17 of Specifications RE 1[illegible]442G

Control A	Control B	Frequency Kc	Kilocycles per Division	Per Cent per Division
		End Tolerance - 7.40%		
1	0000	1857.5	--	--
1	1228	1900.0	0.0346	0.0018
1	2085	1950.0	0.0661	0.0034
1	2828	2000.0	0.0673	0.0034
1	3505	2050.0	0.0738	0.0036
1	4149	2100.0	0.0777	0.0037
1	4823	2150.0	0.0742	0.0035
1	5679	2200.0	0.0584	0.0027
1	7124	2743.5	0.0301	0.0013
		Overlap - 7.95%		
2	0000	2072.0	--	--
2	865	2100.0	0.0324	0.0015
2	1723	2150.0	0.0583	0.0027
2	2429	2200.0	0.0708	0.0032
2	3050	2250.0	0.0805	0.0036
2	3643	2300.0	0.0844	0.0037
2	4212	2350.0	0.0880	0.0037
2	4818	2400.0	0.0826	0.0034
2	5557	2450.0	0.0677	0.0028
2	6838	2500.0	0.0362	0.0014
2	7124	2509.0	0.0314	0.0013
		Overlap - 3.94%		
3	0000	2412.0	--	--
3	1683	2500.0	0.0522	0.0021
3	2391	2550.0	0.0706	0.0028
3	2853	2600.0	0.1081	0.0042
3	3374	2650.0	0.0960	0.0036
3	3870	2700.0	0.1008	0.0040

[redacted] ontinued)

Table 39 (Cont'd)

Control A	Control B	Frequency Kc	Kilocycles per Division	Per Cent per Division
3	4357	2750.0	0.1026	0.0037
3	4887	2800.0	0.0994	0.0034
3	5541	2850.0	0.0765	0.0027
3	6581	2900.0	0.0481	0.0017
3	7124	2913.6	0.0250	0.0009
		Overlap - 5.92%		
4	0000	2749.0	--	--
4	1065	2800.0	0.0479	0.0017
4	1684	2850.0	0.0808	0.0028
4	2223	2900.0	0.0912	0.0031
4	2712	2950.0	0.1022	0.0035
4	3129	3000.0	0.1070	0.0036
4	3620	3050.0	0.1133	0.0037
4	4048	3100.0	0.1169	0.0038
4	4480	3150.0	0.1157	0.0037
4	4959	3200.0	0.1043	0.0036
4	5541	3250.0	0.0860	0.0026
4	6414	3300.0	0.0573	0.0017
4	7124	3322.0	0.0220	0.0007
		Overlap - 6.58%		
5	0000	3110.3	--	--
5	785	3150.0	0.0510	0.0016
5	1379	3200.0	0.0842	0.0026
5	1864	3250.0	0.1032	0.0041
5	2300	3300.0	0.1147	0.0035
5	2711	3350.0	0.1217	0.0036
5	3101	3400.0	0.1281	0.0038
5	3475	3450.0	0.1337	0.0039
5	3834	3500.0	0.1391	0.0040
5	4186	3550.0	0.1420	0.0040
5	4556	3600.0	0.1351	0.0038
5	4954	3650.0	0.1257	0.0034
5	5430	3700.0	0.1050	0.0028
5	6081	3750.0	0.0768	0.0020
5	7124	3791.0	0.0393	0.0010

[redacted] ntinued)

Table 39 (Cont'd)

Control A	Control B	Frequency Kc	Kilocycles per Division	Per Cent per Division
		Overlap - 4.06%		
6	0000	3640.0	--	--
6	765	3700.0	0.0785	0.0021
6	1154	3750.0	0.1286	0.0034
6	1485	3800.0	0.1510	0.0040
6	1783	3850.0	0.1679	0.0044
6	2056	3900.0	0.1832	0.0047
6	2316	3950.0	0.1922	0.0047
6	2565	4000.0	0.201	0.0050
6	2806	4050.0	0.207	0.0051
6	3036	4100.0	0.217	0.0053
6	3262	4150.0	0.221	0.0053
6	3478	4200.0	0.231	0.0055
6	3691	4250.0	0.235	0.0055
6	3897	4300.0	0.243	0.0057
6	4104	4350.0	0.241	0.0055
6	4307	4400.0	0.246	0.0056
6	4527	4450.0	0.227	0.0051
6	4752	4500.0	0.222	0.0049
6	5060	4550.0	0.1623	0.0036
6	5298	4600.0	0.210	0.0046
6	5687	4650.0	0.1285	0.0028
6	6510	4697.0	0.0572	0.0012
6	7124	4679.0	0.0294	0.0006
		End Tolerance - 3.73%		

Note: (1) All other stages inoperative during this test.

(2) Specification Requirements: Variation of resonant frequency per division of master oscillator dial marking shall be between 0.001 per cent and 0.01 per cent.

[redacted]

Table 40

Model TBK-12 Transmitting Equipment

EFFECT OF DIAL LOCKS

Test as per paragraph 3-18 of Specifications RE 13 ,42G

Dial Condition	Dial No.	Frequency (Kc)	Frequency Cycles	nge Cent
Unlocked	B	4500.507		
Locked	B	4500.521	14	00031
Unlocked	C	4500.508		
Locked	C	4500.508	0	
Unlocked	B	2000.595		
Locked	B	2000.600	5	00025
Unlocked	C	2000.598		
Locked	C	2000.597	1	00005

Note: (1) Other dial locks have no effect.

[redacted]

Table 41

Model TBK-12 Transmitting Equipment

FREQUENCY RANGE OF M-O CALIBRATOR

Test as per paragraph 3-19 of Specifications RE 13 442G

Initial Frequency	2000 Kc
6 Turns C	1992 Kc
6.5 Turns CC	2000.6 Kc
Kilocycles Range	8.6
Per Cent Change	0.43
Initial Frequency	4500 Kc
6 Turns C	4499.091 Kc
6.5 Turns CC	4508 Kc
Kilocycles Range	8.909
Per Cent Change	0.20

Specification Requirements: At least 0.03 per cen

Table 42

Model TBK-12 Transmitting Equipment

VOLTAGE REGULATION OF FILAMENT CIRCUIT

Test as per paragraphs 3-34 and 3-36 of Specifications 13A 442G

Circuit	Voltage Key Open	Key Close	Per Cent Regulation
Line Voltage	438.	438.	0.
Secondary Distribution Trans. T-103	114.	113.8	0.176
Primary M.O. Filament Trans. T-102	97.5	97.	0.513
Secondary M.O. Filament Trans. T-102	11.5	11.3	1.32
Voltage at M.O. Filament Socket Connection	9.8	9.6	2.04
Primary I.P.A.-P.A. Filament Trans. T-101	98.0	97.5	0.51
1st I.P.A. Filament, Socket Voltage	9.9	9.8	0.503
2nd I.P.A. Filament, Socket Voltage	9.9	9.8	0.503
P.A. Filament, Socket Voltage	10.95	10.9	0.457

Range of Filament Rheostat

Line Volts	Key Position	Maximum Filament Volts:	Minim Filam Volt
396	Closed	12.15	----
484	Open	-----	12.1

Normal Filament Voltage: 11 volts.

[redacted]

Table 43

Model TBK-12 Transmitting Equipment

R-F VOLTAGE OUTPUT OF FREQUENCY METER COUPLING CI UIT

Test as per paragraph 3-43-(3) of Specifications RE A 442G

Control A	Control B	Control C	Oscillator Output Frequency (Kc)	R-F utput (Mil volts)
1	1615	0	1919.0	.0
	7124	29	2243.5	.0
2	0000	17	2072.0	.0
	7124	44	2509.0	.0
3	0000	38	2412.0	.2
	7124	59	2913.6	.0
4	0000	53	2749.0	.3
	7124	68	3322.0	.5
5	0000	64	3110.3	.0
	7124	76	3791.0	.5
6	0000	73	3640.0	.0
	6510*	85	4697.0	.0

Note: (1) Voltages measured at end of a 10-foot shi ded line terminated in 70 ohms.

*(2) Highest frequency of M.O.

(3) Specification Limit: 15 to 750 millivolt

[redacted]

Table 44

Model TBK-12 Transmitting Equipment

POWER REQUIRED FROM SUPPLY LINE

Test as per paragraph 6-5 of Specifications RE 13[illegible]420

Frequency Kc	Output Watts	Line Current	Line Voltage	Line Kw	Condition
2,000	554		396	2.98	Key [illegible]ked.
2,000	562		445	3.00	Key [illegible]ked.
2,000	570		484	3.15	Key [illegible]ked.
18,000	334		396	2.93	Key [illegible]ked.
18,000	340		440	3.00	Key [illegible]cked.
18,000	348		484	3.10	Key [illegible]ked.
		46.3	445	--	Star[illegible]ng.
			445	0.405	Star[illegible]y, heater and [illegible]wer.
			445	0.305	Heat[illegible] and blower.
		3.5	445	1.50	Key [illegible]n.
		4.3	445	2.33	Keye[illegible](20 w.p.m.)

[redacted]

Table 45

Model TBK-12 Transmitting Equipment

REGULATION OF GENERATORS

Test as per paragraph 6-31 of Specs. RE 13A 442G

Generator	Full Load (Volts)	No Load (Volts)	Reg. (%)
Plate	3000	3000	0.
M.O. Tap	1500	1500	0.
Bias	230	225	2.17
Auxiliary	1325	1310	1.15

Note: (1) Specification Requirement: 5 per cent.

(2) Frequency at which test was conducted: 2[illegible] kc.

Table 46

Model TBK-12 Transmitting Equipment

MEASUREMENT OF GENERATOR RIPPLE

Test as per paragraph 6-31 of Specifications RE 13[illegible] 42G

Generator	Output Volts Key Open	Output Volts Key Closed	Ripple Volts Key Open	Ripple Volts Key Closed	Per Cent Ripple Key Open	Per Cent Ripple Key Closed
Plate	3000	3000	5.5	5.	0.183	.167
M.O. Tap	1500	1500	3.2	3.6	0.213	.240
Bias	225	230	0.09	0.1	0.040	.044
Auxiliary	1340	1350	1.33	1.5	0.099	.111

Note: (1) Specification Requirements: 0.25 per cent

(2) Test conducted at 2000 kc.

[redacted]

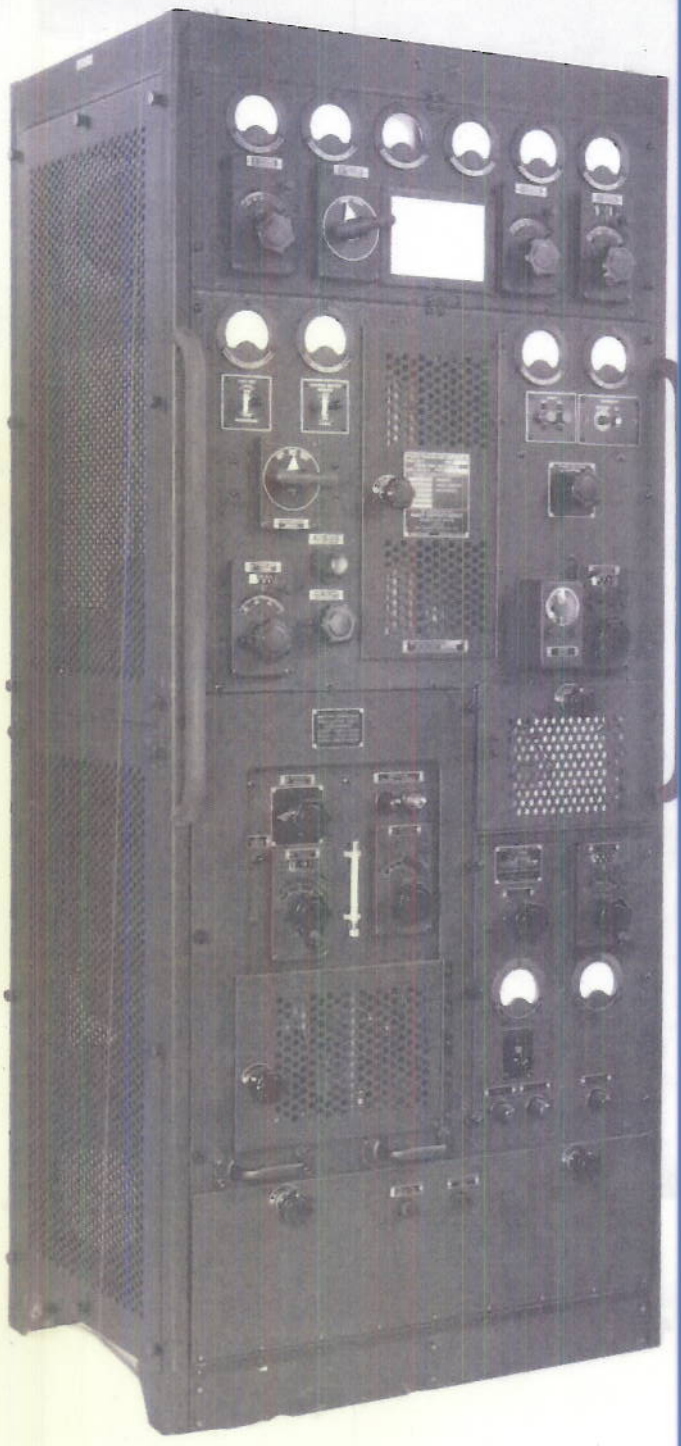


PLATE 1

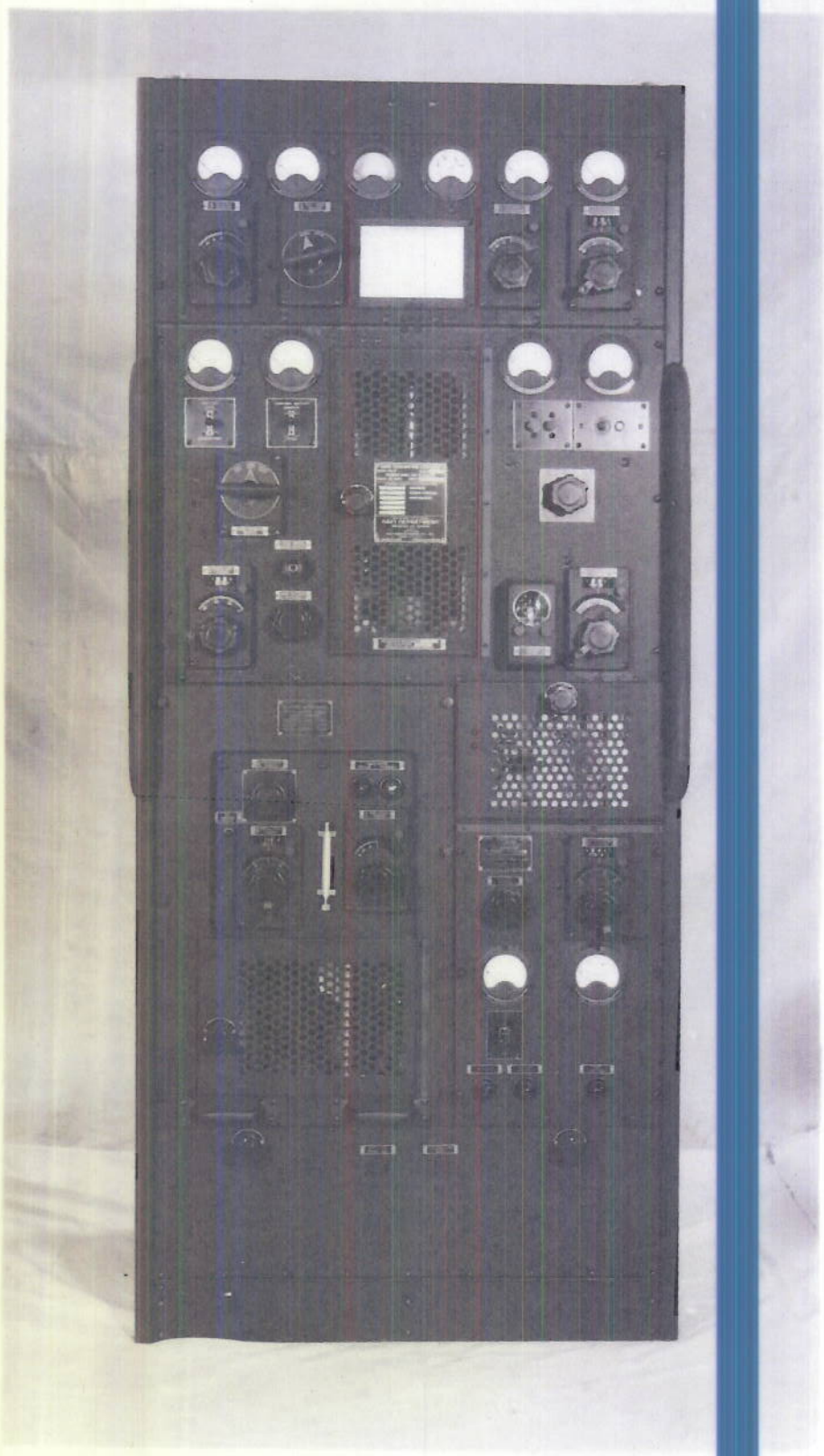


PLATE 2

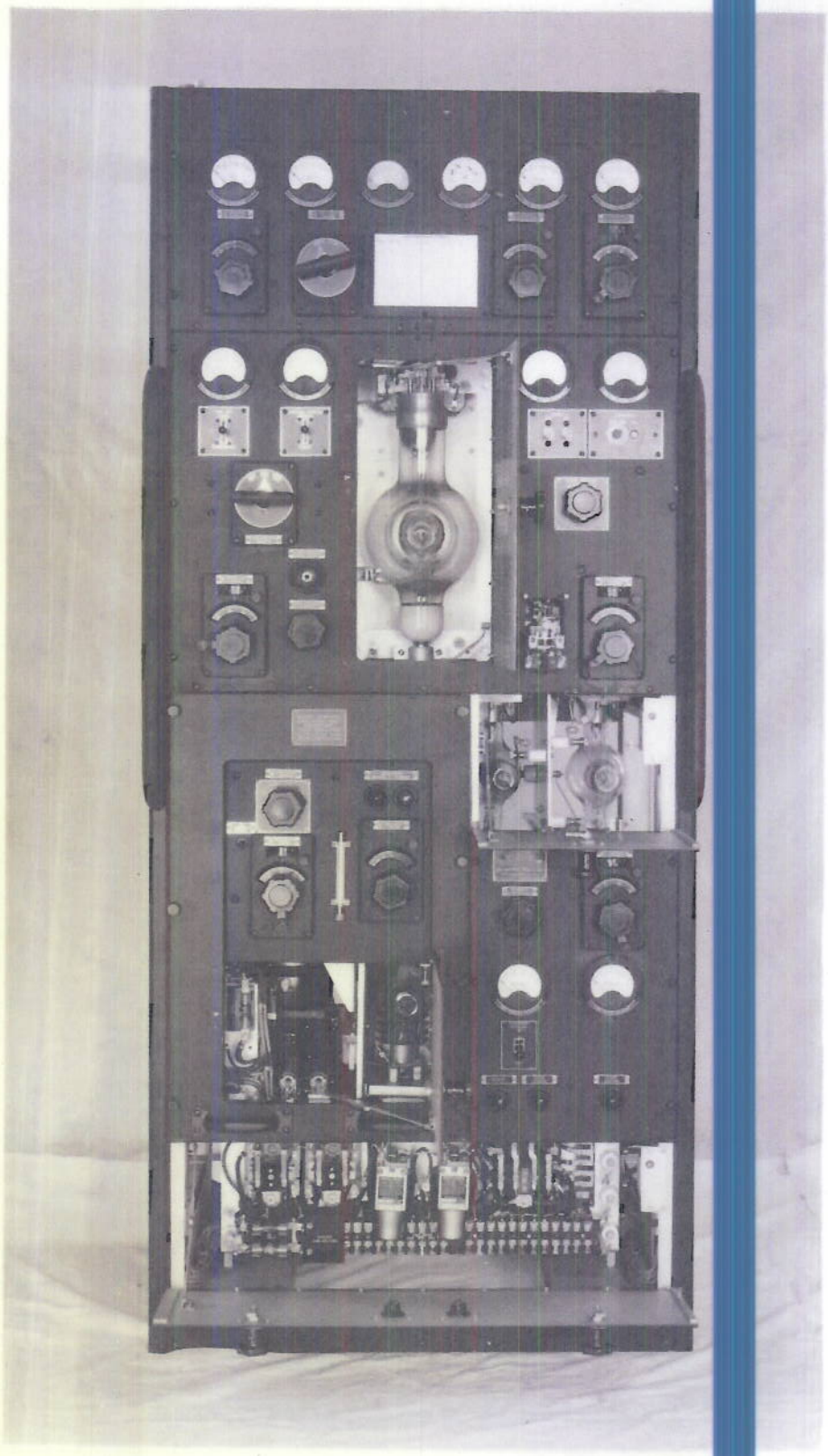


PLATE 3

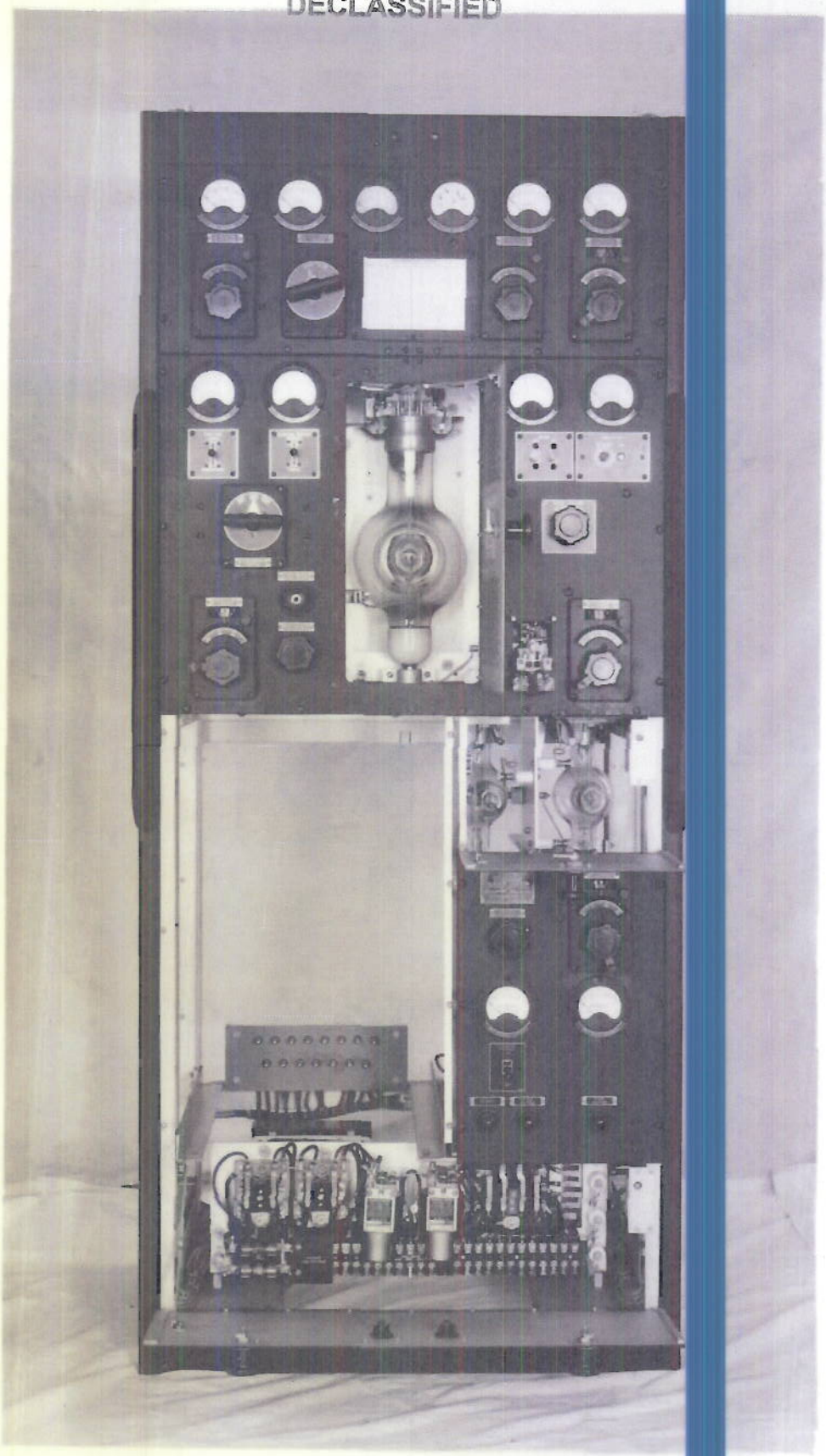


PLATE 4

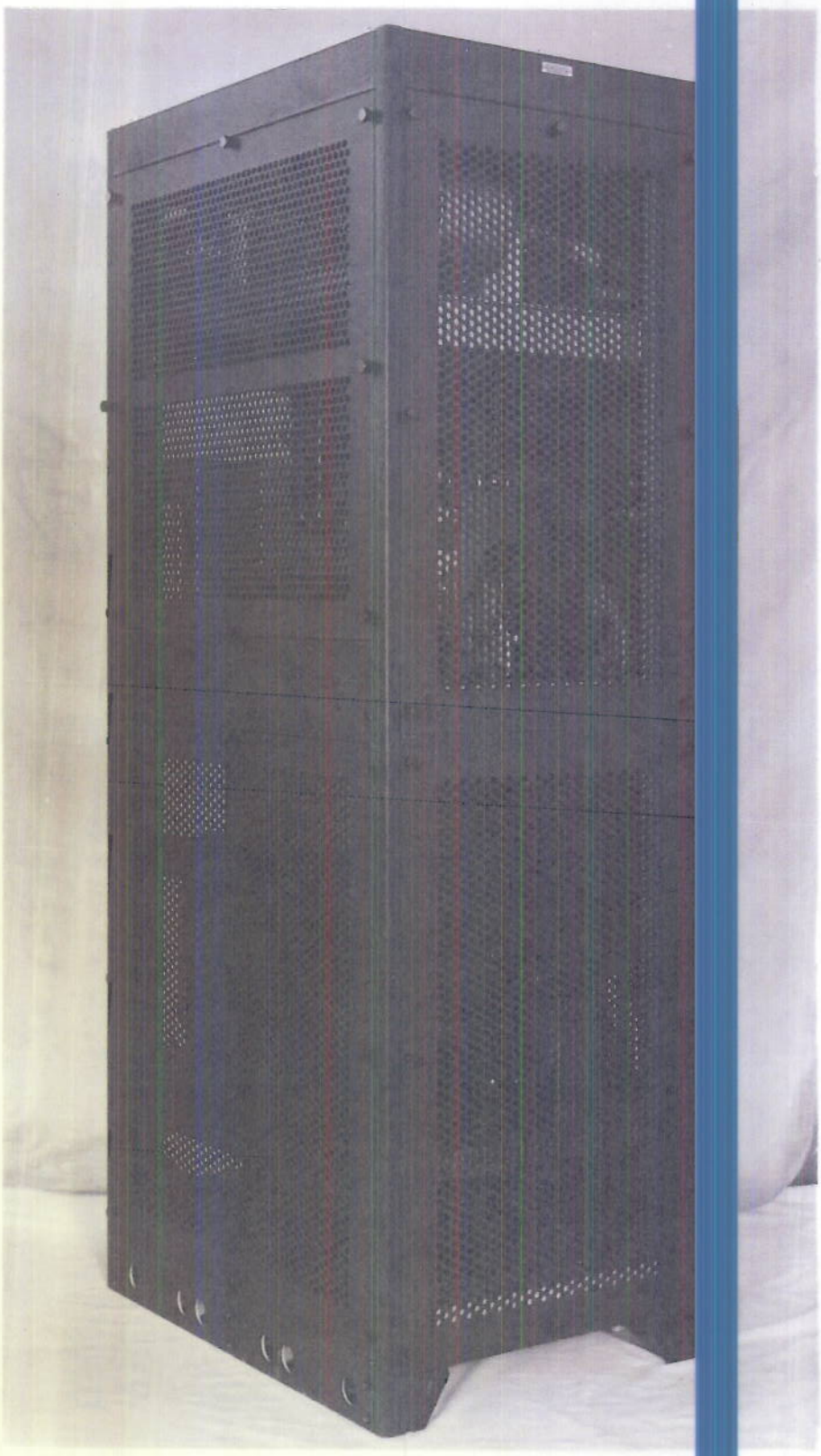


PLATE 5

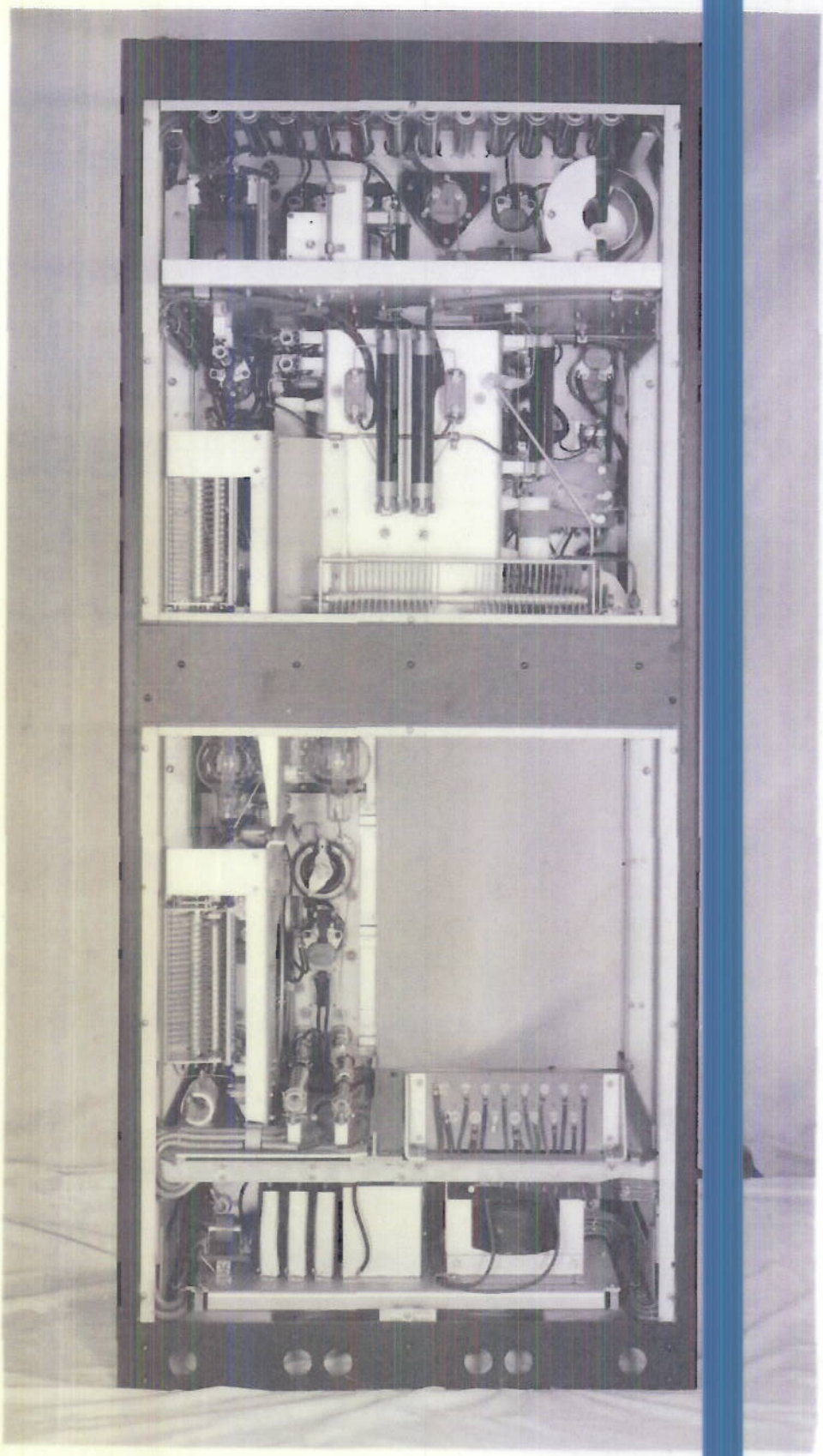


PLATE 6

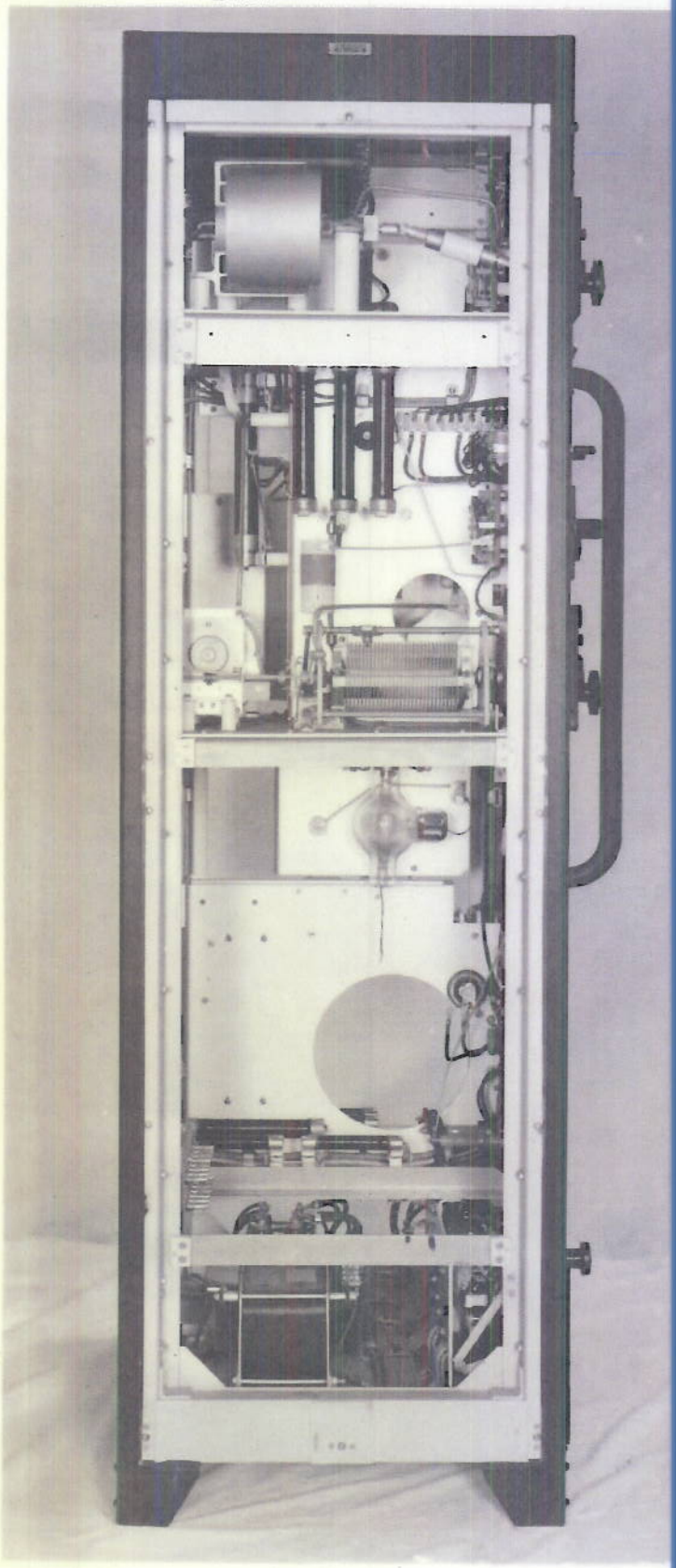


PLATE 7

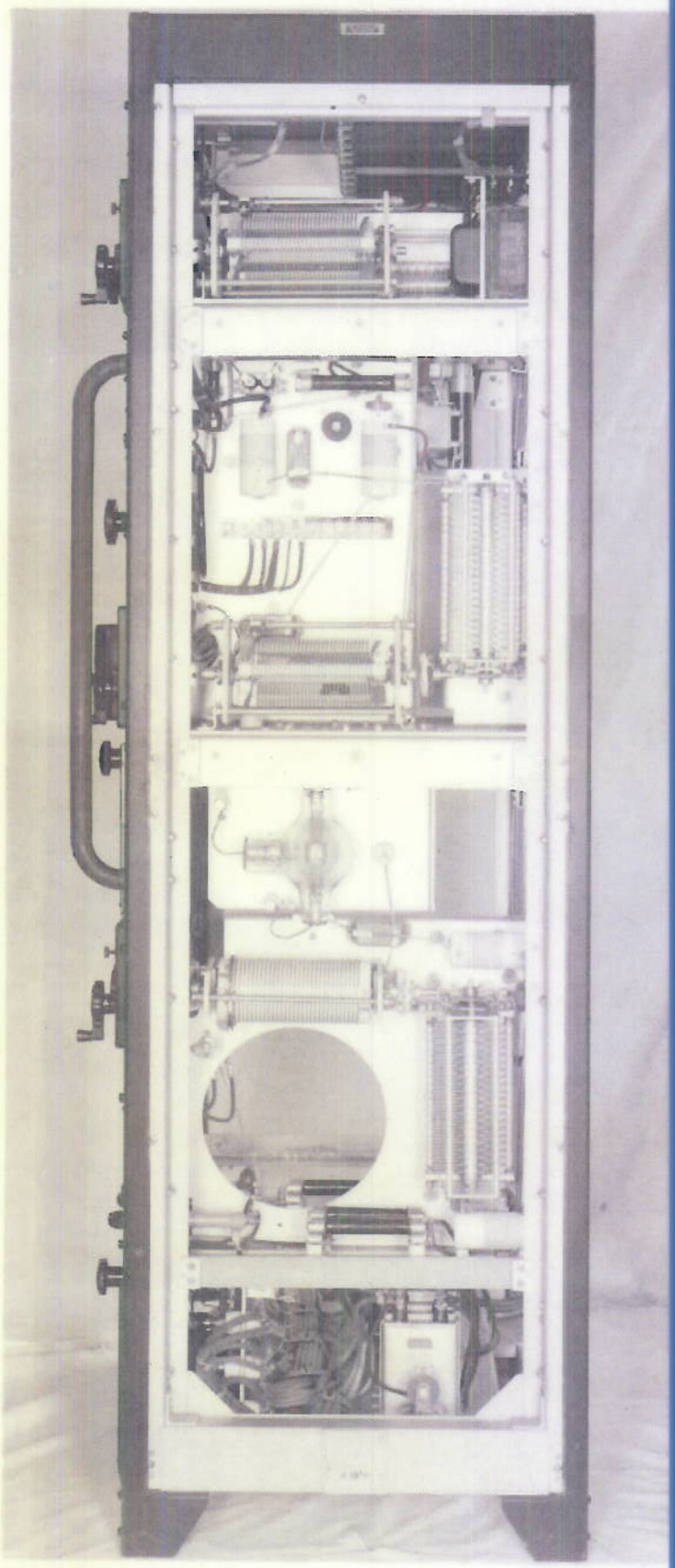


PLATE 8

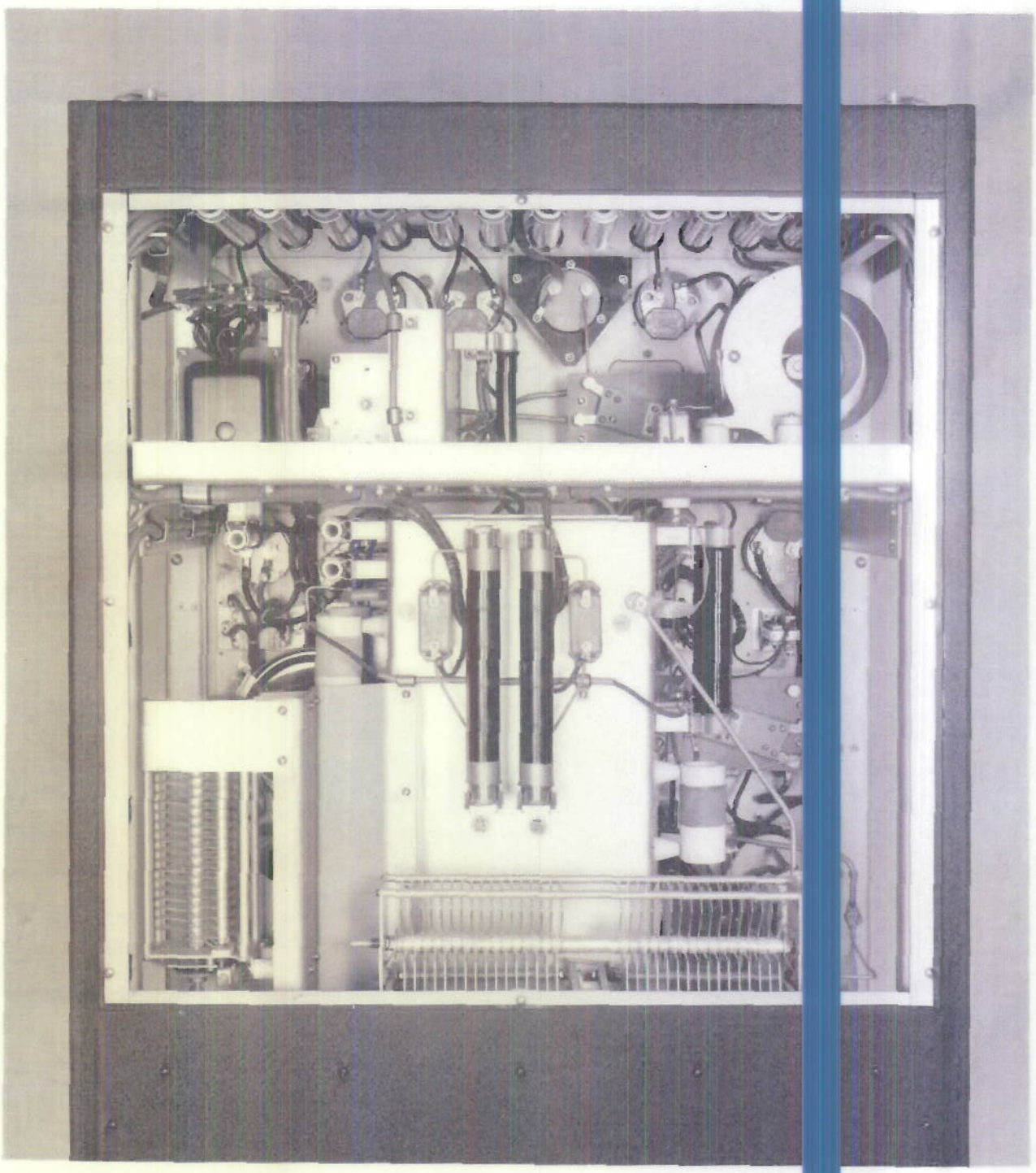


PLATE 9

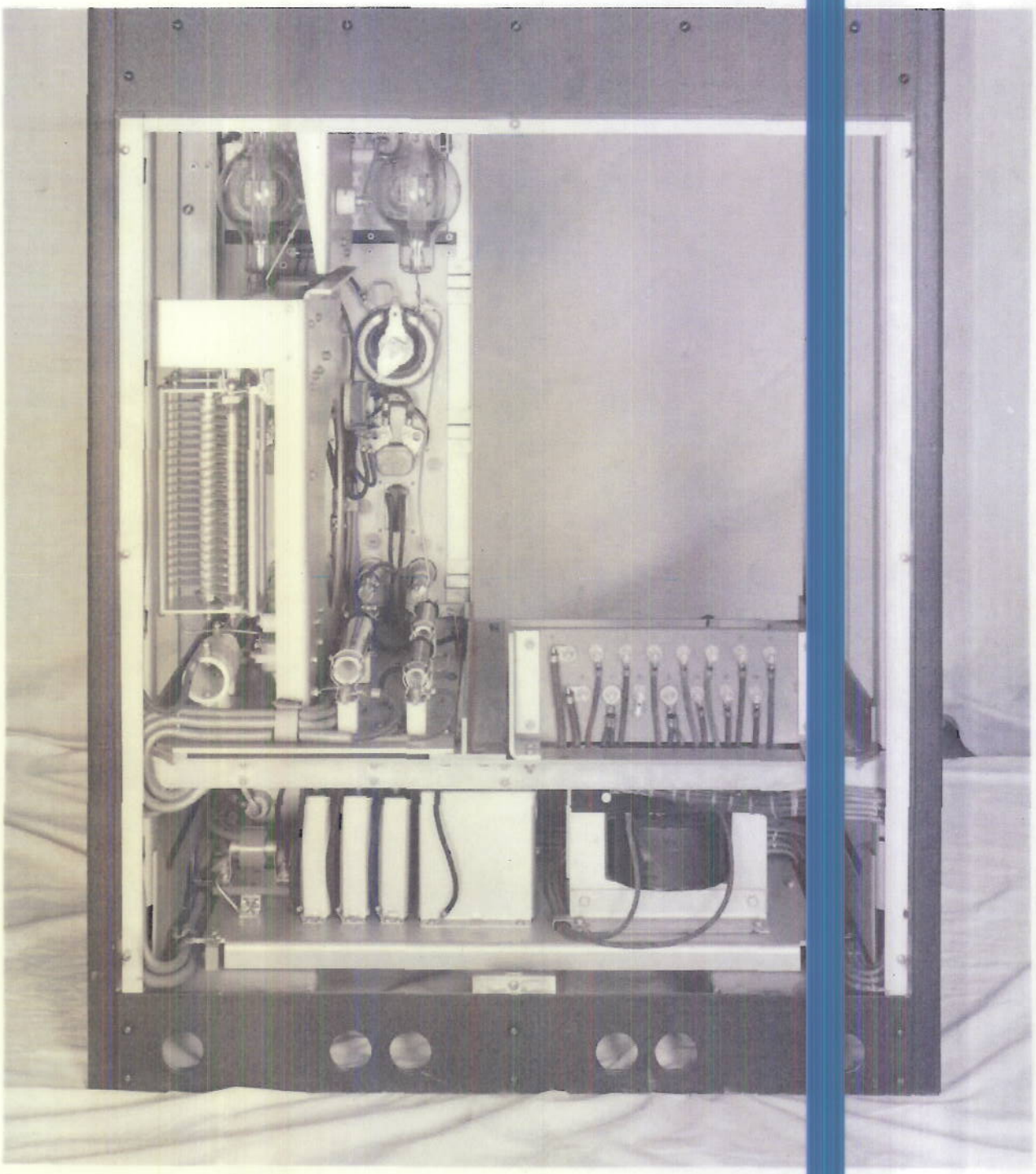


PLATE 10

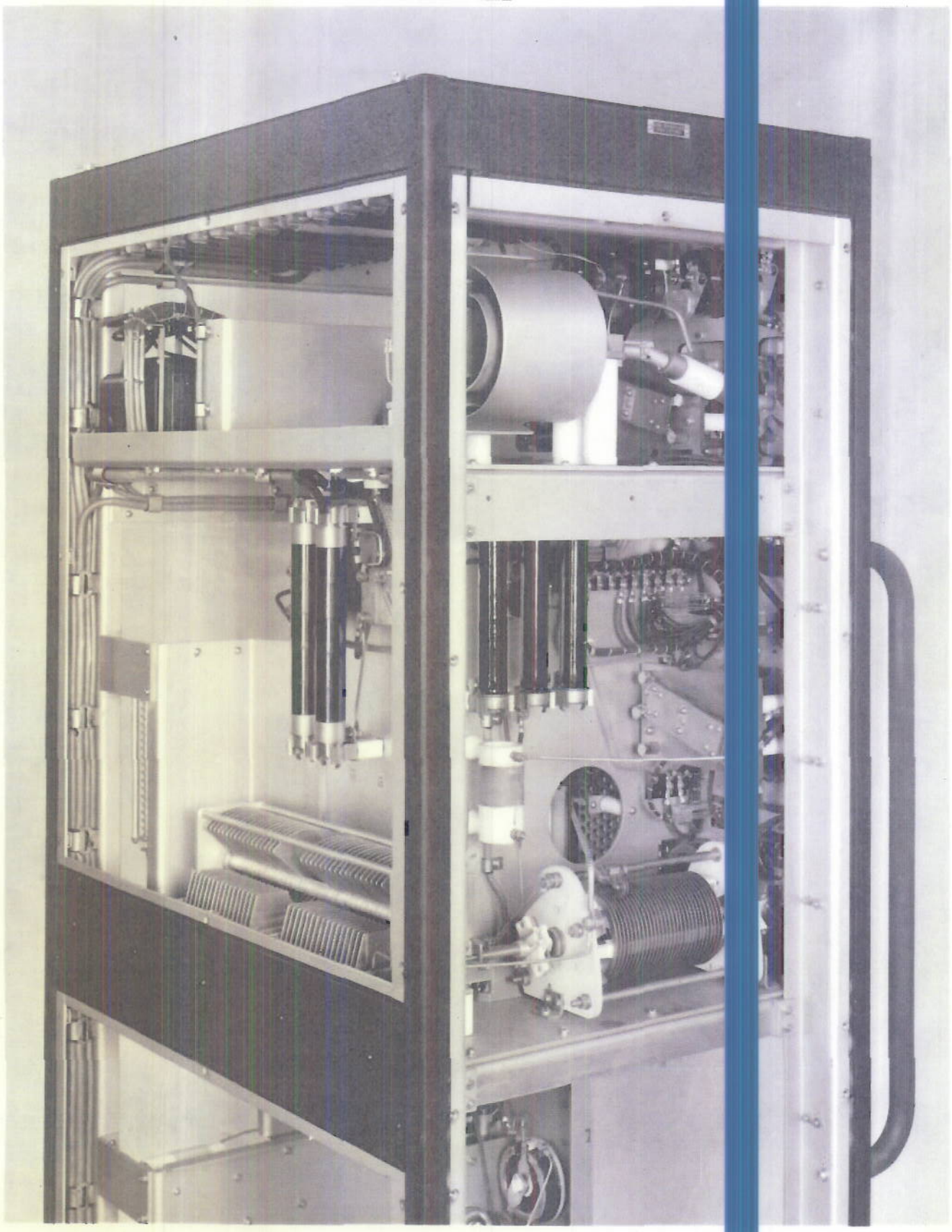


PLATE 11

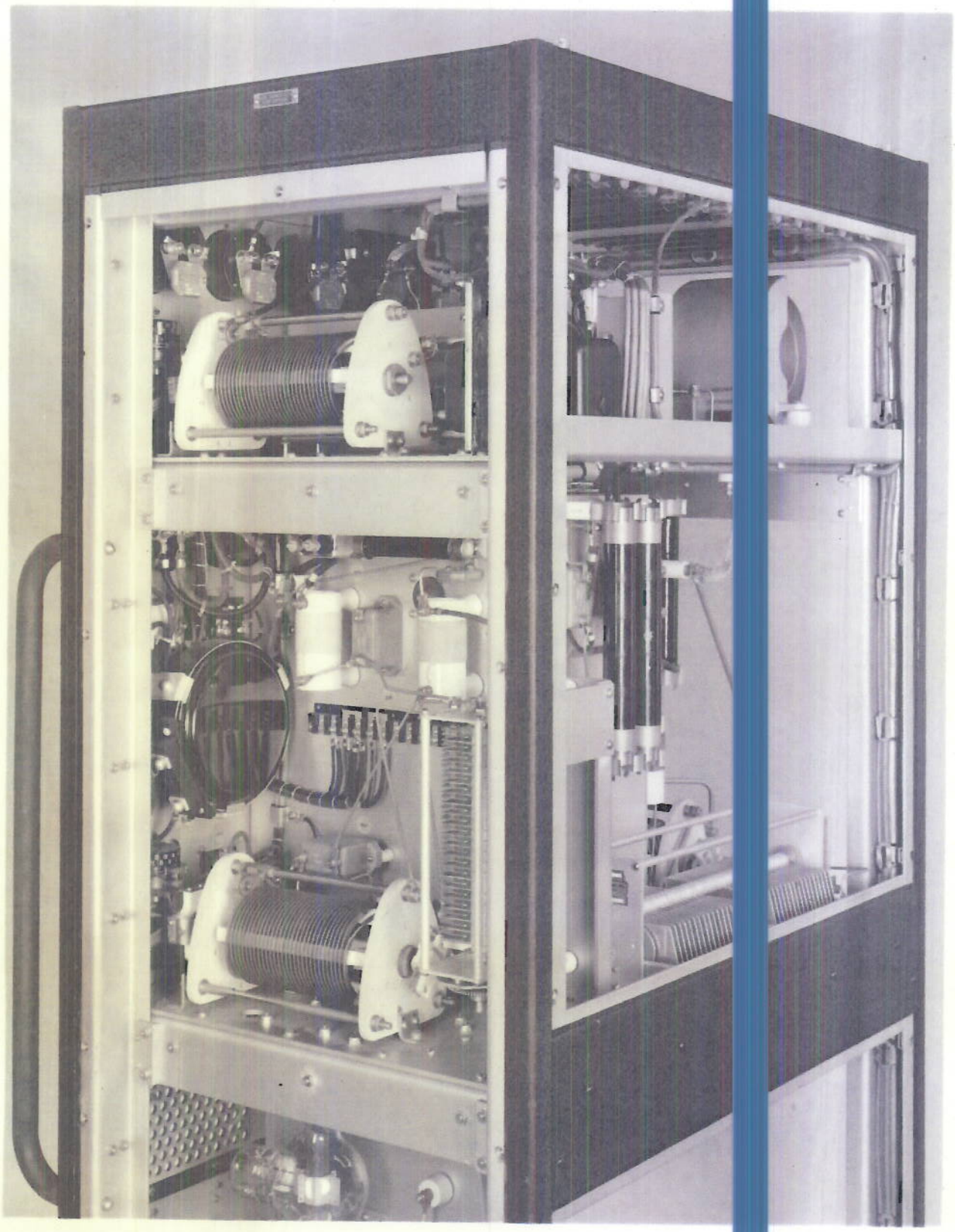


PLATE 12

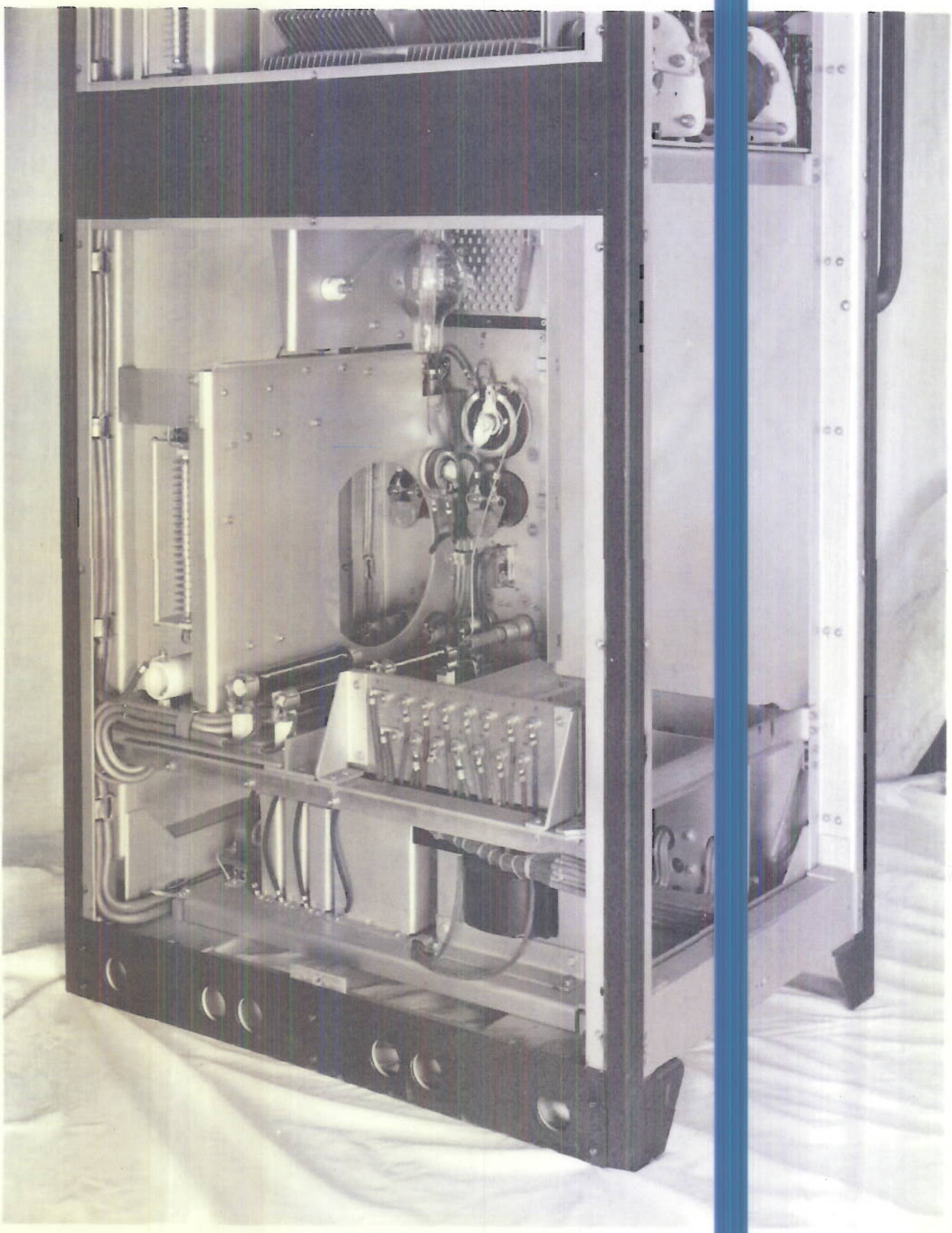
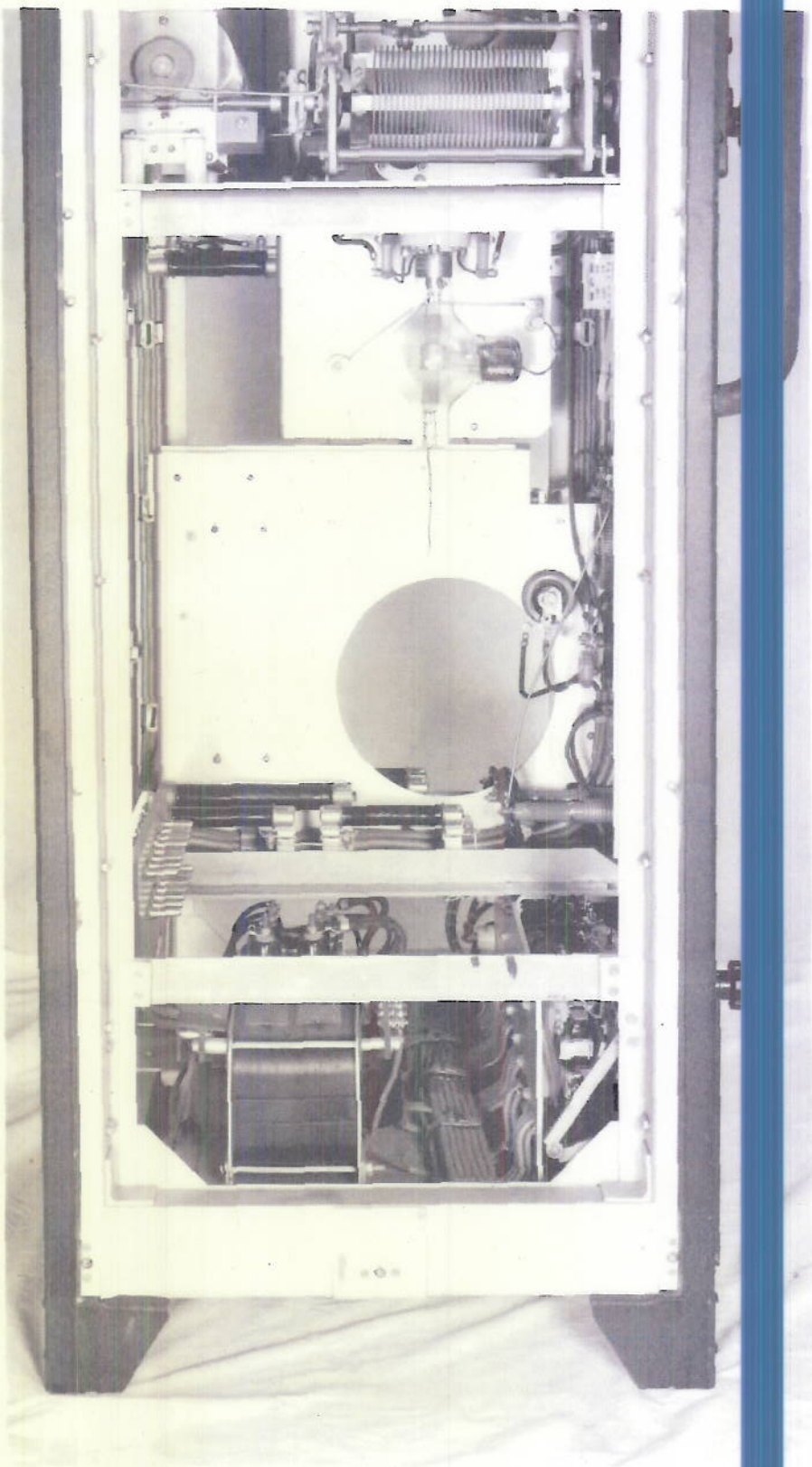


PLATE 13.



LATE 14

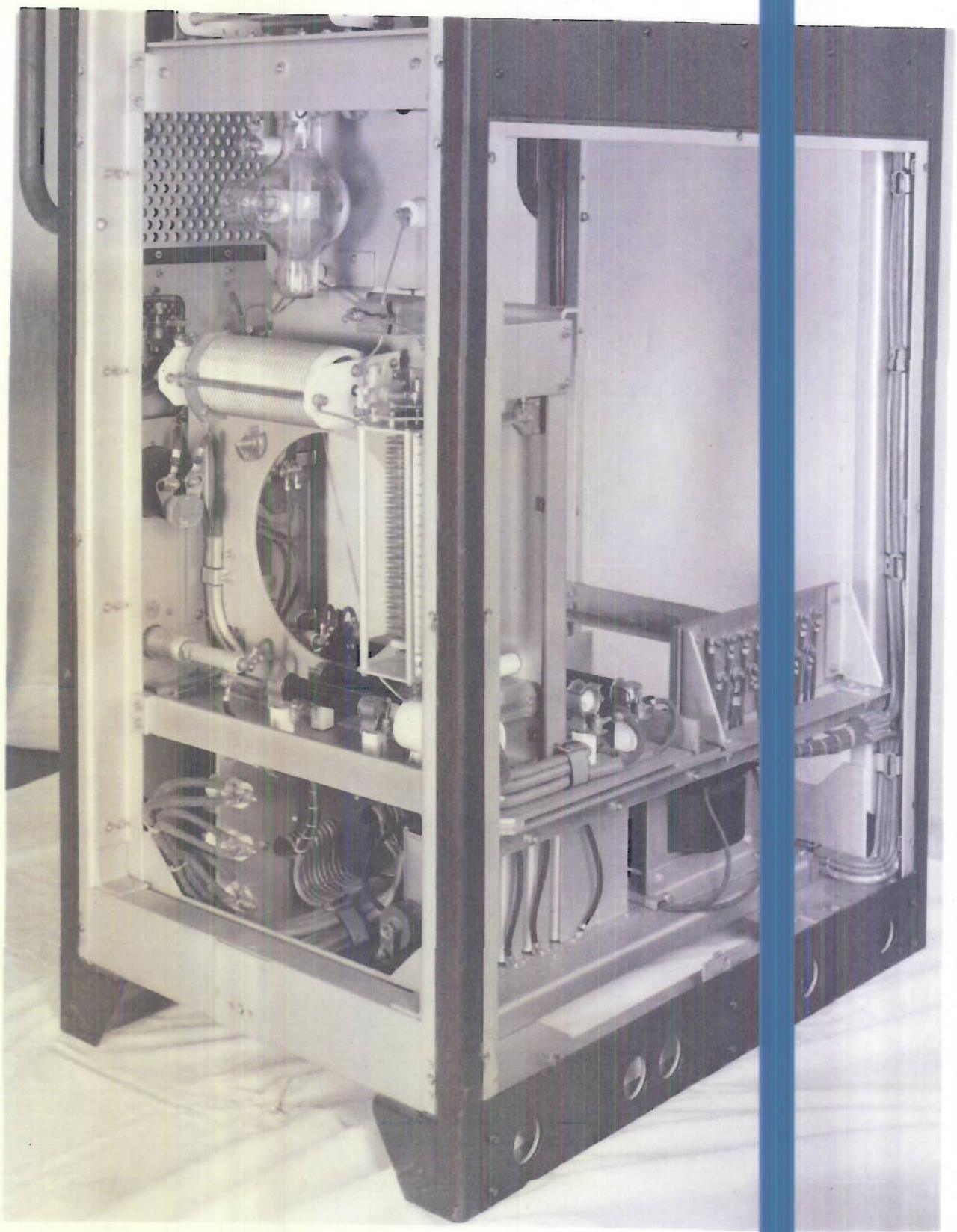


PLATE 15

PLATE 16

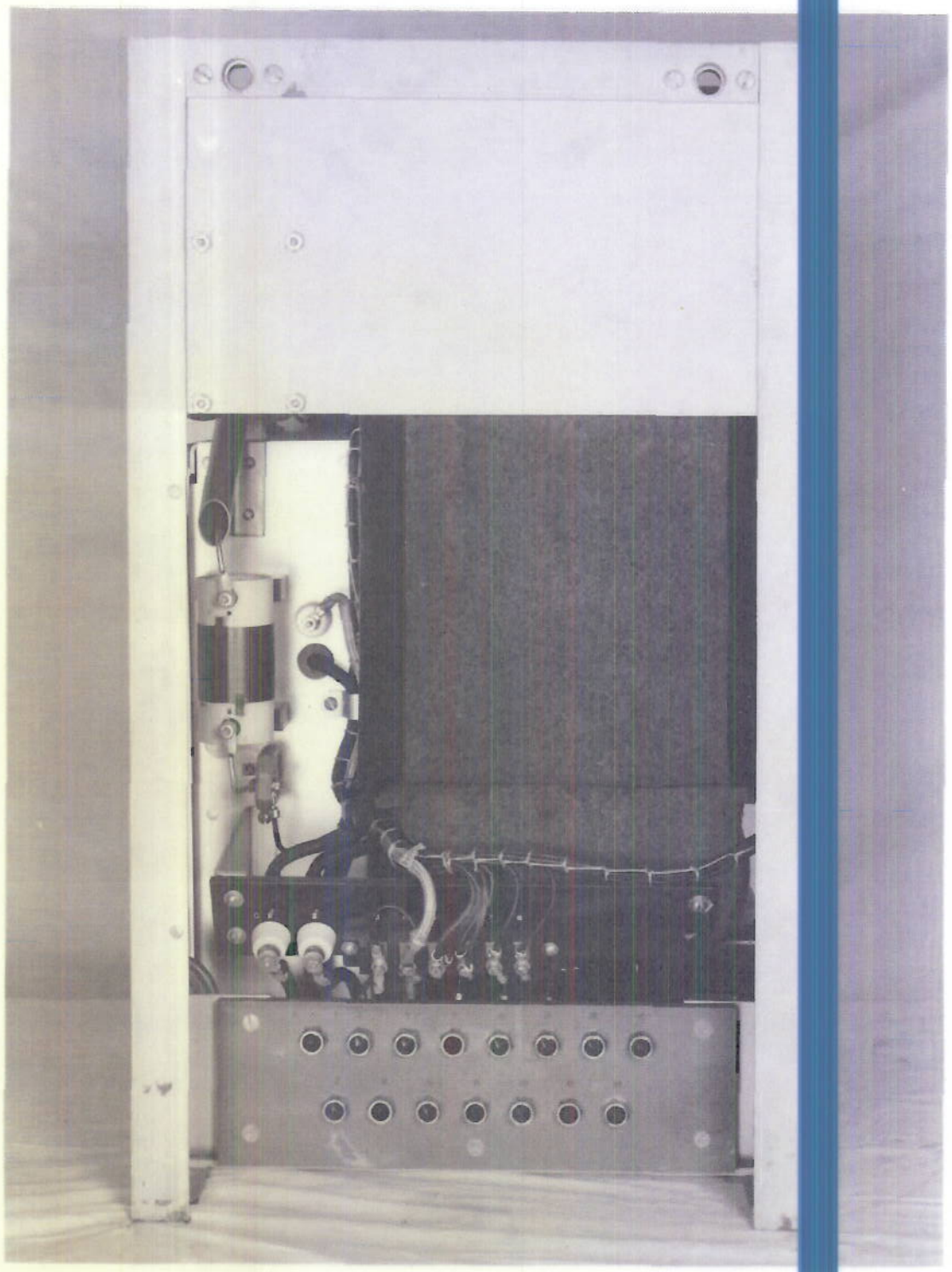


PLATE 17

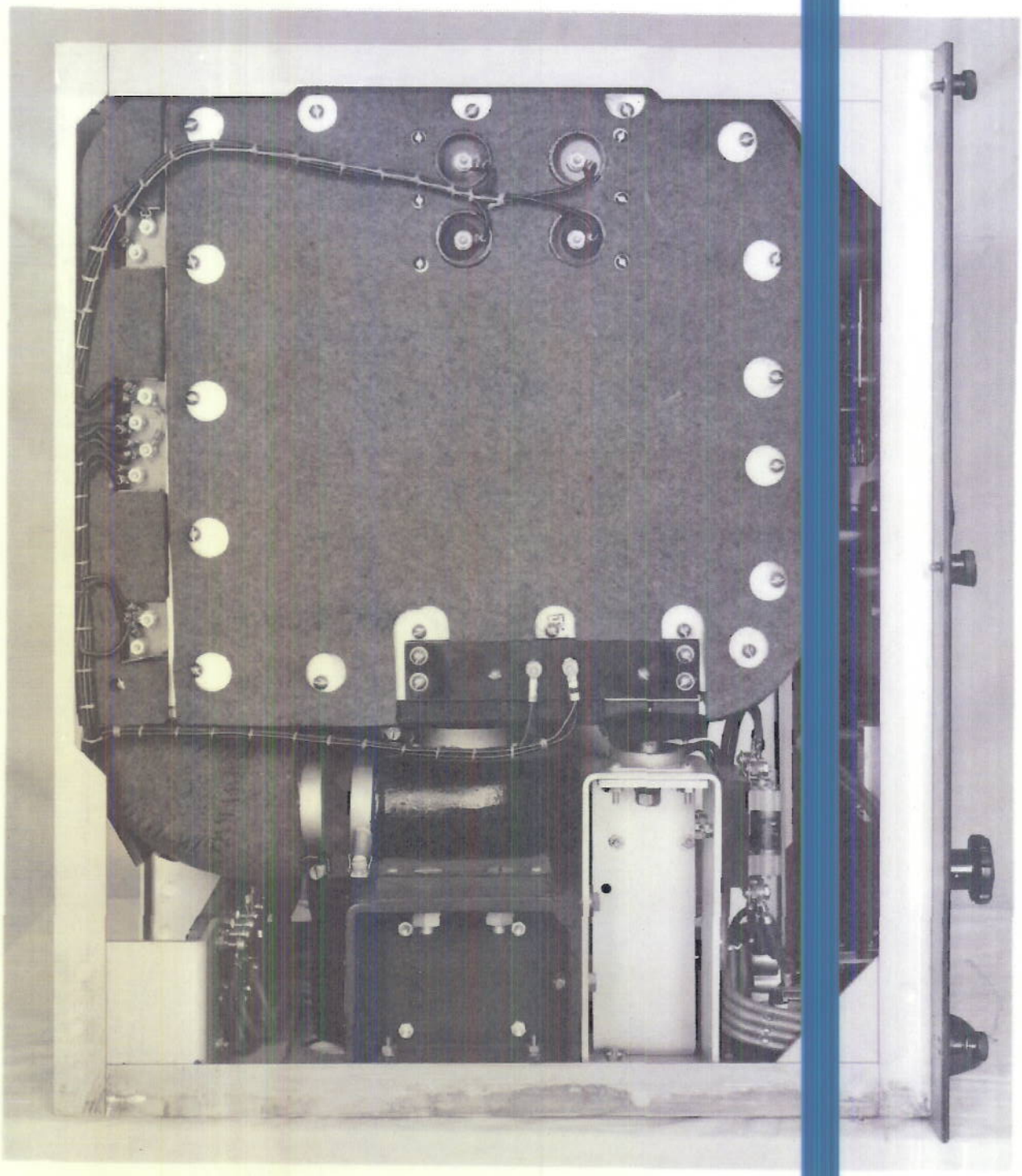


PLATE 18

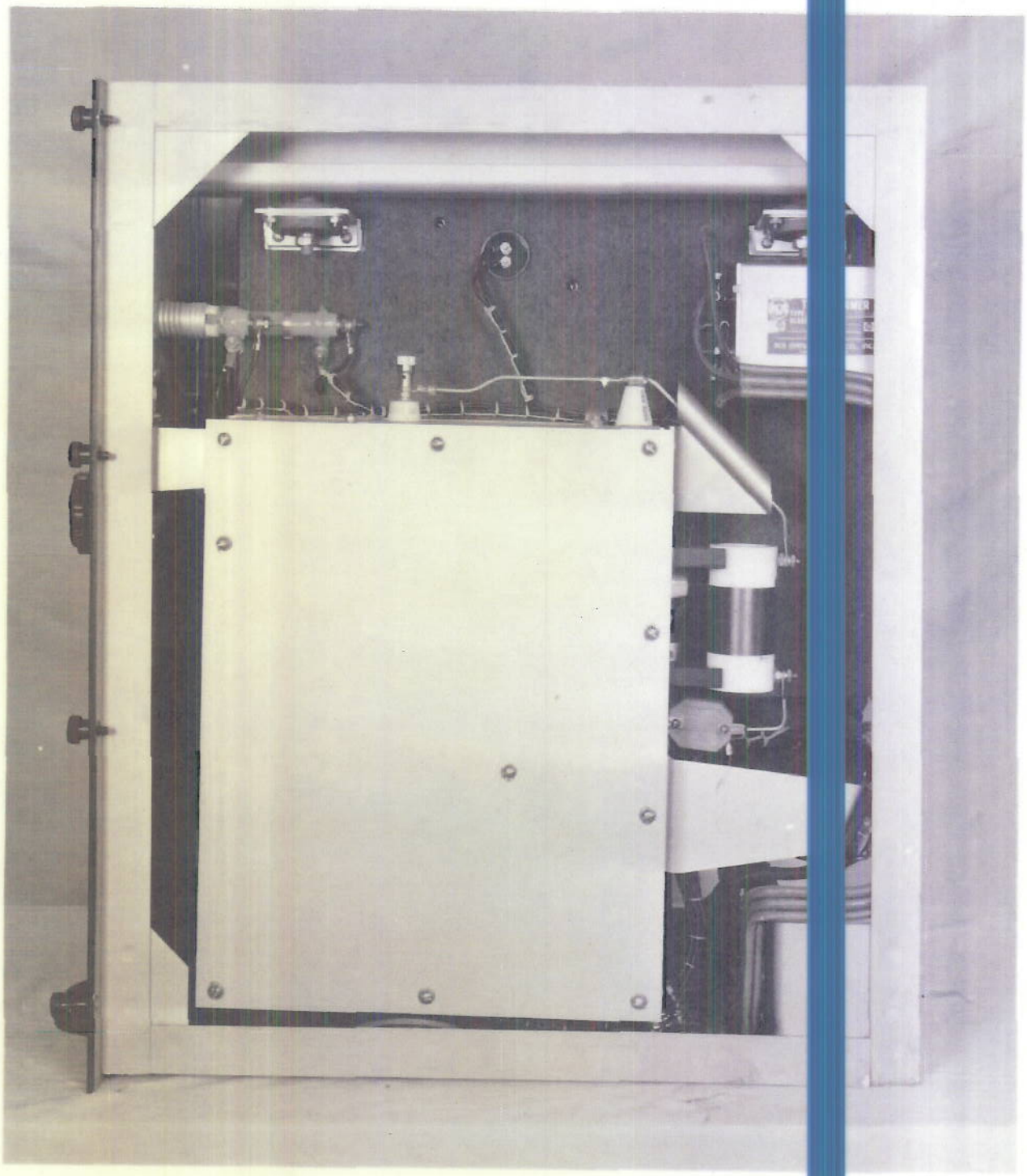
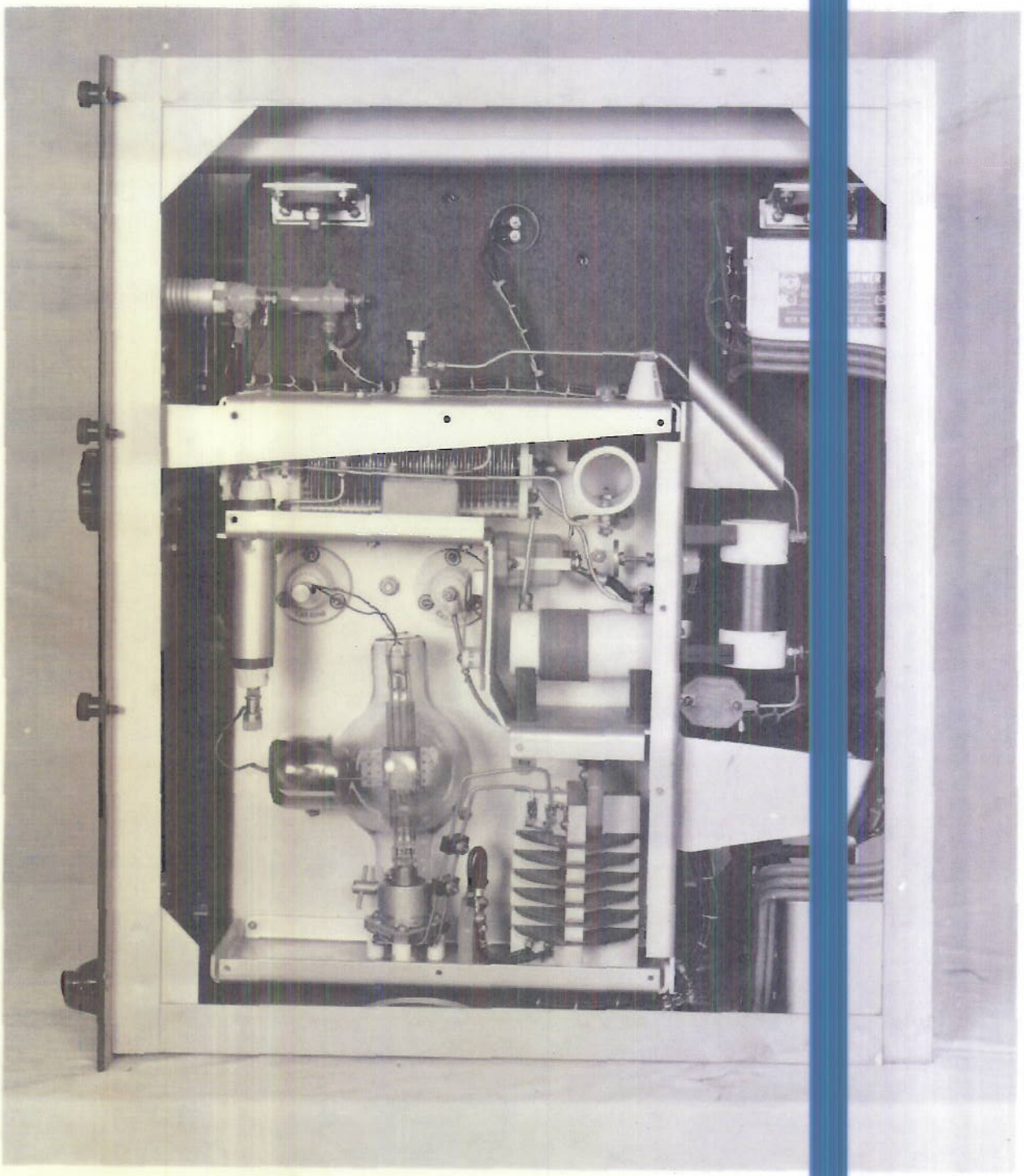


PLATE 19



LATE 20

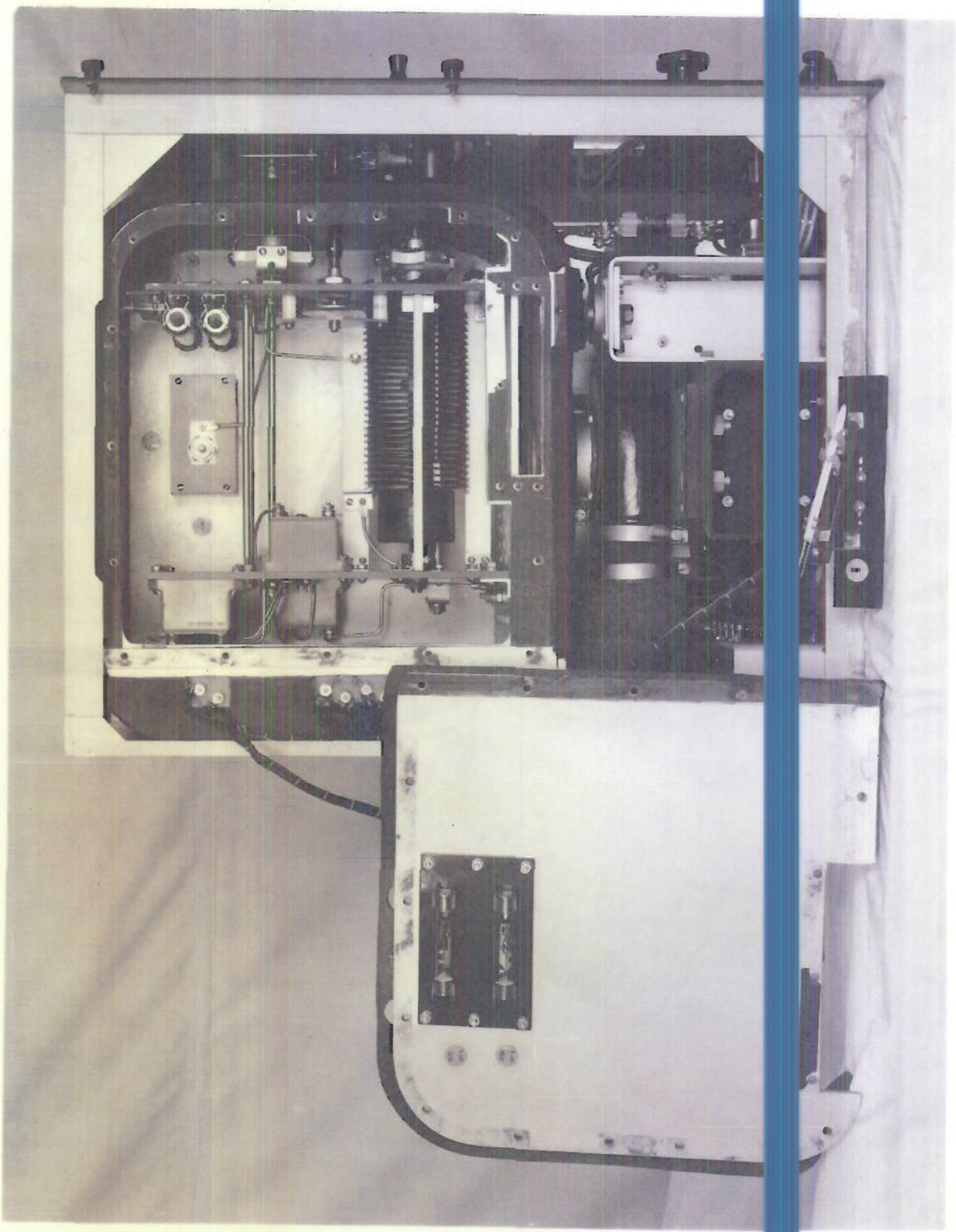


PLATE 21

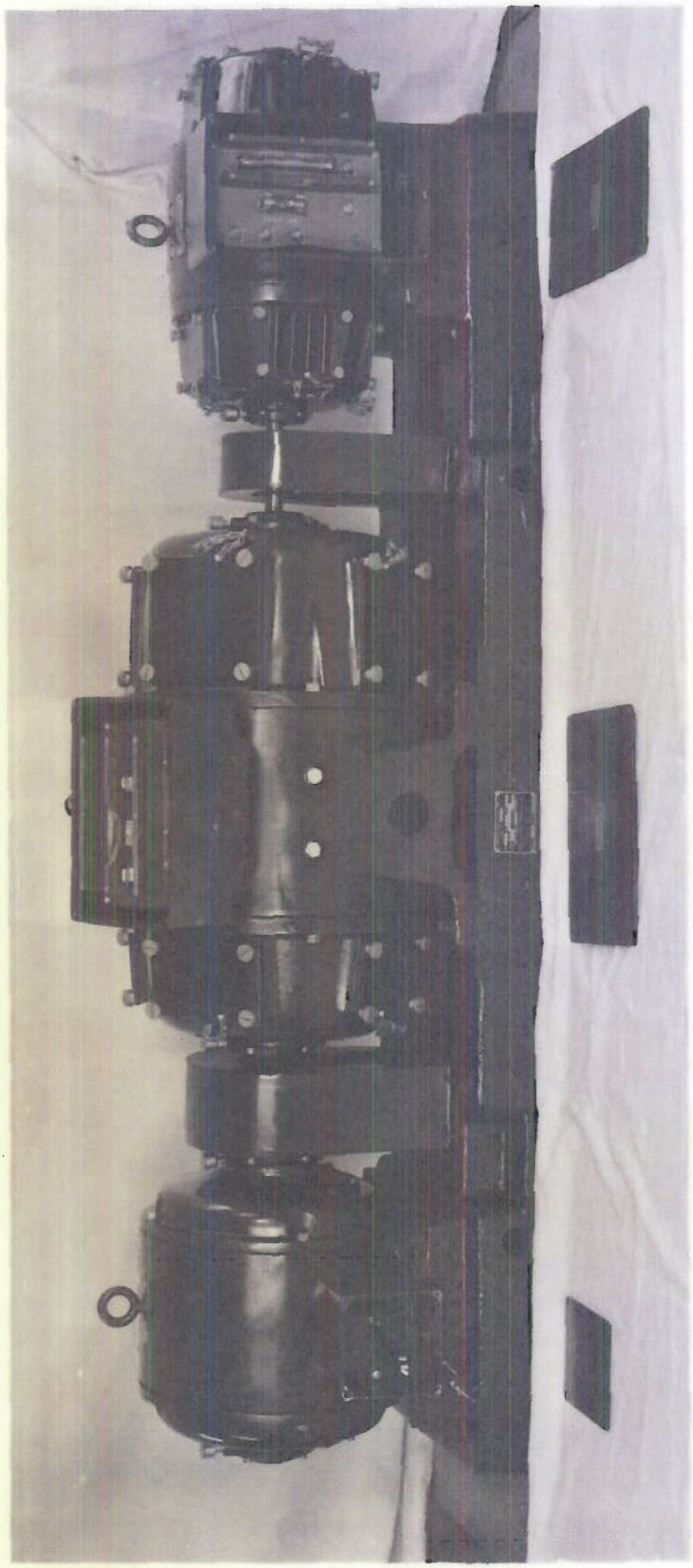


PLATE 22

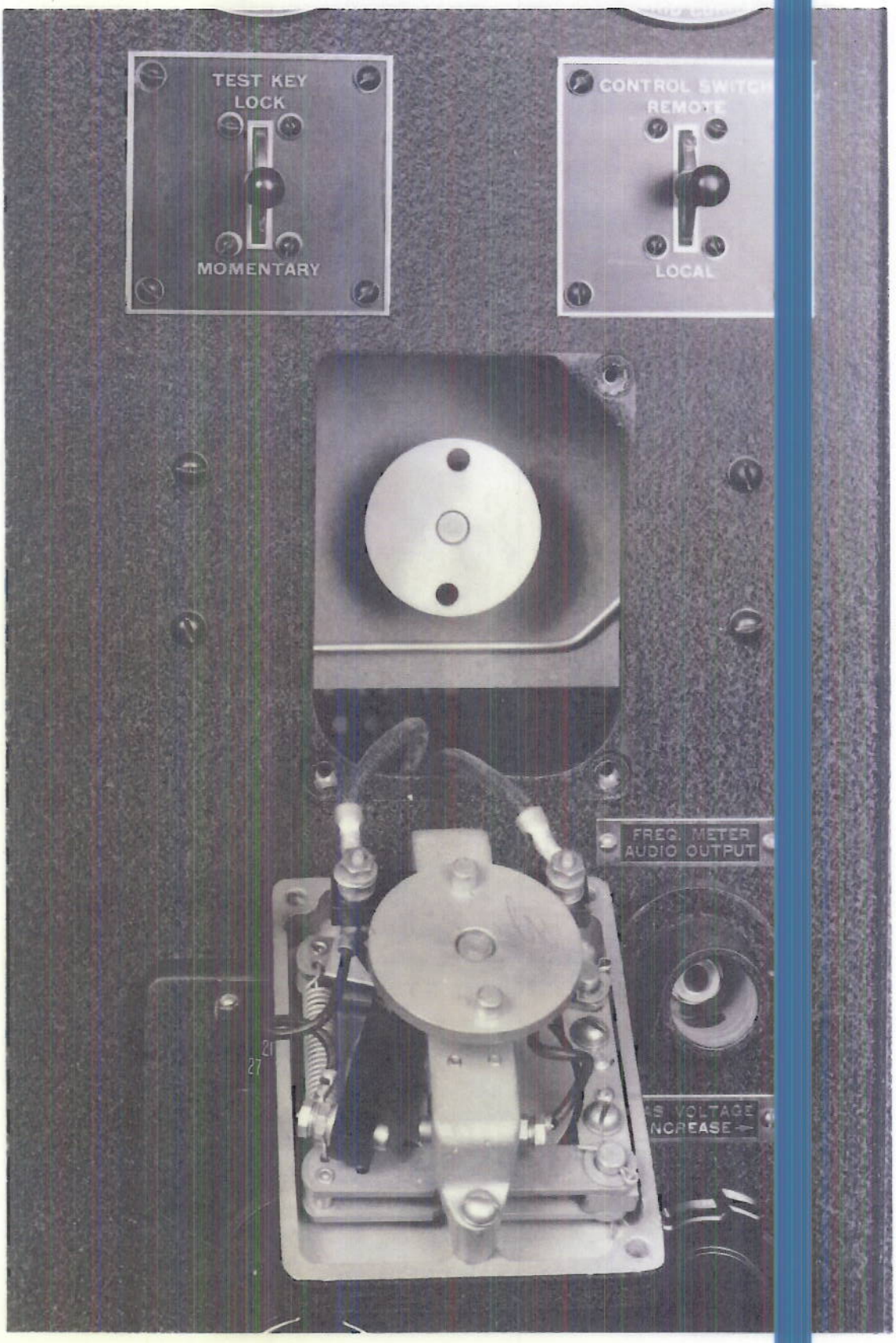
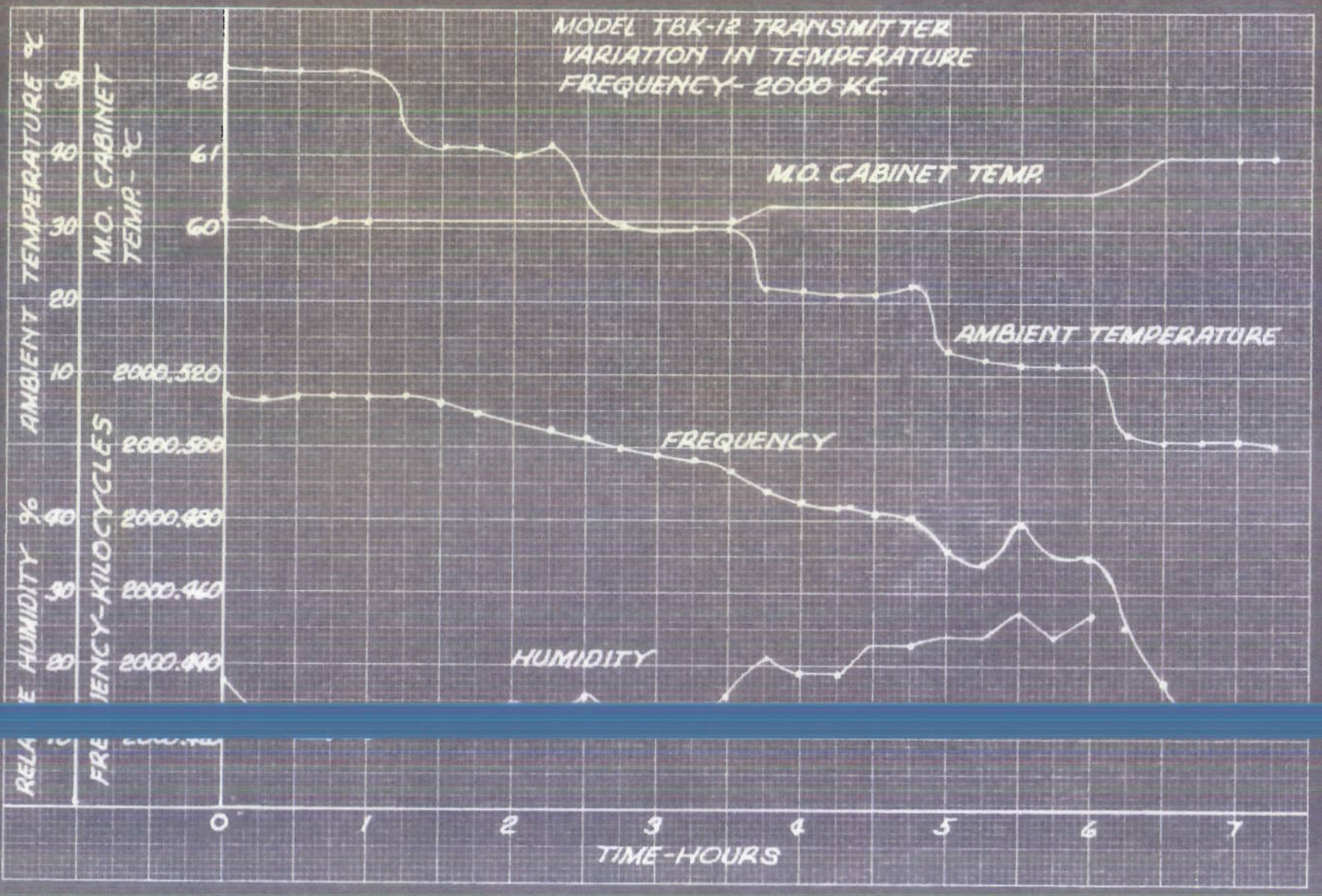
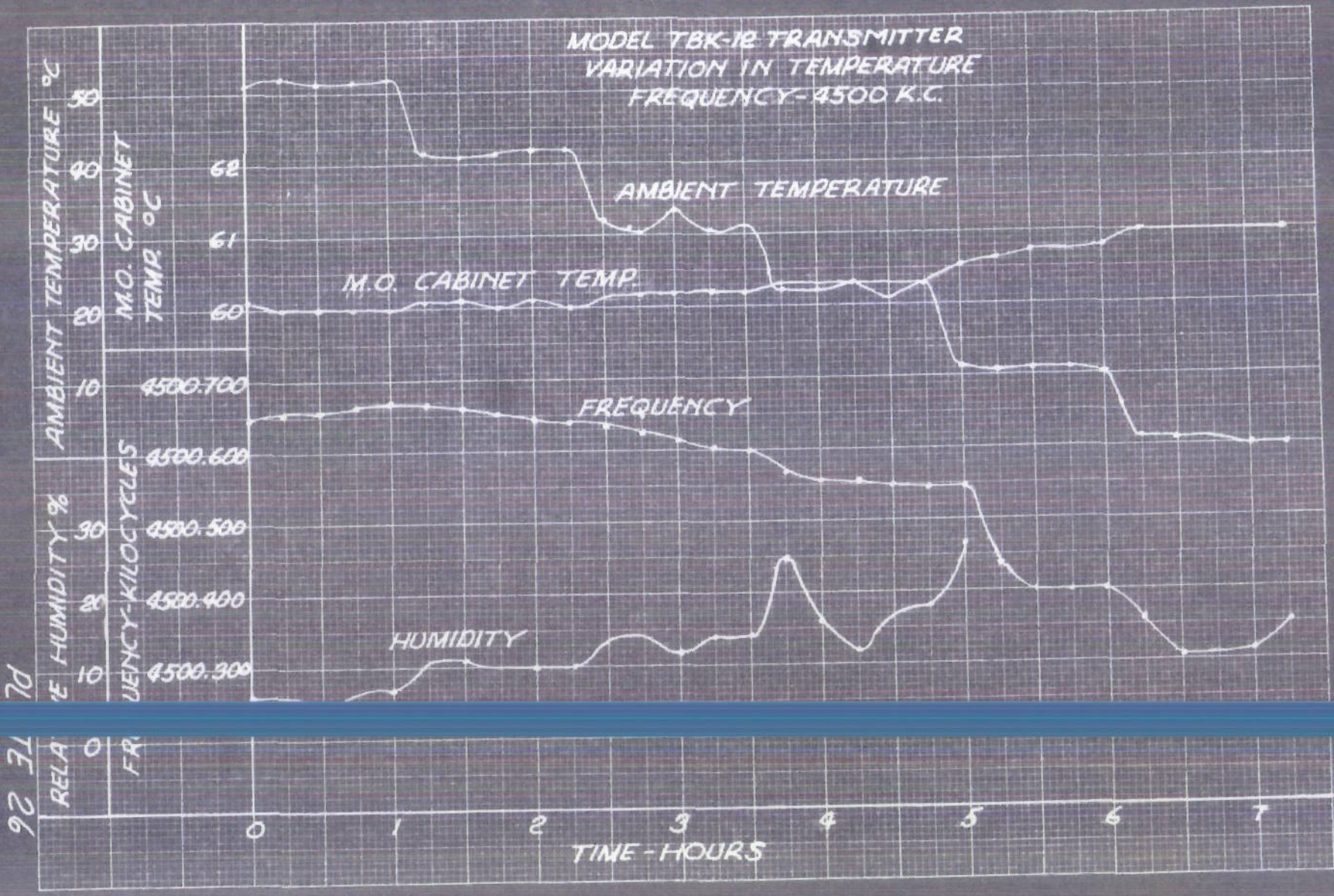
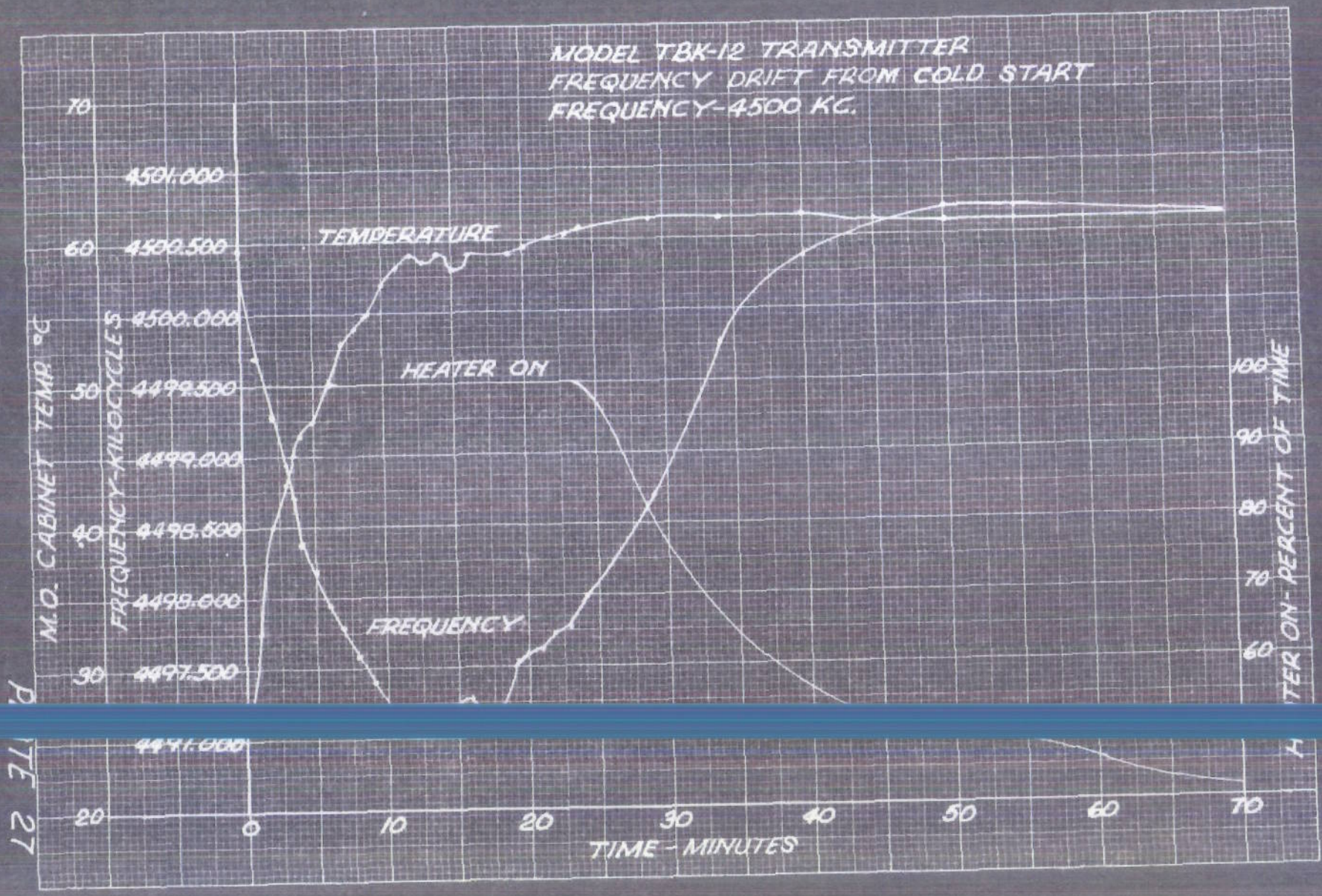
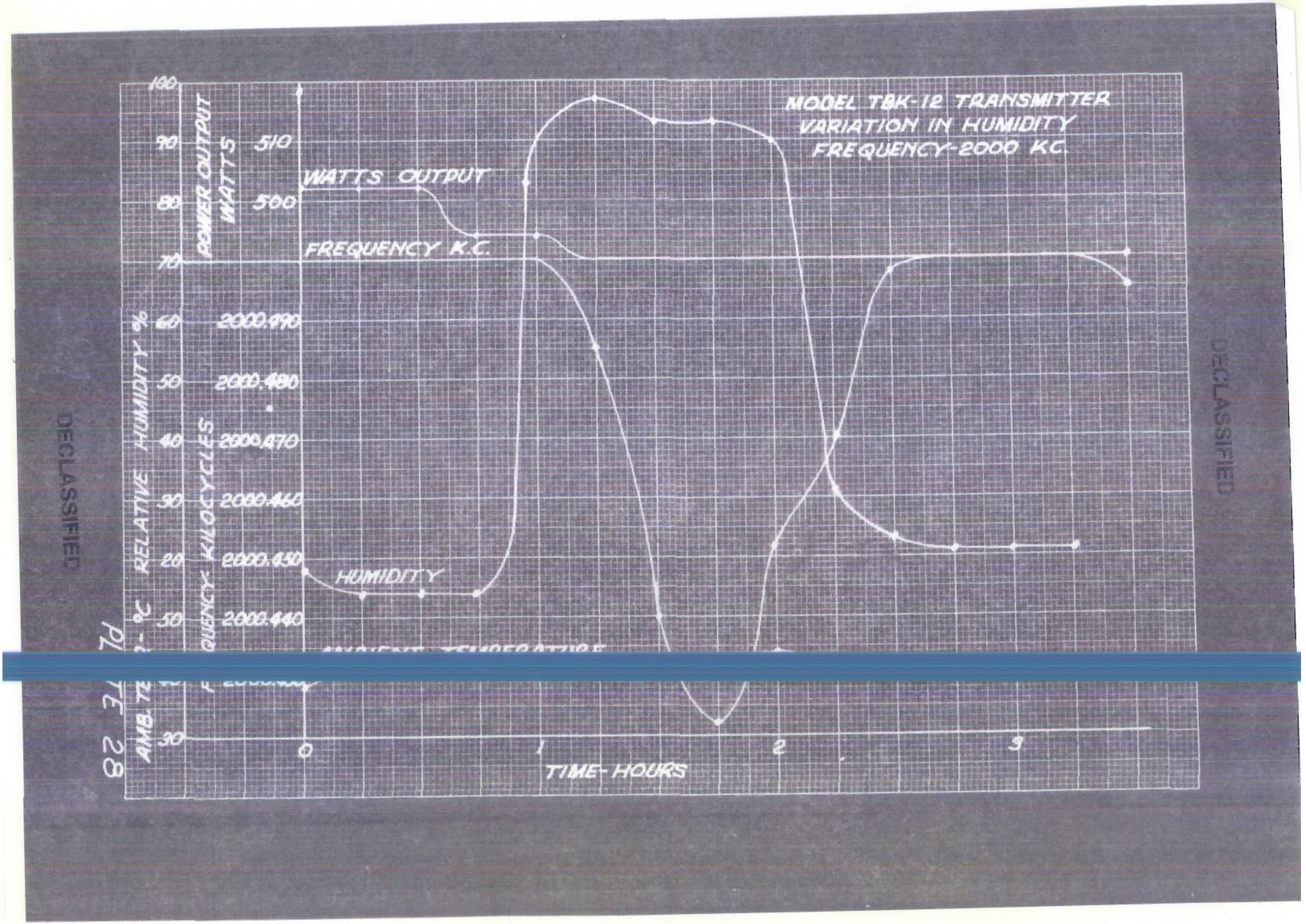


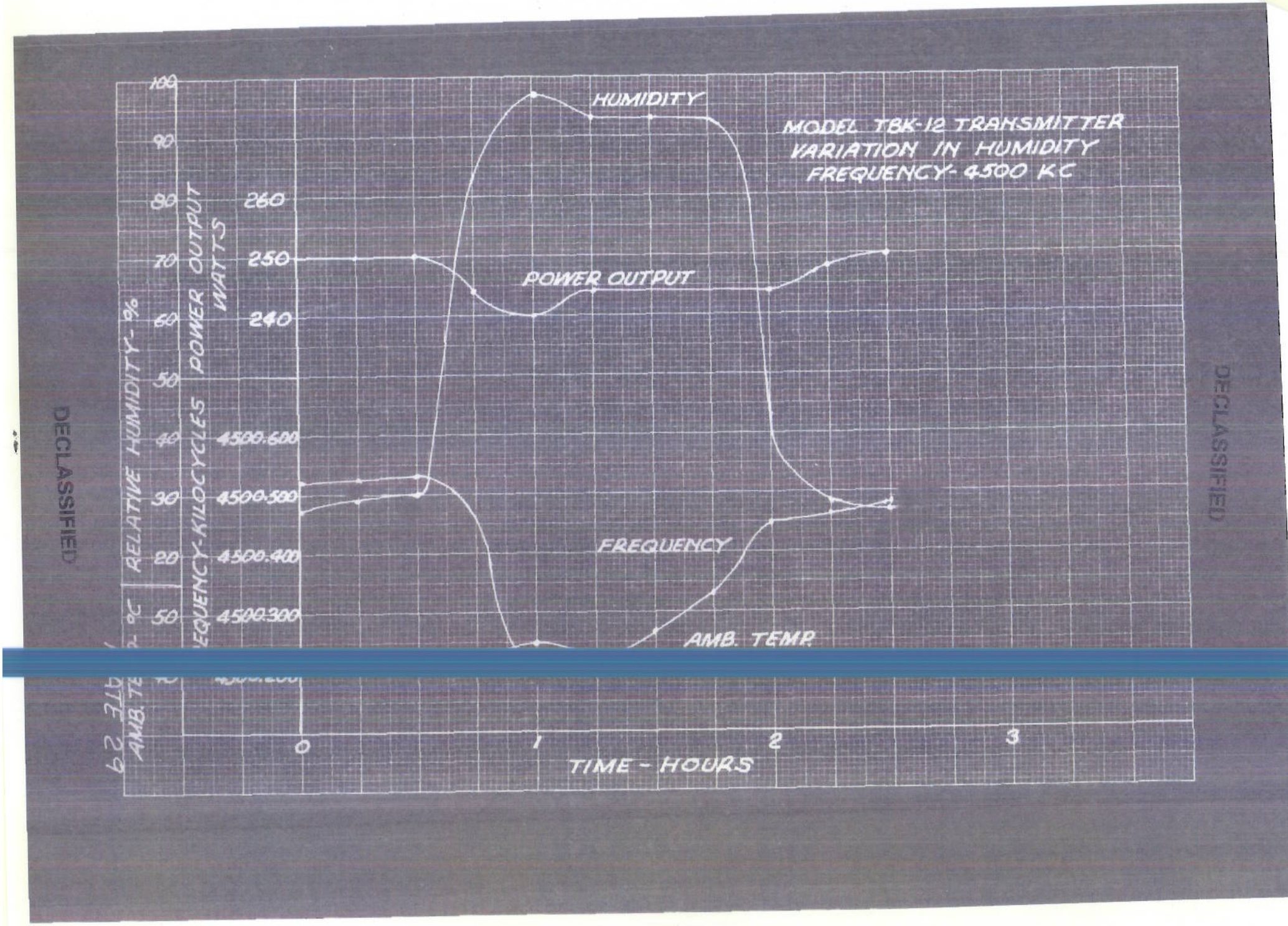
PLATE 24







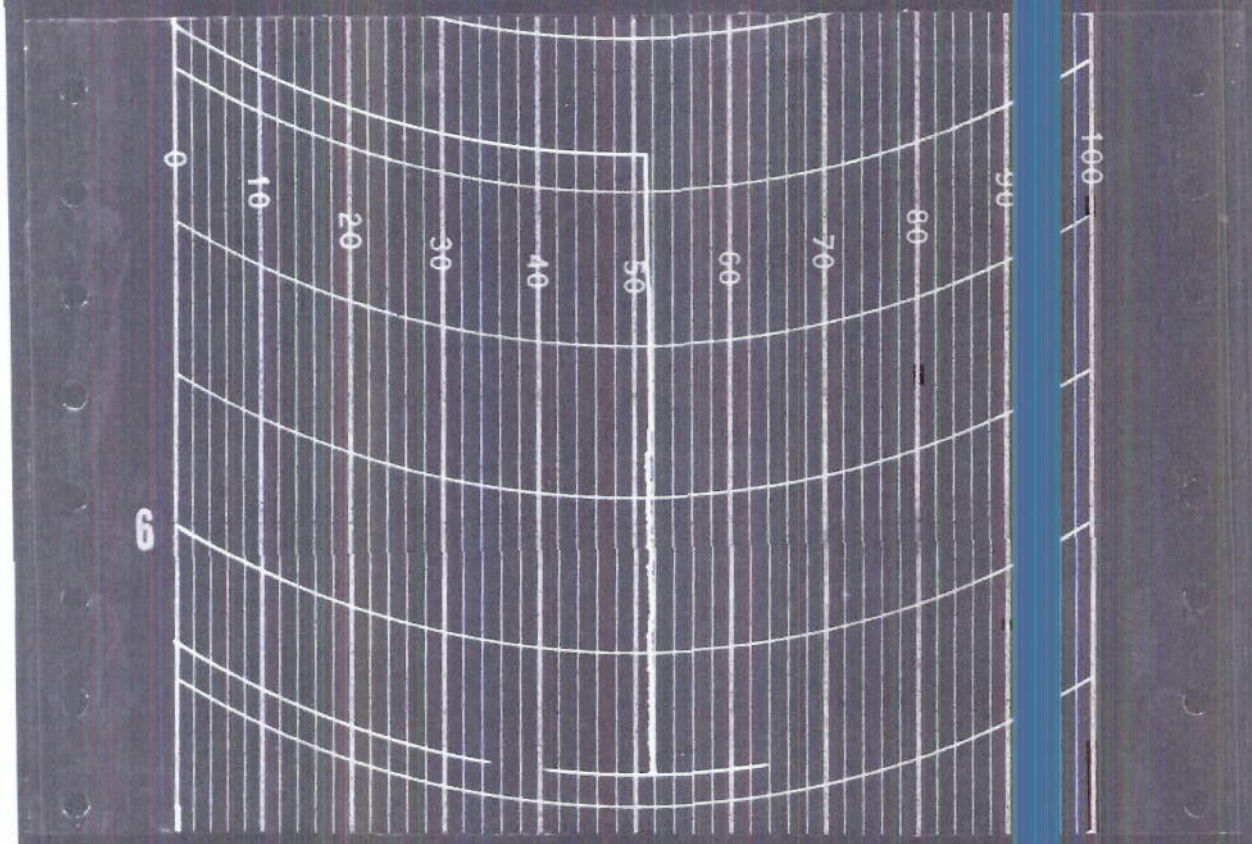

MODEL TBK-12 TRANSMITTER
VARIATION IN HUMIDITY
FREQUENCY-2000 KC.
WATTS OUTPUT
FREQUENCY K.C.
HUMIDITY
POWER OUTPUT WATTS
510
500
2000.490
2000.480
2000.470
2000.460
2000.450
2000.440
RELATIVE HUMIDITY %
100
90
80
70
60
50
40
30
20
10
0
1
2
3
TIME- HOURS
DECLASSIFIED
DECLASSIFIED


MODEL TBK-12 TRANSMITTER
VARIATION IN HUMIDITY
FREQUENCY- 4500 KC
HUMIDITY
POWER OUTPUT
FREQUENCY
AMB. TEMP
RELATIVE HUMIDITY- %
POWER OUTPUT WATTS
FREQUENCY-KILOCYCLES
100
90
80
70
60
50
40
30
20
50
260
250
240
4500.600
4500.500
4500.400
4500.300
0
1
2
3
TIME - HOURS
DECLASSIFIED
DECLASSIFIED

Model TBK-12 Transmitting Equipment

Inclination Test at 2000 Kc.
Inclination: Side to Side.

1000-Cycle Range of LK Used.
Scale: 20 Cycles per Division.



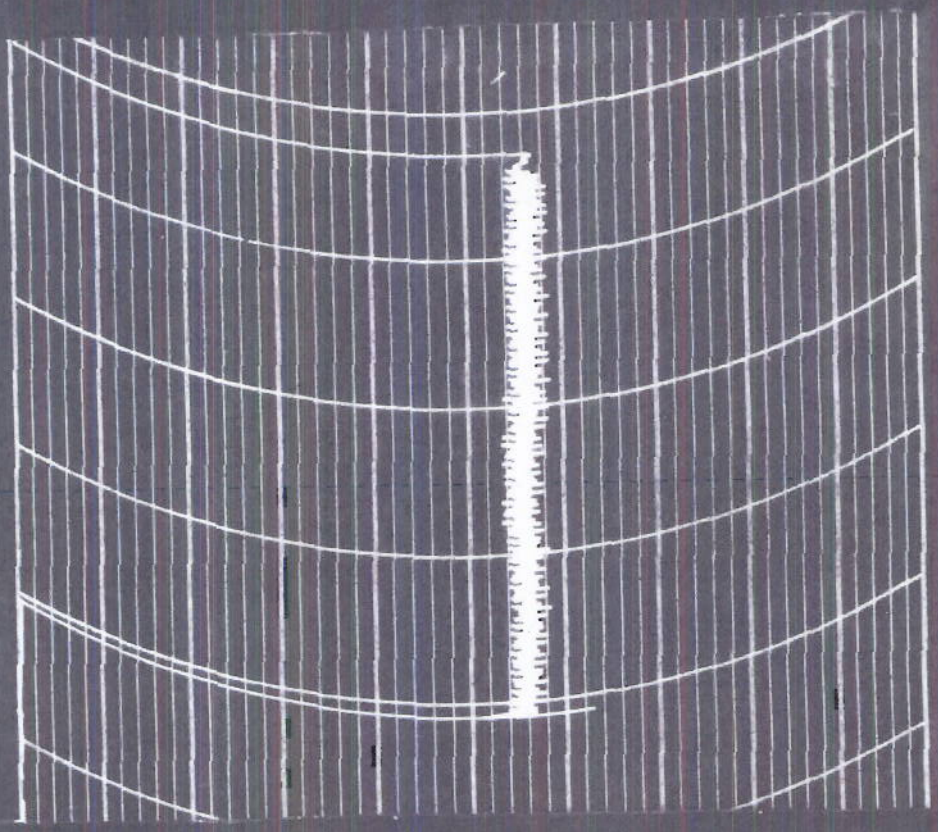
Maximum frequency change during test from freque y at start of test: 10 cycles or 0.0005 per cent.

Maximum frequency change noted during test, mini m to maximum: 9 cycles or 0.00045 per cent.

Model TBK-12 Transmitting Equipment

Inclination Test at 18,000 Kc.
Inclination: Side to Side.

1000-Cycle Range of LK Used.
Scale: 20 Cycles per Division.



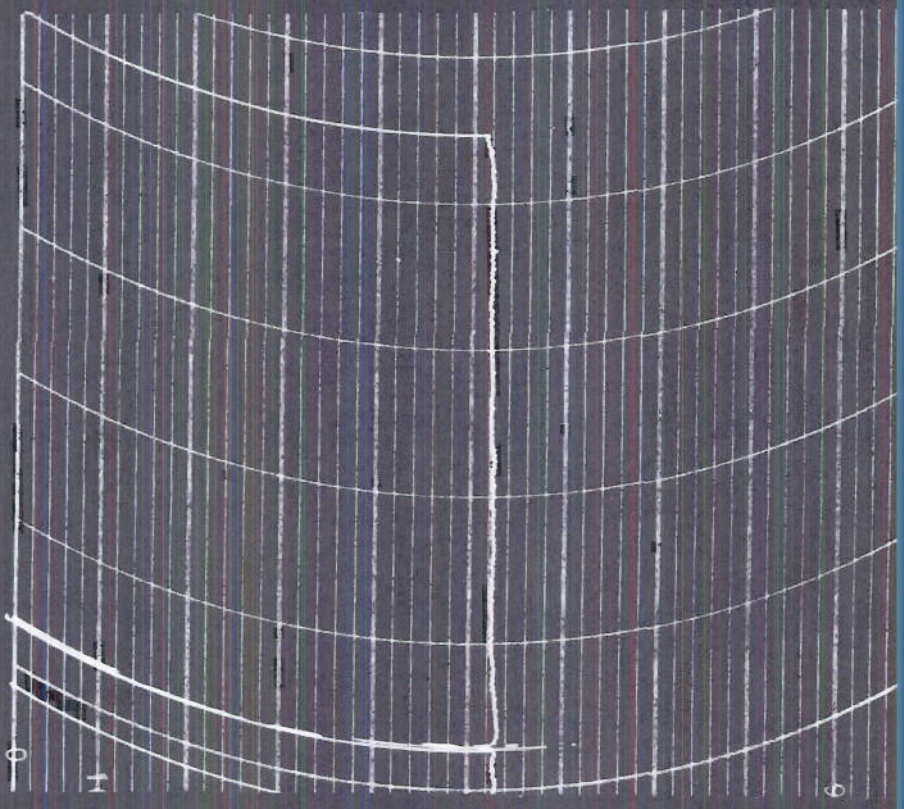
aximum frequency change during test from frequency a start
f test: 62 cycles or 0.00034 per cent.

aximum frequency change noted during test, minimum t
aximum: 44 cycles or 0.00024 per cent.

Model TBK-12 Transmitting Equipment

Inclination Test at 2000 Kc.
Inclination: Front to Back.

1000-Cycle Range of LK Used.
Scale: 20 Cycles per Division.



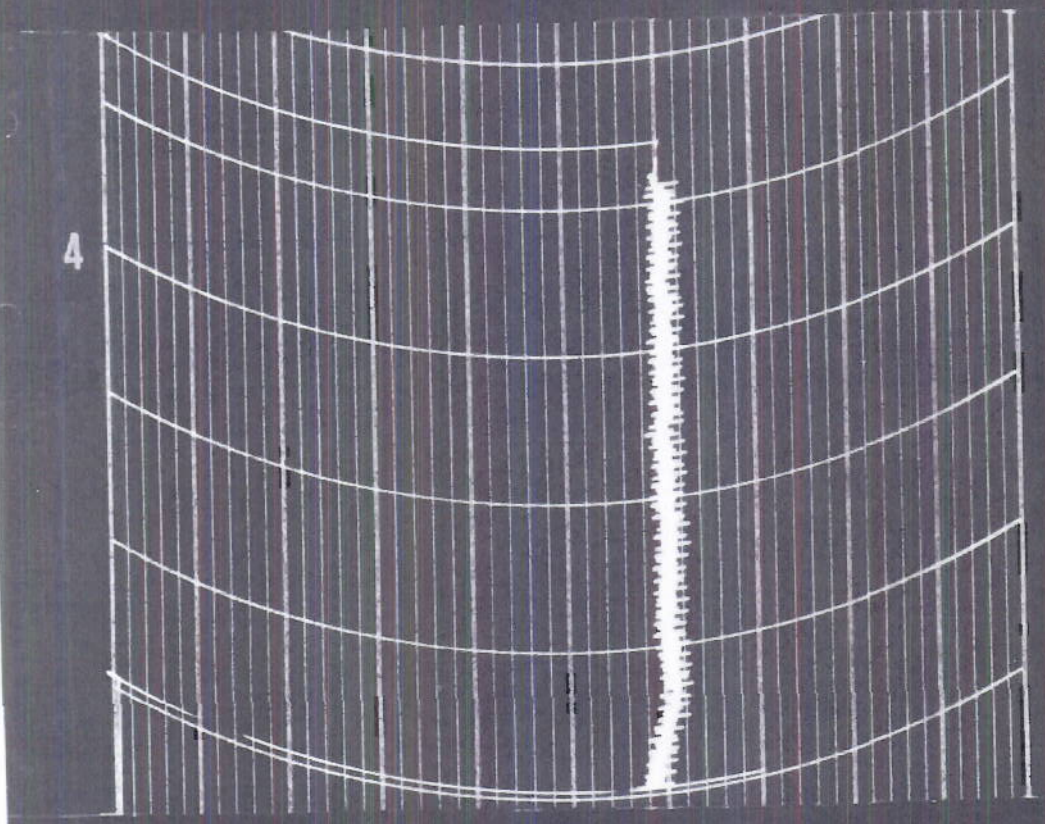
Maximum frequency change during test from frequency at start of test: 25 cycles or 0.00125 per cent.

Maximum frequency change noted during test, minimum to maximum: 6 cycles or .0003 per cent.

Model TBK-12 Transmitting Equipment

Inclination Test at 18,000 Kc.
Inclination: Front to Back.

1000-Cycle Range of LK Used.
Scale: 20 Cycles per Division.



aximum frequency change during test from frequency at tart
f test: 50 cycles or 0.00028 per cent.

aximum frequency change noted during test, minimum to aximum:
2 cycles or 0.00023 per cent.

Table 25 (Cont'd)

Summary

Temperature Change (°C)	Cycles Change	Per ent Ch ge Pe °C
50 to 40	9	0.0 05
40 to 30	11	0.0 06
30 to 20	13	0.0 07
20 to 10	11	0.0 06
10 to 0	45	0.0 23

Specification Requirements: Frequency change ot to exceed 0.000 per 1°C.

[redacted]

Table 27

Model TBK-12 Transmitting Equipment

VARIATION IN HUMIDITY - 2000 KC

Test as per paragraph 3-7(9) of Specifications RI 3A 442G

Time	Amb. Temp. (°C)	Rel. Hum. (%)	Frequency (Kc)	Power Amp. Ep	Power Amp. Ip	Ou ut (Wa s)	M-O Cabinet Temp. (°C)
0945	38.5	18	2000.500	3000	300	5	60.1
1000	41.5	14	2000.500	3000	300	5	60.1
1015	42.0	14	2000.500	3000	300	5	60.1
1030	41.5	14	2000.500	3000	300	4	60.1
1045	41.0	90	2000.485	3000	300	4	60.1
1100	42.0	97	2000.440*	3000	300	4	60.8
1115	43.0	93	2000.422	3000	295	4	60.85
1130	43.0	93	2000.452**	3000	295	4	60.2
1145	44.0	90	2000.470	3000	295	4	60.2
1200	42.0	31	2000.498	3000	297	4	60.1
1215	42.0	23	2000.500	3000	297	4	60.1
1230	41.0	21	2000.500	3000	297	4	60.1
1245	42.0	21	2000.500	3000	298	4	60.1
1300	41.5	21	2000.495	3000	295	4	60.1

* Heater has stopped regulating.
** Heater resumed regulation.

Frequency at end of first test period - 2000.500 kc
Frequency of maximum departure thereafter - 2000.422 kc
Difference: 78 cycles, 0.0039 per cent.
Specification Requirements: Not to exceed 0.003 per nt.

Power output at end of first test period - 494 watts
Maximum power decrease thereafter - 490 watts
Difference: 4 watts, 0.81 per cent.
Specification requirements: Not to exceed 5 per cent

Antenna: 115-volt, 500-watt lamp.

Table 33

Model TBK-12 Transmitting Equipment

INCLINATION TEST - FRONT TO BACK

Test as per paragraph 3-7(13) of Specifications RE A 442G

Time	Maximum Frequency (Kc)	Difference (Cycles)	Minimum Frequency (Kc)	Test Condition
1158	2000.515			Stationary
1200	2000.540	5	2000.535	Inclination
1205	2000.536	6	2000.530	Inclination
1210	2000.540	6	2000.534	Inclination
1215	2000.534	4	2000.530	Inclination
1220	2000.531	6	2000.525	Inclination
1225	2000.530	5	2000.525	Inclination
1230	2000.531	6	2000.525	Inclination
1231	2000.525			Stationary

Maximum frequency change from stationary condition start of test: 25 cycles; 0.00125 per cent.

Maximum frequency change from stationary condition end of test: 15 cycles; 0.00075 per cent.

Maximum frequency change noted during test, minimum to maximum: 6 cycles; 0.00035 per cent.

1120	18000.590			Stationary
1121	18000.620	42	18000.578	Inclination
1125	18000.635	35	18000.600	Inclination
1130	18000.640	28	18000.612	Inclination
1135	18000.638	33	18000.604	Inclination
1140	18000.635	31	18000.610	Inclination
1145	18000.639	29	18000.610	Inclination
1150	18000.640	30	18000.610	Inclination
1151	18000.613			Stationary

Maximum frequency change from stationary condition start of test: 50 cycles; 0.00028 per cent.
Maximum frequency change from stationary condition end of test: 35 cycles; 0.00019 per cent.
Maximum frequency change noted during test, minimum to maximum: 42 cycles; 0.00023 per cent.

Specification Requirements: Not to exceed 0.001 per cent.

[redacted]

Table 34

Model TBK-12 Transmitting Equipment

INCLINATION TEST - SIDE TO SIDE

Test as per paragraph 3-7(13) of Specifications RE A 442G

Time	Maximum Frequency (Kc)	Difference (Cycles)	Minimum Frequency (Kc)	Test Condition
1327	2000.527			Stationary
1328	2000.531	6	2000.525	Inclination
1330	2000.527	7	2000.520	Inclination
1335	2000.527	7	2000.520	Inclination
1340	2000.526	6	2000.520	Inclination
1345	2000.530	9	2000.521	Inclination
1350	2000.522	5	2000.517	Inclination
1355	2000.525	8	2000.517	Inclination
1356	2000.521			Stationary

Maximum frequency change from stationary condition start of test: 10 cycles; 0.0005 per cent.
Maximum frequency change from stationary conditions t end of test: 10 cycles; 0.0005 per cent.
Maximum frequency change noted during test, minimum o maximum: 9 cycles; 0.00045 per cent.

1403	18000.533			Stationary
1404	18000.590	40	18000.550	Inclination
1410	18000.585	35	18000.550	Inclinati on
1415	18000.582	27	18000.555	Inclination
1420	18000.591	31	18000.560	Inclination
1425	18000.595	44	18000.551	Inclination
1430	18000.590	30	18000.560	Inclination
1431	18000.580			Stationary

Maximum frequency change from stationary condition start of test: 62 cycles; 0.00034 per cent.
Maximum frequency change from stationary condition end of test: 30 cycles; 0.00017 per cent.
Maximum frecuency change noted during test, minimum o maximum: 44 cycles; 0.00024 per cent.

Specification Requirements: Not to exceed 0.001 per cen

[redacted]

Table 38

Model TBK-12 Transmitting Equipment

DETERMINATION OF LIMITING FREQUENCIES
TO WHICH TRANSMITTER CAN BE TUNED AND LOADED

Antenna: 115-Volt, 500-Watt Lamp.

Test as per paragraph 3-13 of Specifications RE 13A ,2G

	Low	Hgh
Output Frequency	1,919.0	1 788.0
Specified Frequency	2,000.0	1 ,00.0
Overlap Kilocycles	81.0	88.0
Mean Frequency	1,959.5	1 444.0
Per Cent Overlap	4.13	3.73
Limiting Circuit	Osc. Plate Tuning	1.0.

ontrol:	A	B	C	D	E	F	G	I	J
1,919 Kc	1	1,591	0	383	195	124	50	60	0
13,778 Kc	6	6,510	85	2,502	2,761	2,651	25	76	2,855
eter	M-O I_p	1st I-A I_p		2nd I-A I_p		P-A I_g		-A I_p	
,919 Kc	26	34		91		43		300	
18,788 Kc	40	37		64		9		300	

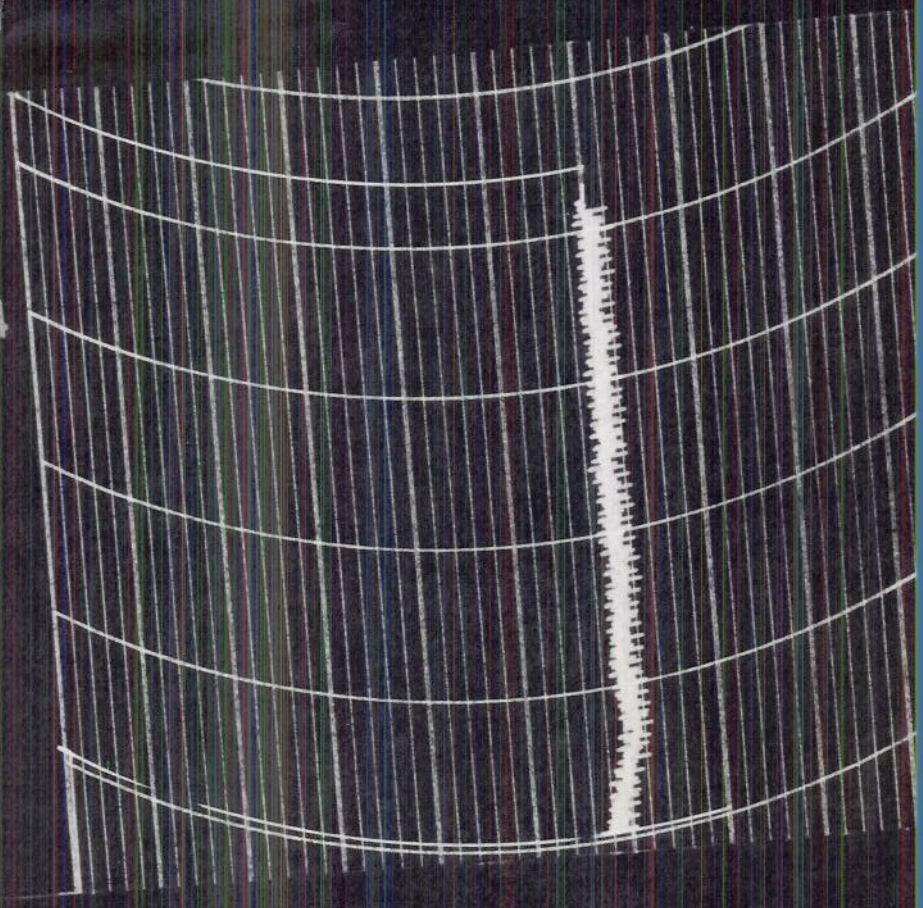
ote: (1) Specification Requirements: 3 per cent overla

[redacted]

Model TBK-12 Transmitting Equipment

Inclination Test at 18,000 Kc.
Inclination: Front to Back.

1000-Cycle Range of LK Used.
Scale: 20 Cycles per Division.



Maximum frequency change during test from frequency at start of test: 50 cycles or 0.00028 per cent.

Maximum frequency change noted during test, minimum to maximum: 42 cycles or 0.00023 per cent.

Plate 33

Table 25

Model TBK-12 Transmitting Equipment

VARIATION IN AMBIENT TEMPERATURE - 2000 KC

Test as per paragraph 3-7(8) of Specifications RE 13 442G

e	Amb. Temp. (°C)	Rel. Hum. (%)	Frequency (Kc)	M.O. Cabinet Temp. (°C)	Power Amp Ep	I	Output (Watts)
)	52.0	18	2000.514	60.1	3000	3(	480
5	51.5	13	2000.513	60.1	3000	3(	480
)	51.5	10	2000.514	60.0	3000	3(	480
5	51.5	10	2000.514	60.1	3000	3(	480
)	51.7	10	2000.514	60.1	3000	3(	470
5	42.0	11	2000.514	60.1	3000	3(	480
)	41.0	13	2000.512	60.1	2960	3(	480
5	41.0	13	2000.509	60.1	2960	3(	480
)	40.0	15	2000.507	60.1	2960	3(	488
5	41.5	13	2000.505	60.1	2960	3(	492
)	34.0	16	2000.503	60.1	2960	3(	494
5	30.5	12	2000.500	60.1	2960	3(	504
)	30.0	12	2000.498	60.1	2960	3(	508
5	30.0	12	2000.497	60.1	2960	3(	508
)	30.2	16	2000.494	60.1	2960	3(	512
5	22.0	21	2000.488	60.3	3000	3(	520
0	21.5	19	2000.485	60.3	3000	3(	520
5	21.0	19	2000.484	60.3	3000	3(	520
0	21.0	23	2000.482	60.3	3000	3(	524
5	22.2	23	2000.481	60.3	2950	3(	520
30	13.5	24	2000.472	60.4	2960	3(	540
45	12.0	24	2000.468	60.5	2950	3(	560
00	11.5	27	2000.479	60.5	2920	3(	570
15	11.5	24	2000.470	60.5	2920	3(	580
30	11.5	27	2000.470	60.5	2920	3(	580
5	2.0	--	2000.451	60.7	2950	3(	585
00	1.0	--	2000.436	61.0	3000	3(	590
15	1.0	--	2000.425	61.0	3000	3(	595
30	1.0	--	2000.425	61.0	3000	3(	597
45	0.5	--	2000.425	61.0	3000	3(	600

(Continued)

[redacted]