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SUBJECT

Report on

Preliminary Model XGO-3 Transmitting Equipment

by

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BELLEVUE, D. C.

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NAVY DEPARTMENT

BUREAU OF ENGINEERING

Report on

Preliminary Model XGO-3 Transmitting Equipment

Contractor:

Westinghouse Electric and Manufacturing Company

[redacted]

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

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Appendix B

Naval Air Station,Anacostia, Report F42-1/52 NA6(339)
Serial Number 38007 of 4 February 1938, with enclosures.

AUTHORIZATION

1. The tests herein reported were authorized by Bureau of Engineering letter, reference (d). Additional pertinent references are also listed.

Reference: (a) NRL let.F42-1/52 of 29 June 1937
to CO, NAS Anacostia.
(b) BuEng Specification RE 13A 472D.
(c) BuEng let.C-NOs-52339(1-22-W3) of 27 Jan.1937
to INM Hartford, Conn. with enclosure (A).
(d) BuEng let.C-NOs-52339(5-7-W8) of 10 May 1937
to NRL, copy to NAS Anacostia.
(e) BuEng let.C-NOs-52339(6-30-W3-26) of 10 July 1937
to NAS Anacostia, with enclosures (A), (B), and (C).
(f) BuEng let.C-NOs-52339(8-31-W3) of 2 Sept.1937
to NAS Anacostia with enclosure (A).
(g) BuEng let.C-NOs-52339(8-26-W3) of 11 Sept.1937
to INM Hartford, copy to NAS Anacostia,
with enclosure (A).
(h) BuEng let.C-NOs-52339(10-8-W3) of 29 Oct.1937
to INM Hartford, copy to NAS Anacostia,
with enclosure (A).

OBJECT OF TESTS

2. These tests were made to determine the compliance of the Model XGO-3 equipment with the governing specifications and to determine its suitability for use in Naval aircraft service.

ABSTRACT OF TESTS

3. The Model XGO-3 transmitting equipment was tested for compliance with governing specifications. These tests covered the following points.

(a) General inspection relative to features for which specific tests cannot be made but which are determined by observation and operation of the equipment.

(b) Size and weight.

(c) Power output; power input.

(d) Resettability - backlash.

(e) Effect of temperature on frequency.

(f) Effect of voltage on frequency.

(g) Effect of humidity on frequency.

(h) Effect of antenna detuning on frequency.

(i) Effect of tune-operate control on frequency.

(j) Effect of altitude on frequency.

(k) Frequency range and overlap.

(l) Rectifier conversion.

(m) Rectifier regulation.

(n) Rectifier ripple.

(o) Voltage compensation.

(p) Frequency reset in flight.

4. Additional tests covering the operation of the equipment in flight were made at the Naval Air Station. Serial No. 1 was delivered to the Naval Air Station, Anacostia, on 22 June 1937.

Conclusions

(a) Numerous deficiencies were encountered during the course of the XGO-3 tests but the majority of these have been corrected by the contractor's representative or by Navy personnel. Others are to be corrected in production equipments. Deficiencies encountered were chiefly of a mechanical nature.

(b) The Model XGO-3 incorporates excellent electrical characteristics such as its frequency stability, freedom from flashover at altitude, good power output and antenna coupling circuits. However, its performance under vibration, especially quality of emitted note does not compare favorably with the best in the Naval service.

(c) Circuit design is straightforward, simple, and satisfactory. The equipment represents considerable thought and care in its design and with modifications made to make it sufficiently rugged for aircraft service, it is believed that Model GO-3 equipments will be a distinct asset to Naval aircraft radio.

Recommendations

As a result of these tests it is recommended that:

(a) The specification requirement relating to frequency variations under extreme conditions of humidity be waived.

(b) Provided the production Model GO-3 equipments correct the deficiencies brought to the contractor's attention at Bureau of Engineering conferences, that the equipments be considered satisfactory for Naval service.

(c) For future specifications, paragraph 9-11 be clarified so as to require preliminary instruction books with submission of equipment.

(d) Paragraph 3-12 be changed to the following for future specifications:

3-12(1) No change.

3-12(2) Assuming the filaments are turned on for five minutes before beginning a measurement, the frequency shall not vary from the starting point beyond the following tolerances.

3-12(2)(a) With equipment tuned to full power but with key open except when actually taking a measurement, the frequency shift shall not exceed 0.04% for intermediate frequencies or 0.02% for high frequencies for a 20° Centigrade change of ambient temperature.

3-12(2)(b) $\pm$ 5% change of supply voltage shall not shift frequency more than 0.02% in the intermediate band or 0.01% in the high band. Maximum frequency shifts will be measured - not departure from original value.

3-12(2)(c) Antenna tuning changed 20% as indicated by 20% change of plate current shall not vary frequency more than 0.005%. Maximum frequency shifts will be measured - not departure from original value.

3-12(2)(d) Use of tune-operate control shall not shift frequency more than 0.008%.

3-12(3) Omit.

3-12(4) The frequency variation shall not exceed 0.05% for 30 minutes locked key full power operation. Five minute filament warm-up permitted; frequency variation considered as departure from starting value.

3-12(5) and 3-12(6) No change.

DESCRIPTION OF EQUIPMENT UNDER TEST

5. The XGO-3 transmitting equipment submitted by the Westinghouse Electric and Manufacturing Company consisted essentially of a high frequency transmitter (3,000 - 13,575 kilocycles) and an intermediate frequency transmitter (300 - 600 kilocycles) which operate from a common rectifier power supply. Each transmitter unit consists of a type 38101 oscillator, a type 38837 intermediate amplifier, and a type 38803 power amplifier. The circuit is so arranged that the power amplifier tube is switched from one transmitter to the other as required. The intermediate amplifier in the high frequency unit operates either as a straight amplifier or a frequency multiplier. The high frequency oscillator range is from 3,000 to 6,000 kilocycles. Two type 38266A rectifiers are used for the high voltage plate supply while a rectifier using a type 38593 tube supplies screen and low power plate voltages. In addition, there were two receiver monitor cables, two instruction books, one waterproof slip cover and a complete set of vacuum tubes. The above enumeration represents one equipment; submission was made in duplicate. See paragraph 4 of Appendix B.

METHOD OF TEST

6. The equipment was given a general inspection of workmanship, type of materials, etc. The component parts were measured and weighed and then set up for electrical tests.

7. Power Measurements. Power outputs were determined in the usual I^2R method. The antenna current was measured by an external radio frequency panel meter in the ground return of the dummy antenna. The meter was first checked for accuracy at 60 cycles. At the low frequencies, Ward Leonard plaques were used for resistors and at the high frequencies, zircon rods were employed. Power inputs were determined by a wattmeter in the primary circuit. Care was taken to have proper adjustment of control, proper voltage supply and proper compensation throughout. Data were recorded for both cw and mcw conditions.

8. Frequency drift measurements for all bench tests were made with the Model LK-1 drift indicator. For the half hour tests the key was locked but for temperature coefficient and humidity tests the equipment was operated at 25 words per minute keying. Temperature coefficients over the range of $-30^{\circ}C$ to $+50^{\circ}C$ were made in the aircraft section, using the refrigerator for temperature variation and due to the small capacity of the refrigerator all tests had to be made beginning at a low temperature and recording the frequency drift as the temperature increased. For humidity tests the facilities of the transmitter section's large temperature control room were used. In all cases the transmitter filaments were energized for five minutes before frequencies were recorded.

9. Line voltage variations of ± 5% were secured by adjustment of the NF-1 voltage regulator. Frequencies were measured with the Model LK-1 drift indicator.

10. The Model XGO-3 transmitting equipment is the first aircraft set to be given a formal humidity test and the technique of measurement was patterned along lines used by the shipboard transmitter section. The procedure was to select a temperature at which the test was to be made and then key the transmitter long enough to stabilize the frequency; meanwhile reducing the relative humidity to a value below 15%. After this stabilization period, the relative humidity would be increased to approximately 95%, maintained for thirty minutes and again reduced to a low value. Temperature was kept constant throughout and frequency recorded at numerous intervals.

11. Altitude drift measurements were made by the precision measurement section in cooperation with the Naval Air Station.

12. Frequency range and overlap were checked with a General Radio Model LD-2 Type CAG 74016 frequency indicator.

13. Rectifier conversion was measured by determining the ratio of rectified output to rectifier plate transformer input at full load operation, 1/2 power, 1/4 power, and tune position. Figures are given for combined efficiency of main and auxiliary rectifier for cw and mcw conditions.

14. Rectifier regulation was obtained by varying the rectifier load and securing an output voltage versus current curve and extrapolating the straight line portion of the characteristic and then computing the regulation from the formula

$$\frac{\text{No load voltage minus full load voltage}}{\text{Full load voltage}} \times 100 = \%$$

15. Voltage compensation was checked by measuring the key up and key down filament voltage on cw and mcw transmission on power frequencies varying from 500 to 800 cycles.

16. Rectifier ripple was measured by oscillograms made with a calibrated string oscillograph.

DATA RECORDED DURING TEST

17. The data recorded during these tests is presented in the form of tables and curves in Appendix A. A discussion of the data will be found under RESULTS OF TESTS.

DISCUSSION OF PROBABLE ERRORS

18. The following paragraph lists instruments used and their corresponding accuracy. However, the accuracy of the various tests is not necessarily that of the instruments used. Radio frequency

power measurements are accurate within 5%. Frequency measurements made with the LK-1 drift indicator are accurate to a few parts in a million and other frequency measurements are good to 0.005%. In the temperature coefficient data there is a possible source of error of a few degrees in reading the temperature due to inadequate ventilation.

19. Equipment used in the tests includes the following:

Instrument	Model or Type	Serial	Accuracy
Weston voltmeter	341	8661	0.25%
Weston ammeter	370	4576	0.25%
Weston wattmeter	310	8922	0.25%
General Radio frequency meter	LD-2	1	0.005%
General Radio frequency oscillator	713-A	209	
Westinghouse string oscillograph	509823	913659	
Radio Research drift indicator	LK-1	1	
Oppenheim Corp. temperature control cabinet			
Naval Research Laboratory frequency measuring equipment	LF		0.005%

RESULTS OF TESTS

20. Two Bureau of Engineering conferences were held regarding the tests of the XGO-3. The discussions are summarized in references (g) and (h).

21. The following discussion will be based on the requirements of Specifications RE 13A 472D. Comments will be made on each paragraph of the specifications except those of a general or informative nature. The numbering of the following paragraphs corresponds to the specification paragraph notation.

22. 2-3. Construction of the Model XGO-3 was not entirely satisfactory as numerous details required attention during tests and others will need to be corrected in production equipment. Constructional deficiencies became apparent more readily during flight tests and a list of changes made at the Naval Air Station during the test period appears in paragraph 23 of Appendix B.

23. 2-8. When tuned to any antenna normally encountered in service use, no damage is caused by open circuiting, short circuiting or grounding the antenna.

24. 2-15, 2-17. Redesign of the shock mounts was necessary during the test period.

25. 2-16. Interlocks were provided at all points of access to the set but frequent failures occurred. A discharge resistor across the filter condenser was added to prevent shock to personnel from the charged condenser.

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26. 2-19(2). Accessibility of component parts of the Model XGO-3 is of the best compatible with aircraft design.

27. 2-20. Vacuum tube mountings are satisfactory.

28. 2-22. The operation of the equipment is straightforward and the design of the circuits as simple as possible within the requirements of the specifications.

29. 2-23(2). Control markings as originally submitted were not totally satisfactory. Additional designating letter was put on each control at Naval Air Station.

30. 2-25(3). Six controls are of the velvet vernier type friction drive and are not believed to be rugged enough for service use. Positive gear drive would be superior.

31. 2-26. The cabinet of the equipment is insulated from ground by the shock mounts. Suitable grounding was accomplished by shorting each mount with a flexible lead.

32. 2-31. Snap slides are of proper finish but are too light for service use.

33. 2-41. The voltage compensating capacitor is variable in steps of one microfarad from 8 to 20 microfarads. There is no objection to having more than 15 microfarads in a common container.

34. 2-59. The weight of the equipment as tested at the Laboratory was 133.6 pounds.

35. 2-61. The requirement limiting the current drain of the key relay to two amperes is barely met and even at slightly more than two amperes, the relay is underpowered and proper adjustment is critical.

36. 2-62. The equipment operates satisfactorily with one side of the 800 cycle supply grounded.

37. 2-63. See paragraph 18, Appendix B, for altitude breakdown comment.

38. 2-64. Power output is given in Tables 2 to 9.

39. 2-66. Snap slides are too flimsy to carry the weight of the equipment when lying on a side.

40. 3-1. Shock mounts provided with the equipment appeared adequate during bench tests but flight tests showed that a complete redesign was necessary. Enclosure (H) of Appendix B shows a photograph of the redesigned shock mounts.

41. 3-2. Common rectifier circuits are used for the two transmitter units and in addition a single 38803 power amplifier tube mounted in the rectifier compartment is used for the output stage of both transmitting units.

42. 3-3. The redesign of the shock mounts mentioned in paragraph 22 facilitated the installation and removal of component units of the equipment.

43. 3-5. For tube line-up of the equipment see paragraph 9 of Appendix B.

44. 3-6. Amplifier circuits tune to the proper harmonic in a straightforward fashion. Frequency multiplication is accomplished in the intermediate amplifier of the high frequency unit but never in the power amplifier.

45. 3-7. Break-in operation is discussed in Appendix B. Power output is shown in Tables 2 to 9.

46. 3-8. Flexibility and performance of antenna coupling circuits were generally satisfactory throughout the frequency range and suitable for both trailing and fixed antenna operation.

47. 3-11. Short circuiting, open circuiting, or grounding of the antenna caused no damage to the equipment when the equipment had been tuned up previously for normal operation.

48. 3-12(1). Errors due to reset are shown in Tables 10 to 17 inclusive. Results are within specification limits.

49. 3-12(2)(a). Tables 18 to 24 inclusive show the temperature coefficient of the equipment. The same information is provided in graphic form in Plates 1 to 7. In the Plates 1 to 7 it is readily observed that the curves of frequency versus temperature are very irregular. This is partly due to the fact that adequate ventilation cannot be supplied in the refrigerator used for equipment as large as the Model XGO-3. The average value of results taken throughout the range is believed reasonably accurate but the maximum shift over a given 20° is probably excessive. In spite of this the set performs satisfactorily within specification limits. Additional information regarding temperature coefficient of the equipment is contained in Tables 85, 86, and 87 or Plates 27, 28, and 29, which give the frequency drift during altitude tests. Attention is invited to the fact that the equipment reverses its direction of drift when tested in the air compared to results on the bench. At 4515 kilocycles in flight (Plate 28) the Model XGO-3 frequency drift was opposite to temperature. Plate 3 showing bench tests at 4500 kilocycles gives a curve showing temperature and frequency going in the same direction over the temperature range which obtained during the flight test. The explanation of the reversal in direction of drift between flight and bench tests lies in the fact that in flight the equipment is subjected to a change of pressure. A rough calculation, not experimentally verified, indicates about 0.02% change of frequency is encountered for 17,500 feet altitude. Assuming that pressure affects only the dielectric constant, the value of frequency change expressed in per cent for any given change of pressure is the same for all inductance-capacity self-oscillators regardless of L/C ratio or base frequency pro-

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vided the master oscillator capacitor is of the air dielectric type. From the above it becomes apparent that aircraft equipment will give better operational frequency stability if it is designed to have a small temperature coefficient with frequency and temperature going in the same direction.

50. 3-12(2)(b). Change of frequency for a ± 5% change of supply voltage is given in Tables 25 to 31. Operation is satisfactory.

51. 3-12(2)(c). Antenna reaction is recorded in Tables 32 to 38. Operation is excellent.

52. 3-12(2)(d). Variation of frequency due to change of relative humidity is given in Tables 39 to 45. It becomes evident that the specifications cannot be met for large variations of humidity at 50° C. In order to meet the governing specification it would be necessary either to seal the master oscillator circuits hermetically or provide temperature control. Both of these are unreasonable in aircraft design and the performance of the equipment on this particular point under even abnormal service conditions should prove satisfactory in so far as frequency stability is concerned.

53. 3-12(3). Arithmetical sum of frequency shifts is beyond specified limit in practically every case due to excessive shift caused by humidity. Table 46 gives the results and it is evident that the results are satisfactory, in fact exceptionally good, if the frequency shift due to humidity is ignored. In this connection it is pointed out that no other aircraft transmitter has been formally tested for frequency variations due to humidity and from the knowledge gained, it is not believed advisable to retain the specification in its present form.

54. 3-12(4). Locked key full power half hour tests are recorded in Tables 46 - 59 or Plates 15 to 22. Results are satisfactory.

55. 3-12(5). Vibration caused serious trouble in flight tests at Naval Air Station. Redesign of shock mounts improved this condition.

56. 3-14. The tune position control removes the supply voltage from the power amplifier. Frequency variations due to operation of the tune-operate control are recorded in Tables 60 to 66. Operation is satisfactory.

57. 3-15. Crystal frequency indicator posts were added during flight tests. One source of confusion results in using frequency meters built to specification RE 13A 489 with Model XGO-3 transmitters. If both are set for 12,000 kilocycles, the XGO-3 master oscillator will be on 4,000 kilocycles while the frequency meter will be on 3,000 kilocycles and the resulting beat note will be very weak if at all audible. This occurs only when the XGO-3 is tripling frequency and in these cases most of the confusion will be eliminated by including master frequencies on the calibration on the front of the XGO-3.

58. 3-18. Overlap is shown in Tables 68 to 78. More uniformity would be desirable.

59. Voltage compensating capacitors variable from 8 to 20 microfarads in steps of one microfarad are provided. Normal series connection is employed.

60. 3-30. A single keying relay operates both transmitters. Break-in tests made at the Naval Air Station, Anacostia, are shown in Appendix B.

61. 4-5. Time delay relay for allowing rectifier filaments to come up to temperature is not totally satisfactory. It is strictly mechanical in its operation and will not reset itself for operation when power is removed from the equipment unless the main power switch is thrown to the off position.

62. 4-7. Rectifier regulation is shown in Table 80 and on Plate 23. It does not meet the specifications. Rectifier conversion efficiency is given in Table 81. Efficiency is computed as the ratio of rectifier output to plate transformer input.

63. 4-8. Numerous interlocks were provided but considerable trouble was experienced during tests with failures.

64. 4-10. Ripple measurements were made with a string oscillograph. Tabulated results are shown in Table 83 and photographs on Plates 24, 25, and 26. Root mean square value of the ripple component was computed in each case and computation was made including the extreme variations of ripple voltage so that the low frequency ripple present in NEA-2 outputs was part of the final value.

65. 5-1. Shock mounts required redesigning.

66. 6-1. No power cable was supplied.

67. 7-1. No spare parts were provided.

68. The following deficiencies were observed during the tests conducted at Bellevue in addition to those previously commented upon:

(a) Switch contacts of i-f antenna tuning are unsatisfactory.
(b) The hand cranks on controls E, H, J of the h-f unit are unsatisfactory.
(c) Control H of h-f unit has no stops to prevent roller contact from jumping off end of coil.
(d) Interlocks failed on numerous occasions.
(e) Panels would fit in improper positions.
(f) Panels were not rugged enough to withstand vibration.
(g) Tune operate switch caused arcing when operated with the key down.

(h) The antenna ammeter reads erroneously in the h-f unit when connected as in the submitted model.

(i) The visibility of control markings is unsatisfactory.

(j) More rigid wiring is necessary to withstand vibration.

(k) Rust-proof lock washers have not been used throughout the equipment.

(l) The cover of filament voltmeter showed signs of corrosion.

(m) High frequency side of key relay is inaccessible.

(n) Paper stickers were used for identification of parts.

(o) Radio frequency chokes required more rigid mounting.

(p) Isolantite coil forms of the antenna load coil and antenna tuning coil are mounted in such a manner that the screws are threaded into the Isolantite. These holes should be body holes for the machine screws.

(q) The cotter keys in the snap catches which secure the units together should be replaced with pins so that there will be no ragged edges.

CONCLUSIONS

69. Numerous deficiencies were encountered during the course of the XGO-3 tests, but the majority of these have been corrected by the contractor's representative or by Navy personnel. Others are to be corrected in production equipments. Deficiencies encountered were chiefly of a mechanical nature.

70. The Model XGO-3 incorporates excellent electrical characteristics such as its frequency stability, freedom from flashover at altitude, good power output and antenna coupling circuits. However, its performance under vibration, especially quality of emitted note does not compare favorably with the best in the Naval service.

71. Circuit design is straightforward, simple, and satisfactory. The equipment represents considerable thought and care in its design and with modifications made to make it sufficiently rugged for aircraft service, it is believed that Model GO-3 equipments will be a distinct asset to Naval aircraft radio.

MODEL GO-3 TRANSMITTER
SERIAL NO. 1
POWER INPUT AND OUTPUT
IF - UNIT
TRAILING WIRE ANTENNA

Freq. Kcs.	ANT. Res. Ohms	ANT. Cap MMF	Input Watts	ANT. CURRENT External Amps.	Output Watts	Guar. Output Watts	Emission
300	10	666	640	3.85	148	125	CW
300	10	666	580	3.65	133	125	MCW
355	10	666	640	4.0	160	125	CW
355	10	666	575	3.7	137	125	MCW
375	16.57	666	645	3.25	175	130	CW
375	16.57	666	585	3.05	154	130	MCW
500	20.5	1000	645	3.15	203	135	CW
500	20.5	1000	590	2.9	172	135	MCW
544	20.5	1000	645	3.15	203	135	CW
544	20.5	1000	590	2.9	172	135	MCW
600	31.1	1500	645	2.6	211	135	CW
600	31.1	1500	590	2.4	179	135	MCW

Table 2

300	10	500	635	3.75	140		CW
300	10	500	570	3.45	119		MCW
600	10	500	630	3.9	152		CW
600	10	500	575	3.6	129.5		MCW

Table 3

[redacted]

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
POWER INPUT AND OUTPUT
IF - UNIT
TRAILING WIRE ANTENNA

Freq. Kcs.	ANT. Res. Ohms	ANT. Cap MMF	Input Watts	Ant.Current External Amps.	Output Watts	Guar. Output Watts	Emission
300	10	666	620	3.85	148.5	125	CW
300	10	666	555	3.55	126	125	MCW
355	10	666	620	3.9	152	125	CW
355	10	666	555	3.62	131	125	MCW
375	16.75	666	625	3.25	175	130	CW
375	16.75	666	570	3.0	149	130	MCW
500	20.5	1000	620	3.1	197	135	CW
500	20.5	1000	570	2.9	172	135	MCW
544	20.5	1000	635	3.1	197	135	CW
544	20.5	1000	585	2.85	166.5	135	MCW
600	31.1	1500	630	2.6	211	135	CW
600	31.1	1500	585	2.4	179	135	MCW

Table 4

300	10	500	625	3.7	137		CW
300	10	500	550	3.4	115.5		MCW
600	10	500	620	3.85	148		CW
600	10	500	565	3.55	126		MCW

Table 5

MODEL GO-3 TRANSMITTER
SERIAL NO. 1
POWER INPUT AND OUTPUT
FIXED ANTENNA

Freq. Kcs.	ANT. Res. Ohms	ANT. Cap MMF	Input Watts	Ant. Current External Amps.	Output Watts	Guar. Output Watts	Emission
300	4.33	200	635	4.0	69.0	50	CW
300	4.33	200	545	3.55	54.6	50	MCW
355	4.33	200	635	4.25	78.0	50	CW
355	4.33	200	545	3.85	64.0	50	MCW
375	4.53	250	635	3.7	62.0	50	CW
375	4.53	250	555	3.4	52.5	50	MCW
500	4.53	333	645	5.0	113.0	50	CW
500	4.53	333	570	4.55	93.5	50	MCW
544	4.53	333	645	5.0	113.0	50	CW
544	4.53	333	555	4.55	93.5	50	MCW
600	4.53	333	645	4.95	111.0	50	CW
600	4.53	333	565	4.55	93.5	50	MCW

Table 6

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
POWER INPUT AND OUTPUT
FIXED ANTENNA

Freq. Kcs.	ANT Res. Ohms	ANT Cap. MMF	Input Watts	Ant. Current External Amps.	Output Watts	Guar. Output Watts	Emission
300	4.33	200	635	4.05	71.0	50	CW
300	4.33	200	540	3.55	54.6	50	MCW
355	4.33	200	635	4.35	82.0	50	CW
355	4.33	200	550	3.85	64.0	50	MCW
375	4.53	250	650	4.25	81.5	50	CW
375	4.53	250	560	3.8	65.0	50	MCW
500	4.53	333	640	4.95	111.0	50	CW
500	4.53	333	565	4.45	90.0	50	MCW
544	4.53	333	625	4.85	106.5	50	CW
544	4.53	333	555	4.45	90.0	50	MCW
600	4.53	333	640	4.8	104.0	50	CW
600	4.53	333	555	4.4	87.5	50	MCW

Table No. 7

MODEL GO-3 TRANSMITTER
SERIAL NO. 1
POWER INPUT AND OUTPUT
H.F. UNIT

Freq. Kcs.	Ant. Res.	Input Watts	Ant.Current External Amps	Output Watts	Guar. Output Watts	Emission
3000	40.4	640	2.25	204	125	CW
3000	40.4	575	2.13	183	125	MCW
3665	40.4	630	2.25	204	125	CW
3665	40.4	570	2.15	186	125	MCW
4000	40.4	630	2.25	204	125	CW
4000	40.4	570	2.13	183	125	MCW
4135	40.4	630	2.25	204	125	CW
4135	40.4	570	2.13	183	125	MCW
8270	40.4	630	2.35	223	125	CW
8270	40.4	575	2.2	195	125	MCW
12,405	40.4	630	2.35	223	125	CW
12,405	40.4	570	2.2	195	125	MCW
13,575	40.4	625	2.25	204	125	CW
13,575	40.4	560	2.15	186	125	MCW

Table No. 8

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
RESET
MAN-MINUTE AND FREQUENCY CHANGE

	300 KCS Beat Freq.	Reset Time
Original Setting	605	
Clockwise Reset	625	30 Sec.
Counter Clockwise Reset	602	32 Sec.
Max. Change 20 = .0066%		Allowed .02%

Table 10

	400 KCS	
Original Setting	590	
Clockwise Reset	593	33 Sec.
Counter Clockwise Reset	582	31 Sec.
Max. Change 8 = .002%		Allowed .02%

Table 11

	500 KCS	
Original Setting	520	
Clockwise Reset	545	28 Sec.
Counter Clockwise Reset	475	31 Sec.
Max. Change 45 = .009%		Allowed .02%

Table 12

	600 KCS	
Original Setting	740	
Clockwise Reset	750	35 Sec.
Counter Clockwise Reset	655	35 Sec.
Max. Change 85 = .0142%		Allowed .02%

Table 13

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
VARIATION OF AMBIENT TEMPERATURE
Keyed at 25 W.P.M.
450 KCS

Time Min.	Temp. °C	Beat Freq.	Time Min.	Temp. °C	Beat Freq.
0	-30	478	105	+15.7	735
5	-28.5	478	110	+18.0	733
10	-26.0	500	115	+19.5	730
15	-24.0	532	120	+21.8	725
20	-22.5	565	125	+22.5	720
25	-20.5	595	130	+25.0	725
30	-16.0	618	135	+26.0	715
35	-13.0	645	140	+28.5	710
40	-10.0	670	145	+30.0	705
45	- 7.5	685	150	+32.0	700
50	- 5.5	695	155	+33.5	690
55	- 3.0	653	160	+35.0	690
60	+ 1.0	665	165	+36.0	680
65	+ 3.0	695	170	+37.5	675
70	+ 5.0	710	175	+39.5	660
75	+ 5.2	720	180	+41.0	660
80	+ 7.5	725	185	+42.5	660
85	+ 8.0	735	190	+44.0	655
90	+10.5	732	195	+46.5	645
95	+11.0	735	200	+48.5	640
100	+14.0	740	205	+50.5	630

Max. 20° Change - 26° -6°

500 to 692 cycles 192 = .0427% Allowed .05%

Table 19

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
VARIATION OF AMBIENT TEMPERATURE
KEYED AT 25 W.P.M.

600 KCS

Time Min.	Temp. °C	Beat Freq.	Time Min.	Temp. °C	Beat Freq.
0	-28.5	645	115	+8.5	828
5	-27.0	645	120	+11.0	825
10	-24.5	670	125	+12.3	820
15	-22.5	710	130	+14.5	818
20	-21.5	740	135	+16.8	805
25	-20.0	755	140	+20.0	800
30	-18.5	790	145	+20.5	795
35	-17.0	800	150	+22.3	789
40	-16.0	810	155	+23.8	780
45	-15.0	815	160	+25.1	772
50	-14.0	810	165	+27.0	762
55	-13.4	772	170	+29.8	755
60	-11.5	780	175	+30.8	750
65	-10.0	790	180	+34.5	735
70	- 9.5	806	185	+37.0	728
75	- 6.8	813	190	+39.7	715
80	- 4.8	820	195	+42.8	700
85	- 3.3	824	200	+44.2	688
90	- 1.2	830	205	+46.1	677
95	+ 1.3	835	210	+48.2	665
100	+ 3.0	830	215	+50.0	645
105	+ 5.0	830	220	+51.0	638
110	+ 6.8	832			

Max. 20° change - 27° to - 7°
645 to 813 cycles
168 = .028% Allowed .05%

Table 20

[redacted]

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MODEL GO-3 TRANSMITTER
SERIAL NO. 2
VARIATION OF AMBIENT TEMPERATURE
KEYED AT 25 W.P.M.

3000 KCS

Time Min.	Temp. °C	Beat Freq. Cycle	Time Min.	Temp. °C.	Beat Freq. Cycles.
0	-30.0	1375	90	+12.0	925
5	-29.0	1200	95	+15.7	900
10	-28.0	1125	100	+18.7	890
15	-25.5	1075	105	+22.0	875
20	-23.5	1025	110	+24.8	875
25	-22.0	1000	115	+27.3	875
30	-20.5	1000	120	+30.0	875
35	-19.5	1025	125	+32.0	900
40	-16.5	1025	130	+34.5	910
45	-13.5	1025	135	+36.8	1000
50	-10.5	1000	140	+38.6	1075
55	- 7.5	1040	145	+40.8	1175
60	- 4.0	1050	150	+42.8	1250
65	- 1.0	1050	155	+45.0	1330
70	+ 2.5	990	160	+47.0	1390
75	+ 4.0	960	165	+49.0	1450
80	+ 7.0	950	170	+50.9	1515
85	+ 8.5	940			

Max. 20° Change +29° to +49°

575 cycles = .0191% Allowed .05%

Table 21

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
VARIATION OF AMBIENT TEMPERATURE
KEYED AT 25 W.P.M.

4500 KCS
LOW C

Time Min.	Temp. °C.	Beat Freq. Cycles	Time Min.	Temp. °C.	Beat Freq. Cycles
0	-28.5	1100	95	+ 9.0	985
5	-27.5	700	100	+12.0	1000
10	-26.0	600	105	+14.0	1020
15	-24.0	540	110	+17.0	1000
20	-22.2	510	115	+20.0	1025
25	-21.2	505	120	+23.0	1025
30	-20.0	540	125	+26.0	1060
35	-19.0	580	130	+28.5	1100
40	-18.0	610	135	+31.5	1125
45	-17.0	650	140	+33.5	1150
50	-15.0	690	145	+36.0	1225
55	-13.0	820	150	+38.0	1250
60	-11.0	880	155	+40.2	1275
65	- 7.5	910	160	+42.5	1325
70	- 4.5	925	165	+44.5	1350
75	- 1.0	940	170	+46.5	1425
80	+ 2.0	950	175	+48.5	1475
85	+ 4.5	965	180	+50.5	1550

Max. 20° Change +50.5° to +30.5°

434 cycles = .0096% Allowed .05%

Table 23

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
VARIATION OF AMBIENT TEMPERATURE
KEYED AT 25 W.P.M.

6000 KCS

Time Min.	Temp. °C.	Beat Freq. Cycles	Time Min.	Temp. °C.	Beat Freq. Cycles
0	-26.5	2500	100	+ 9.0	1600
5	-26.0	1850	105	+12.0	1600
10	-24.0	1575	110	+13.0	1575
15	-22.0	1400	115	+14.5	1675
20	-21.0	1350	120	+16.0	1650
25	-20.0	1250	125	+19.0	1575
30	-18.5	1300	130	+23.0	1500
35	-17.5	1350	135	+27.0	1625
40	-16.5	1375	140	+30.0	1650
45	-15.5	1425	145	+32.5	1625
50	-14.3	1725	150	+35.0	1500
55	-13.3	1800	155	+37.0	1550
60	-10.0	1875	160	+40.0	1575
65	- 7.5	1825	165	+41.8	1575
70	- 5.0	1750	170	+44.0	1575
75	-3.0	1700	175	+46.0	1575
80	0	1700	180	+48.0	1550
85	+ 3.0	1650	185	+49.5	1575
90	+ 5.0	1625	190	+51.0	1650
95	+ 7.5	1625			

Max. 20° change -20° to 0°

450 cycles = .0075% Allowable .05%

Table 24

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
VARIATION OF SUPPLY VOLTAGE

300 KCS

	Beat Freq. Cycles
Normal Volts	610
+5% Volts	635
-5% Volts	560
Max. Change	75 Cycles = .025%

Table No. 25

400 KCS

Normal Volts	605
+5% Volts	625
-5% Volts	565
Max. Change	60 Cycles = .015%

Table No. 26

500 KCS

Normal Volts	470
+5% Volts	485
-5% Volts	430
Max. Change	55 Cycles = .011%

Table No. 27

600 KCS

Normal Volts	770
+5% Volts	785
-5% Volts	730
Max. Change	55 Cycles = .009%

Allowable Change .05%

Table No. 28

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
DETUNING ANTENNA

300 KCS

	Beat Freq. Cycles
Normal Plate Current	600
Detuned 20% Clockwise	600
Detuned 20% Counter Clockwise	595
Max. Change	5 Cycles = .0016%

Table 32

400 KCS

Normal Plate Current	575
Detuned 20% Clockwise	580
Detuned 20% Counter Clockwise	570
Max. Change	5 Cycles = .0012%

Table 33

500 KCS

Normal Plate Current	480
Detuned 20% Clockwise	480
Detuned 20% Counter Clockwise	475
Max. Change	5 Cycles = .0001%

Table 34

600 KCS

Normal Plate Current	730
Detuned 20% Clockwise	730
Detuned 20% Counter Clockwise	725
Max. Change	5 Cycles = .0008%

Allowable Change .05%

Table 35

3000 KCS

Normal Plate Current	735
Detuned 20% Clockwise	740
Detuned 20% Counter Clockwise	720
Max. Change	15 Cycles =.0005%

Table 36

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
DETUNING ANTENNA

4500 KCS

	Beat Freq. Cycles
Normal Plate Current	2475
Detuned 20% Clockwise	2450
Detuned 20% Counter Clockwise	2440
Max. Change	35 Cycles =.0007%

Table 37

6000 KCS

Normal Plate Current	2200
Detuned 20% Clockwise	2175
Detuned 20% Counter Clockwise	2125
Max. Change	75 Cycles = .00125%

Allowable Change .05%

Table 38

[redacted]

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
FREQUENCY HUMIDITY DATA

600 KCS
KEYED AT 25 W.P.M.

Time Min.	Humidity	Beat Freq. Cycles	Temp. ° C.
0	9	640	30
15	66	640	30.6
30	77	630	30
45	84	625	28.9
60	88	625	29.5
75	92	625	29.5
90	88	630	30
105	92	625	29.5
120	92	630	30
135	31	630	28.3
150	26	635	28.3
165	14	640	30
195	11	635	30
210	11	640	30
225	10	635	30

Max. Change 15 Cycles = .0025%

Allowable .05%

Table 40

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
FREQUENCY HUMIDITY DATA
3000 KCS
KEYED AT 25 W.P.M.

Time Min.	Time Min	Humidity %	Beat Freq. Cycles	Temp. °C.
0	0	9	2900	30
5	10	46	2650	28.9
10	20	77	2175	30
15	30	77	2000	30
20	40	88	1600	30
25	50	92	1600	30
30	60	88	1800	30
35	70	92	1650	30
40	80	92	1875	28.9
45	90	92	1675	30.6
50	100	96	1500	31.1
55	110	96	1575	30.6
60	120	96	1575	30.6
65	130	63	2200	30
70	140	29	2700	26.6
75	150	20	2750	30
	165	16	2825	30
	180	9	2950	30
	195	9	3000	30.6
	210	9	3000	30

Max. Change 1500 Cycles = .05%

Allowable .05%

Table 41

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
FREQUENCY HUMIDITY DATA
6000 KCS
KEYED AT 25 W.P.M.

Time Min.	Humidity %	Beat Freq. Cycles	Temp. °C.
0	7	4805	30
10	36	4580	30
20	47	4330	29.5
30	92	2430	30
40	92	2030	30.5
50	96	1630	31.2
60	96	1580	31.2
70	96	1180	31.2
80	92	2230	31.2
90	94	1530	30.5
100	77	2450	30
110	70	2680	30
120	45	3630	30.5
130	35	3980	31.2
140	14	4430	31.2
150	10	4630	29.5
160	9	4705	30
170	9	4805	30
180	9	4350	30

Max. Change 3670 Cycles = .061%

Allowed .05%

Table 43

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
FREQUENCY HUMIDITY DATA
3000 KCS
KEYED AT 25 W.P.M.

Time Min.	Humidity %	Beat Freq. Cycles	Temp. °C.
0	8	3350	2
15	30	3250	0
30	39	3250	0
45	36	3250	1.3
60	59	3300	0
75	39	3250	0
90	69	3200	0
105	79	3200	0
120	95	3120	0

Maximum Change 225 cycles - .0075%

Allowed - .05%

Table 44

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
COMBINED FREQUENCY STABILITY

300 Kcs	20°C	Variable ambient	.04%	
	10%	Change supply volts	.025%	
		Antenna detuning	.0016%	
		Variable humidity	.01%	
		Total	.0766%	Allowed .08%
600 Kcs	20°C	Variable ambient	.028%	
	10%	Change supply volts	.009%	
		Antenna detuning	.0008%	
		Variable humidity	.0025%	
		Total	.0403%	Allowed .08%
3000 Kcs	20°C	Variable ambient	.0191%	
	10%	Change supply volts	.0016%	
		Antenna detuning	.0005%	
		Variable humidity	.05%	
		Total	.0712%	Allowed .05%
4500 Kcs	20°C	Variable ambient	.0188%	
	10%	Change supply volts	.0022%	
		Antenna detuning	.0007%	
		Variable humidity	.053%	
		Total	.0747%	Allowed .05%
6000 Kcs	20°C	Variable ambient	.0075%	
	10%	Change supply volts	.0087%	
		Antenna detuning	.0012%	
		Variable humidity	.061%	
		Total	.0784%	Allowed .05%

Table 46

MODEL GO-3 TRANSMITTER
SERIAL NO. 1
30 MINUTE LOCKED KEY OPERATION
FULL POWER AMBIENT TEMPERATURE 28°C.

300 Kcs Time Min.	Beat Freq. Cycles
0	565
5	545
10	540
15	537
20	535
25	532
30	530

Max. Change
35 cycles = .0117%
Allowed .08%

Table No. 47

500 Kcs Time Min.	Beat Freq. Cycles
0	550
5	530
10	518
15	509
20	504
25	500
30	497

Max. Change
53 cycles = .0106%
Allowed .08%

Table No. 48

TRANSMITTER SERIAL NO. 2

300 Kcs Time Min.	Beat Freq. Cycles
0	620
5	617
10	610
15	610
20	605
25	603
30	600

Max. Change
20 Cycles = .0066%
Allowed .08%

Table No. 49

400 Kcs Time Min.	Beat Freq. Cycles
0	610
5	583
10	575
15	568
20	565
25	560
30	558

Max. Change
52 Cycles = .013%
Allowed .08%

Table No. 50

500 Kcs Time Min.	Beat Freq. Cycles
0	538
5	505
10	486
15	478
20	472
25	462
30	458

Max. Change
80 Cycles = .016%
Allowed .08%

Table No. 51

600 Kcs Time Min.	Beat Freq. Cycles
0	715
5	640
10	615
15	597
20	588
25	580
30	575

Max. Change
140 Cycles = .0233%
Allowed .08%

Table No. 52

MODEL GO-3 TRANSMITTER
SERIAL NO. 1
30 MINUTE LOCKED KEY OPERATION
FULL POWER AMBIENT TEMPERATURE 28^{o} C.

4500 Kcs (Low C)	
Time Min.	Beat Freq. Cycles
0	2925
5	2340
10	2225
15	2275
20	2400
25	2500
30	2550

Max. Change
700 Cycles = .0155%
Allowed .05%

Table No. 53

4500 Kcs (High C)	
Time Min.	Beat Freq. Cycles
0	1550
5	950
10	725
15	650
20	640
25	650
30	685

Max. Change
910 Cycles = .0202%
Allowed .05%

Table No. 54

6000 Kcs	
Time Min.	Beat Freq. Cycles
0	4700
5	3175
10	2400
15	2325
20	2250
25	2225
30	2200

Max. Change
2500 Cycles = .042%
Allowed .05%

Table No. 55

TRANSMITTER SERIAL NO. 2

3000 Kcs	
Time Min.	Beat Freq. Cycles
0	745
5	469
10	382
15	355
20	350
25	360
30	385

Max. Change
395 Cycles = .0132%
Allowed .05%

Table No. 56

4500 Kcs	
Time Min.	Beat Freq. Cycles
0	3325
5	2500
10	2265
15	2125
20	2075
25	2075
30	2075

Max. Change
1250 Cycles=.0278%
Allowed .05%

Table No. 57

6000 Kcs	
Time Min.	Beat Freq. Cycles
0	4550
5	2925
10	2500
15	2175
20	2070
25	1985
30	1975

Max. Change
2575 Cycles=.043%
Allowable .05%

Table No. 58

13,500 Kcs	
Time Min.	Beat Freq. Cycles
0	4900
5	2175
10	1525
15	1275
20	1165
25	1050
30	1000

Max. Change
3900 Cycles=.0289%
Allowable .05%

Table No. 59

[redacted]

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
30 MINUTE LOCKED KEY OPERATION
FULL POWER
10% HUMIDITY AMBIENT TEMPERATURE 30°C.

6000 Kcs

Time Min.	Beat Freq. Cycles
0	2150
5	975
10	550
15	300
20	250
25	250
30	250

Max. Change
1900 Cycles = .0316%
Allowed .05%

Table No. 60

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
OPERATION OF TUNE - OPERATE CONTROL

300 Kcs

Switch Position	Beat Freq. Cycles
Tune	620
Full Power	605
Frequency Change	15 Cycles = .005%
Allowable	.02%

Table No. 61

400 Kcs

Switch Position	Beat Freq. Cycles
Tune	610
Full Power	595
Frequency Change	15 Cycles = .0037%
Allowable	.02%

Table No. 62

500 Kcs

Tune	490
Full Power	465
Frequency Change	25 Cycles = .005%
Allowable	.02%

Table No. 63

600 Kcs

Tune	730
Full Power	710
Frequency Change	20 Cycles = .0033%
Allowable	.02%

Table No. 64

3000 Kcs

Tune	550
Full Power	555
Frequency Change	5 Cycles = .0016%
Allowable	.02%

Table No. 65

4500 Kcs

Tune	2025
Full Power	2000
Frequency Change	25 Cycles = .0005%
Allowable	.02%

Table No. 66

6000 Kcs

Switch Position	Beat Freq. Cycles
Tune	2050
Full Power	2350
Frequency Change	300 Cycles = .005%
Allowable	.02%

Table No. 67

[redacted]

MODEL GO-3 TRANSMITTER
SERIAL NO. 1
FREQUENCY RANGE AND OVERLAP
I.F. MASTER OSCILLATOR

Range Step A	M.O. Dial B	Freq. Kcs	Mean Freq. Kcs	Overlap Freq. Kcs	Overlap Percent
1	00	272.2	300.0	27.8	9.3
1	800	335.9	327.6		
2	00	319.3		16.6	5.07
2	800	390.8	380.8		
3	00	370.9		19.9	5.2
3	800	453.1	441.0		
4	00	429.0		24.0	5.44
4	800	540.8	527.5		
5	00	514.3		26.5	5.0
5	800	703.7	600.0	103.7	17.3

Table No. 68

I.A. RANGE AND OVERLAP

Dial C	Freq. Kcs.	Mean Freq.	Overlap Freq. Kcs.	Overlap Percent
8	272.2	300.0	27.8	9.3
91	703.7	600.0	103.7	17.3

Table No. 69

Required Overlap 5%

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
FREQUENCY RANGE AND OVERLAP
I.F. MASTER OSCILLATOR

Range Step A	M.O. Dial B	Freq. Kcs	Mean Freq. Kcs	Overlap Freq. Kcs	Overlap Percent
1	00	270.0	300.0	30	10.0
1	800	335.6	326.5		
2	00	318.4		17.2	5.3
2	800	389.9	379.6		
3	00	369.4		20.5	5.4
3	800	451.2	439.0		
4	00	426.8		24.4	5.5
4	800	536.7	523.8		
5	00	510.9		25.8	4.94
5	800	695.8	600.0	95.8	15.95

Table No. 70

I.A. RANGE AND OVERLAP

Dial C	Freq. Kcs	Mean Freq.	Overlap Freq. Kcs.	Overlap Percent
8	270.0	300.0	30.0	10.0
91	695.8	600.0	95.8	15.95

Table No. 71

Required Overlap 5%

MODEL GO-3 TRANSMITTER
SERIAL NO. 1
FREQUENCY RANGE AND OVERLAP
I.F. POWER AMPLIFIER

Range Step D	Dial E	Freq. Kcs.	Mean Freq. Kcs.	Overlap Freq. Kcs.	Overlap Percent
1	22	272.2	300.0	27.8	9.3
1	100	315.7	310.0		
2	00	304.4		11.3	3.65
2	100	374,3	364.5		
3	00	354.7		19.6	5.4
3	100	446.2	429.9		
4	00	413.7		32.5	7.5
4	100	488.5	480.0		
5	00	471.5		17.0	3.5
5	100	579,7	564.6		
6	00	549.5		30.2	5.3
6	100	688.8	600.0	88.8	14.8

Table No. 72

Required Overlap 5%

SERIAL NO. 2

Range Step D	Dial E	Freq. Kcs.	Mean Freq. Kcs.	Overlap Freq. Kcs.	Overlap Percent
1	20	270.0	300.0	30.0	10.0
1	100	315.0	309.4		
2	00	303.8		11.2	3.6
2	100	374.5	364.0		
3	00	353.5		21.0	5.8
3	100	445.0	427.9		
4	00	410.9		34.1	8.0
4	100	486.4	477.0		
5	00	467.6		18.8	3.9
5	100	576.6			
6	00	549.7		26.9	4.9
6	100	684.6	600	84.6	14.0

Table No. 73

Required Overlap 5%

MODEL GO-3 TRANSMITTER
SERIAL NO. 1
FREQUENCY RANGE AND OVERLAP
H.F. MASTER OSCILLATOR

Range Step A	MO Dial B	Freq. Kcs.	Mean Freq. Kcs.	Overlap Kcs.	Overlap Percent
1	00	2846.8	3000	153.2	5.1
1	800	3854.8	3687.9		
2	00	3521.0		333.8	9.0
2	800	4768.0	4498.0		
3	00	4228.2		539.8	12.0
3	800	5643.2	5260.6		
4	00	4878.0		765.2	14.5
4	800	6435.28	6000	435.28	7.3

Table No. 74

I. A. RANGE

Dial C	Dial D	Freq. Kcs.	Mean Freq. Kcs.	Overlap Kcs.	Overlap Percent
1	17	2846.8	3000	153.2	5.1
1	100	5966.0	5264.1		
2	00	4562.2		1403.8	26.5
2	100	10,365.6	8759.8		
3	00	7154.0		3211.6	36.7
3	100	16,137.6	13,575	2562.6	18.9

Table No. 75

Required Overlap 5%

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MODEL GO-3 TRANSMITTER
SERIAL NO. 2
FREQUENCY RANGE AND OVERLAP
H.F. MASTER OSCILLATOR

Range Step A	MO Dial B	Freq. Kcs.	Mean Freq.	Overlap Kcs.	Overlap Percent
1	00	2899.24	3000	100.76	3.3
1	800	3918.8	3763		
2	00	3607.5		311.3	8.3
2	800	4790.88	4553.5		
3	00	4316.2		474.6	8.6
3	800	5740.7	5357		
4	00	4973.5		767.2	15.3
4	800	6544	6000	544	9.1

Table No. 76

I. A. RANGE

Dial C	Dial D	Freq. Kcs.	Mean Freq.	Overlap Kcs.	Overlap Percent
1	22	2899.24	3000	100.7	3.35
1	100	6188.4	5362.5		
2	00	4536.6		1651.8	30.8
2	100	10,352	8751		
3	00	7150		3202	36.5
3	100	16,142.4	13,575	2567.4	18.9

Table No. 77

Required Overlap 5%

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
RECTIFIER REGULATION

MAIN RECTIFIER

INPUT VOLTS	OUTPUT		
	M.A.	Volts	Watts
123	175	1930	338
118	125	2010	251.5
116	75	2125	159.4
116	60	2170	130.3
119	0	2660	

NOTE: Under full power, rated load condition (175 M.A.), the regulation obtained by extrapolating the straight portion of the regulation curve to zero load is $\frac{2300 - 1930}{1930} = 19.15\%$

AUXILIARY RECTIFIER

INPUT VOLTS	OUTPUT		
	M.A.	Volts	Watts
124	250	485	33.3
124	200	508	56.2
124	150	535	80.3
124	100	562	101.6
124	56	595	121.3
124	0	692	0

NOTE: Under the rated load condition (200 M.A.), a regulation obtained by extrapolating the straight line portion of the regulation curve to zero load is $\frac{615 - 508}{508} = 18.45\%$

Table No. 80

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
COMBINED EFFICIENCY
OF
MAIN AND AUXILIARY RECTIFIER

C.W.

Control Switch Position	Input Watts	Output Watts Aux. Rect.	Output Watts Main Rect.	Pct. Efficiency
Tune	131	103.3		79
1/4 Power	221	93.1	86.4	81.2
1/2 Power	286	87.4	148.7	82.6
Full Power	471	78.2	324.0	85.4

Table No. 81

M.C.W.

Control Switch Position	Input Watts	Output Watts Aux. Rect.	Output Watts Main Rect.	Pct. Efficiency
Tune	133	103.3		77.7
1/4 Power	211	97.0	58.6	73.8
1/2 Power	269	97.0	105.4	75.2
Full Power	421	89.3	237.0	77.6

Table No. 82

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
RECTIFIER RIPPLE

MAIN RECTIFIER

		Plate Volts	Plate Current	P.to P. RMS Volts	%
Film 1A	Full Power	1940	175 MA	17.67	.91
Film 1B	Half Power	1340	135 MA	12.95	.966
Film 1C	Quarter Power	980	100 MA	10.4	1.04

AUXILIARY RECTIFIER

Film 2A		425	0	1.86	0.4

MAIN RECTIFIER

Film 2B)	Same Condition	1940	175	17.2	.89
Film 2C)	as Film 1A	1940	175	19.45	1.0

Table No. 83

See Plates 24, 25, and 26 for oscillographs of ripple voltage.

MODEL GO-3 TRANSMITTER
COMPENSATION AT VARIOUS FREQUENCIES

12,405 KCS

CAP. SELECTED FOR BEST OPERATION

CW

Power Input Freq. Cycles	Cap	Key Up	Key Down	%
800	5 MFD	10. V	9.9 V	-1
700	8 MFD	10. V	9.9 V	-1
600	12 MFD	10. V	10.2 V	+2
500	12 MFD	10. V	10.5 V	+5

MCW

Power Input Freq. Cycles	Cap	Key Up	Key Down	%
800	5 MFD	10. V	10.4	+4
700	8 MFD	10. V	10.4	+4
600	12 MFD	10. V	10.4	+4
500	12 MFD	10. V	9.5	-5

Table No. 84

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
ALTITUDE - FREQUENCY DRIFT

450 KCS

ASCENT				DESCENT			
Time	Alt. Ft.	Freq. Kcs.	Temp. ° C.	Time	Alt. Ft.	Freq. Kcs.	Temp. ° C.
9:57	2000	450.021	28.3	10:43	17,500	450.078	-2.9
9:59	3000	.021	27.2	10:46	17,000	.078	-3.3
10:02	5000	.021	23.4	10:48	16,000	.073	-2.9
10:06	6000	.016	22.8	10:50	15,000	.073	-1.3
10:08	7000	.010	21.6	10.51	14,000	.073	-1.3
10:09	8000	.010	21.6	10:52	13,000	.073	0.
10:11	9000	.010	18.2	10.53	12,000	.073	2.
10:12	10,000	.010	17.6	10:54	11,000	.073	4.3
10:13	11,000	.010	17.0	10:56	10,000	.078	5.5
10:16	12,000	.021	15.4	10:58	9,000	.083	6.6
10:18	13,000	.021	13.2	10:59	8,000	.083	9.0
10:20	14,000	.026	11.5	11:01	7,000	.073	10.6
10:22	15,000	.026	9.2	11:02	6,000	.073	12.3
10:26	16,000	.031	7.6	11:03	5,000	.078	14.5
10:28	17,000	.036	2.0	11:04	4,000	.073	16.3
10:30	17,500	.042	0	11:06	3,000	.078	19.3
				11:09	2,000	.073	22.1
				11:12	1,000	.068	25.0

Max. Change Ascent 32 Cycles = .0071%
Max. Change Descent 15 Cycles = .0033%
Max. Total Change 73 Cycles = .0162%

Table No. 85

DECLASSIFIED

[redacted]

MODEL GO-3 TRANSMITTER
ALTITUDE - FREQUENCY DRIFT

4515 KCS

Time	Alt. Ft.	Freq. Kcs.	Temp. ° C.	Time	Alt. Ft.	Freq. Kcs.	Temp. ° C.
10:12	1,000	4514.89	29.5	11:15	17,500	4516.89	5
10:15	2,000	14.95	29.5	11:17	17,500	16.73	4.3
10:20	3,000	14,84	29.5	11:18	17,000	16.58	4.3
10:24	4,000	14.84	28.9	11:21	16,000	16.15	4.3
10:28	5,000	14,84	27.2	11:23	15,000	15.84	4.3
10:32	6,000	14.95	26.2	11:24	14,000	15.94	5
10:34	7,000	14.95	25.0	11:25	12,000	16.00	6.6
10:35	8,000	15.05	23.4	11:27	11,000	15.94	8.3
10:37	9,000	15.16	22.1	11:28	10,000	15.94	9.4
10:40	10,000	15.21	22.1	11:29	9,000	15.73	11.2
10:43	11,000	15.37	21.6	11:31	8,000	15.26	12.3
10:47	13,000	15.79	19.3	11:32	7,000	15.26	13.4
10:49	14,000	15.79	18.4	11:34	6,000	15.16	14.5
10:52	15,000	16.00	16.3	11:36	5,000	14.90	16.3
10:57	16,000	16.05	14.5	11:38	4,000	15.00	18.9
11:01	17,000	16.00	12.8	11:40	3,000	15.16	20.1
11:04	17,500	16.10	11.7	11:41	2,000	14.63	22.1
				11:42	1,000	14.53	25.0

Max. Change Ascent 1,210 Cycles = .0268%
Max. Change Descent 2,360 Cycles = .052%
Max. Total Change 2,360 Cycles = .052%

Table No. 86

MODEL GO-3 TRANSMITTER
RESET IN FLIGHT

350 KCS

Original Setting	Measured Freq. Kcs.	Freq.Diff Cycles	%
Original Setting	349.969	—	—
1st Reset.	350.004	35	.01
2nd Reset.	350.004	35	.01
3rd Reset.	350.035	66	.019

450 KCS

Original Setting	449.989	—	—
1st Reset.	449.945	44	.0098
2nd Reset.	449.950	39	.0087
3rd Reset.	449.834	55	.0122

542 KCS

Original Setting	542.069	—	—
1st Reset.	542.083	14	.0026
2nd Reset.	542.053	16	.0029
3rd Reset.	542.130	61	.0112

Table No. 88

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
RESET IN FLIGHT
H.F.Unit

	No. 1			No. 2		
ssigned req.Kcs.	Measured Freq.Kcs.	Diff Cycles	%	Measured Freq.Kcs.	Diff Cycles	%
3,385	3,384.95	-50	.0014	3,385.03	+30	.008
4,255	4,254.8	-200	.0047	4,255.2	+200	.0076
6,235	6,234.5	-500	.008	6,235.35	+350	.0056
3,270	8,270.3	+300	.0036	8,270.1	+100	.0012
2,405	12,405.8	+800	.0063	12,405.1	+100	.0008

	No. 3			No. 4		
ase Freq. Kcs.	Measured Freq.Kcs.	Diff Cycles	%	Measured Freq.Kcs.	Diff Cycles	%
3,385.03	3,384.9	-130	.0038	3,384.83	-200	.0059
4,255.2	4,255.0	-200	.0047	4,255.25	+ 50	.0012
6,235.35	6,235.03	-320	.0051	6,236.05	+700	.0112
8,270.1	8,271.3	+1200	.0145	8,269.9	-200	.0024
2,405.1	12,406.9	+1800	.0145	12,406.5	+1400	.0113

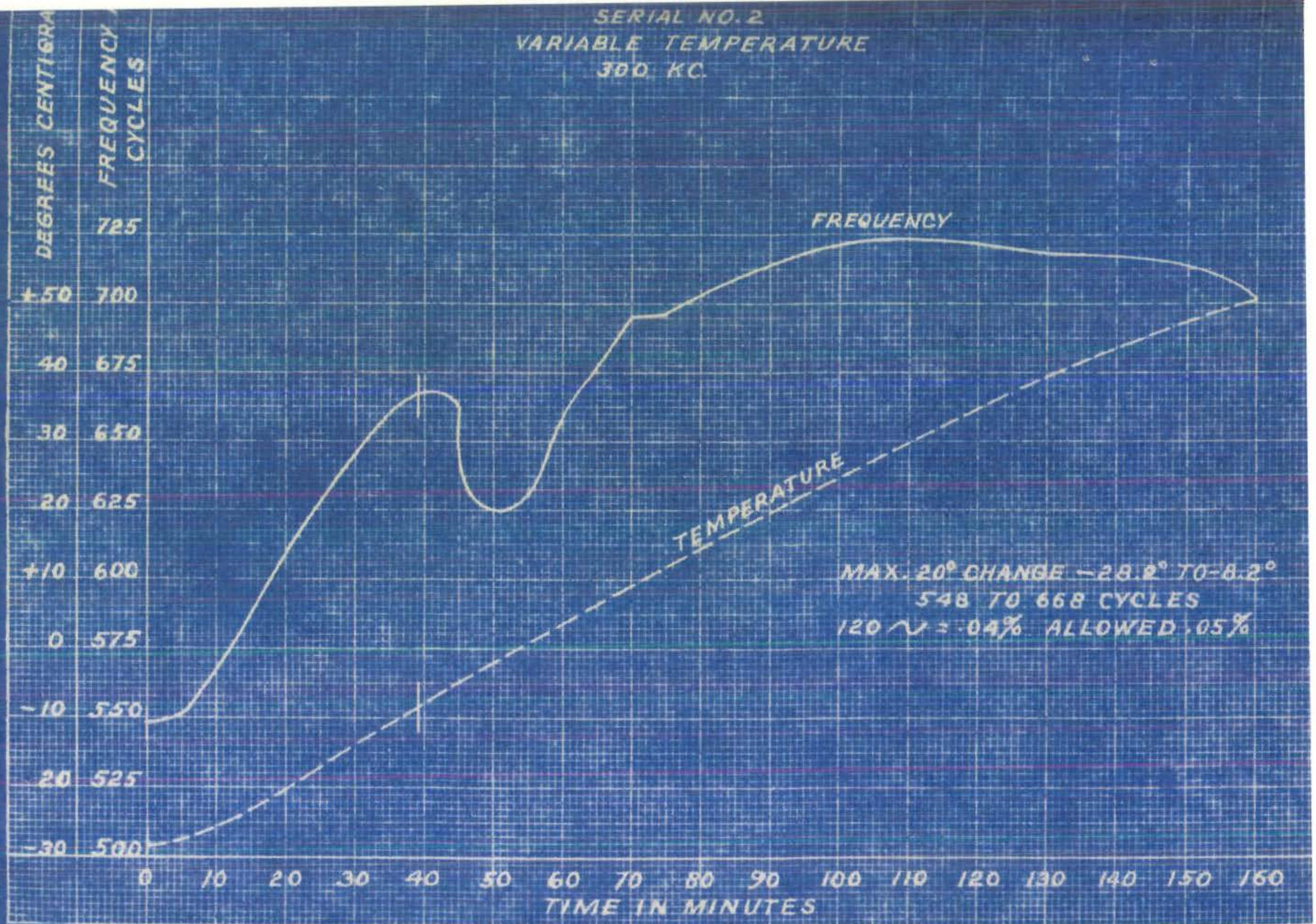
'ests - No. 1 and No. 2 were made using the LM-2 frequency indicator to set the transmitter on frequency.

:ests - No. 3 and No. 4 were made using the recorded dial settings of test No. 2.

The measured frequency of test No. 2 is used as the base frequency for letermining the percentage of tests No. 3 and No. 4.

Table No. 89

[redacted]



SHEET

PLATE I

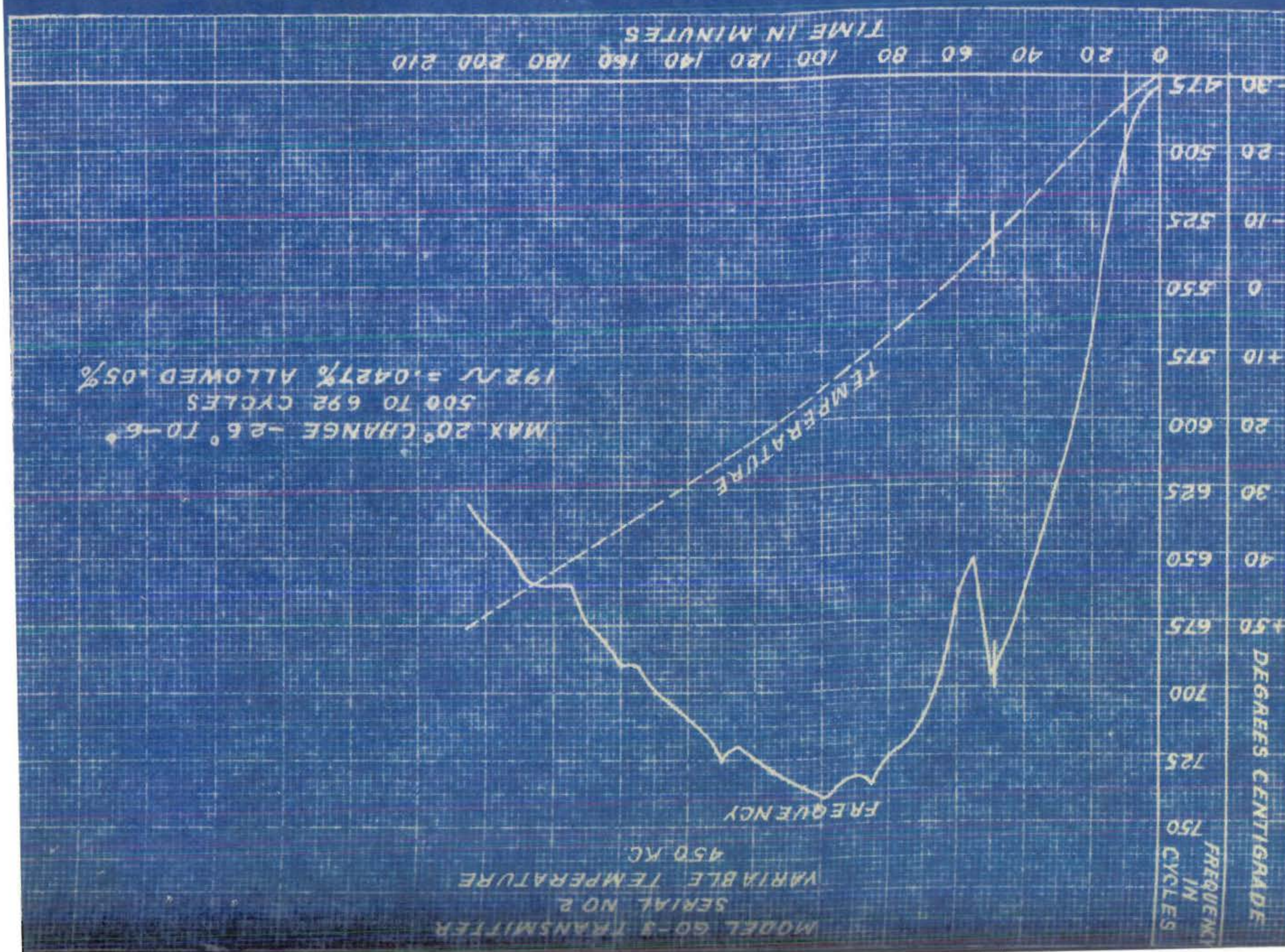

MODEL GO-3 TRANSMITTER
SERIAL NO 2
VARIABLE TEMPERATURE
450 KC
FREQUENCY
TEMPERATURE
MAX 20° CHANGE -26° TO -6°
500 TO 692 CYCLES
192 Λ =.0427% ALLOWED .05%
TIME IN MINUTES
0 20 40 60 80 100 120 140 160 180 200 210
DEGREES CENTIGRADE
FREQUENCY IN CYCLES
-30 475
-20 500
-10 525
0 550
+10 575
20 600
30 625
40 650
+50 675
700
725
750
SHEET

PLATE 2

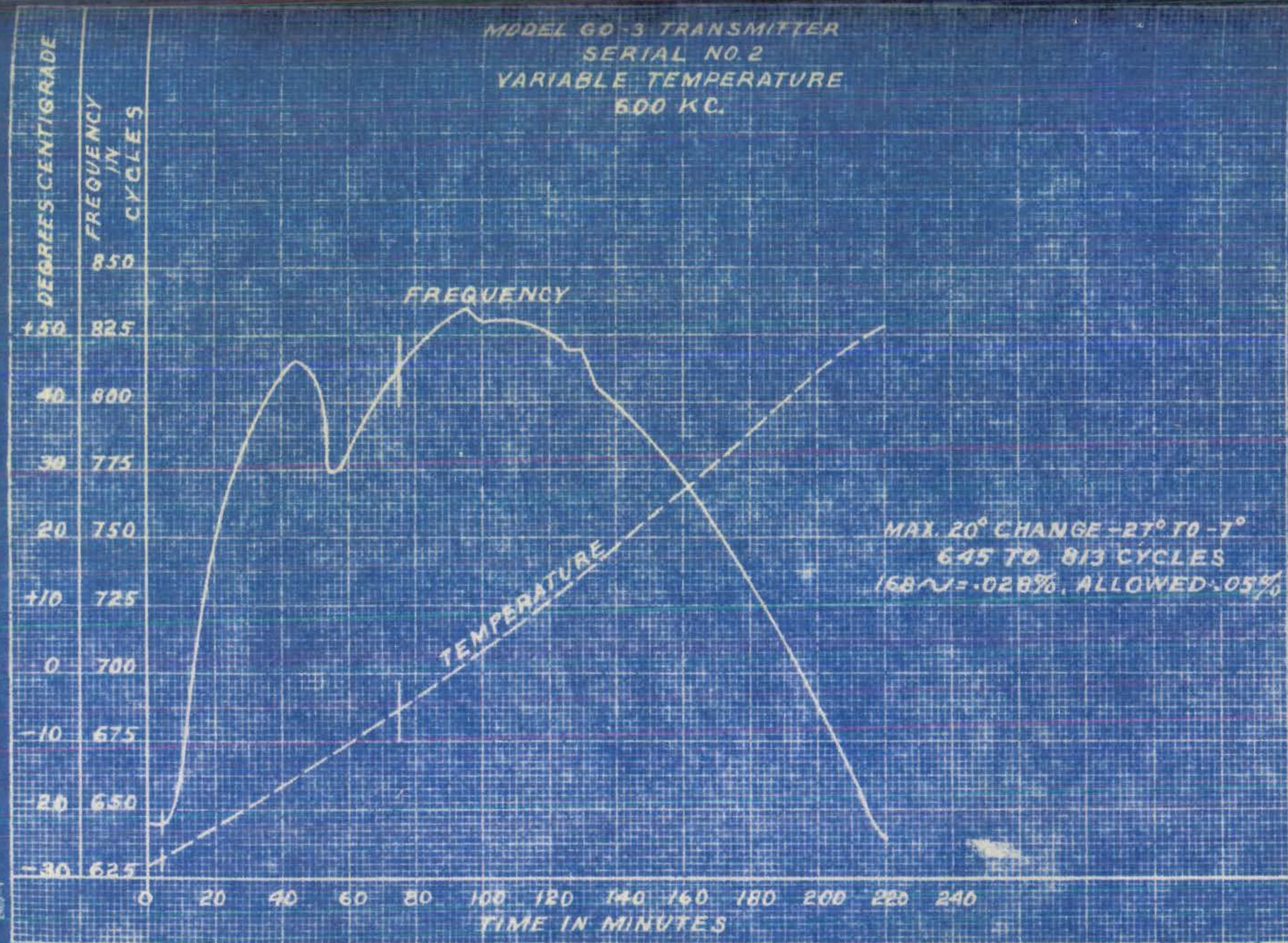
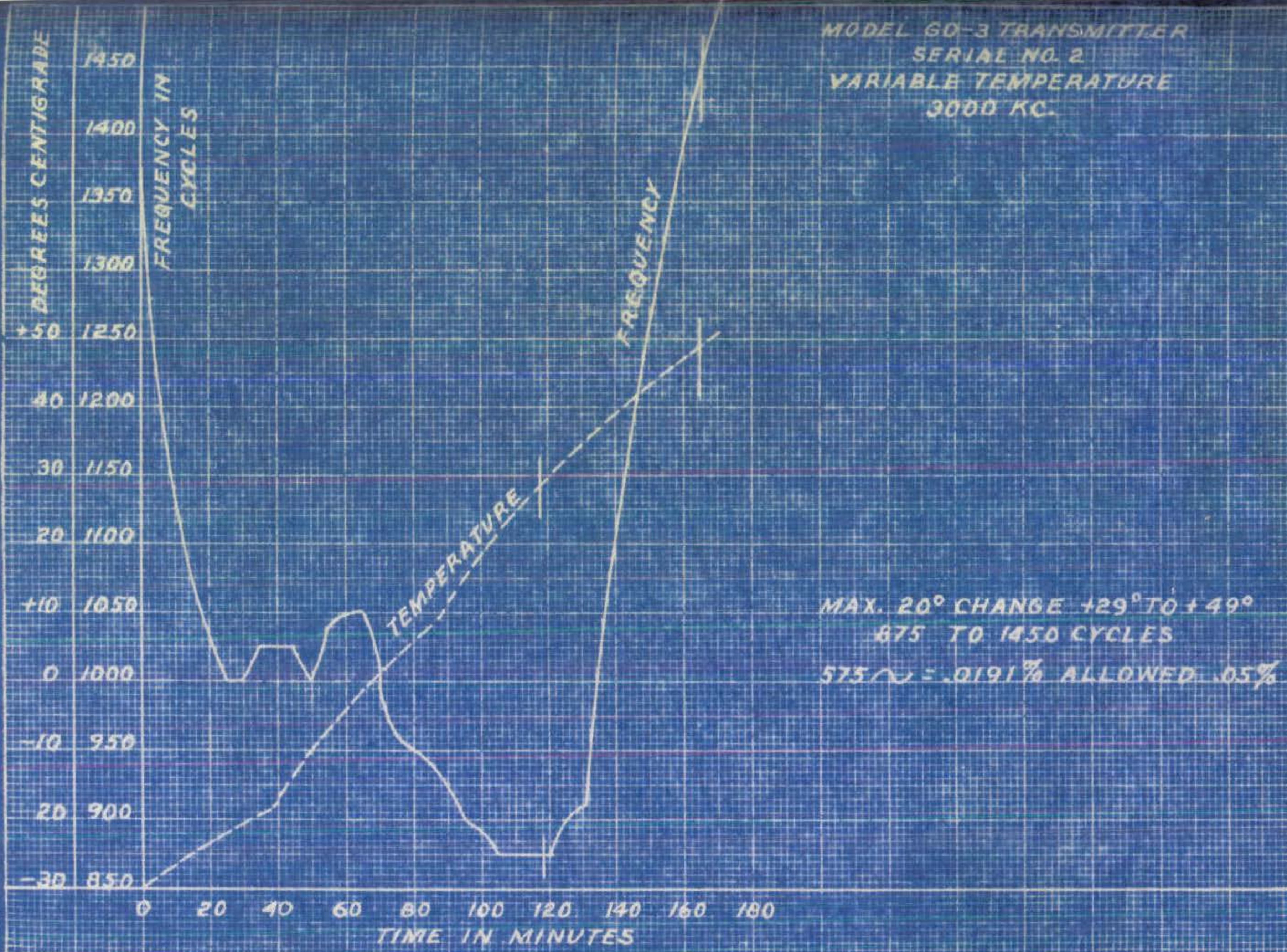
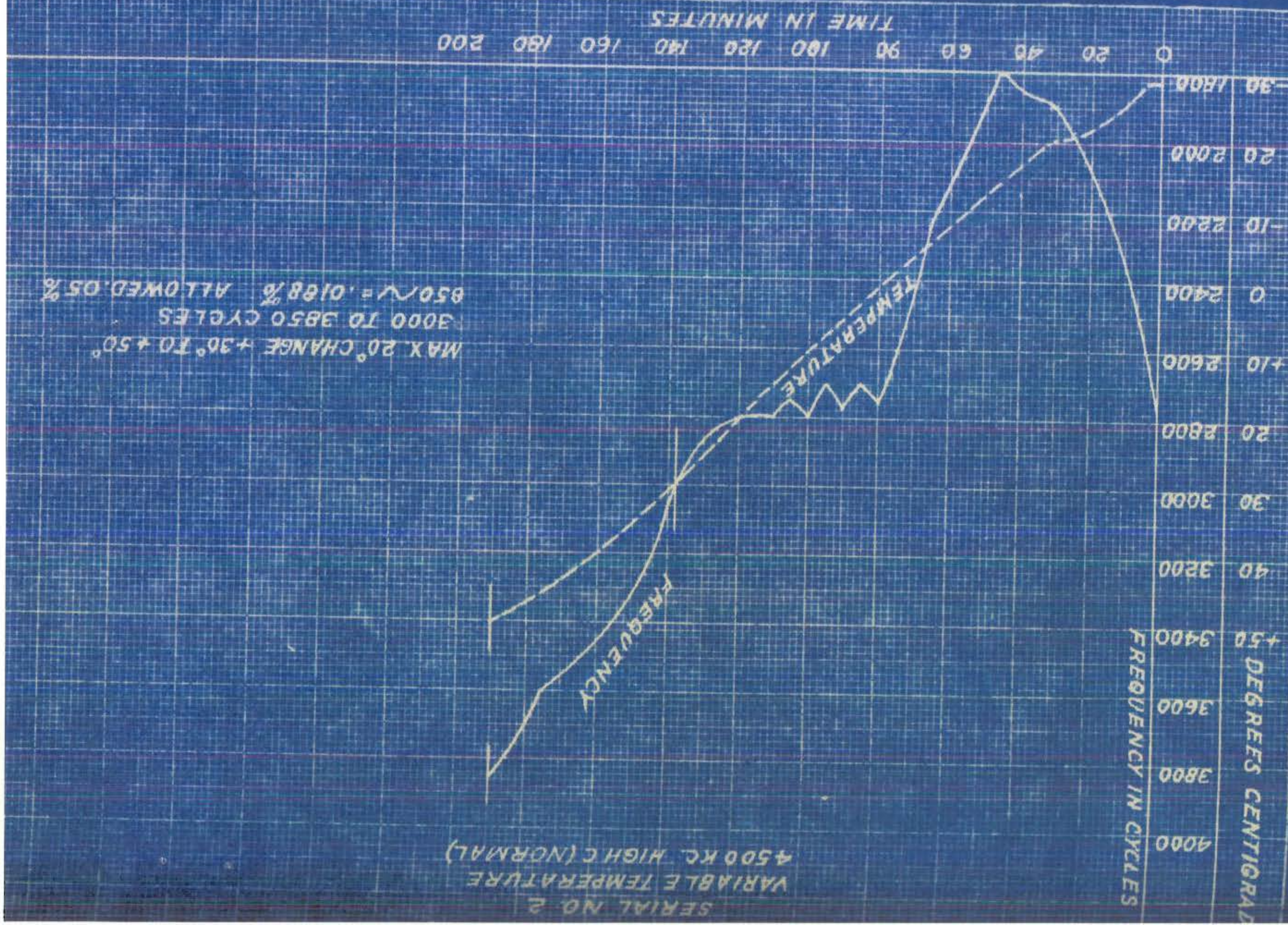

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
VARIABLE TEMPERATURE
600 KC.
DEGREES CENTIGRADE
FREQUENCY IN CYCLES
FREQUENCY
TEMPERATURE
MAX. 20° CHANGE -27° TO -7°
645 TO 813 CYCLES
168 ~ = .028%. ALLOWED .05%
TIME IN MINUTES

PLATE 3



SHEET

PLATE 4



SHEET

PLATE 5

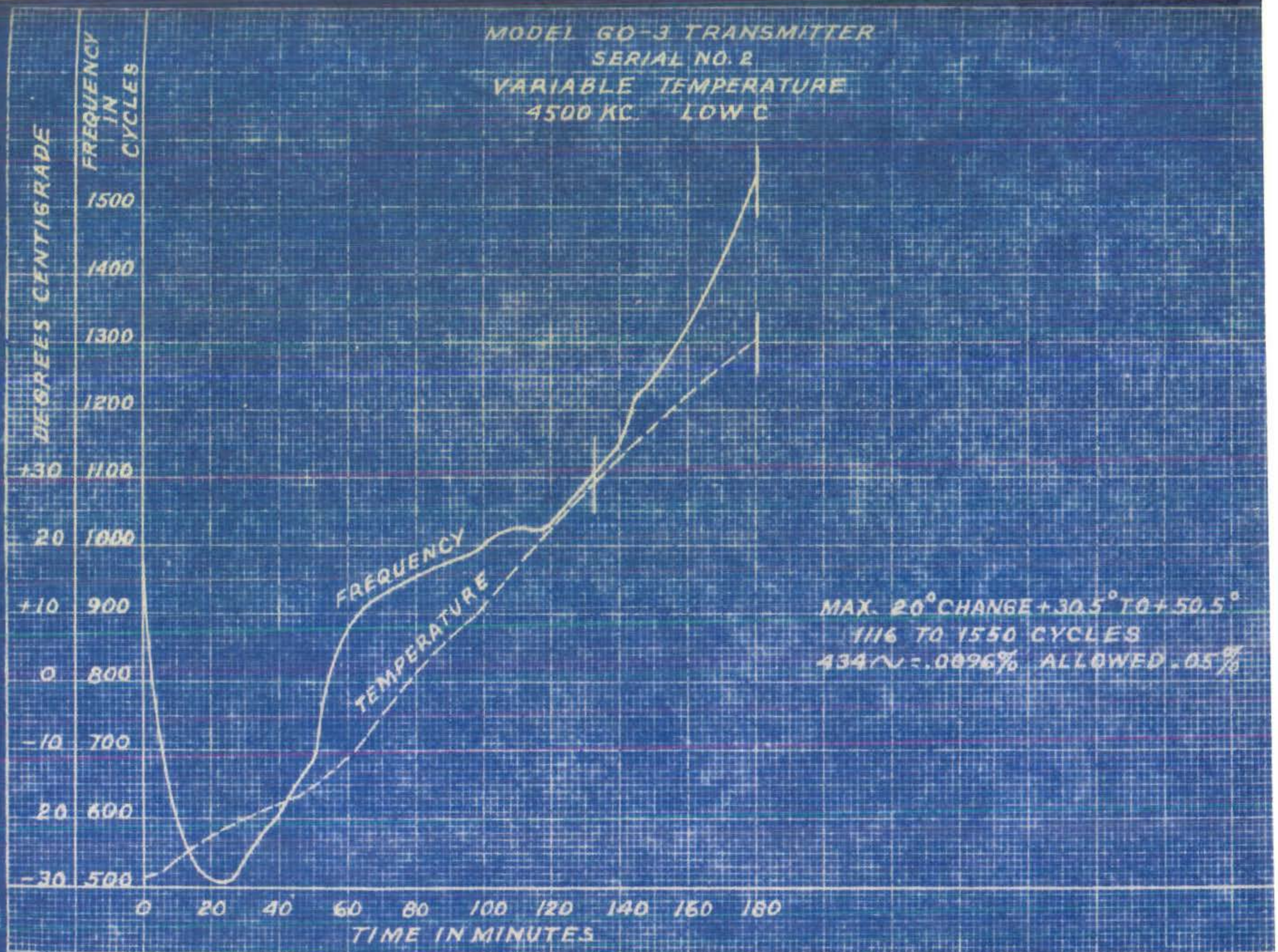
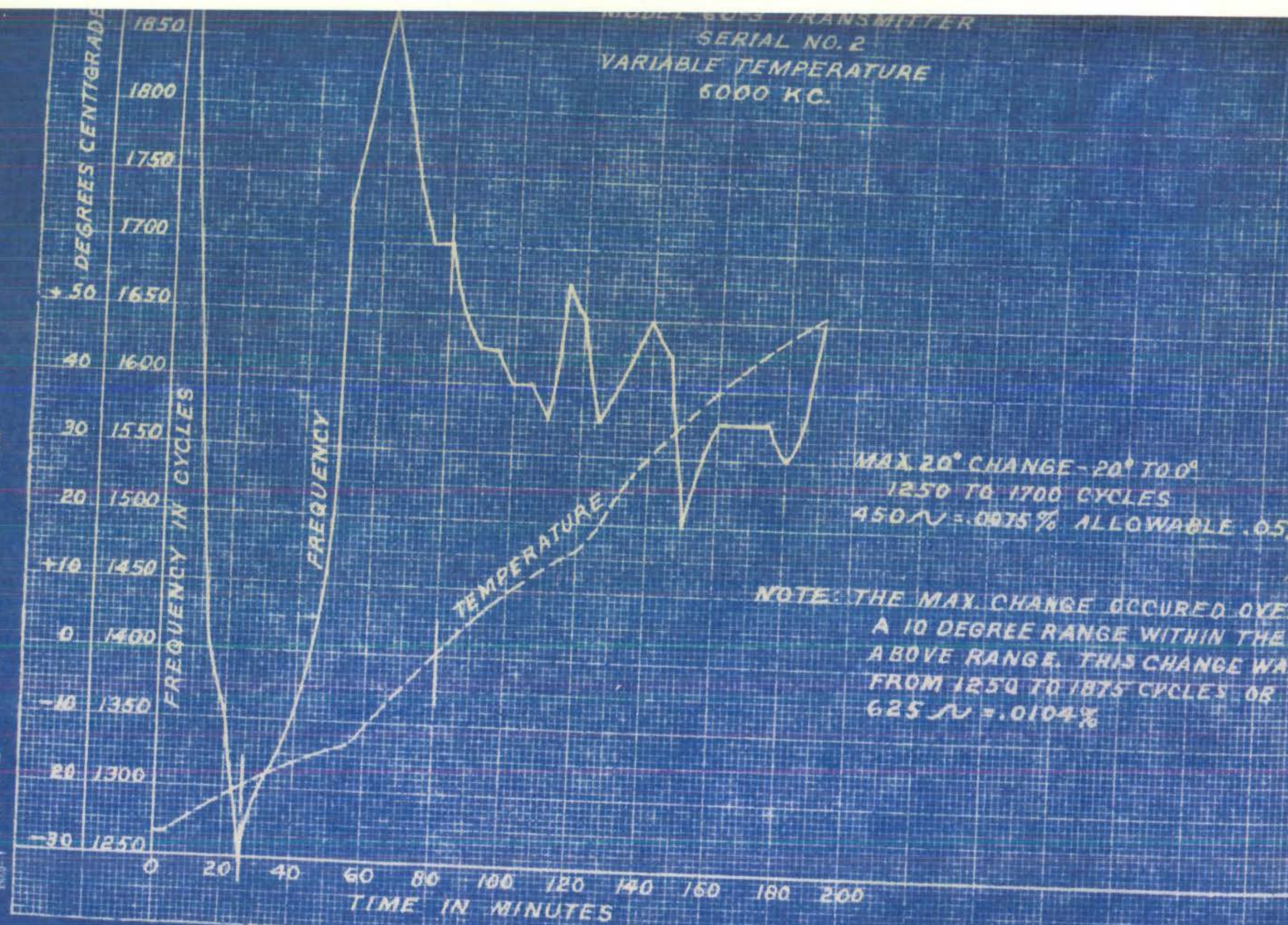

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
VARIABLE TEMPERATURE
4500 KC. LOW C
DEGREES CENTIGRADE
FREQUENCY IN CYCLES
1500
1400
1300
1200
+30 1100
20 1000
+10 900
0 800
-10 700
20 600
-30 500
FREQUENCY
TEMPERATURE
MAX. 20° CHANGE +30.5° TO +50.5°
1116 TO 1550 CYCLES
434∼ = .0096% ALLOWED .05%
0 20 40 60 80 100 120 140 160 180
TIME IN MINUTES
SHEET

PLATE 6



SHEET

PLATE 7

NRL Report No. R-1434
Improvements in the Measurement of the Direct

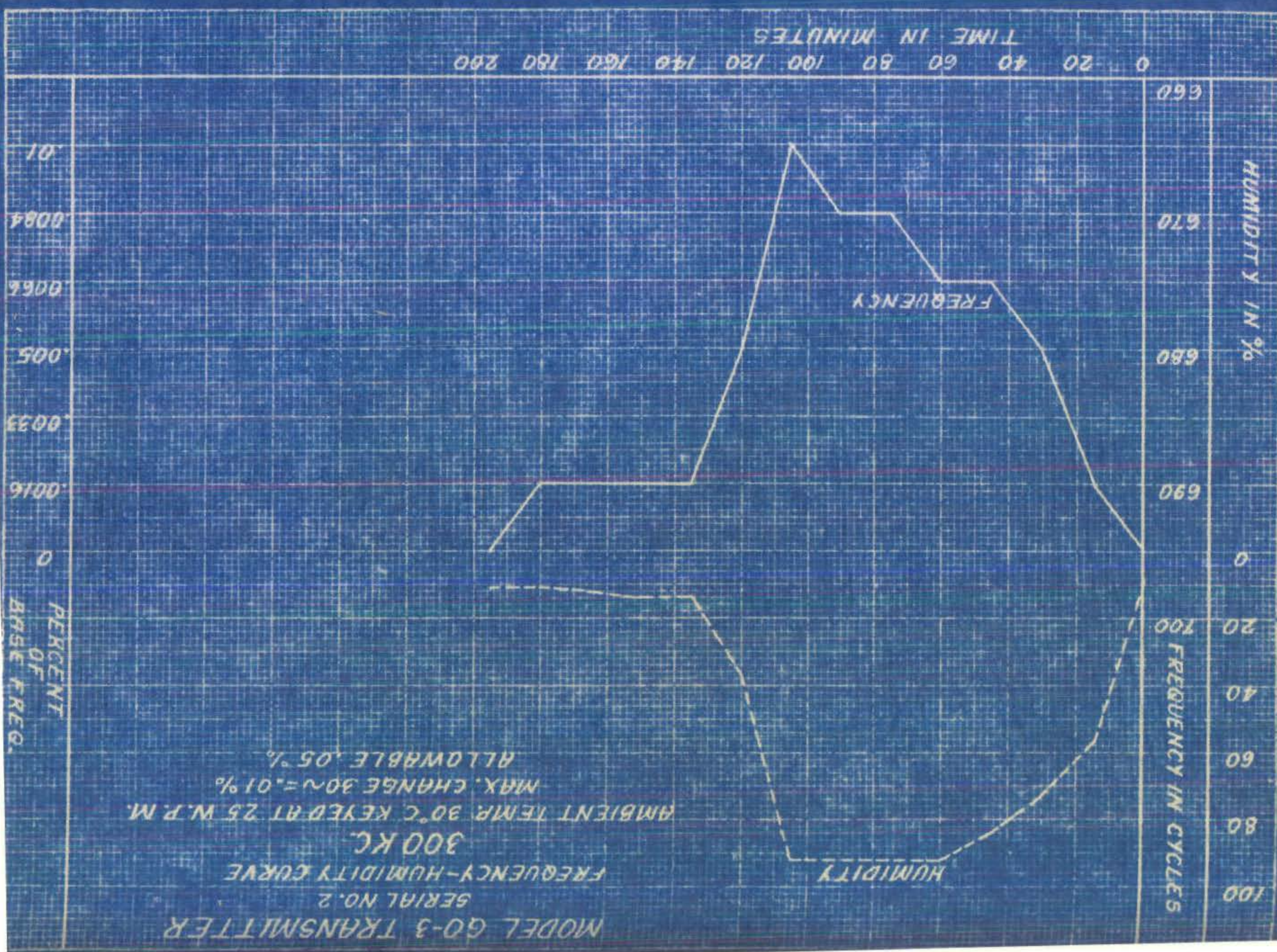
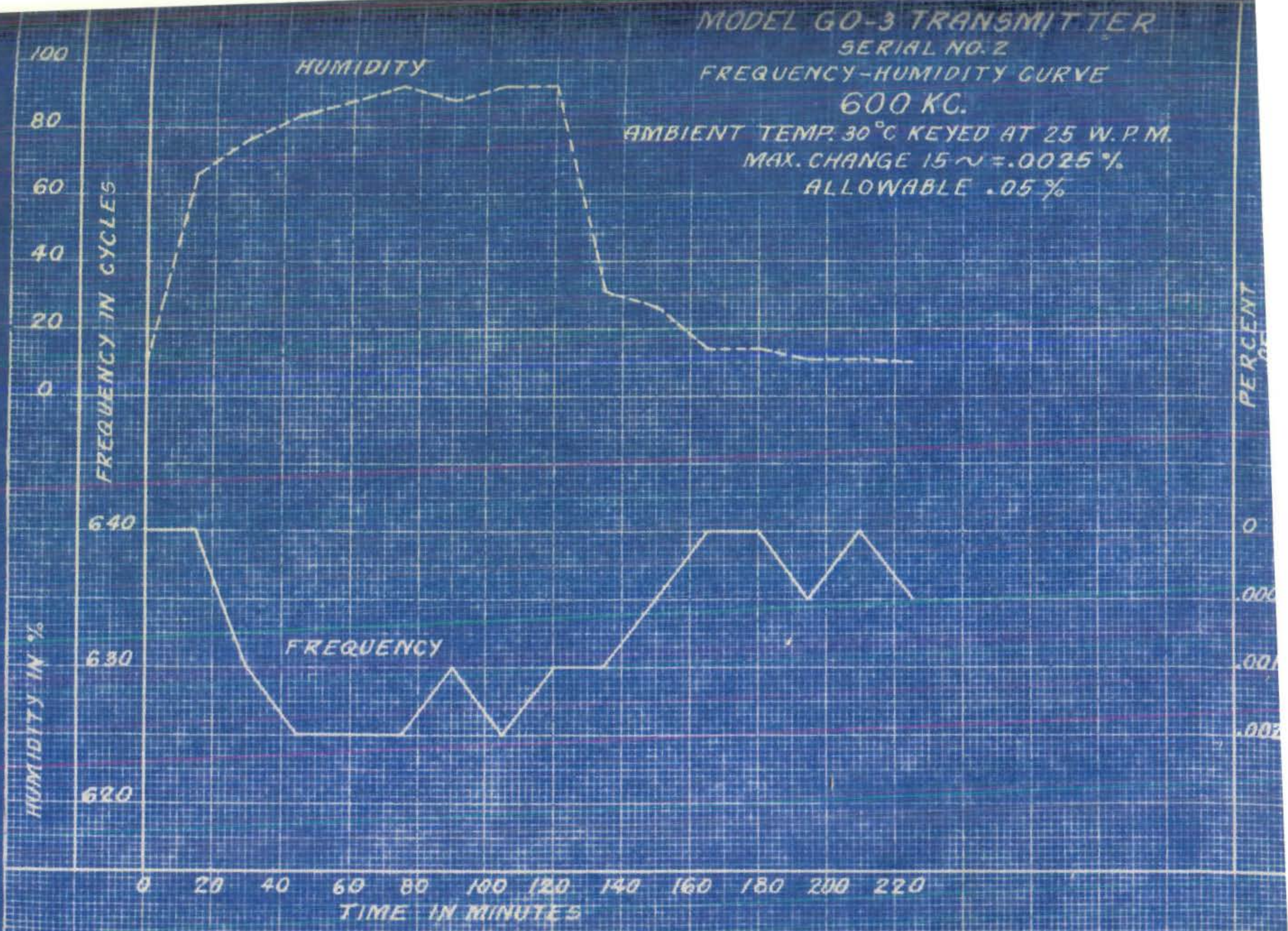
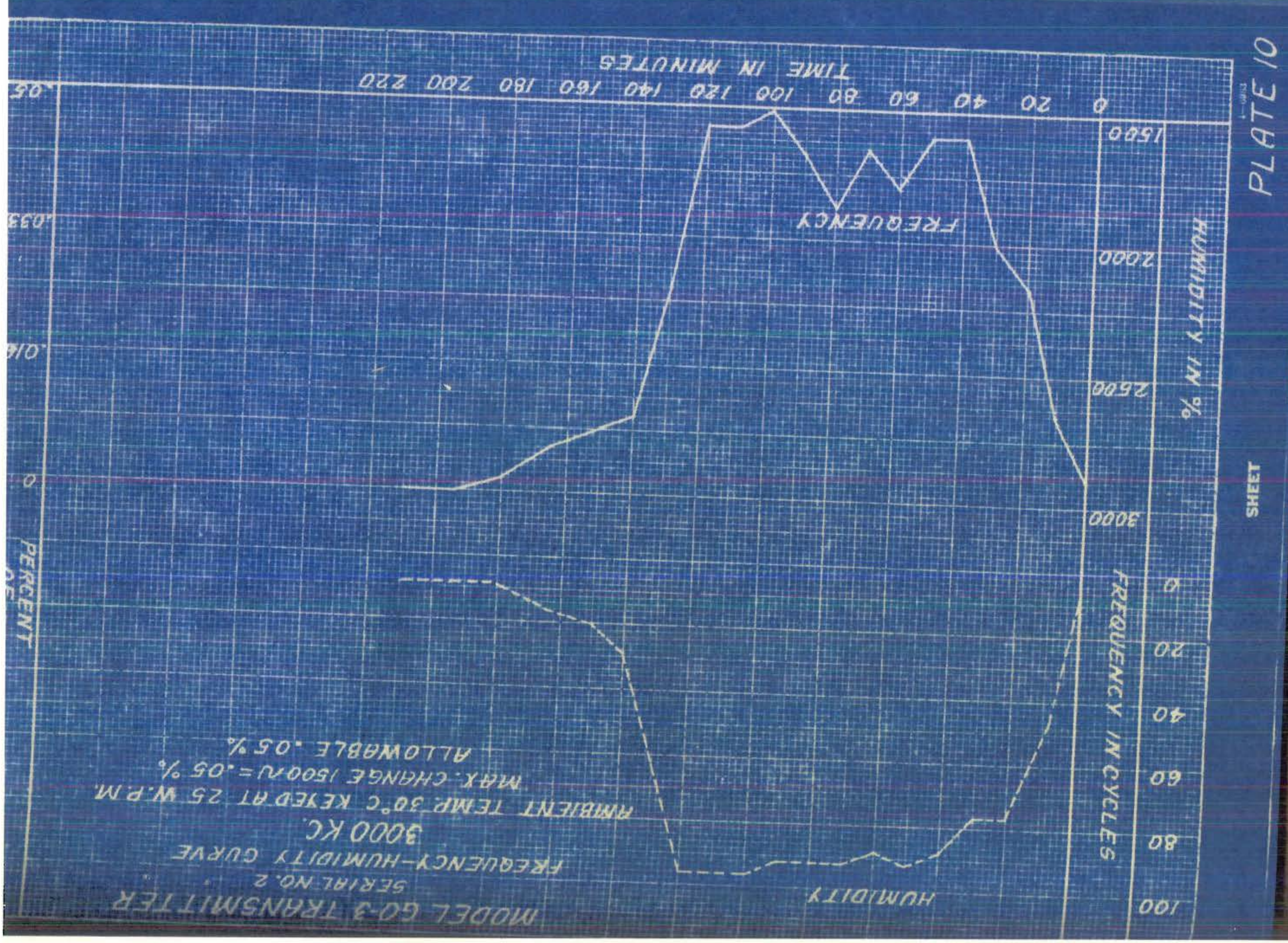

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
FREQUENCY-HUMIDITY CURVE
300 KC.
AMBIENT TEMP. 30°C KEYED AT 25 W.P.M.
MAX. CHANGE 30~=.01%
ALLOWABLE .05%
HUMIDITY
FREQUENCY
TIME IN MINUTES
0
20
40
60
80
100
120
140
160
180
200
FREQUENCY IN CYCLES
660
670
680
690
700
HUMIDITY IN %
0
20
40
60
80
100
PERCENT OF BASE FREQ.
0
.0016
.0033
.005
.0066
.0084
.01
SHEET

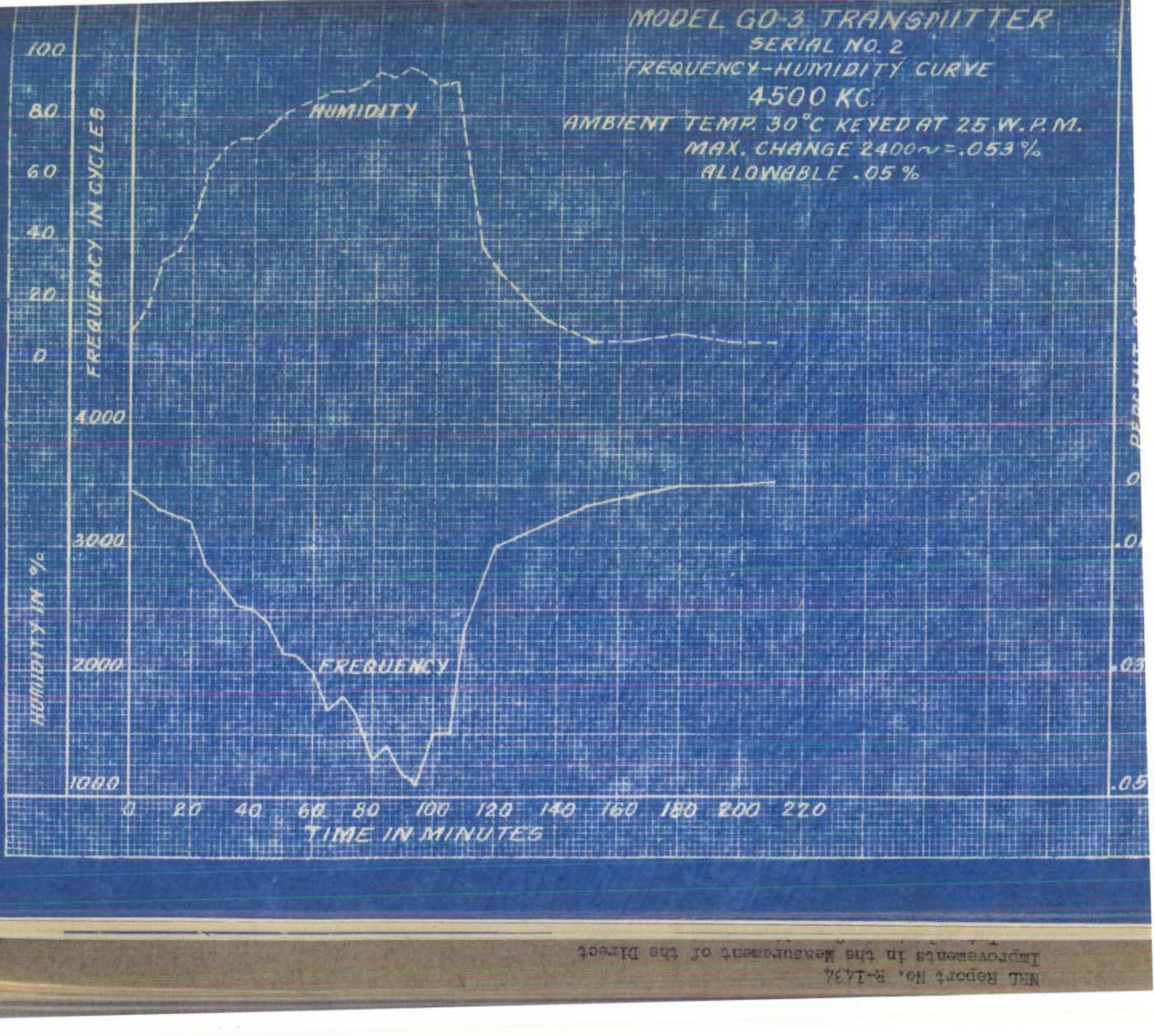
PLATE 8



SHEET

PLATE 9

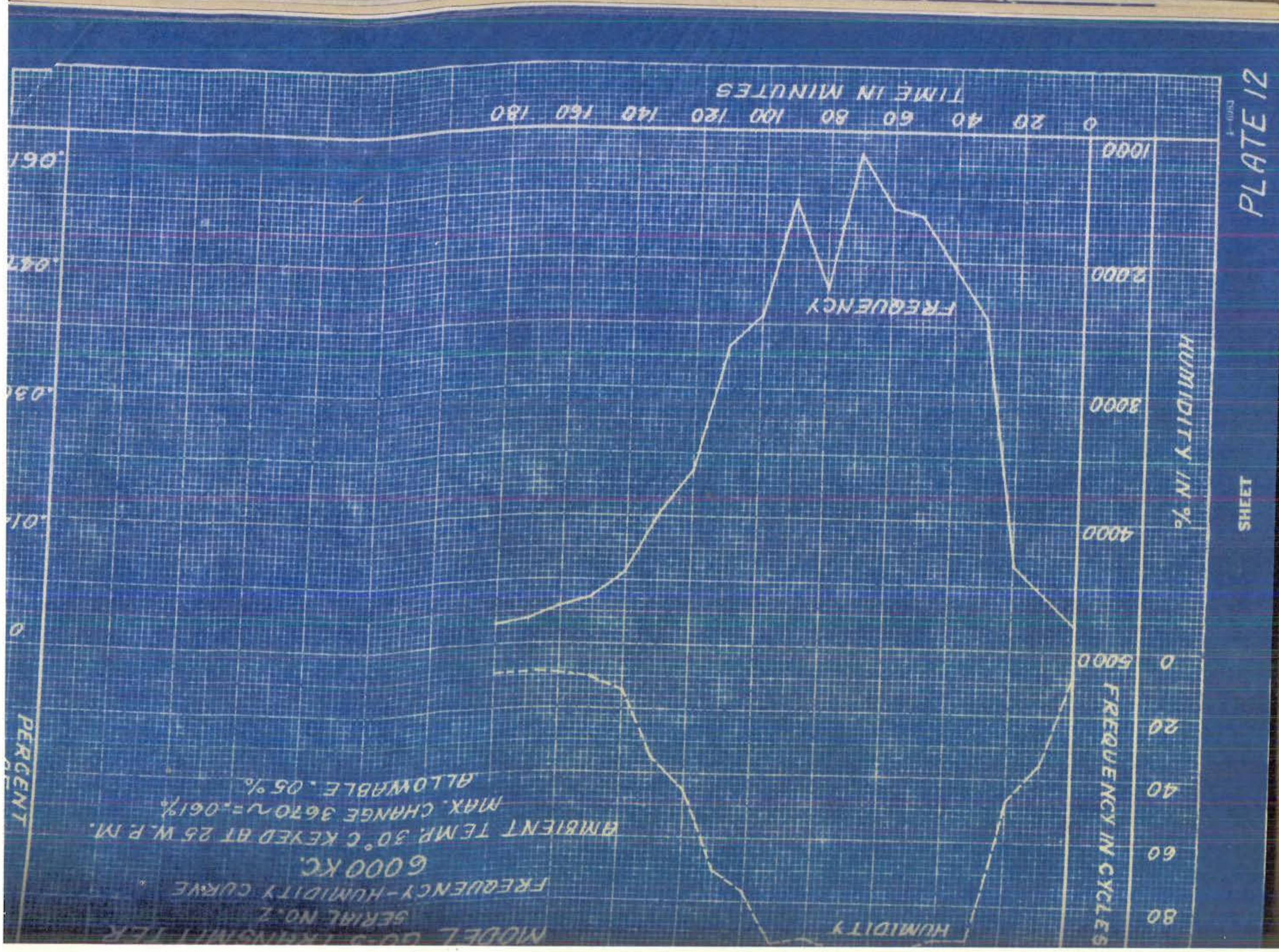

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
FREQUENCY-HUMIDITY CURVE
3000 KC.
AMBIENT TEMP. 30°C KEYED AT 25 W.P.M.
MAX. CHANGE 1500 ∩ = .05 %
ALLOWABLE .05 %
HUMIDITY
FREQUENCY
TIME IN MINUTES
FREQUENCY IN CYCLES
HUMIDITY IN %
PERCENT
SHEET
PLATE 10



SHEET

PLATE II

NRL Report No. R-1434
Improvements in the Measurement of the Direct



NRL Report No. R-1434
Improvements in the Measurement of the Direct

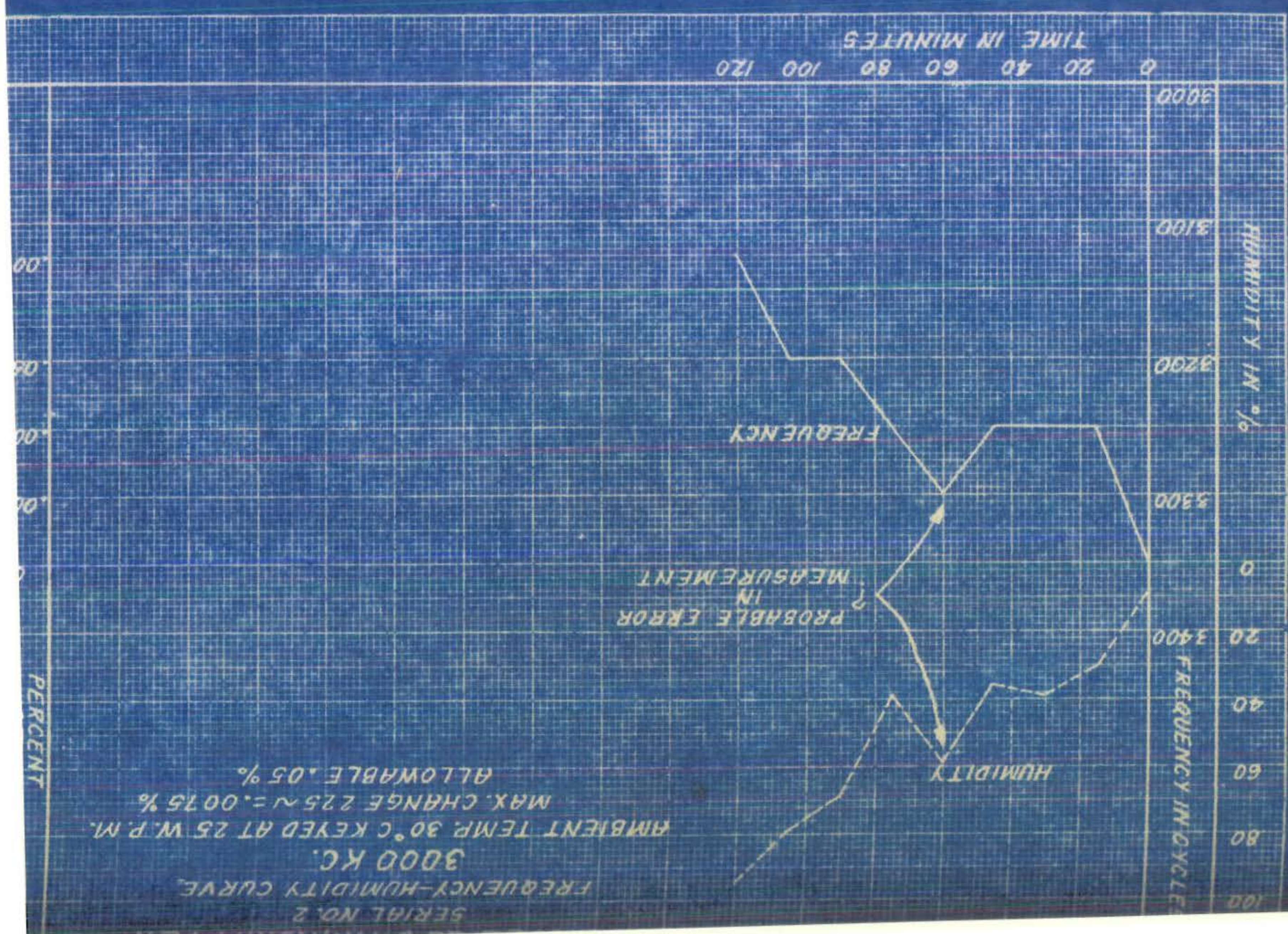


PLATE 13

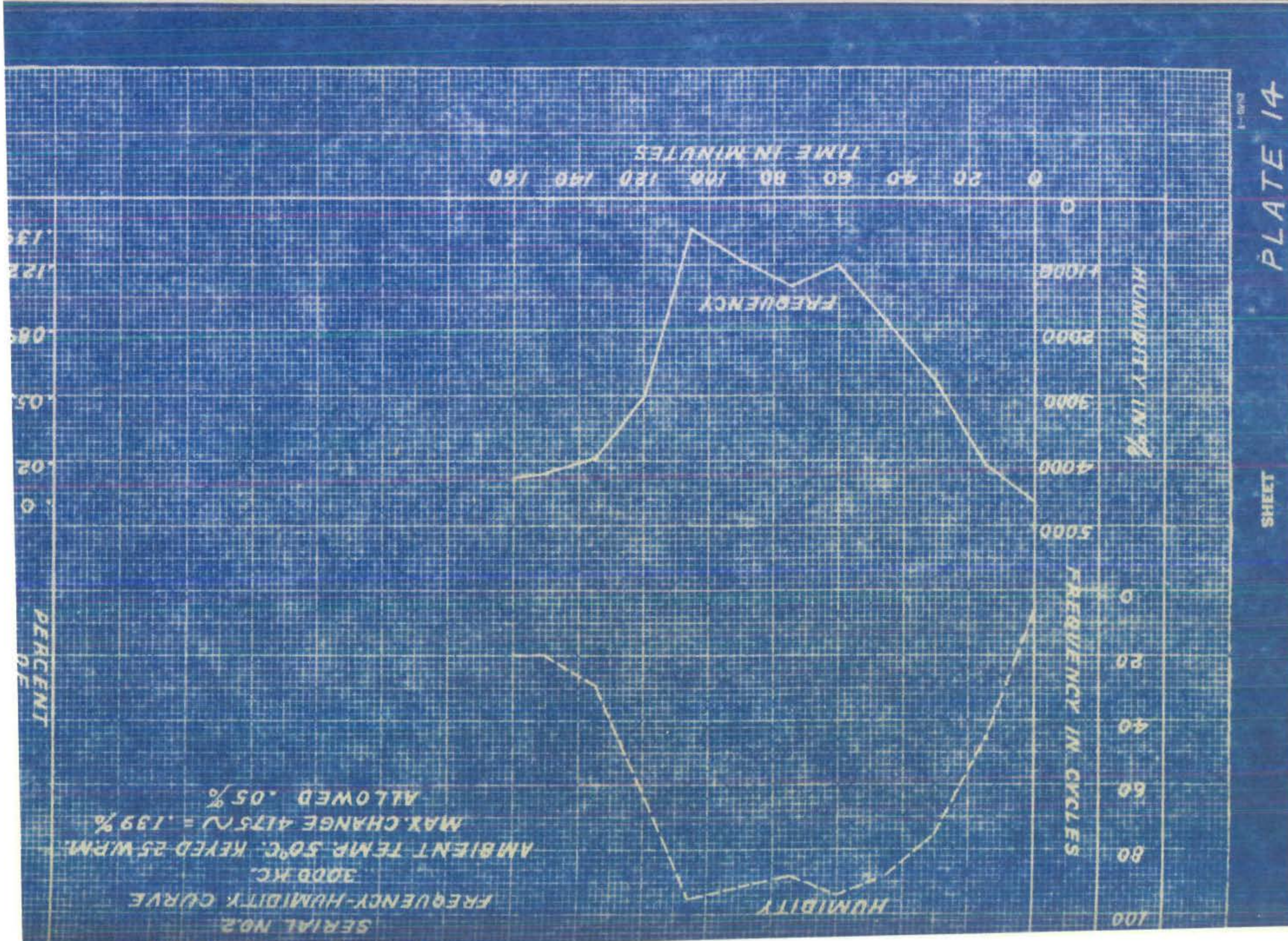

SERIAL NO.2
FREQUENCY-HUMIDITY CURVE
3000 KC.
AMBIENT TEMP. 50°C. KEYED 25 W.P.M.
MAX. CHANGE 4175 ~ = .139 %
ALLOWED .05 %
HUMIDITY
FREQUENCY
TIME IN MINUTES
0 20 40 60 80 100 120 140 160
FREQUENCY IN CYCLES
0 1000 2000 3000 4000 5000
HUMIDITY IN %
0 20 40 60 80 100
PERCENT
.0
.02
.05
.085
.122
.139
SHEET

PLATE 14

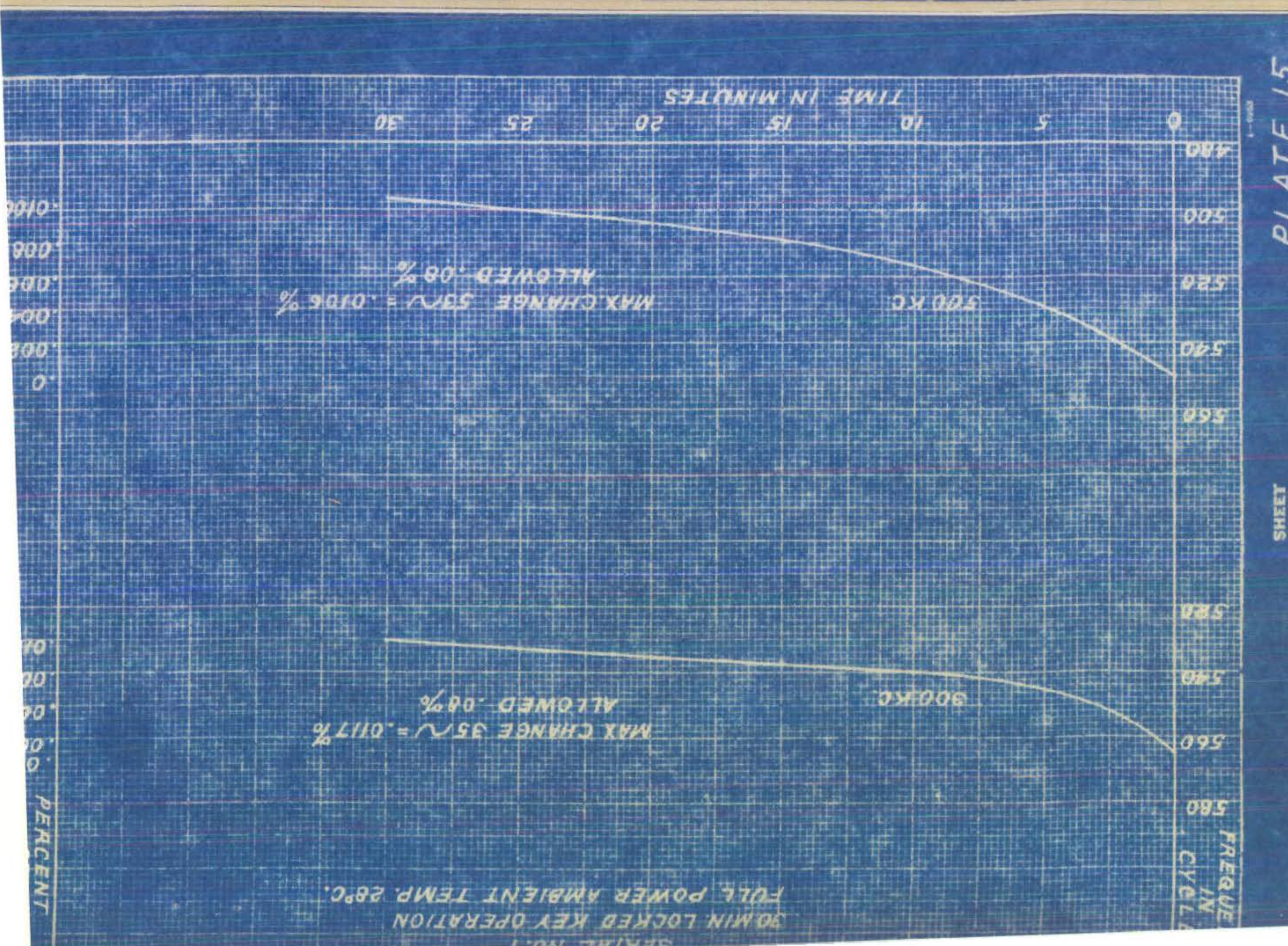

30 MIN LOCKED KEY OPERATION
FULL POWER AMBIENT TEMP. 28°C.
MAX CHANGE 35 ∿ = .0117%
ALLOWED .08%
300 KC
MAX CHANGE 53 ∿ = .0106 %
ALLOWED .08%
500 KC
TIME IN MINUTES
0
5
10
15
20
25
30
FREQUE
IN
CYCL
580
560
540
580
560
540
520
500
480
PERCENT
SHEET

PLATE 15

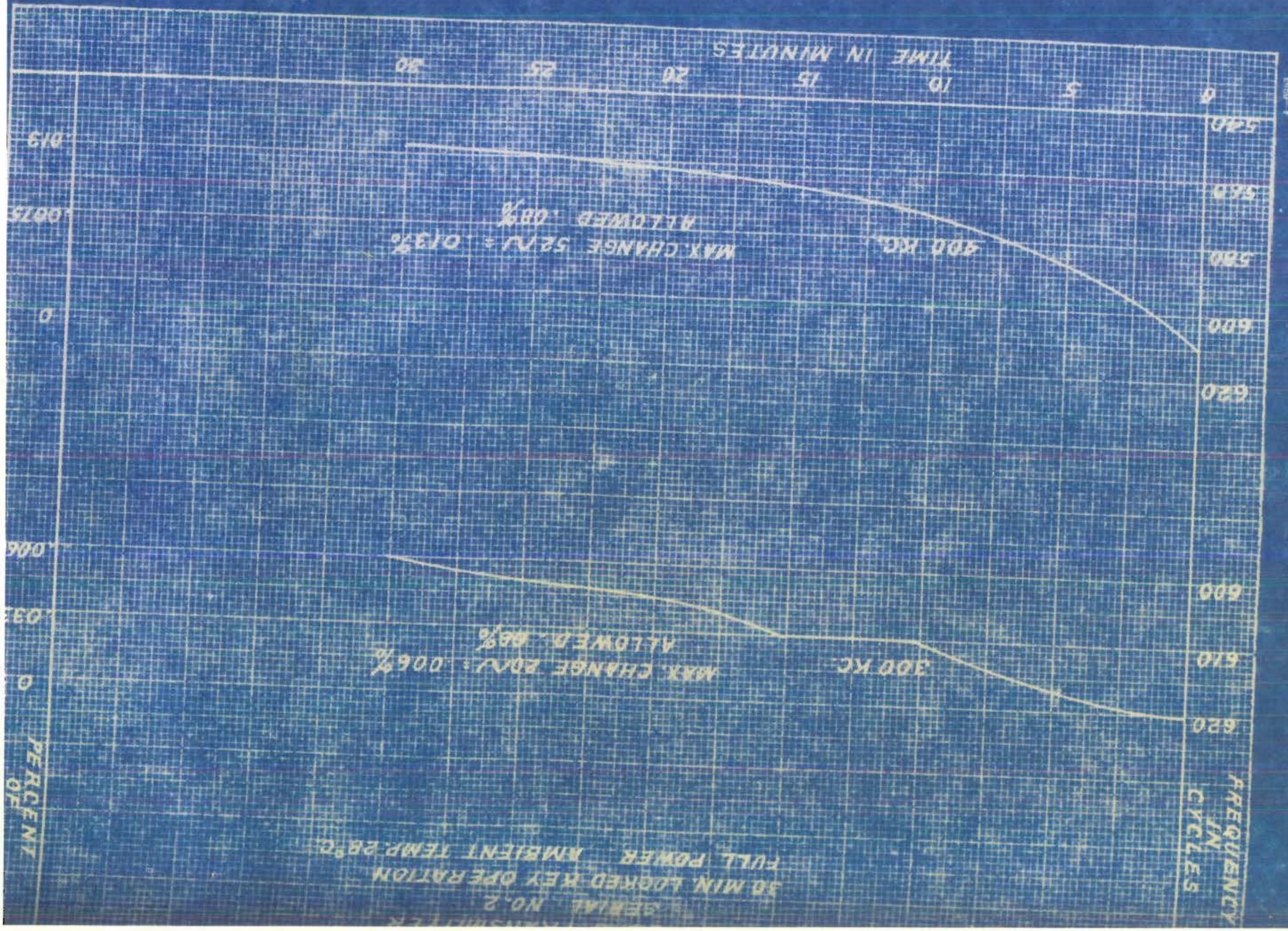

SERIAL NO. 2
30 MIN. LOCKED KEY OPERATION
FULL POWER AMBIENT TEMP. 28°C.
FREQUENCY IN CYCLES
PERCENT OF
300 KC.
MAX. CHANGE 20 ~ = .006%
ALLOWED .08%
400 KC.
MAX. CHANGE 52 ~ = .013%
ALLOWED .08%
TIME IN MINUTES
0
5
10
15
20
25
30
620
610
600
620
600
580
560
540
0
.033
.066
0
.0075
.013

PLATE 16

NRL Report No. R-1434
Improvements in the Measurement of the Direct

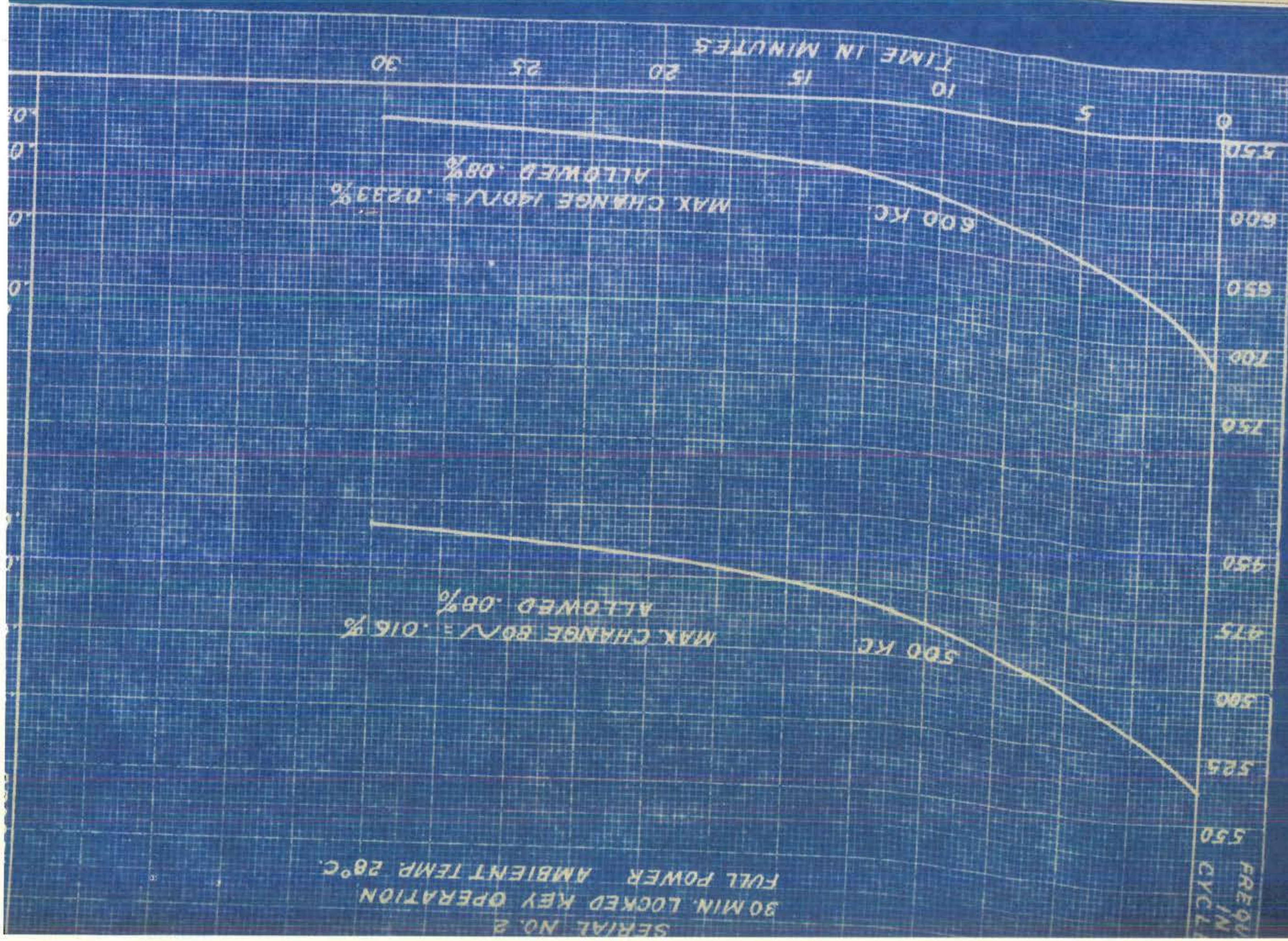


PLATE 17

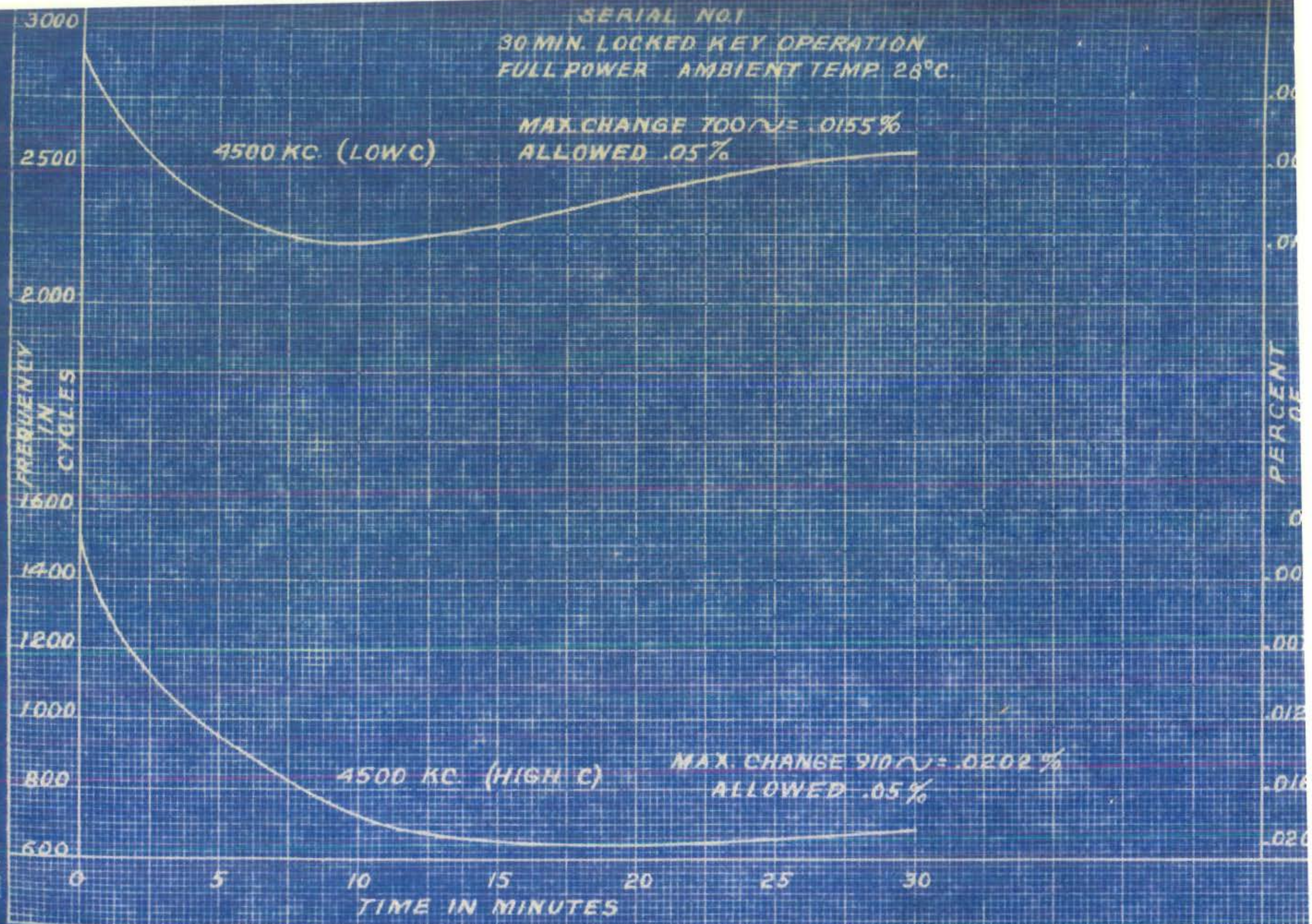
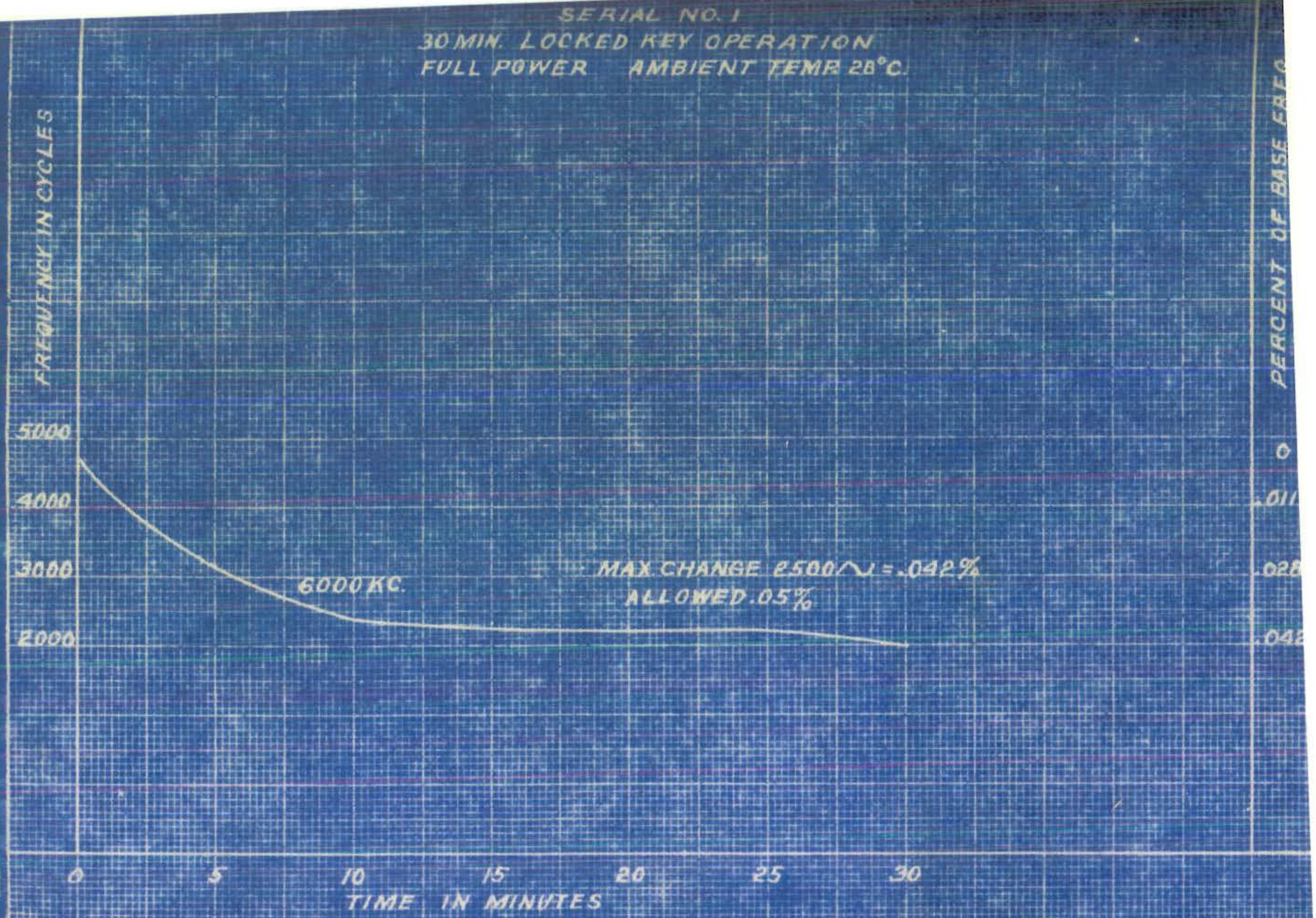

SERIAL NO.1
30 MIN. LOCKED KEY OPERATION
FULL POWER AMBIENT TEMP. 28°C.
MAX. CHANGE 700 ~ = .0155%
ALLOWED .05%
4500 KC. (LOW C)
4500 KC. (HIGH C)
MAX. CHANGE 910 ~ = .0202%
ALLOWED .05%
3000
2500
2000
1600
1400
1200
1000
800
600
FREQUENCY IN CYCLES
PERCENT
0
5
10
15
20
25
30
TIME IN MINUTES

PLATE 18



SHEET

PLATE 19

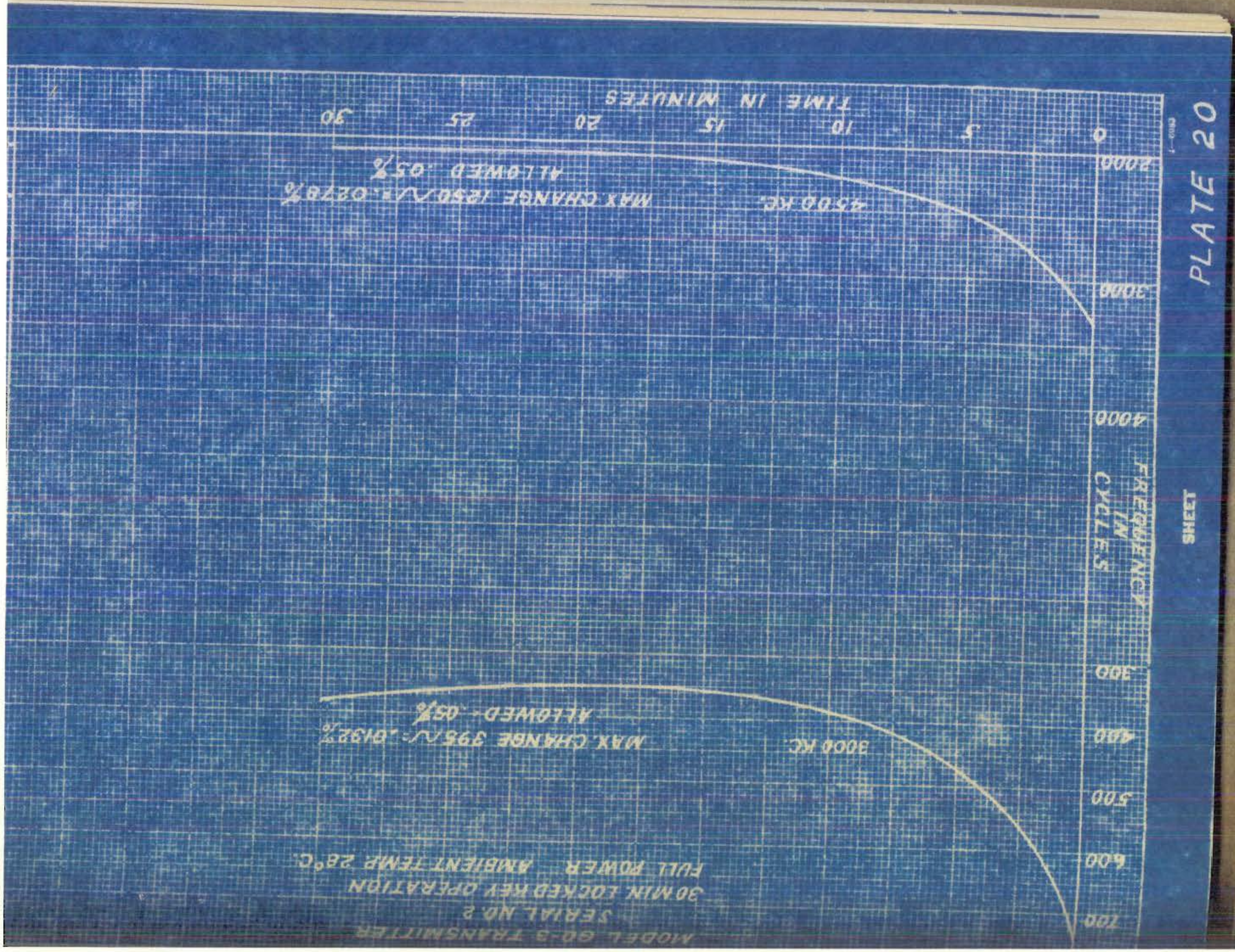

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
30 MIN. LOCKED KEY OPERATION
FULL POWER AMBIENT TEMP. 28°C.
3000 KC.
MAX. CHANGE 395 ∿ .0132%
ALLOWED .05%
4500 KC.
MAX. CHANGE 1250 ∿ .0278%
ALLOWED .05%
FREQUENCY IN CYCLES
TIME IN MINUTES
0
5
10
15
20
25
30
700
600
500
400
300
4000
3000
2000
SHEET

PLATE 20

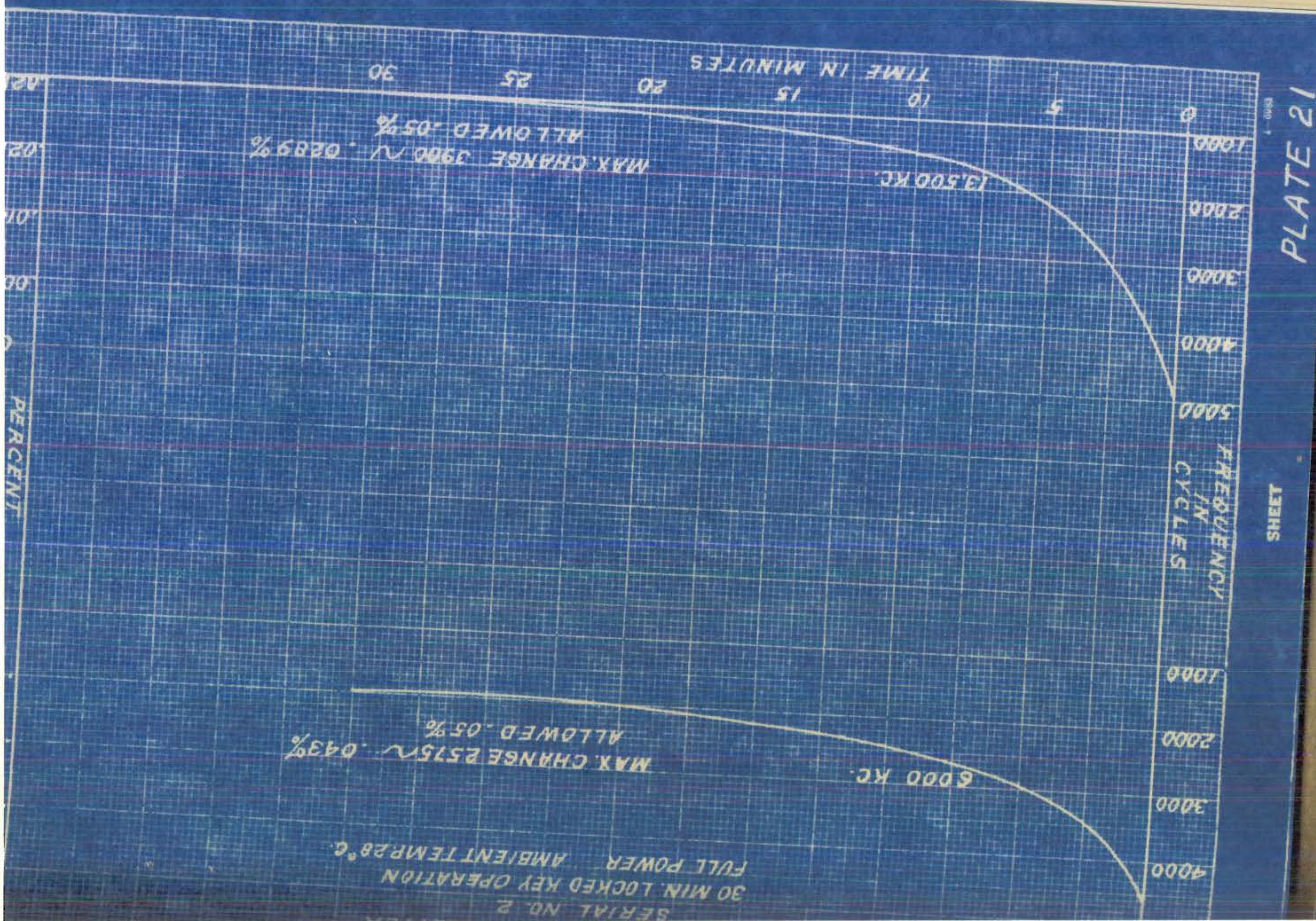
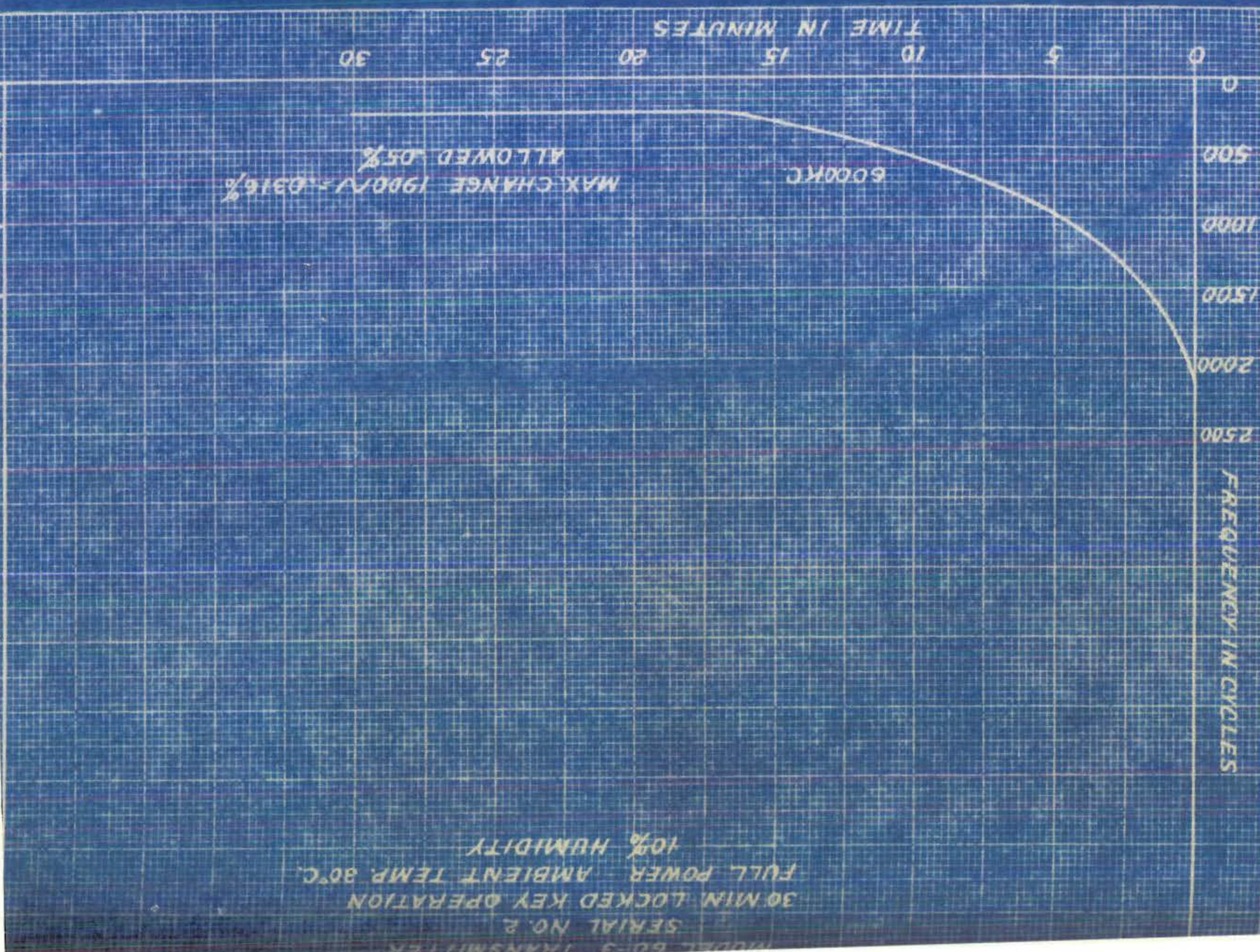

SERIAL NO. 2
30 MIN. LOCKED KEY OPERATION
FULL POWER AMBIENT TEMP. 28°C.
6000 KC.
MAX. CHANGE 2575 ~ .043%
ALLOWED .05%
13,500 KC.
MAX. CHANGE 3900 ~ .0289%
ALLOWED .05%
FREQUENCY IN CYCLES
TIME IN MINUTES
PERCENT

PLATE 21



SHEET

PLATE 22

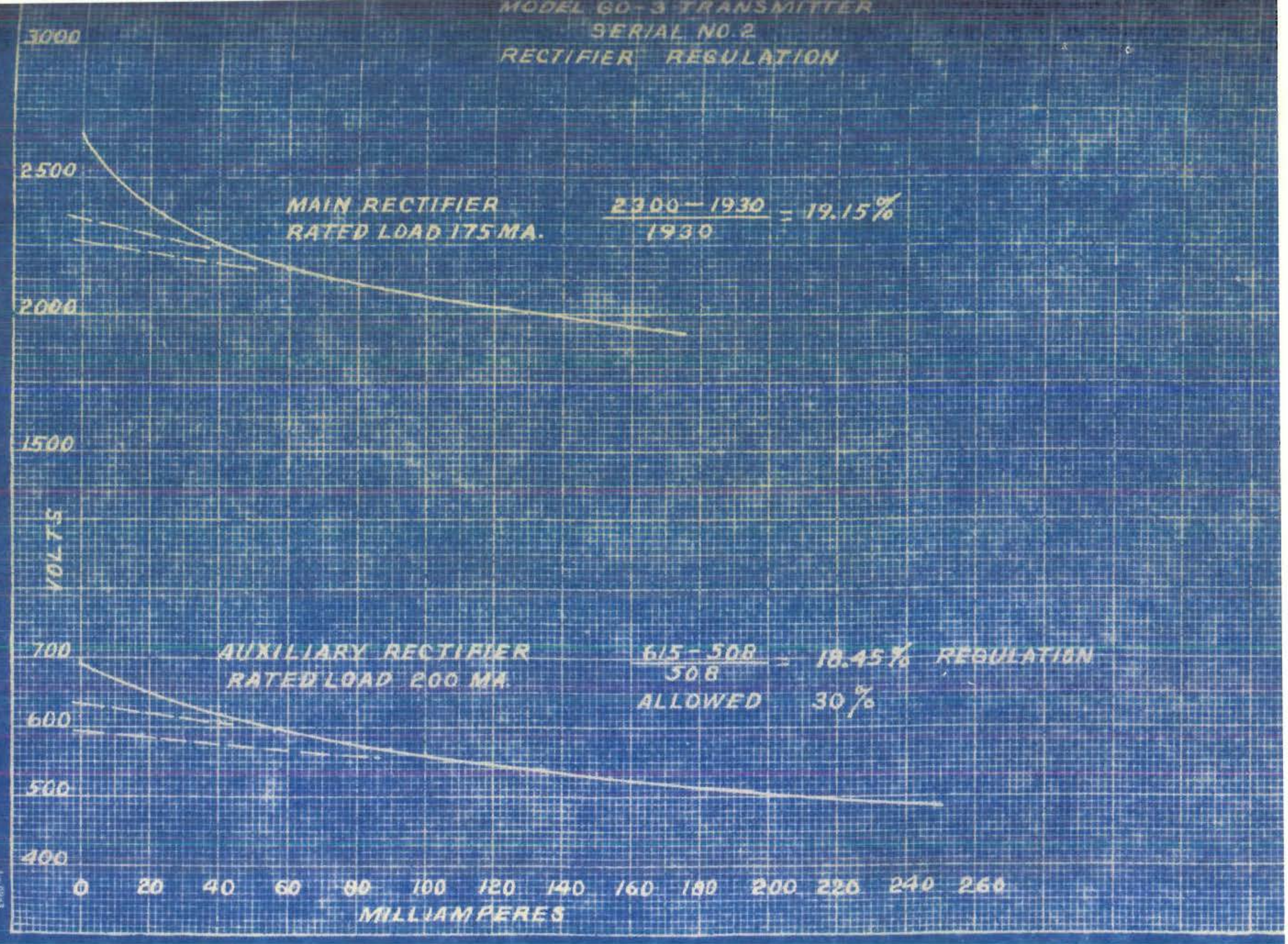
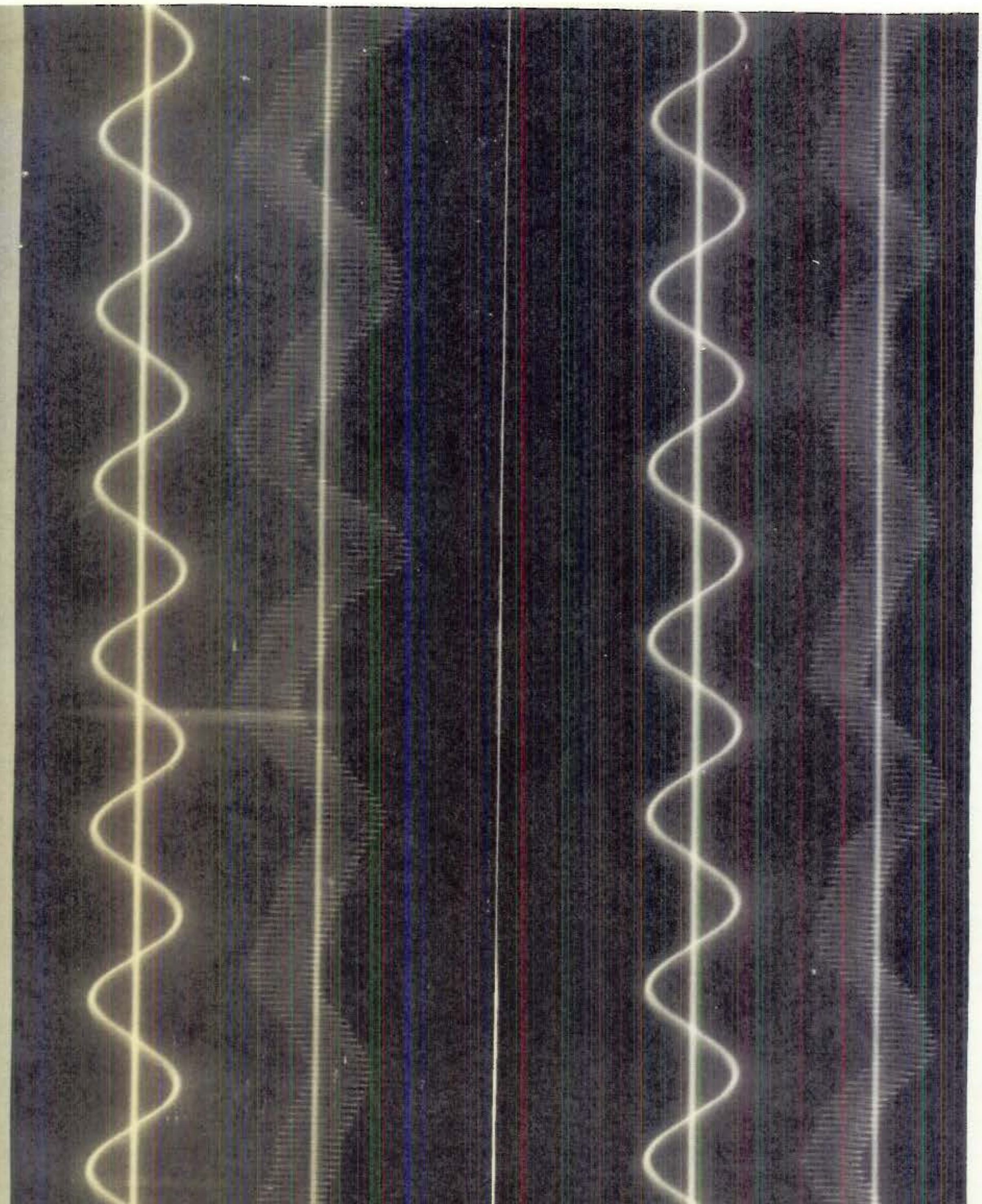
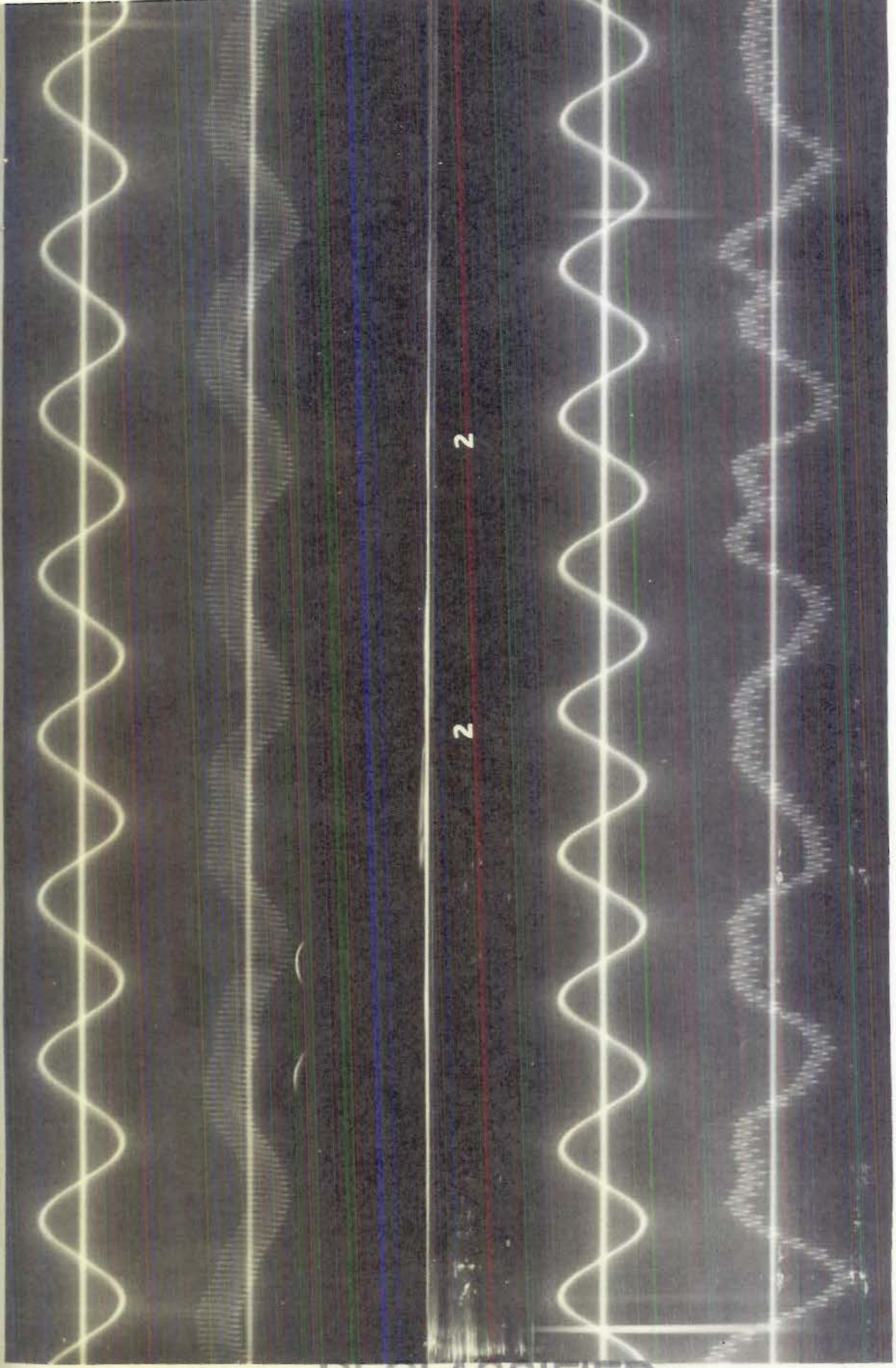

MODEL GO-3 TRANSMITTER
SERIAL NO. 2
RECTIFIER REGULATION
MAIN RECTIFIER
RATED LOAD 175 MA.
2300 − 1930 / 1930 = 19.15%
AUXILIARY RECTIFIER
RATED LOAD 200 MA.
615 − 508 / 508 = 18.45% REGULATION
ALLOWED 30%
VOLTS
3000
2500
2000
1500
700
600
500
400
0 20 40 60 80 100 120 140 160 180 200 220 240 260
MILLIAMPERES
SHEET

PLATE 23

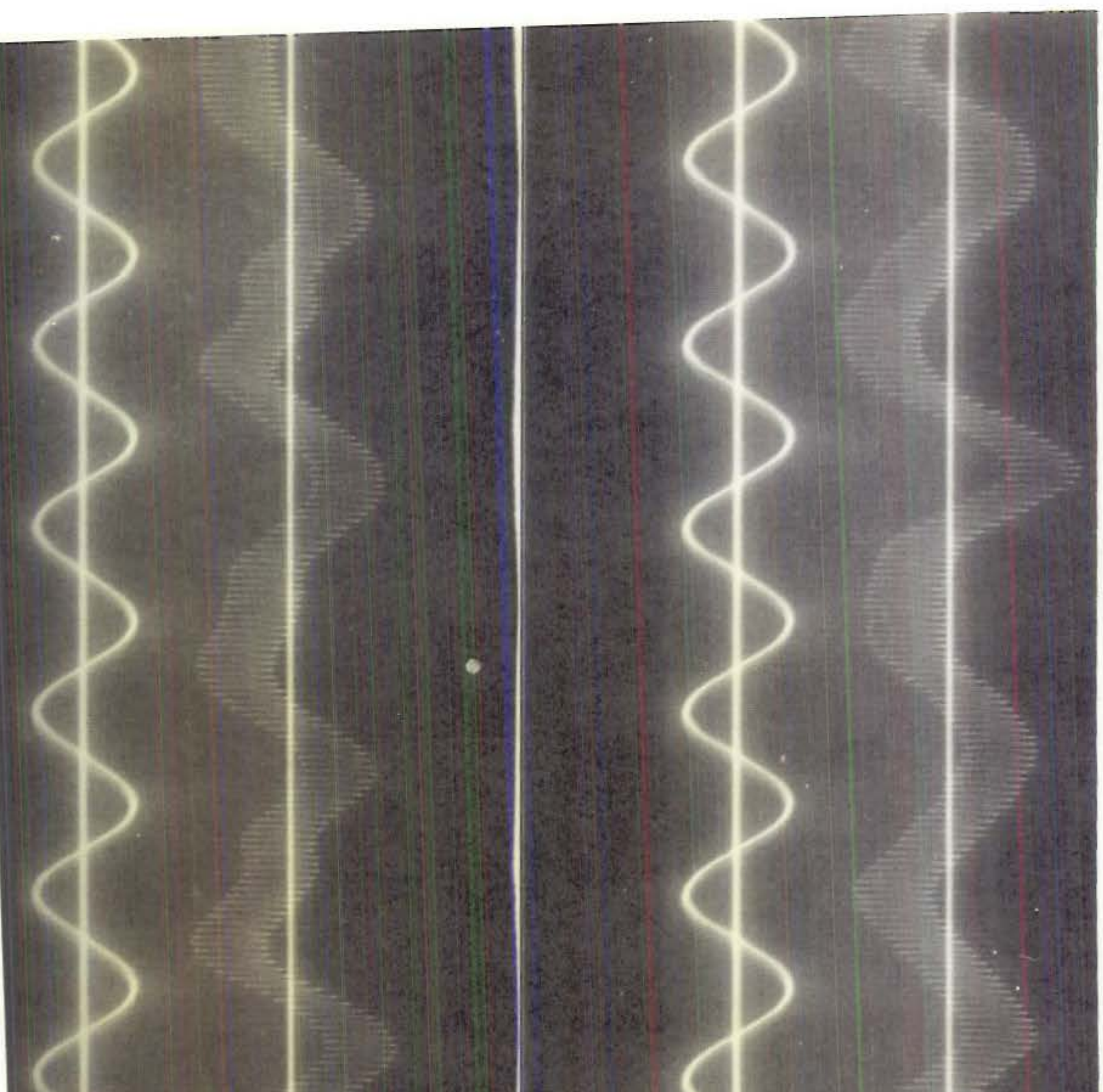


1a 1b

Plate 24



1c 2a



2b DECLASSIFIED 2c

Plate 26

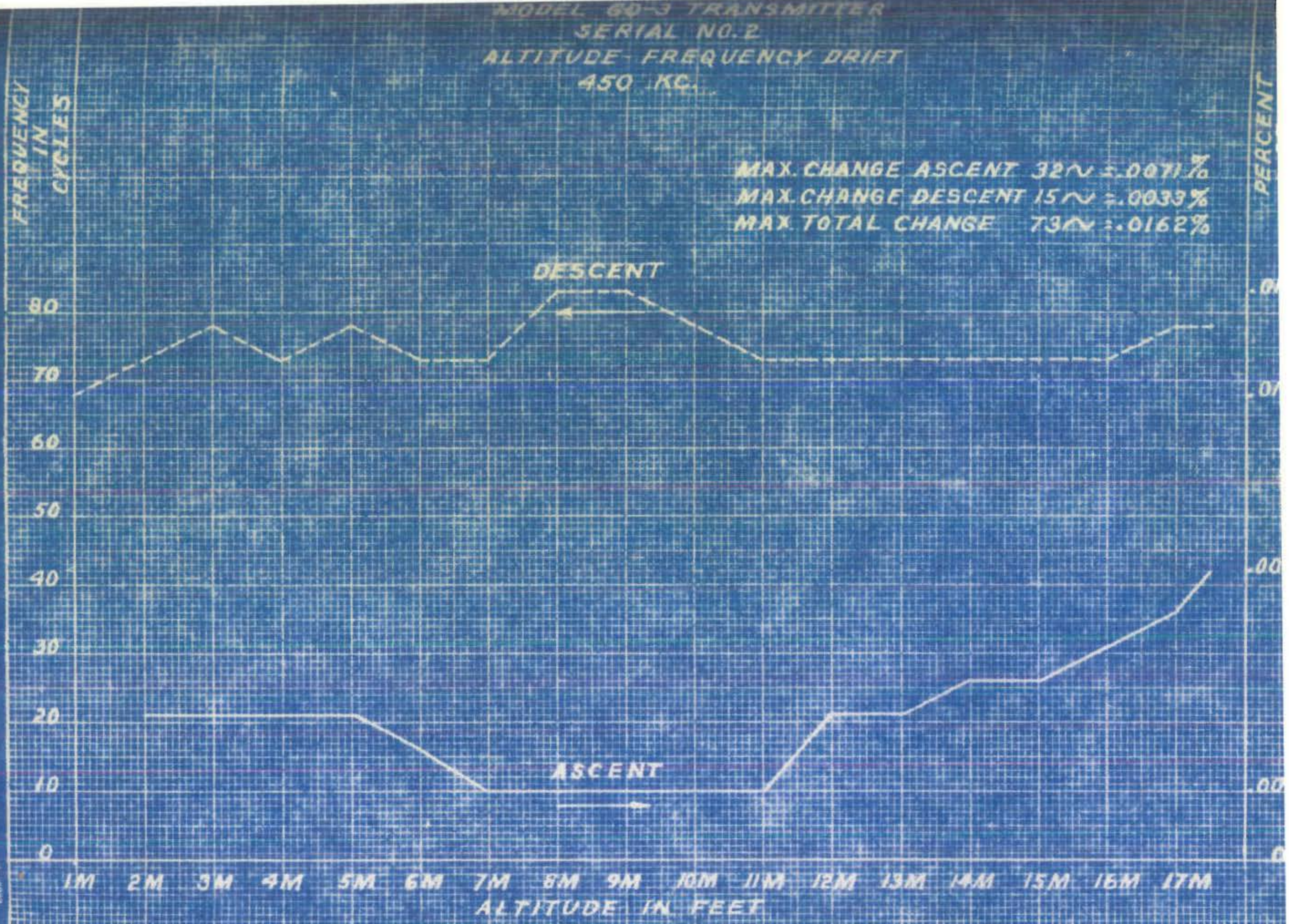

MODEL 60-3 TRANSMITTER
SERIAL NO. 2
ALTITUDE FREQUENCY DRIFT
450 KC.
FREQUENCY IN CYCLES
PERCENT
MAX. CHANGE ASCENT 32~ ±.0071%
MAX. CHANGE DESCENT 15~ ±.0033%
MAX. TOTAL CHANGE 73~ ±.0162%
DESCENT
ASCENT
80
70
60
50
40
30
20
10
0
1M 2M 3M 4M 5M 6M 7M 8M 9M 10M 11M 12M 13M 14M 15M 16M 17M
ALTITUDE IN FEET
SHEET

PLATE 27

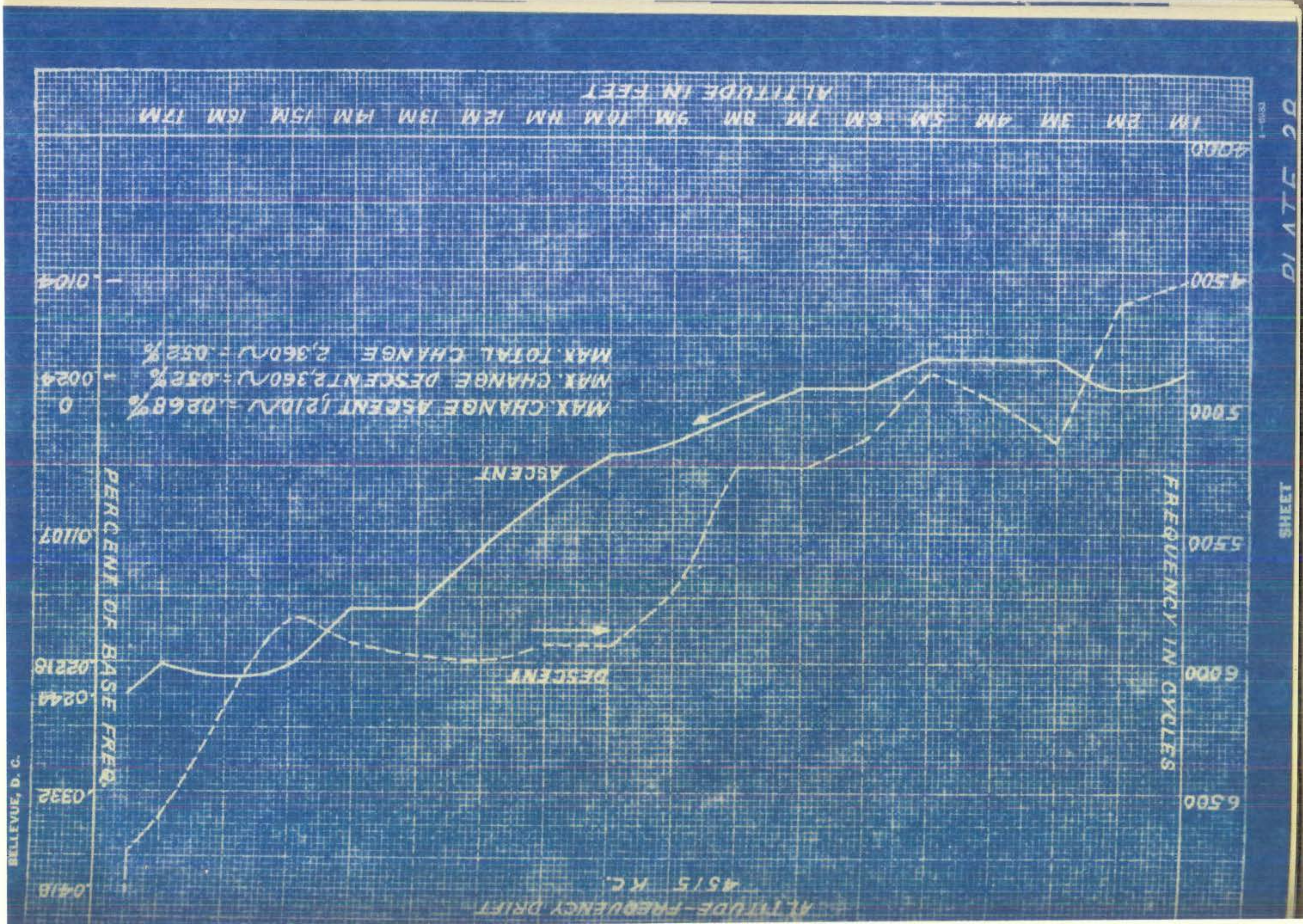

ALTITUDE-FREQUENCY DRIFT
4515 KC.
PERCENT OF BASE FREQ.
.0418
.0332
.0244
.02218
.01107
0
.0024
.0104
FREQUENCY IN CYCLES
6.500
6000
5500
5000
4500
4000
DESCENT
ASCENT
MAX. CHANGE ASCENT 1210∿ = .0268%
MAX. CHANGE DESCENT 2,360∿ = .052%
MAX. TOTAL CHANGE 2,360∿ = .052%
1M 2M 3M 4M 5M 6M 7M 8M 9M 10M 11M 12M 13M 14M 15M 16M 17M
ALTITUDE IN FEET
BELLEVUE, D. C.
SHEET

PLATE 28

C O P Y

U. S. NAVAL AIR STATION
[redacted] ANACOSTIA, D. C. GBHH/adl

F42-1/52 NA6 (339) February 4, 1938

Ser. No. 38007

From: Commanding Officer.
To: The Director, Naval Research Laboratory,
Bellevue, D. C.

SUBJECT: Aircraft Radio - Preliminary Model XGO-3 Transmitting Equipment - Report on Tests of.

Reference: (a) NRL ltr.F42-1/52 of 29 June 1937 to CO, NAS Anacostia.
(b) BuEng. Specification RE 13A-472D.
(c) BuEng.ltr. C NOs-52339 (1-22-W3) of 27 Jan. 1937 to I.N.M. Hartford, Conn. with Enclosure (A).
(d) BuEng.ltr. C NOs-52339 (5-7-W8) of 10 May 1937 to N.R.L., copy to NAS Anacostia.
(e) BuEng.ltr. C NOs-52339 (6-30-W3-26) of 10 July 1937 to NAS Anacostia, with Enclosures (A), (B), and (C).
(f) BuEng.ltr. C NOs-52339 (8-31-W3) of 2 Sept. 1937 to NAS Anacostia, with Enclosure (A).
(g) BuEng. ltr. C NOs-52339 (8-26-W3) of 11 Sept. 1937 to I.N.M. Hartford, copy to NAS Anacostia, with Enclosure (A).
(h) BuEng.ltr. C NOs-52339 (10-8-W3) of 29 Oct. 1937 to I.N.M. Hartford, copy to NAS Anacostia, with Enclosure (A).

Enclosure: (A) Copy of reference (a).
(Herewith) (B) Copy of circuit diagram in final form.
(C) Keying Oscillogram 42B4 and 53C3.
(D) Keying Oscillogram 44A1 and 50A3.
(E) Photograph AN-51147; Front View Model XGO-3 Radio Transmitting Equipment.
(F) Photograph AN-51148; Rear View Model XGO-3 with all shields removed.
(G) Photograph AN-51149; Bottom View XGO-3 showing redesigned bottom shock mounts.
(H) Photograph AN-51150; Redesigned top and bottom shock mounts with top mounting bracket.

1. This letter reports upon the tests performed at this station in conformity with reference (a) and reference (b), upon the preliminary model XGO-3 transmitting equipment submitted to the Navy for test by the Westinghouse Electric and Manufacturing Company.

2. <u>History of Tests:</u>

The XGO-3 transmitting equipment was received from the Naval Research Laboratory on June 22, 1937. The tests extended from the above date until November 8, 1937, when the model was returned to the Naval Research Laboratory. During this time a comprehensive series of tests was completed which covered the operation of the equipment in flight, and, in addition, a number of bench tests were made to supplement the flight data. The progress and results of those tests have been brought to the attention of the Bureau of Aeronautics and the Bureau of Engineering by verbal conferences, and a complete, detailed report covering those conferences can be found by consulting references (g) and (h) as given above. The final Bureau of Engineering conference was held on October 26 and 27, 1937, and the summary of the discussion is given in reference (h). The companion XGO-3 model which had been tested at the Naval Research Laboratory was brought up to date at Anacostia so that all changes made during tests would appear in both models and the Naval Research Laboratory model was returned to the contractor on November 4, 1937.

3. <u>Flight Time:</u>

The XGO-3 was tested on forty flights, totalling sixty-nine hours of flying time.

4. <u>Description of Equipment:</u>

The subject equipment is designed for CW and MCW radio telegraph transmission from patrol type airplanes with the nominal output of 125 watts; it incorporates a central rectifier unit with an intermediate frequency transmitter (300-600 kc) and a high frequency transmitter (3000-13575 kc) attached to the sides. Each transmitter is built on the principle of the master oscillator, intermediate amplifier, power amplifier type of circuit with individual master oscillators, individual intermediate amplifiers and a common power output tube which is located in the rectifier unit. The power supply for the power amplifier is derived from a full wave rectifier made of two 38266A tubes, while the power supply for the other tubes is derived from a 38593 rectifier. The master oscillator of the intermediate frequency transmitter operates on the same frequency as the final output but in the high frequency unit the principle of doubling and tripling frequencies is used to secure the necessary range without operating the master oscillator above 6000 kc. The frequency of each transmitter is continuously variable over the indicated range, but the intermediate and high frequency units cannot be operated concurrently. Provision is made for "break-in" keying up to forty words per minute on both the H.F. and I.F. transmitters.

5. <u>Test Installation:</u>

In the absence of an actual patrol type airplane, the subject equipment was tested in the XRE-2 Bellanca cabin type radio test airplane. The flight test installation further comprised the following auxiliary equipment:

[redacted]

NEA-2 generator
LM crystal frequency indicator
Two RU-4 receivers
Antenna reel, antenna wire, flame-proof telegraph key with cable & plug, patrol boat type of fair-lead and wire counter.

6. Test Objects:

Examinations and tests were performed on the subject equipment to determine the following characteristics:

(a) Weight and dimensions
(b) Tube line-up
(c) Keying action
(d) Time delay operation
(e) Accessibility
(f) Installation facility
(g) Operability
(h) Operating with frequency meter
(i) Suitability of the antenna loading system
(j) Altitude frequency drift
(k) Altitude breakdown test
(l) Resetability
(m) Voltage compensation
(n) Harmonic radiation
(o) Mechanical ruggedness

7. Weight of Equipment after modification at Anacostia:

Weight of transmitter, complete with tubes, slip covers, top and bottom shock mounts	135 lbs. 8 oz.
H.F. Unit	41 lbs.10 oz.
Rectifier Unit	44 lbs. 7 oz.
I.F. Unit	40 lbs. 4 oz.
Shock Mounts (Revised)	6 lbs.11 oz.
Slip Covers	2 lbs. 8 oz.
Total	135 lbs. 8 oz.

8. Dimensions:

Dimensions of individual units exclusive of all projections:

H.F. Unit

Height	25 3/4"
Width	9 5/8"
Depth	13 1/4"

I.F. Unit same as H.F. Unit.

Rectifier Unit

Height	25 3/4"
Width	8 1/2"
Depth	13 1/4"

Overall dimensions of complete installation including projections, shock mounts, and power plug:

[redacted]

Height	30 1/2"
Width	28 1/2"
Depth	17 3/4"

The 17 3/4" depth dimension includes 3" allowance necessary to remove power plug at the back of the set. The revised shock mount uses 2" of this 3" additional space.

9. Tube Lineup:

I.F. Master Oscillator	1 38101
I.F. Intermediate Amplifier	1 38837
H.F. Master Oscillator	1 38101
H.F. Intermediate Amplifier	1 38837
I.F. & H.F. Power Amplifier	1 38803
Main Power Supply	2 38266A
Auxiliary Rectifier Supply	1 38593
Total	8

10. Keying Action:

Break-in operation of the model XGO-3 and general characteristics of the key relay action are shown by Enclosures (C) and (D). The break-in feature of the H.F. unit (see keying oscillogram 53C3 of Enclosure (C)) was suitable for naval service, but the I.F. unit (oscillogram 42B4 of Enclosure (C)) did not perform as satisfactorily. The source of the trouble lies in the action of the contact which transfers the receiver from antenna to ground. This unsatisfactory operation of the I.F. antenna receiver contact is shown by oscillogram 44A1 of Enclosure (D). More suitable operation of the antenna receiver contacts is shown in oscillogram 50A3 of Enclosure (D). Here the I.F. antenna receiver contact is limited to one bounce and the H.F. antenna receiver contact is limited to two bounces. The additional fuzz on the two bounces of the H.F. antenna receiver contact apparently caused no additional interference. Operation comparable to that of the H.F. unit will be satisfactory for naval service, but in view of the fact that the power consumption of the relay is limited by the specifications the proper adjustment of the relay will always tend to be critical.

11. Time Delay System:

The time delay system incorporated in the XGO-3 has been found inadequate in the tests made at this station. An additional feature is deemed necessary whereby the transmitter shuts down automatically when the a.c. voltage drops below a specified value. The present system offers no protection whatsoever in case the operator fails to throw the master switch to the "off" position when the supply voltage is removed.

12. Accessibility:

Mechanical and electrical design of model XGO-3 was such that all components were generally accessible.

13. Installation Facility:

The equipment met service requirements after the shock mounts had been redesigned at Anacostia.

[redacted] DECLASSIFIED

14. <u>Operability</u>:

The set in its final form operated in a straightforward and satisfactory manner. Numerous changes in the circuit were made at Anacostia which contributed to the performance of the equipment but did not change the fundamental circuit as submitted by the contractor. Chief among these circuit changes were the reconnecting of the antenna ammeter in the high potential side of the antenna circuit and reversing the connections in the H.F. antenna coupling coil.

15. <u>Operating with Frequency Meter</u>:

A crystal frequency meter coupling circuit and suitable terminal was added to each transmitter and thereafter operation was satisfactory with one exception. When setting up 13000 kc with model LM-2 frequency indicator, the master oscillator of the XGO-3 would oscillate on one-third the output frequency or 4333 kc and the model LM-2 adjusted to 13000 kc would oscillate on one-quarter frequency or 3250 kc. Consequently, no strong beat note could be heard until the XGO-3 amplifiers were brought in tune. The objection is not serious and the difficulty was eliminated by adding the master oscillator frequency as well as the output frequency to the calibration chart on the H.F. unit.

16. <u>Antenna Coupling Circuits</u>:

Resonating of the antenna on the I.F. unit is accomplished by an inductance system composed of five distinct inductances. Beginning at the antenna terminal the first of these is a fixed coil of 740 microhenries which is required for tuning to low capacity antennas. It has no control on the front panel but an additional antenna post is provided with suitable connecting lead so that fixed coil can readily be connected in circuit. Next is a tapped inductor (control H) whose value at its three settings is 0, 218 microhenries and 518 microhenries. The antenna lead then goes through the keying relay to a 300 microhenry variometer which is continuously variable by means of a six point tap switch (Control F) and the antenna tuning control (Control G). The final component of the antenna coupling circuit is a 60 microhenries coupling variometer (Control J) and the lead from the low potential side of this variometer goes to ground through the antenna ammeter. The design of suitable antenna coupling circuits which provide good operation from 300 to 600 kc and still are rugged enough to withstand the voltages developed when working at full power into a low capacity antenna at high altitudes, presents one of the most difficult problems encountered in building equipment of the XGO-3 type, but the electrical and mechanical design of the present equipment has provided generally satisfactory service throughout the tests made at this station. More suitable overlap is desired and this can be secured by changing the value of inductance of (H) from 0-218-518 microhenries to 0-275-550 microhenries. The H.F. coupling circuit provides more suitable operation than the coupling circuits used in previous similar equipments. Some difficulty was encountered in not securing zero coupling at zero setting of the coupling control, but reconnecting the coupling variometer improved this condition.

[redacted]

17. Altitude - Frequency Tests:

Altitude tests were made in cooperation with the Naval Research Laboratory. Frequency measurements were made at the Laboratory and the data appears in their report.

18. Altitude - Breakdown Test:

Very little trouble due to breakdown at high altitudes was encountered during the entire tests made at this station. One revision of the upper left-hand shock mount was necessary to eliminate flashover from the fixed antenna post on I.F. unit. The general performance at altitude was satisfactory, even when misadjusted or operated with a 25 foot antenna on intermediate frequencies with the resultant development of abnormally high voltages. During tests, voltages were developed on the antenna which necessitated the development of a new patrol plane type fairlead.

19. Resetability:

Flight tests were made to determine frequency resetability in cooperation with the Naval Research Laboratory where all frequency measurements were made.

20. Voltage Compensation:

Satisfactory compensation was obtained on NEA-1A and NEA-2 generators over the range of 600 to 800 cycle power supply frequencies and on the NEB-1 at 800 cycles. MCW compensation was usable but not satisfactory and could not be improved either by representative of the Navy or the contractor. Further work on this point is recommended.

21. Harmonic Radiation:

Test made on 352 kc full power showed the second harmonic to be 73 db below the fundamental and the radio test output to be 49 db below the full power output. On 4080 kc the second harmonic was 76 db below the fundamental and the radio test output was 43 db below the full power output.

22. Mechanical Ruggedness:

The mechanical design of the model XGO-3 transmitting equipment as submitted to this station for test was not sufficiently rugged for naval aircraft service. Numerous changes were made at this station and others were required in the production equipments. A list of changes incorporated in the two models during test at Anacostia appears in the next paragraph and a complete discussion covering the mechanical and also electrical deficiencies of the XGO-3 can be found in Enclosure (A) of reference (f), and Enclosure (A) of reference (h). With the indicated modifications incorporated in production equipments the GO-3 is considered suitable for naval service.

23. Changes made on Model XGO-3 at Anacostia:

(1) Lowered side tone series R from 50 to 20 ohms.
(2) Lowered side tone potentiometer from 1000 to 25 ohms.
(3) Added CW filter condenser discharge resistor.
(4) Added ground terminal to bottom of each unit.
(5) Added CFI coupling circuit and terminal to each transmitter unit.
(6) Added by-pass capacitor to I.F. and H.F. intermediate amplifier grid leak choke.
(7) Replaced I.F. M.O. grid leak by-pass paper capacitor with mica unit and grounded direct instead of through relay contact.
(8) Disconnected H.F. and I.F. intermediate amplifier grid leak circuits from ground and tied to M.O. quenching lead to relay.
(9) Reversed coupling connections in H.F. antenna coupling roller coil.
(10) Moved H.F. antenna ammeter from ground to antenna side, and insulated same.
(11) Added static shield between H.F. P.A. plate lead and antenna circuit condenser.
(12) Replaced several bus wires by stiffer, more direct wires.
(13) Altered shock mount, changing to double Lord unit suspension.
(14) Altered mounting slots in top shock mounts.
(15) Replaced H.F. P.A. tank roller and shaft.
(16) Added insulating separators behind H.F. antenna condensor frame.
(17) Replaced all choke and pigtail resistor mounting panels by improved rigid mounting brackets.
(18) Replaced unsuitable Volvet vernier spacers.
(19) Replaced chopped off screws on inner shields.
(20) Replaced H.F. antenna tuning dial and crank assembly by improved type.
(21) Added designation marker tags to panel controls.
(22) Replaced time delay switch after failure.
(23) Staked all interlock safety switches.
(24) Replaced loosened connecting lug behind 12 v. fuse.
(25) Freed and reamed out frozen H.F. antenna tuning dial lock.
(26) Freed and overhauled frozen H.F. P.A. tuning bearing.
(27) Freed and reamed out frozen H.F. P.A. roller.
(28) Freed and reamed out frozen H.F. antenna tuning roller.
(29) Replaced broken H.F. P.A. tuning knob.
(30) Re-wired bus for greater clearance to P.A. tube.
(31) Repaired several defective flexible insulated couplings.
(32) Tightened several loose coupling joints.
(33) Tightened H.F. antenna tuning roller coil.
(34) Replaced two sets of mycalex 3/16" terminal strips with more rugged 1/4" strips, with improved bolted instead of riveted contacts.
(35) Replaced broken Isolantite H.F.-I.F. switch.
(36) Overhauled and freed binding I.F.-H.F. switch assembly.
(37) Tightened up on loose H.F. P.A. condenser plates.
(38) Repaired faulty crank handle springs.

(39) Tightened loose H.F. antenna coupling driving gear on shaft.
(40) Repaired damaged strap slide on shield.
(41) Fixed misaligned interlock switches on I.F. unit.
(42) Readjusted keying relay to reduce contact bounce.
(43) Placed lower H.F.-I.F. switch wire connection under binding head screw.
(44) Replaced I.F. M.O. circuit flat head grounding screw by binding head screw and cleaned off paint for head.
(45) Filed slots in upper mounting brackets.
(46) Made re-tracking spacer for H.F. P.A. roller.
(47) Replaced lost snap slide button.
(48) Changed H.F. interlock location.
(49) Deepened vertical flange and added second slot to mounting slides on transmitter units.
(50) Changed axis of upper shock mounting buttons from vertical to horizontal for better cushioning effect.

24. It is requested that two copies of the Naval Research Laboratory's report be furnished this station for information and future reference.

/s/ V. C. Griffin

Copy to:
BuAero (2)
BuEng
N.A.F. Phila.

[redacted]

C O P Y

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D. C.

F42-1/52

29 June 1937

From: Director.
To: Commanding Officer, Naval Air Station, Anacostia, D. C.

Subject: Aircraft - Test of Model GO-3 Transmitting Equipment. (Bu.Eng. Problem A5-12)

Reference: (a) Bu.Eng. Ltr. C-NOs-52339 (5-7-W8) of 10 May 1937.
(b) Bu.Eng. Ltr. F42-1(11-8-W3) of 17 Nov.1934.
(c) Bu.Eng. Specification RE 13A 472D dated 15 August 1936.
(d) Contractors descriptive specifications dated October 1936.

1. It is requested that flight tests be conducted on the Model GO-3 transmitting equipment in accordance with reference (b).

2. In conference with personnel of the Naval Air Station, the flight tests were discussed and data will be taken on the following tests.

(a) Character and intensity (if any) of interference in radio receiver due to transmitter noises on both I.F. and H.F. units. Determine if break-in operation can be accomplished satisfactorily.

(b) Keying action. Determine if keying relay functions properly. This test shall include oscillographic records.

(c) Determine if unsatisfactory modulation effects occur due to plane vibration on any frequency.

(d) Check resetability in accordance with instructions during flight. Note time of resetting including changing of antenna length.

[redacted]

(e) During altitude tests note whether there is arcing or shorting across the high voltage terminals. Also if there is any other failure or break down of the equipment. A drift run will be made on the altitude test on 450 kcs and 9000 kcs. The drift on each of these frequencies to be made on both ascent and descent. The transmitter will be shut off at the maximum altitude and allowed to cool for ten minutes before starting the descent. This Laboratory will cooperate with the Air Station on the reset and drift tests of para. (d) and (e).

(f) Any other difficulties encountered with the equipment and general comment on the operation of the transmitter will be included in the report.

(g) The Model GO-3 transmitting equipment was delivered to the Naval Air Station, Anacostia, D.C., on 22 June 1937.

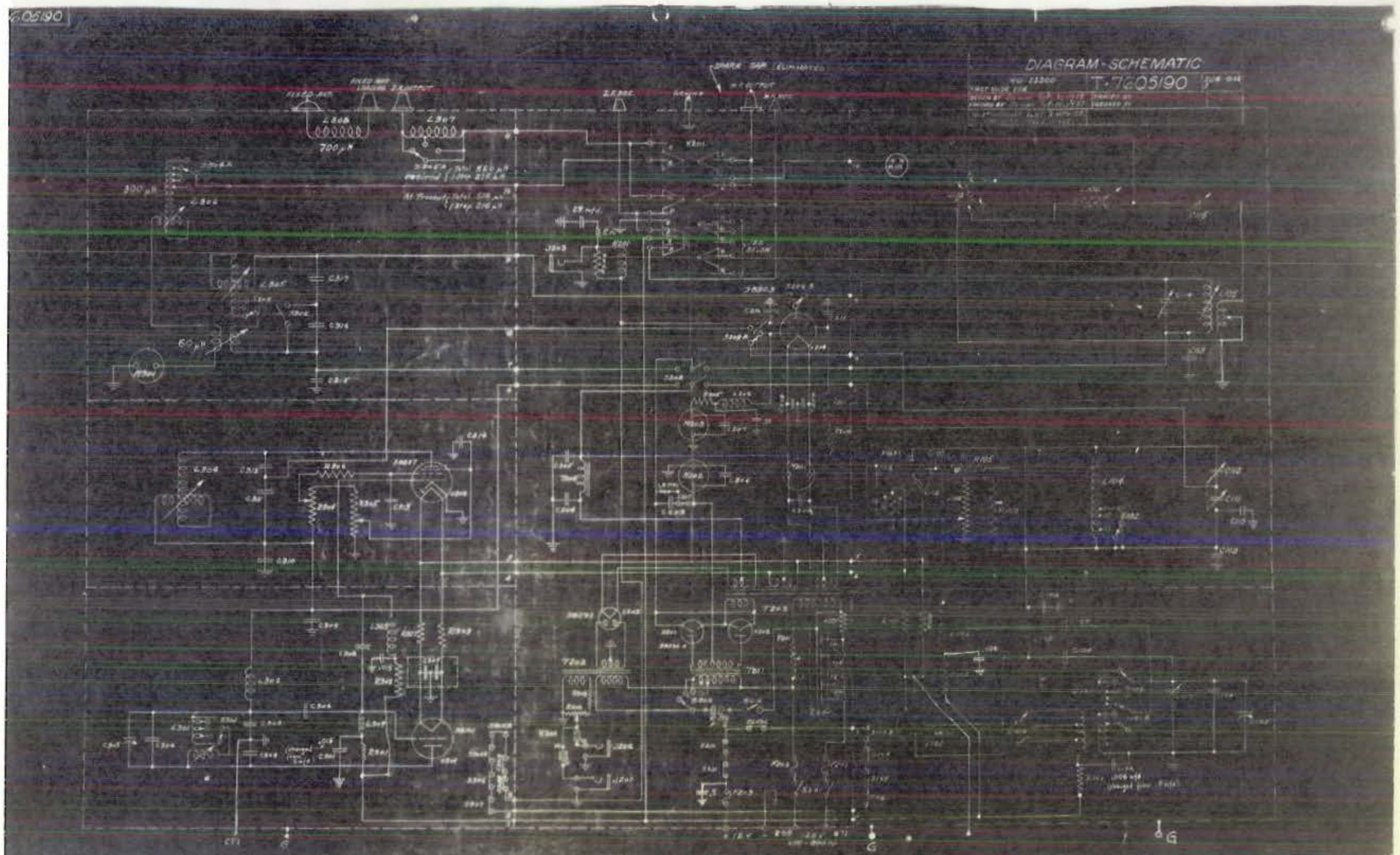
/s/ H. M. Cooley

Copy to: BuEng

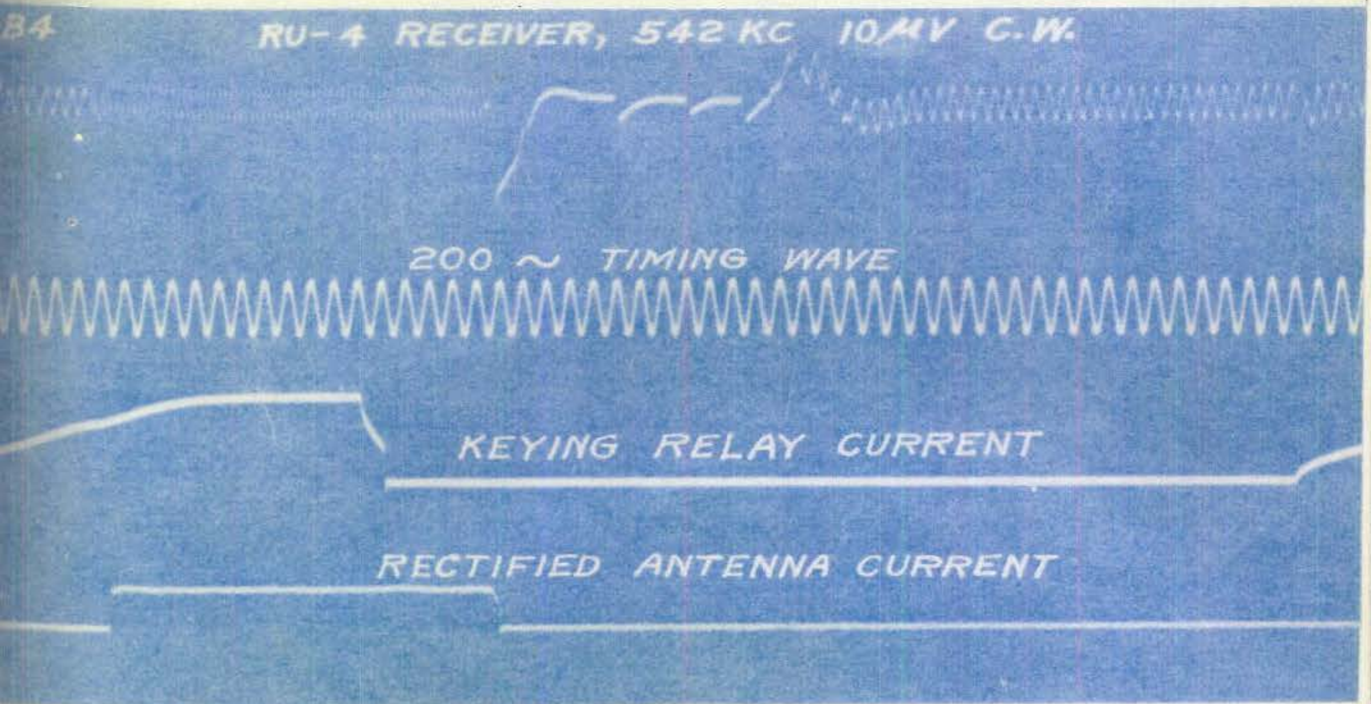
[redacted]

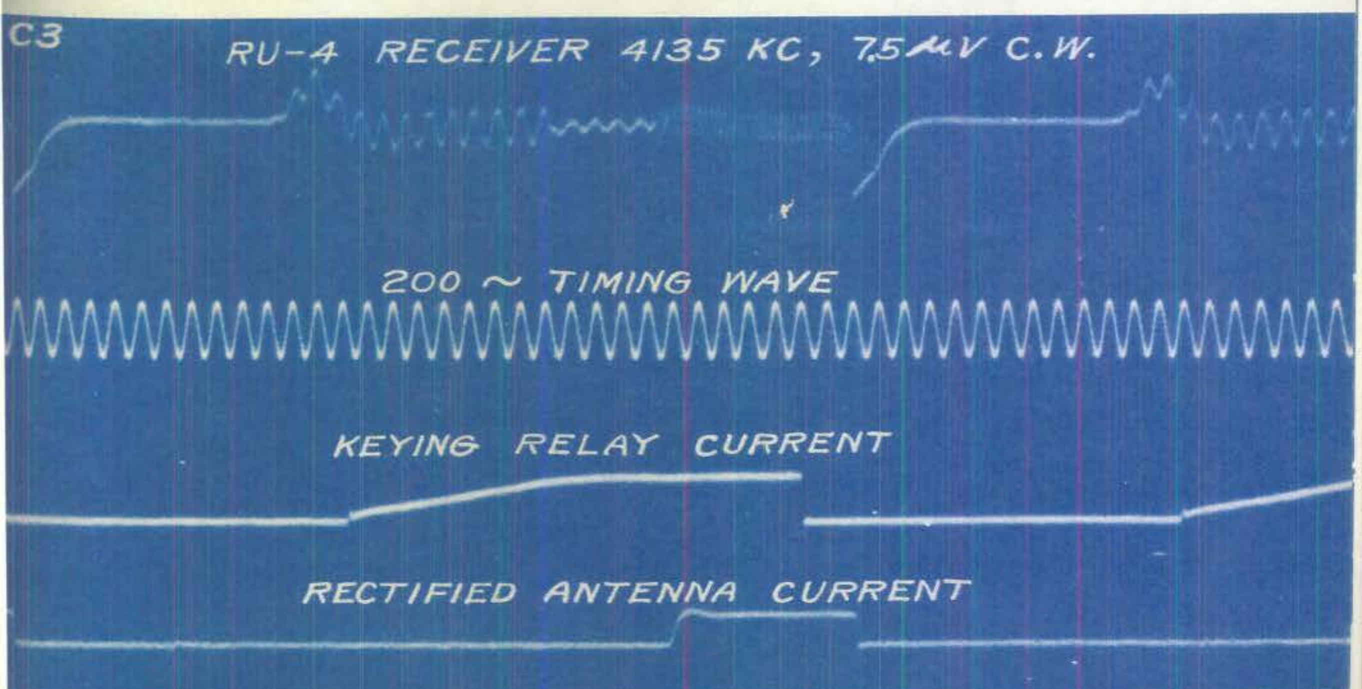
NRL Report No. R-1434
Improvements in the Measurement of the Direct

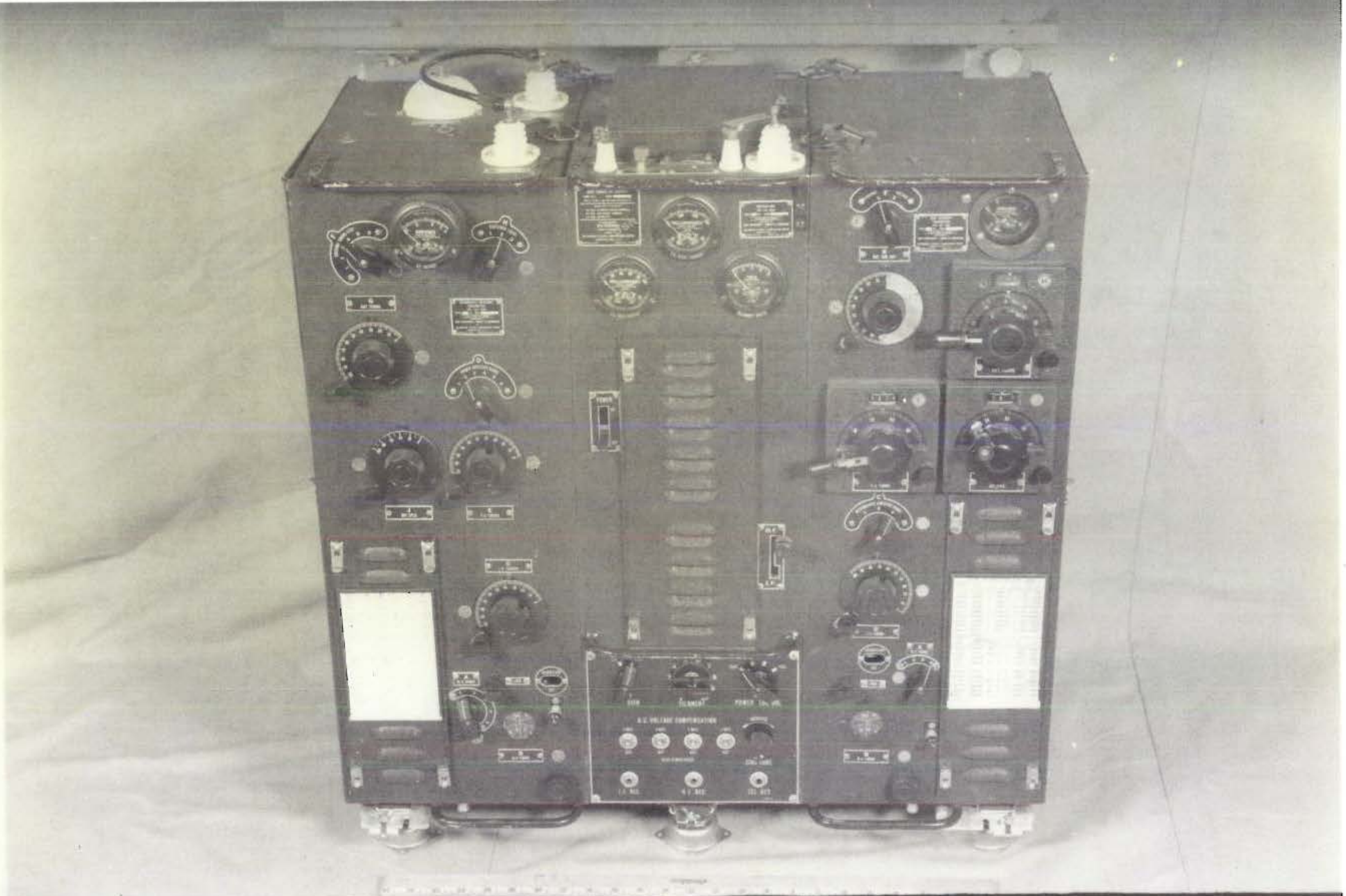
FR-1433
All Plates



ENCLOSURE (B)

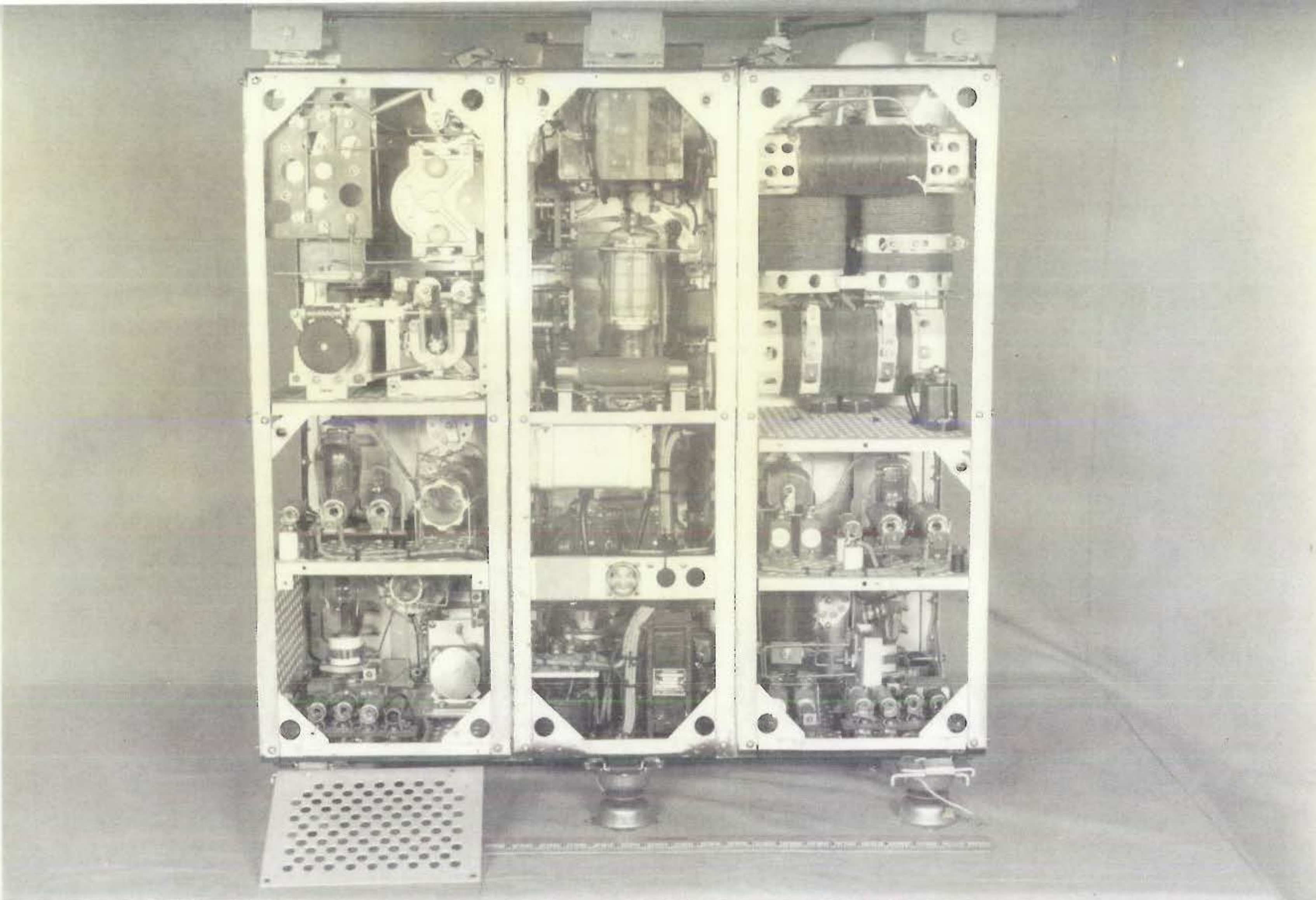

B4
RU-4 RECEIVER, 542 KC 10 µV C.W.
200 ~ TIMING WAVE
KEYING RELAY CURRENT
RECTIFIED ANTENNA CURRENT


C3
RU-4 RECEIVER 4135 KC, 7.5 µV C.W.
200 ~ TIMING WAVE
KEYING RELAY CURRENT
RECTIFIED ANTENNA CURRENT



Front View Model XGO-3 Radio Transmitting Equipment. AN-51147 1-27-38

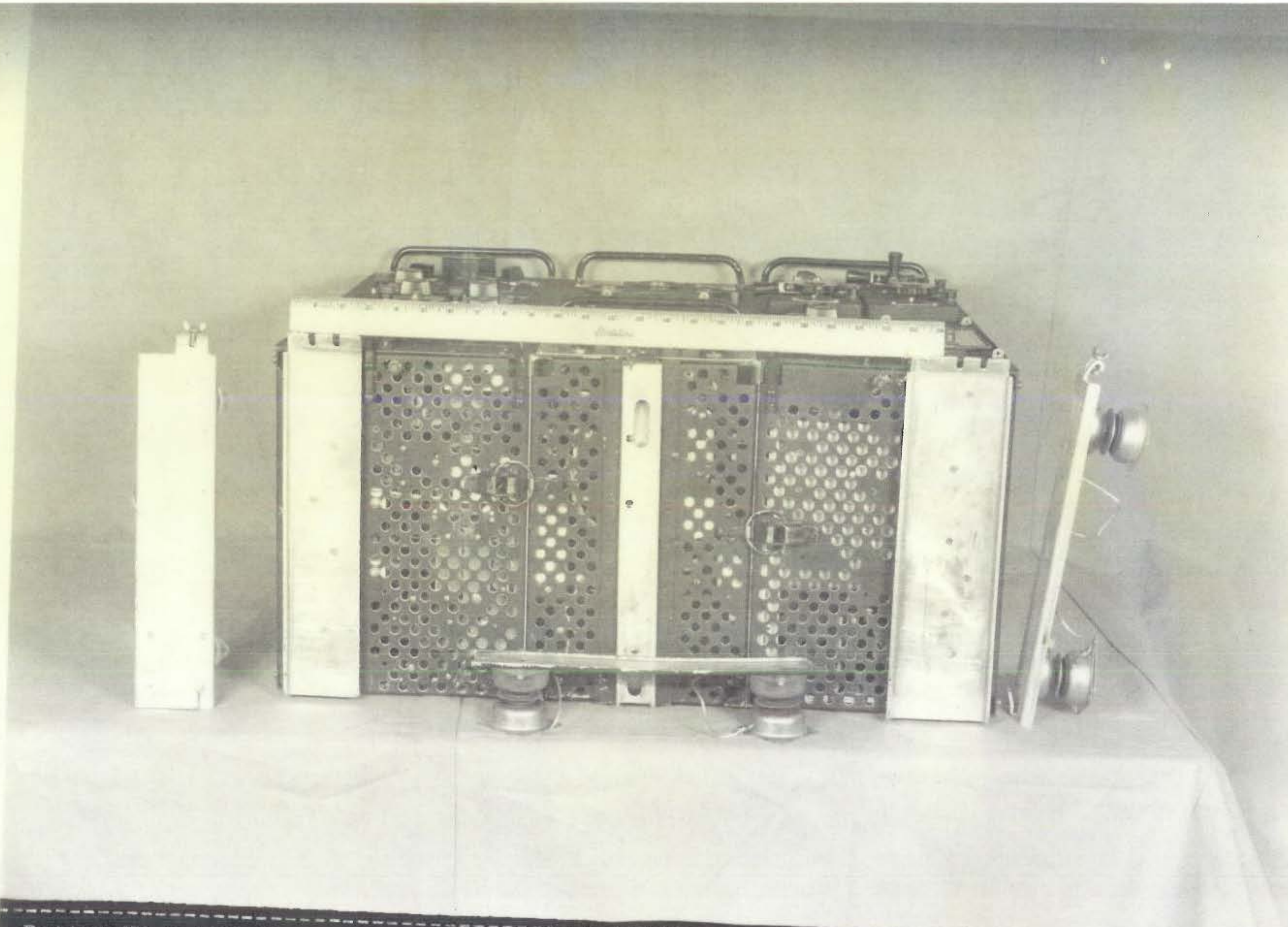
OFFICIAL NAVY PHOTOGRAPH
NOT TO BE USED FOR PUBLICATION
ENCLOSURE (E)



Rear View Model XGO-3 with all shields removed. AN-51148 1-27-38

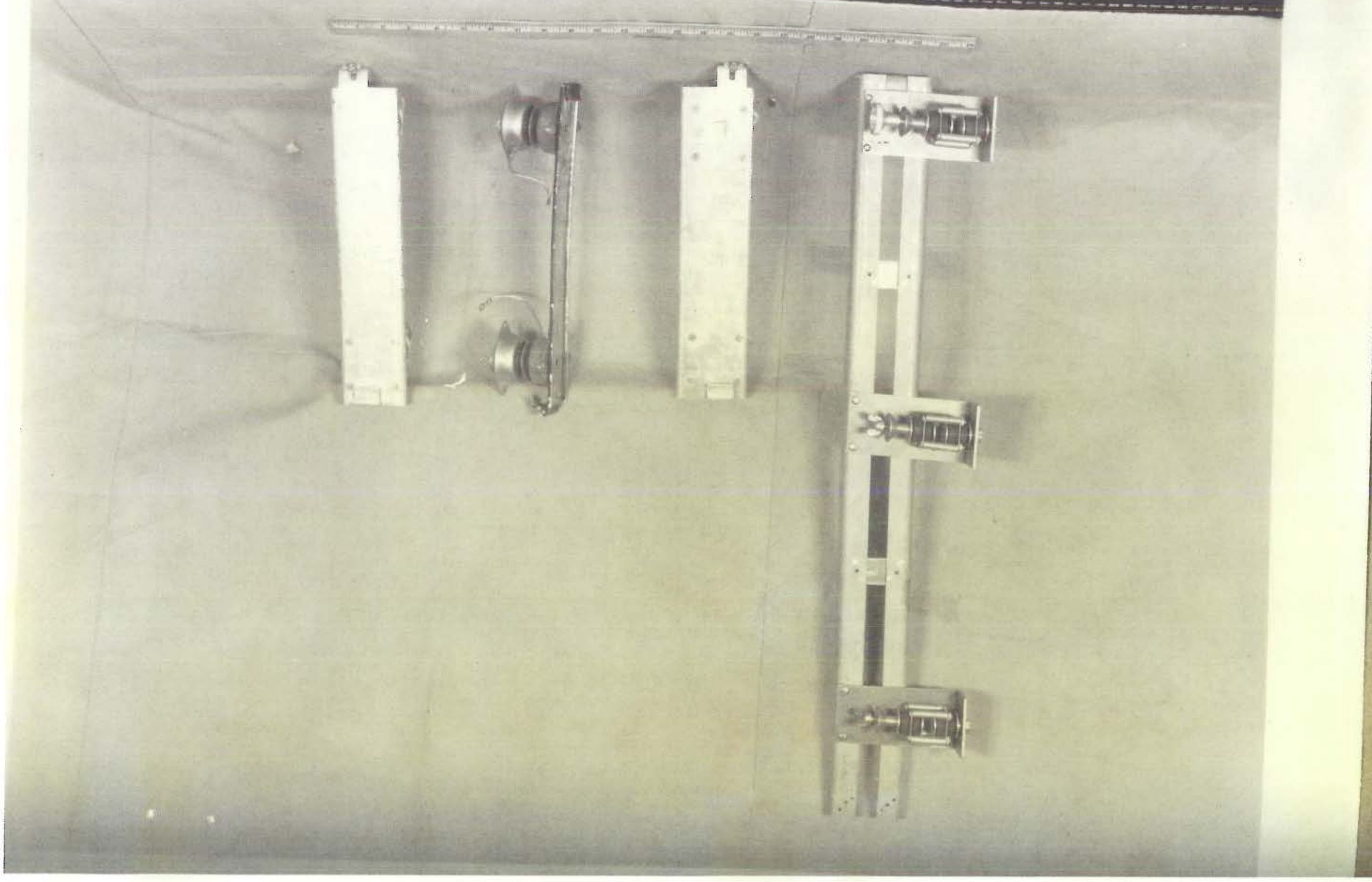
OFFICIAL NAVY PHOTOGRAPH
NOT TO BE USED FOR PUBLICATION
ENCLOSURE (F)

NRL Report No. R-1434
Improvements in the Measurement of the Direct



Bottom View XGO-3 showing redesigned bottom shock mounts. AN-51149 1-27-38

OFFICIAL NAVY PHOTOGRAPH
NOT TO BE USED FOR PUBLICATION
ENCLOSURE (G)



edesigned top and bottom
hock mounts with top mounting bracket.
AN-51150 1-27-58
OFFICIAL NAVY PHOTOGRAPH
NOT TO BE USED FOR PUBLICATION
ENCLOSURE (H)