

10 May 1934

Report No. R-1051

NAVY DEPARTMENT
BUREAU OF ENGINEERING

Report on
Tests of Model TAZ-1 Transmitting Equipment,
Serial No. 3.

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D.C.

NUMBER OF PAGES - Text - 18 Tables - 42 Plates - 9

AUTHORIZATION - Bu.Eng. letter NOs-31455(3-12-W8) of
15 March 1934.

DATE OF TEST - February 15, 1934 to May 1, 1934.

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Distribution:
BuEng (5)

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ABSTRACT OF TESTS

During this testing it is desired to point out briefly the conditions under which the tests were conducted. The test equipment and certain electrical characteristics which do not comply with the governing specifications.

(a) Due partly to improper handling during shipment and to the fact that improper precautions were taken in preparing the transmitter for shipment, the T-12 equipment was received in a damaged condition.

(b) The "A.C. Muting" control was damaged.

(c) The metal buffers on the flexible windings of the A.C. equipment were broken.

(d) An excessive load between the polar modulator circuit and the last I.F. stage carried away.

(e) Loose windings carrying the supply leads into the A.C. equipment were broken.

AUTHORIZATION

1. The tests herein reported were authorized by the Bureau of Engineering in letter NOs-31455(3-12-W8) of 15 March 1934 to the Director, Naval Research Laboratory.

OBJECT OF TESTS

2. The object of the tests was to determine detailed compliance with the requirements of the applying contract specifications and the presence of desirable features over and above the specific requirements.

MATERIALS UNDER TEST

3. The materials under test consisted of one complete Model TAZ-1 Transmitting Equipment, Serial No. 3. The equipment was manufactured by the Hygrade Sylvania Company under Contract NOs-31455 and covers the frequency ranges of 300 to 600 KC and 2000 to 18,100 KC. The required output in both the Intermediate and High Frequency bands is 200 Watts. The equipment was received at the Naval Research Laboratory on February 9, 1934 and is destined for final installation on the USS DEWEY (DD349).

REFERENCES

4. (a) BuEng letter NOs-31455(3-12-W8) of 15 March 1934 to Dir. Nav. Res. Lab.
- (b) Specifications RE 13A 418C
- (c) Specifications RE 13A 442C
- (d) Hygrade Sylvania Co's Descriptive Specifications
- (e) Schedule 900-6542 (Engineering) and "Note" of Contract NOs-31455.

ABSTRACT OF TESTS

5. Under this heading it is desired to point out, briefly, the mechanical defects which were noted in the TAZ-1 equipment and certain electrical characteristics which do not comply with the governing specifications.

(a) Due partly to improper handling during shipment and to the fact that inadequate precautions were taken in preparing the transmitter for shipment, the TAZ-1 equipment was received in a damaged condition.

(b) The "M.O. Tuning" control was damaged.

(c) The metal buffers on the flexible mountings of the M.O. compartment were broken.

(d) The excitation lead between the outer anode tuned circuit and the 1st I.P. stage carried away.

(e) Bakelite bushings carrying the supply leads into the MO compartment were broken.

(f) About 50 odd metallic parts, such as washers, bolts, screws and nuts were found lying in the various compartments of the transmitter. Most of these parts, it was determined, did not belong in the transmitter.

(g) Although the M.O. compartment was designed to be secured by means of four bolts, only three bolts had been used. This inadequate support permitted the M.O. compartment to move about sufficiently to chafe the lead covered leads in the corners of the transmitter framework.

(h) Ten 38160 tubes were supplied with the transmitter. In attempting to place these tubes in the sockets the bayonet pins in the base of five of the tubes carried away. The pins in the base of the remaining tubes became loose.

(i) Due to the fact that the plate and grid leads of the 38160 tubes furnished by the Hygrade-Sylvania Company are longer than those supplied by other manufacturers, it was necessary to provide adaptors in the M.O. and 1st IPA stage in order to make the plate connections when using tubes supplied by other than the Hygrade-Sylvania Company.

(j) A voltage breakdown occurred in the Low Power Plate Rectifier Transformer. Simultaneously with this breakdown the following items were damaged:

The filament of a type 38166 rectifier tube in the LV Plate rectifier opened.

Condenser "C2", Audio Oscillator Plate By-pass, 0.5 Mfd., 2500 volts, Navy Type CCA-48282, short circuited.

Bias voltmeter, M7, 0-750 volts, became inoperative. It is exceedingly difficult to change tubes in the Master Oscillator when the compartment is at a temperature of 60° C.

Plate contactor relay does not function satisfactorily.

(k) With certain values of antenna constants the guaranteed output of 200 watts cannot be obtained in the Intermediate Frequency range. Guaranteed output cannot be obtained at 18,000 KC without overloading the P.A. tubes.

(l) The percentage change of frequency per division of master oscillator tuning exceeds the specification value of 0.05% in the Intermediate Frequency range.

(m) Variation of line voltage in 1% steps per minute exceeds the specification value of 0.0025% change in frequency.

(n) The figure of 0.005% change permitted for detuning of resonant circuits is exceeded.

(o) Control "C" gives variable contact which produces "jumps" and "flutters" in output frequency, particularly in 2000 KC band.

(p) Change of tubes in Master Oscillator causes average frequency change of 0.031% at 4500 KC. Specifications permit only 0.01%.

(q) Change of tubes in 1st I.P.A. stages causes average change in frequency of 0.0049% at 4500 KC. Specifications permit change of only 0.001%.

(r) Two hour locked key tests in accordance with paragraph 3-7-8 of Spec. RE 13A 442C produce frequency drifts of 0.01% to 0.02%. Specifications permit only 0.0025%.

(s) The "emergency" control switches on Transmitter and Rectifier should be marked in a more distinctive manner.

(t) The locking device on Control "E" is inoperative.

(u) The key is not accessible from the front panel.

(v) The temperature coefficient of the transmitter exceeds the figure permitted by specifications.

(w) The mercury thermostat controlling the coil oven temperature failed.

METHOD AND RESULTS OF TESTS

6. Upon the receipt of the Model TAZ-1 equipment, it was noted that the packing box containing the transmitter unit had been **damaged**. A section of the front panel of the packing case had been stove in damaging the master oscillator control of the transmitter. This blow caused damage to other parts of the equipment also. The connection stud which carried the excitation lead between the outer anode circuit and the grid of the 1st I.P.A. stage was broken. The bakelite bushings or grommets which protect the input leads to the master oscillator compartment were also broken. The master compartment is mounted on four "Lord" flexible suspensions. These suspensions had been provided with thin metallic buffers to limit the motion of the compartment. The severe shock, however, had broken these buffers. It was noted, upon close examination, that one of the securing bolts which fastened the master compartment to the flexible mounting had not been inserted; thus the compartment was actually secured on three corners only. The violent movement which resulted from the combination of these circumstances permitted the master oscillator compartment to chafe the lead covered leads which are secured in the corner angles of the transmitter. The leads, however, were not chafed badly enough to destroy the insulation and no voltage breakdown occurred at these chafed places.

7. Upon removing the equipment from the packing cases, a large number of loose screws, washers and nuts were found in the various compartments. Most of these items did not actually belong in the transmitter but were excess parts which had not been removed before shipment. It is pointed out, however, that the failure to remove such loose parts may cause short circuits which might damage the equipment.

8. Although all screws and nuts were fitted with lock washers

a number of loose connections were noted which had to be tightened before satisfactory operation could be secured.

9. During the process of placing the transmitter into commission the bayonet pins in the base of the 38160 tubes became loose. These pins actually dropped out of the base of five of the tubes. The pins in the bases of the remaining five tubes became loose and would undoubtedly shear off if the tubes were removed and replaced in the sockets several times. The flexible grid and plate leads with which the 38160 tubes are provided were considerably longer on the tubes provided by the Hygrade-Sylvania Company than on tubes furnished by other manufacturers. Thus it was found impossible to use tubes in the M.O. and 1st IPA circuits whose leads were less than 4-1/2" long. The specifications covering 38160 tubes require that the flexible leads be not less than 4" long, but do not limit the length of the lead. It is believed that the tube specifications should be so written that the length of these leads is definitely stated. The Manufacturer provided adaptors, which enables tubes of any manufacture to be used, when this matter was brought to his attention.

10. It should also be stated that the manufacturer provided the necessary replacement parts to take the place of those damaged in shipment.

11. During the course of the tests of the TAZ-1 equipment, a voltage breakdown occurred in the Low Voltage Plate Rectifier Transformer. Apparently one of the procelain bushings which act as terminals for the high tension leads was defective. An arc occurred between the high tension lead and the grounded case of the transformer. In order to continue the tests it was necessary to break off these bushings in order to locate the exact cause of the trouble. The Manufacturer has provided replacement bushings.

12. Simultaneously with the breakdown of the transformer several other items in the equipment were damaged. The filament of a type 38166 rectifier tube became open circuited. The Audio Oscillator Plate by-pass condenser short circuited and the 750 volt D.C. voltmeter which indicates bias voltage on the panel of the transmitter became inoperative. Replacements were obtained from the spare parts provided with the transmitter and at a later date the Hygrade-Sylvania Company furnished replacements for the condenser and the voltmeter. No replacement of the rectifier tube has been made since it was deemed advisable to take the tube situation up separately. It is believed that none of the 38160 tubes should be forwarded with the set while they are in their present condition. It is recommended that the Manufacturer be requested to provide an entire new set of 38160 tubes, including spares, of an improved design to prevent the failure of the bayonet pin.

13. Due to the fact that the Master Oscillator tube compartment is maintained at a temperature of about 60° Centigrade coupled with the fact that the tube is in a rather inaccessible location, difficulty is experienced in replacing tubes in this compartment.

14. Table No. 1 lists the dimensions of the units comprising the Model TAZ-1 equipment. It will be noted that the requirements of the of the specifications are adhered to.

15. Table No. 2 lists the results of a test conducted to determine the voltage regulation of the Main Plate, Intermediate Plate and Bias Rectifiers. The percentage regulation falls well within the requirements of the governing specifications.

16. Plate No. 1 includes oscillographs showing the amount of ripple present in the output of the various rectifiers under full load conditions. A study of these oscillograms shows that the following values of ripple are present:

<u>Rectifier</u>	<u>Max. Peak Value</u>	<u>R.M.S. Value</u>
Bias	0.85%	0.6%
L.V. Plate	1.03%	0.73%
H.V. Plate	0.36%	0.25%

Paragraph 6-47 of RE 13A 442C states that the ripple of the plate rectifiers shall not exceed one half of one percent (0.5%). It will be noted that the Low Voltage plate rectifier exceeds this value slightly on the basis of the R.M.S. value and is approximately twice this value if the peak value is considered. It is pointed out, however, that no trace of ripple modulation or interference was observed in the output of the TAZ-1 transmitter which could be directly attributed to the ripple voltages present in the output of the various rectifiers. A certain amount of frequency modulation was noted on High Frequency operation, but frequency modulation was not noticeable on intermediate frequency operation. Hence, it is believed that the modulation observed on the high frequencies was not caused by the ripple voltage present in the output of the rectifiers. The filament transformer which lights the filament of the high frequency master oscillator tube is located in the same compartment with the tube. It may be possible that this juxtaposition of tube and transformer may give rise to some form of magnetic modulation, but no definite evidence could be obtained to bear out this theory.

17. Table No. 3 lists the amount of power required from the Supply lines to operate the various circuits of the equipment. It will be seen that the entire equipment when operating at full power, key locked, meets the requirements of the specifications.

18. Table No. 4 indicates that the antenna may be short circuited or open circuited while operating at full power, either as an intermediate frequency transmitter or as a high frequency transmitter, without any damage to the equipment.

19. Tables No. 5, 6, 7 and 8 give the detailed results of tests conducted to determine the power output of the transmitter in the Intermediate Frequency band when operating into load circuits of the constants laid down in the governing specifications. A study of these tables reveals the fact that the specified output cannot be obtained, especially at the low end of the Intermediate Frequency Range when operating into dummy antennas of low capacity and low resistance. When operating into an antenna of approximately 500 to 600 mmfd. apparent capacity it is impossible to resonate the transmitter to 300 KC. If

higher values of capacity and resistance are used the transmitter functions satisfactorily as illustrated in Table No. 8, Columns 1, 2 and 3, and in Table No. 6, Columns 1 to 4 inclusive. It will be noted that two sets of calculations are submitted; one where the power output was determined from the current readings obtained with an ammeter connected in the ground side of the dummy antennas and another set where the antenna ammeter in the transmitter was used to determine the antenna current.

20. Table No. 9 covers the test for continuity of frequency range and overlap in the Intermediate Frequency range and shows that the requirements of the specifications are complied with.

21. Table No. 10 shows the variation of resonant frequency of the Master Oscillator per division of marking in the Intermediate Frequency Band. It will be noted that in some sections of the range the value of 0.05% is exceeded. The excess, however, is quite small and in no way interferes with the accurate adjustment of the circuit.

22. Table No. 11 shows that the power output may be varied between the limits of 100% and 25% in the Intermediate Frequency band by means of the step control on the Rectifier unit.

23. Table No. 12 shows that the requirements of MCW operation are complied with. The power reduction between CW and MCW operation is less than the 40% required by the specifications and the percentage of modulation is in excess of the 50% required by the specifications. The frequency of modulation is 785 cycles.

24. Intermediate Frequency signals were observed on a nearby receiver and the quality of the note was found to be satisfactory. Lilt and undesirable modulation were absent and key clicks appeared to be of the same order of magnitude as observed in connection with other transmitters of similar design.

25. In general, it may be stated that the Intermediate Frequency operation of the TAZ-1 is satisfactory and complies with the requirements of the specifications except for the fact that less than the required output is obtained when operating into antennas of low resistance and low capacity. Keying action at the Intermediate Frequencies was satisfactory up to 40 words per minute as required by paragraph 3-43 of Specifications RE 13A 418C. Attention is invited to the fact that Specifications RE 13A 442C, which also apply to the TAZ-1 equipment, requires in paragraph 3-12 that satisfactory keying shall be obtained up to 100 words per minute. The keying relay furnished with this equipment permits keying up to 100 words per minute when operating in the high frequency band, but it is necessary to re-adjust the keying to accomplish this. This high frequency adjustment will not operate satisfactorily in the Intermediate Frequency range. It is believed, however, that the spirit of the specifications is complied with in this respect.

26. Paragraph 3-35-5 of Specifications RE 13A 418C requires that the key relay be accessible from the front panel. The TAZ-1 transmitter does not comply with this requirement since it is necessary to remove

the left-hand top shield in order to service the relay. In this connection, however, it may be pointed out that in attempting to make a break-in key relay more accessible the entire operation of the transmitter on high frequency is liable to be interfered with. Instances have been noted where the additional length of antenna lead required to reach the relay when it was located so as to be more readily accessible caused violent reactions upon the earlier circuits of the transmitter when the antenna was tuned and in one instance the additional length of antenna lead almost prohibited operation in one range of the high frequency band. This interference with normal operation cleared up immediately when the additional length of antenna lead was short circuited.

HIGH FREQUENCY OPERATION

27. The transmitter may be changed from Intermediate Frequency operation to High Frequency operation through the medium of a single ruggedly constructed switch of the multiple contact type. The same tubes are used for both Intermediate and High Frequency operation but separate tuning controls, suitably marked, are provided for operation in the two bands.

28. The number and type of tubes used in the transmitter complies with the requirements laid down in paragraph 3-1 of Specifications RE 13A 442C. The Master Oscillator or frequency establishing circuit is of the Electron Coupled Oscillator type. The Master Oscillator, including the outer anode circuit is contained in a flexibly mounted cabinet. The inner and outer anode circuits are shielded from each other and each compartment is provided with separate temperature control equipment. The inductor and capacitor elements of the frequency establishing circuit are maintained at a temperature of 60 degrees Centigrade through the medium of an adjustable mercury thermostat. The Master Oscillator tube and the outer anode circuit are contained in the right hand section of the flexibly mounted cabinet. The temperature of this compartment is controlled by an adjustable bi-metallic thermostat. No provision is made for the forced circulation of air in this compartment and the insulation is such that it permits considerable heat to escape to the outer atmosphere. The manufacturer recommends that the bi-metallic thermostat be set to regulate at 55 degrees Centigrade.

29. Tables No. 13, 14, 15 and 16 list the results of tests conducted to determine the power output in the High Frequency band. It will be noted that in the range of 2000 KC to 17,000 KC inclusive no difficulty is experienced in obtaining a power output in excess of 200 watts without overloading the power amplifier tubes. Since the plate ammeters in the TAZ-1 equipment are connected in the common return these meters read the summation of plate, screen and grid currents. The screen and grid currents total approximately 35 to 50 M.A.

30. Reference to Table No. 16 shows that it was impossible to obtain an output of 200 watts at 17,700 and 18,000 KC. without overloading the P.A. tubes. Numerous tests were conducted in the range between 17,000 and 18,000 KC in an effort to obtain 200 watts output, but it was noted that while 200 watts could be obtained at a frequency of

paragraph 3-7-6.

37. Changing tubes in the Master Oscillator circuit causes an average variation from the mean frequency of 0.031% at an output frequency of 4500 KC. Reference (c) permits a change of only 0.01%. It should be stated, however, that this test was conducted with tubes which were not obtained from the same manufactured lot, in fact, tubes of three different manufacturers were used in this test. This was necessitated by the fact that half of the tubes supplied with the transmitter could not be used due to the failure of the bayonet pin in the tube base. The detailed results of this test are shown on Table No. 22.

38. Table No. 23 shown the results of a test wherein tubes were changed in the 1st Intermediate Amplifier Circuit. The average variation from the mean frequency was 0.0049% while the specification requirements limit the change to 0.001%.

39. Tables No. 24, 25, 26 and 27 show the results of tests conducted in conformity with paragraph 3-7-8 of reference (c). Tables No. 24, 26 and 27 cover tests where the tube cabinet had been adjusted to a temperature of 60 degrees by means of the bimetallic thermostat. This adjustment was made preliminary to these tests and after the transmitter had assumed normal operating temperature.

40. The test shown in Table No. 25 was made after the tube cabinet had been adjusted to a temperature of 55 degrees in conformity with the suggestion of the Manufacturer's representative. It will be noted, however, that this change had very little influence upon the final result and that in all cases the frequency change observed was in excess of the amount permitted by the specifications. During the first half hour of the tests the temperature of the outer or tube cabinet could not be recorded since the temperature was lower than could be observed on the scale of the thermometer. It will also be noted that the temperature of the tube cabinet continued to rise throughout the duration of the tests, showing that the bimetallic thermostat loses control during key locked operation over extended periods of time.

41. Table No. 28 shows the effect upon frequency when the transmitter is subjected to the test to simulate the shock produced by gun fire. The average change in frequency from this cause is less than that required by paragraph 3-7-9 of the governing specifications.

42. Paragraph 3-7-10 of reference (c) requires that the application of a horizontal force of 200 pounds at any of the top frame members of the transmitter shall not produce a frequency change greater than 0.002%. When the TAZ-1 transmitter was subjected to this test the change in frequency noted was of negligible proportions, no change exceeding 5 cycles.

43. In order to obtain further information as to the effects of vibration and shock an additional series of tests were conducted. A 1/2 horsepower motor was bolted securely to the frame of the transmitter. An eccentric weight was secured to the shaft of the motor and provision was made for varying the speed of rotation. In this manner the

frequency and amplitude of vibration could be varied. Although no quantitative measurements of the degree of vibration could be made, it is believed that the vibration produced in this manner is sufficient to bring out any defects in the transmitter, such as poor contacts or other defects of a similar nature. A code message was transmitted while the TAZ-1 transmitter was subjected to varying degrees of vibration. In addition, while the transmitter was being vibrated it was also subjected repeatedly to the shock test as outlined under paragraph 3-7-9 of reference (c). Reception was accomplished on a Model RAB receiver. The test was transmitted on two frequencies, 4500 KC and 18,000 KC. Although the effects of severe vibration were noticeable, particularly at 18,000 KC the receiving operator was able to make solid copy. It was reported, however, that during the 18,000 KC transmission the note became very rough and broken.

44. In order to determine the quality of the emitted signal test transmissions were conducted at 2000, 4500, 8000, 12,000, 16,000 and 18,000 KC. Signals were observed on a nearby RAB receiver. Distance between transmitter and receiver approximately 500 feet. The following are the comments on this test made by an experienced receiver operator:

2000 KC - Key clicks fairly strong; D.C. note with slight keying lilt, not objectionable.

4500 KC - Key clicks fairly strong; D.C. note; keying lilt more noticeable. Probably not objectionable for any service except automatic, where constant beat is required for best results. No trouble with sharp tuning on RAB receiver.

8000 KC - Key clicks not quite so strong, but still noticeable. Note shows slight frequency modulation. Keying lilt same as at 4500 KC. No trouble with sharp tuning on TAB receiver.

12000 KC - Key clicks noticeable; about same as at 8000 KC. Considerable frequency modulation; keying lilt more noticeable; signal still OK for copy. Sharp tuning still works on RAB receiver but note not quite as pure as on lower frequencies.

16000 KC - Key clicks not very noticeable. Note not very good. Frequency modulation. Lilt beginning to be objectionable. Signal still OK for copy but would not cut through interference very well as compared to a pure DC note.

18000 KC - Key clicks hardly noticeable. Note about same as 16000 KC, considerable frequency modulation. Lilt objectionable. Signal still OK for copy but cannot compare with DC note.

During the foregoing tests the transmitter was not subjected to vibration or shock. It will be noted that the keying lilt increases as the frequency becomes higher and key clicks become less evident as the frequency increases.

45. Table No. 29 illustrates the variation of resonant frequency of the Master Oscillator per division of marking. Paragraph 3-17 of reference (c) requires that the variation of resonant frequency shall not exceed 0.01%. It will be noted that the average for the TAZ-1 transmitter is approximately 0.006%.

46. Table No. 30 covers tests conducted to determine the degree of lost motion and back-lash present in the frequency establishing controls. Attention is invited to the "note" accompanying this Table. Control "D", Oscillator Tuning Condenser is designed to cover the frequency range between the various "notches" cut into the periphery of the rotating Oscillator Band Coil which is operated by control "C". The amount of back-lash or lost motion present in Control "D" is of no great magnitude, although it is somewhat greater than the back-lash present in other types of controls used on similar equipment. The operation of Control "C", however, is unsatisfactory. The loose turns which were noted on this coil and the apparent intermittent contact which the slider makes with the rotating coil, especially in the neighborhood of the 2000 KC settings, was so erratic at times that it was impossible to obtain satisfactory reset. This erratic action made it impossible to duplicate results. During some tests the action of Control "C" was quite satisfactory, while during other tests such violent fluctuations occurred as to make frequency measurements impractical.

47. It must be stated, therefore, that the resetability of the TAZ-1 equipment, in its present condition, is unsatisfactory.

48. Table No. 31 illustrates that the control of power output in the High Frequency band is satisfactory and complies with the specifications.

49. The TAZ-1 coil cabinet is equipped with a thermal fuse of the bi-metallic type. When the temperature within this cabinet rises to a dangerous level the fuse opens the supply to the heater circuit. When the temperature recedes to a normal value the fuse automatically closes. A test was conducted to determine the action of this device and the results of this test are shown in Table No. 32. The fuse performs satisfactorily and it is believed that a fuse of this type is to be preferred to the type which melts when the temperature rises too high and then has to be replaced with a new fuse.

50. The necessary tests to determine the temperature coefficient of the Model TAZ-1 transmitter in accordance with paragraph 3-7-2 of the governing specifications were conducted at the Bureau of Standards. Tables 33 to 43 inclusive give the detailed results of tests wherein the ambient temperature was varied between the limits of zero and fifty degrees Centigrade. Tests were conducted at 2000, 3000 and 4500 KC in the high frequency range of the transmitter and at 500 KC in the intermediate frequency range. It should be remembered that while operating as an intermediate frequency range transmitter temperature control of the master is not employed.

51. Plates 8 and 9 and Tables 39 and 40 show the results obtained when operating at 500 KC. It will be noted that the frequency variation between the temperatures of 25 and 50 degrees is approximately twice

as great as the frequency variation between the temperatures of 25 and zero degrees. This action is undoubtedly due to the fact that the normal rise in frequency incident to the decrease in temperature is partially compensated for by the decrease in frequency due to the inherent heating of the frequency establishing circuit. Paragraph 3-42 of Specifications RE 13A 418C states that the variation in frequency due to a change in temperature of minus 1 degree Centigrade to plus 43 degrees Centigrade shall not exceed 350 cycles over and beyond a factor of 0.05% for reset. At 500 KC this total allowable change in frequency would be 0.12%. The actual change in frequency observed between zero degrees Centigrade and 35 degrees Centigrade was 0.15%. Since the frequency to which the transmitter was tuned at the start of the test was accurately known to within at least 5 cycles in 500 KC, it appears doubtful whether the 0.05% for errors in reset should be permitted in this case.

52. Paragraph 3-7-2 of RE 13A 442C requires that the variation in frequency per degree Centigrade permanent change in ambient temperature shall not exceed 0.0012% for any step between the minimum (zero degrees) and ten degrees; 0.001% for any step in the range from ten degrees to twenty-five degrees and 0.0005% for any step within the range from twenty-five degrees to fifty one and a half degrees Centigrade.

53. Reference to Table No. 41 which is a summary of the various tests conducted over a temperature range of 0 to 50 degrees shows that between 0 and 5 degrees the TAZ-1 transmitter met the specification requirements at 3000 KC but not at 2000 KC and 4500 KC. Between 10 and 5 degrees no frequency complies with the specifications. Between 10 and 25 degrees the TAZ-1 complies with the specifications, while in the range of temperatures between 25 and 50 degrees there are numerous points where the specifications are not complied with.

54. During the tests on 2000 KC the emitted note fluttered badly during most of the test and this condition is undoubtedly partly responsible for the fact that the percentage variations at 2000 KC are greater than at 3000 and 4500 KC. During the tests at 3000 KC it was noted that the note fluttered only while the temperature was in the neighborhood of 25 to 30 degrees and steadied down when this range of temperature was exceeded on either the low or high side. At 4500 KC only very small and intermittent flutters were noticed. It appears that the cause of this instability may be traced to the construction of the master oscillator coil. As previously stated, several loose turns were noted and the fact that these loose turns are included in the used portion of the coil when operating at 2000 KC but are not included in the used portion of the coil at 3000 and 4500 KC would indicate that this defect in construction contributes to the instability noted.

55. A study of Plates No. 2 to 7 inclusive, reveals several facts with respect to the temperature control equipment of the TAZ-1 equipment. First, it will be noted that the tube oven temperature follows closely the change in ambient temperature. During the tests covered by the above tables the temperature of this oven varied between the limits of 43 degrees and 75 degrees Centigrade while the ambient temperature was being varied between the limits of 0 to 50 degrees. The insulation of this oven is such that it permits heat to escape

was given a complete inspection. It was found that Transformers T7 and T8, the filament transformers for the High voltage plate rectifier, had become hot enough to exude a portion of the compound with which they are impregnated. The transformers, however, appeared to suffer no injury and operated normally. It was also noted that condenser C-52 in the master oscillator tube compartment showed signs of discoloration due to heating although the circuit continued to function normally.

61. Reference (a) requests that particular attention be paid to the operation of the control circuits. References (l) and (m) of Bueng letter of March 15 provide for tentative modifications to the control circuits of two TAZ-1 transmitting equipments. These modifications consist of a local start-stop switch on the rectifier unit; an emergency stop switch on the transmitter unit connected in series with the emergency stop switch on the rectifier unit and a high voltage transfer switch located on the rectifier unit through the medium of which the high voltage supplies can be removed from the transmitter.

62. A careful examination of the operation of the control circuits indicates that these modifications provide greater flexibility under operating conditions. The high voltage disconnect switch is desirable from the standpoint that it is possible to confine all high voltages to the rectifier unit alone. If trouble develops in connection with the high voltage circuits this is a desirable condition since it aids greatly in isolating the trouble. During the test of this equipment the Low Voltage Plate Rectifier transformer failed. After this fault had been remedied and operation was again attempted the overload breakers blew. It was readily determined that the cause of this action lay in the transmitter unit, since the overload relays functioned only when the high voltage disconnect switch was in position 2 thus energizing the high voltage circuits in the transmitter unit.

63. The emergency stop switch on the transmitter unit furnishes a desirable method of removing all high voltages from the transmitter and yet permitting the filaments of the transmitter tubes to remain at normal brilliancy, so that the transmitter is ready for instant operation whenever the emergency switch is closed and yet does not subject the transmitter tubes to the undesirable condition of applying plate potentials to the tubes at the same instant the filament potential is applied.

64. The circuit arrangement is such that if the control transfer switch on the transmitter is in the local position, it is possible to start or stop the rectifier unit by means of the local rectifier switch on the front of the rectifier and by use of the high voltage disconnect switch to open the high voltage circuits to the transmitter.

65. The emergency stop switches are so arranged that if the equipment is shut down by either switch it cannot be started until the switch is restored to normal position. Since the emergency switches are exact duplicates of the other switches used on the panels of the transmitter and rectifier units they are not readily distinguished from

the others. It is true that they are labeled "Emergency" on an adjacent nameplate, but under poor lighting conditions this marking is not very distinctive. It is believed that the emergency switches should be colored red in a distinctive manner so that an inexperienced operator could readily locate and operate the switch without hesitation.

66. It is the opinion of the Naval Research Laboratory that the control circuits, as modified under the provisions of references (l) and (m) of Bueng letter of 15 March, NOs-31455(3-12-W8) to Director NRL, add desirable flexibility to the operation of the equipment and should be incorporated in all TAZ-1 equipments.

67. Paragraph 3-18 of Specifications RE 13A 442C requires that a suitable friction type locking device shall be provided on each continuously variable tuning control. It was noted that the locking device on Control "E" of the TAZ-1 transmitter was inoperative and it was further observed that the locking device on Control "C" affected the frequency of the transmitter more than is believed allowable.

68. Plate contactor "E-10" carries an auxiliary contact which energizes the keying relay. Due to the fact that the magnetic pull on the armature of E-10 was insufficient it frequently occurred that this auxiliary contact would not close and the transmitter could not be keyed. A representative of the Manufacturer supplied a modified coil for this relay and although the operation was improved somewhat, intermittent failures continued to occur.

69. A very desirable feature which is incorporated into the TAZ-1 transmitter is the method used for identifying the various units which go to make up the assembly. Each capacitor, resistor, reactor, relay and so forth, is stenciled with a letter and number which corresponds to the designation used in the instruction book and on the wiring diagrams. This system of identification permits an operator to readily locate any item in the equipment. Further assistance is rendered by the instruction book which contains a section wherein the exact location of each individual item is tabulated.

70. The aluminum used in the construction of the TAZ-1 equipment has been subjected to the process known as "Anodic" treatment in order to insure against the effects of corrosion. This treatment presents a pleasing and durable surface and should be able to withstand the deleterious effects of a moist, salt atmosphere. It is noted, however, that "Anodic" treatment causes the surface of the aluminum to become non-conducting. It is essential, therefore, that the utmost precaution be taken to insure good ground connections where such connections are necessary. Apparently such precautions were taken in the construction of the TAZ-1 equipment since no evidence of poor connections was discovered. One feature of this type of finish which may be objectionable lies in the fact that the shields with which the transmitter is provided do not make contact with the frame except at the points where the shields are secured through the medium of knurled head screws. It should be stated, however, that no direct evidence was obtained that this condition was causing any difficulty or was interfering with the operation of the equipment.

71. The entire construction of the TAZ-1 equipment is of a strong, rugged character and the entire assembly reflects the results of excellent workmanship. All frame members and supports are fabricated from heavy stock, rigidly secured. The shields are extremely rigid and thus eliminate the possibility of variable shielding effects. A unique and very satisfactory method is employed for securing the shields which prevents the accidental loss of the securing screws. The shielding is not perforated in the conventional manner. Stamped louvres have been provided in each section with the openings pointing downward, thus preventing falling dirt and moisture from entering the transmitter or rectifier units. The form of stamping used also tends to increase the rigidity of the shields. It is not possible to view the interior of the units through the side or back shields, as is the case when perforated shields are used, but this does not appear to be a draw back, since the tubes are readily visible through the doors on the front of the units. These doors are of the perforated type.

72. The interior wiring appears to be of an excellent quality and is run and laid in an orderly fashion. All lead sheaths are bonded at short intervals and rigidly secured to the frame work of the transmitter and rectifier units. All copper tubing connections have been treated with a white, metallic coating which does not appear to oxidize readily and apparently does not interfere with the radio frequency characteristics of the wiring. As previously stated, however, a considerable number of loose connections were discovered. "Shakeproof" type lock washers are used. It is possible that the split type of lock washer would insure more permanent connections.

73. Paragraph 6-42 of "Contract Notes" states that the main plate rectifier shall employ six filament transformers as indicated in this paragraph of Contractor's descriptive specifications. In the rectifier as furnished actually two filament transformers are utilized; one transformer has three secondary filament windings and the other one filament winding of sufficient current carrying capacity to provide for three filaments in parallel. Thus, the equipment as submitted does not comply literally with the descriptive specifications although the rectifier functions satisfactorily in its present condition.

INSTRUCTION BOOKS AND DATA SUPPLIED WITH TRANSMITTER

74. The preliminary instruction books furnished with the TAZ-1 equipment are carefully assembled and present a pleasing appearance. The information and data contained in the books are very complete and presented in such a manner that no difficulty is experienced in placing the equipment in operation.

75. One unusual and excellent feature of the instruction book is the section wherein each item entering into the construction of the equipment is listed under a part number and its exact location within the transmitter has been designated. Since the actual part also carries this same part number it is exceedingly simple to locate any individual item in the transmitter.

76. The wiring diagrams and the schematic diagrams are well arranged but they are unsatisfactory from one point of view. The diagrams

are brown line prints. Apparently the VanDykes from which some of these prints were made were badly creased. As a result of printing these creased drawings certain well defined lines show up which do not belong in the circuits and thus tend to confuse the person consulting the diagram.

77. A number of typographical errors were noted in the instruction books, but the Manufacturer's representative states that these are being corrected in the final instruction books.

78. The Test Data and Type Test Data accompanying the instruction books is helpful in ascertaining whether the transmitter is operating normally, and also serves as calibration data. A few obvious errors were noted in this data which consisted mainly of improperly locating the decimal points in certain calculations.

RECOMMENDATIONS

79. The following recommendations are submitted. Prior to the installation of the Model TAZ-1 Equipment, Serial No. 3, on the vessel for which it is intended the following items should be corrected:

- (a) Ten type 38160 tubes of an improved design should be furnished since the tubes supplied with the equipment are not suitable for service use.
- (b) The instability of the emitted note which apparently is caused by loose turns on the Master Oscillator Coil should be corrected.
- (c) A spare 38166 Rectifier tube should be furnished to replace the one which failed during the tests.
- (d) The plate contactor "E-10" in the Rectifier unit does not function satisfactorily and will undoubtedly become practically inoperative under the influence of vibration. This should be corrected or new relays provided.
- (e) Two new mercury thermostats should be provided to replace those accompanying the transmitters. It should be pointed out that breakage of one thermostat was due to handling by NRL personnel, although it was of an entirely accidental character. The other thermostat failed under normal operation.
- (f) The locking device on Control "E" should be repaired.
- (g) The Laboratory has been informed that the Manufacturer considers it necessary, or at least desirable, to remove the flexibly mounted Master Oscillator Compartment from the transmitter and pack it separately for shipment. Instructions are requested whether this method of packing should be employed when the equipment is transferred from the Naval Research Laboratory to its destination.

DISCUSSION

80. The general construction of the Model TAZ-1 equipment reflects excellent workmanship and the materials used in its construction are of the highest quality. The construction is exceedingly rugged without being clumsy and great care has been used to insure that all parts are adequately protected against the effect of corrosion and aging. The multi-contact controls and switches are of a strong and durable character and should insure good operation and good contact over a long period of time. These controls are accurately machined and fitted so that they operate positively and with ease. The whole assembly presents a very pleasing appearance.

81. The principal basis for criticism lies in the fact that certain principles of design have not been given sufficient weight and certain minor but extremely important items fail to properly perform their function. The master oscillator inductor, although fabricated from excellent materials, is not properly assembled. The method of selecting taps on this inductor should be of a more positive character. The Laboratory feels that an ordinary variable air capacitor does not possess a sufficient degree of rigidity to produce an absolutely stable frequency. It appears that a certain amount of "flutter" is inherent in variable capacitors unless the plates are exceedingly solid and of considerable thickness. This is particularly true when the equipment is subjected to vibration.

82. The temperature controlled master oscillator compartment is unable to maintain a constant temperature over the wide range of ambient temperatures required by the specifications. More adequate insulation is indicated. The principle of attempting to maintain the temperature constant in a compartment housing a tube as large as the 38160 is questioned. Excellent results have been obtained when this compartment was subjected to forced circulation without resorting to additional heating.

83. Adequate buffers should be provided whenever any compartment of considerable mass is flexibly suspended.

84. The use of adjustable mercury thermostats in service equipment should be prohibited. A very considerable degree of skill, proper equipment and a large amount of time is generally required to set the proper operating point. This process subjects the thermostats to breakage even though every precaution is taken. Since the exact temperature at which control is desired is known and since manufacturers of thermostats have demonstrated their ability to produce thermostats of the fixed type which will regulate closely to any predetermined temperature, it is believed that this type only should be approved.

TABLE NO. 1

Dimensions of TAZ-1 Transmitting Equipment.

	Specification Dimensions		Actual Dimensions	
	<u>Transmitter</u>	<u>Rectifier</u>	<u>Transmitter</u>	<u>Rectifier</u>
Height	72"	72"	72"	72"
Width	32"	19"	31-1/4"	18-3/4"
Depth	24"	24"	24"	24-1/8"

Note: The depth of 24-1/8" of the Rectifier unit was measured overall and included the reset pin on the overload relay. During shipment and handling this pin could be tied down and the depth would then be slightly less than 24".

TABLE NO. 2

Test as per paragraph 6-46 of Specifications RE 13A 442C.

Voltage Regulation of Rectifier

<u>Rectifier</u>	<u>No Load</u>	<u>Full Load</u>	<u>Percent Regulation</u>
Main Plate	3000 V	2890 V	3.7%
Int. Plate	2060	2020	1.9%
Bias	515	518	0.6%

Permitted by Specifications

<u>Rectifier</u>	<u>Percent Regulation</u>
Main Plate	8%
Int. Plate	12%
Bias	12%

TABLE NO. 3

Test per paragraphs 6-55 and 10-2-2 of Specifications
RE 13A 442C.

Power Required from Supply Lines

Heater Control	0.320 KW
Heater	0.580
Heater plus Filaments	1.360
Heater, Filaments & Bias	1.520
Heater, Filaments, Bias and Plate	2.060
Entire Transmitter, Key locked.	2.900

Paragraph 6-55 states that power shall not exceed 3.7 KW, key locked, full power operation.

TABLE NO. 4

Test as per paragraph 2-16 of Specifications RE 13A 418C

Antenna short circuited and open circuited

High Frequency Operation

4500 KC

	Antenna Condition		
	<u>Normal</u>	<u>Shorted</u>	<u>Open</u>
Power Amplifier Plate Current:	235 MA	315 MA	200 MA

Intermediate Frequency Operation

350 KC

	Antenna Condition		
	<u>Normal</u>	<u>Shorted</u>	<u>Open</u>
Power Amplifier Plate Current	235 MA	275 MA	122 MA

Note: "Antenna Amps (Set)" refers to the current reading obtained on the meter in the transmitter, i.e., the meter is in the high side of the dummy antenna. "Output Watts (Set)" is the power output calculated on the basis of the current observed in the "Set" antenna. "Antenna Amps (Ground)" are current readings obtained on an ammeter inserted in the ground side of the dummy antenna and "Output Watts (Ground)" are calculations based on these latter current readings.

Refer to paragraph 2-2 of Specs. RE 13A 418C and paragraph 2-2 of Hydrone-Cylindric Descriptive Specifications. The Descriptive Specifications guaranteed the following performance:

Frequency	Ant. Cap.	Ant. Resist.	Power Output
300	435	2.5	200
355	445	2.6	200
375	450	2.6	200
600	584	4.4	200

With an antenna resistance of 2.67 ohms and an antenna capacity of 435 micro-micro-farads, the lowest frequency at which any output power was obtainable was 350 KC, and at this frequency the power was less than 10% of the guaranteed value. The maximum output which could be obtained

TABLE NO. 5

Test as per paragraph 10-3-2 of Specifications RE 13A 418C

Determination of Power Output

Column No.	1	2	3
Output Freq.	356 KC	635 KC	600 KC
"A"	1	1	1
"R"	1	2	2
"S"	544	1000	840
"T"	1	2	2
"U"	91	168	164.5
"V"	11	16	14
"W"	1	4	5
"X"	16	117	83
"Q"	1	1	1
Ef	10	10	10
Eg	525	525	525
L V Ep	2060	2060	2060
H V Ep	2310	2750	2750
M O Ip	120	110	112
P A Ip	235	210	210
Antenna Capacity	437	437	583
Antenna Resistance	2.67	2.67	4.60
Antenna Amps (Set)*	5.7	7.6	7.2
Output Watts (Set)*	86.7	155	238
Antenna Amps (Ground)*	4.9	6.6	6.4
Output Watts (Ground)*	64.2	116	188

*Note: "Antenna Amps. (Set)" refer to the current reading obtained on the ammeter in the transmitter, i.e., the ammeter is in the high side of the dummy antenna. "Output Watts (Set)" is the power output calculated on the basis of the current observed in the "Set" ammeter. "Antenna Amps (Ground)" are current readings obtained on an ammeter inserted in the ground side of the dummy antenna and "Output Watts (Ground)" are calculations based on these latter current readings.

Refer to paragraph 8-2 of Specs. RE 13A 418C and paragraph 8-2 of Hygrade-Sylvania Descriptive Specifications. The Descriptive Specifications guaranteed the following performance:

<u>Frequency</u>	<u>Ant. Cap.</u>	<u>Ant. Resis.</u>	<u>Power Output</u>
300	435	2.5	200
355	445	2.6	200
375	450	2.6	200
600	584	4.4	200

With an antenna resistance of 2.67 ohms and an antenna capacity of 435 micro-micro-farads, the lowest frequency at which any output power was obtainable was 356 KC, and at this frequency the power was less than 50% of the guaranteed value. The maximum output which could be obtained

with these antenna constants was 155 watts (set) or 116 Watts (ground) and in order to obtain this output the frequency had to be increased to 635 KC.

The specification requirements and the values guaranteed by the manufacturer in his descriptive specifications are complied with at 600 KC when using an antenna capacity of 583 mmf and an antenna resistance of 4.6 ohms when using the set ammeter to read the antenna current. The value of current obtained with an ammeter connected in the ground side of the dummy antenna reduces the power output to 188 watts.

	500 KC	600 KC	700 KC	800 KC
Antenna Capacity	583	583	583	583
Antenna Resistance	4.0	4.3	4.67	4.1
Antenna Imp. (Set)*	6.2	7.0	7.8	8.3
Output Watts (Set)*	308	284	282	282
Antenna Imp. (Ground)*	5.7	6.5	7.2	7.7
Output Watts (Ground)*	250	245	238	243

*See "Notes" on Table No. 5

TABLE NO. 6

Test as per paragraph 3-6 and 10-2-3 of Specifications
RE 13A 418C.

Determination of Power Output

Column No.	1	2	3	4
Output Freq.	300 KC	400 KC	500 KC	600 KC
"A"	1	1	1	1
"R"	1	1	2	2
"S"	250	600	613	846.5
"T"	1	1	2	2
"U"	63	104	119	170
"V"	13	11	16	16
"W"	2	3	6	6
"X"	96	124	80	98
"Q"	1	1	1	1
Ef	10	10	10	10
Eg	525	525	530	525
L V Ep	2050	2060	2050	2090
H V Ep	2825	2850	2900	2825
M O Ip	127	124	112	115
P A Ip	250	245	230	225
Antenna Capacity	833	833	833	900
Antenna Resistance	8.0	5.8	4.47	4.1
Antenna Amps (Set)*	6.2	7.0	7.8	8.3
Output Watts (Set)*	308	284	282	282
Antenna Amps (Ground)*	5.7	6.5	7.2	7.7
Output Watts (Ground)*	260	245	232	243

*See "note" on Table No. 5

TABLE NO. 7

Test as per paragraphs 3-7 and 10-2-3 of Specifications
RE 13A 418C

Determination of Power Output

Column No.	1	2	3	4	5
Output Freq.	600 KC	323 KC	300 KC	600 KC	323 KC
"A"	1	1	1	1	1
"R"	2	1	1	2	1
"S"	840	397	250	840	400
"T"	2	1	1	2	1
"U"	155.5	65	47	153	71.1
"V"	14	10	7	13	11
"W"	4	1	2	6	1
"X"	132	10	99	157	11.8
"Q"	1	1	1	1	1
Ef	10	10	10	10	10
Eg	525	520	525	540	520
L V Ep	2100	2060	2060	2060	2060
H V Ep	2950	2900	2725	2900	2900
M O Ip	112	124	120	112	121
P A Ip	235	240	225	230	230
Antenna Capacity	584	584	1400	1400	584
Antenna Resistance	1.6	1.6	1.6	1.6	6.0
Antenna Amps (Set)*	9.6	7.5	9.2	12.1	6.2
Output Watts (Set)*	147	90	135.5	234	231
Antenna Amps (Ground)*	8.9	6.9	9.0	11.7	5.6
Output Watts (Ground)*	127	76.2	129.5	219	188

Note: Par. 3-7 requires that the equipment shall also be capable of satisfactory and efficient operation on antennas having effective resistance values ranging from 1.5 to 6 ohms and equivalent capacity values of 600 to 1400 mmf for the frequency band 200 to 700 KC (300-600). Under operating conditions involving antenna resistance values below two ohms the output requirements of par. 3-40 and 3.46 may be decreased by 25%. (Thus the output required is 150 watts).

Note Column 2: The minimum frequency at which any power could be obtained when $R = 1.6$ and $C = 584$ was 323 KC.

Note Column 5: 323 KC was the lowest frequency to which the transmitter could be tuned when $R = 6$ and $C = 584$.

See Table No. 8 for continuation of this data.

*See note on Table No. 5.

TABLE NO. 8

Test as per paragraphs 3-7 and 10-2-3 of Specifications
RE 13A 418C

Determination of Power Output

Column No.	1	2	3	4
Output Freq.	600 KC	300 KC	600 KC	400 KC
"A"	1	1	1	1
"R"	2	1	2	1
"S"	840	250	840	600
"T"	2	1	2	1
"U"	165	41	161	11
"V"	16	10	14	11
"W"	5	2	6	1
"X"	82	98	158	97
"Q"	1	1	1	1
Ef	10	10	10	10
Eg	520	525	525	525
L V Ep	2060	2050	2060	2075
H V Ep	2900	2730	3000	2800
M O Ip	112	120	112	119
P A Ip	228	230	225	232
Antenna Capacity	584	1400	1400	584
Antenna Resistance	6	6	6	1.6
Antenna Amps (Set)*	7.1	6.6	7.8	7.8
Output Watts (Set)*	295	263	365	97.4
Antenna Amps (Ground)*	6.4	6.4	7.5	7.0
Output Watts (Ground)*	246	246	337	78.4

*See "Note" on Table No. 5

Par. 3-7 requires that the equipment shall also be capable of satisfactory and efficient operation on antennas having effective resistance values ranging from 1.5 to 6 ohms and equivalent capacity values of 600 to 1,400 mmf for the frequency band 200 to 700 (300-600) KC. Under operating conditions involving antenna resistance values below two ohms the output requirements of par. 3-40 and 3-46 may be decreased by 25% (Thus the output required is 150 watts)

Note Column 4. The maximum output obtainable at 400 KC where $R = 1.6$ and $C = 584$ was 97.4 and 78.4 watts respectively depending at what point the antenna current was measured. For comparison see Columns 1 and 2 of Table No. 7.

TABLE NO. 9

Test as per paragraph 10-2-4 of Specifications RE 13A 418C

Test for continuity of Frequency Range and Overlap.

Master Oscillator		Power Amplifier		Frequency
R	S	T	U	KC/S
1	0	1	20	258
1	1000	1	158	462
2	0	2	57	400
2	960	2	180	638

Overlap between bands - 15.5%.

TABLE NO.10

Test as per paragraph 3-44 of Specifications RE 13A 418C

Variation of resonant frequency of Master Oscillator per
division of marking.

<u>Frequency</u>	<u>M.O. Setting</u>	<u>Division Change</u>	<u>KC Change Per Div.</u>	<u>%Change Per Div.</u>
300 KC	1 - 270			
325	435	165	0.15	0.0462
350	540	105	0.24	0.0686
375	630	90	0.28	0.0747
400	726	96	0.26	0.0650
425	821	95	0.26	0.0612
450	919	98	0.26	0.0578

Average for Step 1 - 0.0556%

400	2 - 168			
425	339	171	0.15	0.0353
450	442	103	0.24	0.0534
475	513	71	0.35	0.0737
500	583	70	0.36	0.0720
525	646	63	0.40	0.0762
550	715	69	0.36	0.0654
575	781	66	0.38	0.0661
600	851	70	0.36	0.0600

Average for Step 2 - 0.0628%.

Required by specifications: - Not more than 0.05% nor less than 0.02%.

TABLE NO. 11

Test as per paragraph 3-24-6 of Specifications RE 13A 418C

Control of Power Output300 KC

Step	LV Ep	HV Ep	MO Ip	PA Ip	Antenna			Watts	%
					Cap.	Res.	Cur.		
6	2080	2880	127	245	1400	6	7.2	311	100%
5	2080	2675	122	240	1400	6	6.8	277.5	89.2
4	2080	2425	111	230	1400	6	6.3	238	76.5
3	2080	2125	110	220	1400	6	5.7	195	62.6
2	2080	1875	113	210	1400	6	5.0	150	48.2
1	2100	1325	109	175	1400	6	3.4	69.2	22.2

600 KC

6	2090	2900	112	235	1400	6	7.6	347	100%
5	2090	2660	112	225	1400	6	7.2	311	89.6
4	2090	2400	110	210	1400	6	6.7	269.5	77.6
3	2090	2140	106	205	1400	6	6.0	216	62.2
2	2090	1875	102	195	1400	6	5.4	175	50.4
1	2100	1325	97	135	1400	6	3.6	77.7	22.3

Specifications require that the control of power shall be such that the power may be reduced to at least 25% of full power.

TABLE NO. 12

Test as per paragraph 3-41 of Specifications RE 13A 418C

Comparison of CW and MCW Operation

Type of Emission	CW	MCW	CW	MCW
Output Frequency	300 KC	300 KC	600 KC	600 KC
L V Ep	2090	2050	2100	2060
H V Ep	2700	2700	2700	2700
M O Ip	122	112	112	105
P A Ip	235	200	235	200
Antenna Capacity	1400	1400	1400	1400
Antenna Resistance	6	6	6	6
Antenna Current	6.7	5.8	7.3	6.4
Output Watts	269	202	320	246

Difference between CW & MCW at 300 KC - 67 Watts

15%

" " " " 600 KC - 74 Watts

23%

Tolerance permitted by specifications - 40%

Percentage Modulation

Negative Peaks - 80%

Positive Peaks - 42%

Modulation required by specifications - 50%

Frequency of modulation as measured - 785 cycles

Frequency of modulation required by specs. - 800 cycles
(approx.)

The antenna load consisted of a 110 volt, 500 watt lamp
the D.C. resistance of which is approximately 26.7 ohms.

TABLE NO. 13

Test as per paragraph 10-2-3 of Specifications RE 13A 418C

Determination of Power Output

Column No.	1	2	3	4	5
Output Freq.	<u>2,000 KC</u>	<u>3,00 KC</u>	<u>4,000 KC</u>	<u>8,000 KC</u>	<u>12,000 KC</u>
"A"	2	2	2	2	2
"B"	1	2	2	2	2
"C"	165	100	521	896	787
"D"	1303	8725	2383	4801	3528
"E"	99	431	550	706	659
"F"	1	1	2	2	2
"G"	294	704	433	881	751
"H"	1	1	2	2	2
"I"	259	711	371	862	980
"J"	1	1	2	2	2
"K"	150	593	271	807	945
"L"	2	6	7	8	8
"M"	16	160	122	155	180
"N"	1	1	1	1	1
"O"	1074	934	1074	1127	290
"P"	70	40	70	70	56
"Q"	2	2	2	2	2
Ef	10	10	10	10	10
Eg	525	525	525	515	520
L.V.Ep	2000	2000	2025	2000	2070
H.V.Ep	2700	2690	2700	2640	2760
M O Ip	74	78	77	74	75
IPA Ip-1	48	42	42	22	32
IPA Ip-2	130	120	110	82	115
P A Ip	235	237	215	215	240
Photo Cell	108	91	185	177	105
Power-Watts	234	215	295	296	230
Antenna	Note	Note	Note	Note	Note

Note: The antenna load consisted of a 115 volts, 500 watt Lamp
the D.C. resistance of which is approximately 26.5 ohms.

TABLE NO. 14

Test as per paragraph 10-2-3 of Specifications RE 13A 418C

Determination of Power Output

Column No.	1	2	3	4
Output Freq.	12,000 KC	13,000 KC	14,000 KC	14,000 KC
"A"	2	2	2	2
"B"	2	2	2	2
"C"	786	822	839	839
"D"	3470	3184	8300	8300
"E"	659	673	687	687
"F"	2	2	2	2
"G"	751	798	831	831
"H"	2	2	2	2
"I"	980	998	1014	1014
"J"	2	2	2	2
"K"	946	970	1008	1007
"L"	8	8	8	8
"M"	180	180	168	155
"N"	1	1	1	1
"O"	294	259	205	205
"P"	180	180	180	180
"Q"	2	2	2	2
Ef	10	10	10	10
Eg	525	525	520	520
L V Ep	2000	2000	2000	2000
H V Ep	2910	2910	2850	2850
M O Ip	76	72	71	70
IPA Ip-1	30	52	46	46
IPA Ip-2	124	145	148	148
P A Ip	240	240	245	245
Photo Cell	80	55	112	152
Power: Watts	225	197	260	270
Antenna	Note 1	Note 1	Note 1	Note 2

Note 1: The antenna load consisted of a 220 volt, 500 watt lamp, the d.c. resistance of which is approximately 106 ohms.

Note 2: The antenna load consisted of a 115 volt, 500 watt lamp, the d.c. resistance of which is approximately 26.5 ohms.

TABLE NO. 15

Test as per paragraph 10-3-2 of Specifications RE 13A 418C

Determination of Power Output

Column No. Output Freq.	1 16,000 KC	2 16,000 KC	3 17,000 KC	4 17,000 KC
"A"	2	2	2	2
"B"	2	2	2	2
"C"	896	896	921	921
"D"	4800	4800	1300	1300
"E"	708	707	714	714
"F"	2	2	2	2
"G"	883	882	899	899
"H"	2	3	3	3
"I"	1046	1035	1047	1047
"J"	3	3	3	3
"K"	1024	1024	1043	1041
"L"	8	8	8	8
"M"	150	154	55	142
"N"	1	1	1	1
"O"	997	939	147	1019
"P"	180	180	180	180
"Q"	2	2	2	2
Ef	10	10	10	10
Eg	525	520	520	520
L V Ep	2050	2000	2000	2000
H V Ep	2850	2850	2850	2850
M O Ip	70	71	70	70
IPA Ip-1	23	36	20	20
IPA Ip-2	119	138	115	115
P A Ip	245	245	245	245
Photo Cell	150	78	70	130
Power: Watts	295	200	216	278
Antenna	Note 1	Note 2	Note 1	Note 1

Note 1: The antenna load consisted of a 220 volt, 500 watt lamp, the d.c. resistance of which is approximately 106 ohms.

Note 2: The antenna load consisted of a 115 volt, 500 watt lamp, the d.c. resistance of which is approximately 26.5 ohms.

TABLE NO. 16

Test as per paragraph 10-3-2 of Specifications RE 13A 418C

Determination of Power Output

Column No.	1	2
Output Freq.	17,700 KC	18,000 KC
"A"	2	2
"B"	2	2
"C"	931	931
"D"	3500	4600
"E"	721	721
"F"	2	2
"G"	918	920.5
"H"	3	3
"I"	1060	1062
"J"	3	3
"K"	1062.5	1071
"L"	8	8
"M"	116	75
"N"	1	2*
"O"	1040	1017
"P"	180	180*
"Q"	2	2
Ef	10	10
Eg	515	515
L V Ep	2000	2000
H V Ep	2850	2850
M O Ip	68	68
IPA Ip-1	48	48
IPA Ip-2	172	172
P A Ip	245	250
Photo Cell	16	8
Power: Watts	125	100
Antenna	(220 V 500 Watt Lamp used in both tests)	

*Denotes that condenser "P" (Antenna Tuning) was short circuited.
This improved output roughly about 30%.

Range permitted by specifications: 0.0025L.

TABLE NO. 17

Test as per paragraph 3-7-1 of Specifications RE 13A 442C

Variation of Line Voltage

<u>Line Volts</u>	<u>Variation 1% per Minute</u>		<u>Rapid Variation</u>	
	<u>2000 KC</u>	<u>4500 KC</u>	<u>2000 KC</u>	<u>4500 KC</u>
207.0	792	676	708	558
209.3	788	681		
211.6	792	678		
213.9	785	682		
216.2	776	659		
218.5	767	639		
220.8	760	628		
223.1	765	618		
225.4	762	624		
227.7	762	631		
230.0	766	633		
232.3	781	642		
234.6	769	626		
236.9	758	570		
239.2	775	532		
241.5	759	496		
243.8	730	480		
246.1	742	470		
248.4	729	478		
250.7	743	464		
253.0	750	472	750	472
Max change:	63 cycles 0.0031%	218 cycles 0.0048%	42 cycles 0.0021%	86 cycles 0.0019%
Plus and minus 5% variation:	23 cycles 0.0011%	143 cycles 0.003%		

Change permitted by specifications: 0.0025%.

TABLE NO. 18

Test as per paragraph 3-7-3 of Specifications RE 13A 442C

Frequency change caused by detuning resonant circuits.

<u>Circuit Detuned</u>	<u>2000 KC</u>		<u>4500 KC</u>	
	<u>Cycles</u>	<u>%</u>	<u>Cycles</u>	<u>%</u>
	<u>Change</u>	<u>Change</u>	<u>Change</u>	<u>Change</u>
"E" M O Plate	80	0.004	600	0.0137
"G" 1st I.P.A.	120	0.006	400	0.0089
"I" 2nd I.P.A.	35	0.0017	40	0.0009
"K" Pr Amp.	20	0.001	20	0.00045

Change permitted by specifications - 0.005%

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Test as per paragraph 3-7-4 of Specifications RE 13A 442C

Frequency change between "Adjust", "Tune" & "Operate" Positions

	<u>2000 KC</u>	<u>4500 KC</u>
"Adjust"	522 cycles	995 cycles
"Tune"	522	995
"Operate"	516	995

Change permitted by specifications -.0.001%

TABLE NO. 19

Test as per paragraph 3-7-5 pf Specifications RE 13A 442C

Key Locked Test

Frequency - 2000 KC

<u>Time</u>	<u>Filament</u>	<u>Key</u>	<u>Beat Note</u>	<u>Tube Oven Temperature</u>
1250	Lighted	Locked	825	56.2°
1300		Opened	650	56.2
1320		10 sec dash	700	57.3
		Change:	50 cycles or 0.0025%	
1350	Lighted	Locked	-	57.7°
1400		Opened	690	57.9
1420		10 sec dash	620	58.6
		Change:	70 cycles or 0.0035%	
1420	Lighted	Locked	620	58.6°
1430		Opened	596	58.6
1450		10 sec dash	600	59.2
		Change:	4 cycles or 0.0002%	
1450	Unlighted	Locked	600	59.2°
1500		Opened	582	59.2
1520		10 sec dash	635	59.2
		Change:	53 cycles or 0.0026%	

Specification requirements: 0.005% when filament lighted
0.01% when filament unlighted

Note: "Tube Oven Temperature" refers to the temperature of the compartment containing the master oscillator tube and not the compartment containing the inductance and capacity elements of the frequency establishing circuit.

During the course of these tests the frequency "fluttered" so badly several times that the tests could not be conducted. This condition was traced to poor contact and loose turns on the Master Oscillator rotating indicator. See body of report for a discussion of this defect.

TABLE NO. 20

Test as per paragraph 3-7-5 of Specifications RE 13A 442C

Key Locked Test

Frequency - 4500 KC

<u>Time</u>	<u>Filament</u>	<u>Key</u>	<u>Beat Note</u>	<u>Tube Oven Temperature</u>
0925	Lighted	Locked	835	Not visible
0935		Opened	690	Not visible
0955		10 sec dash	740	Below 55°
		Change:	50 cycles or	0.0011%
0955	Unlighted	Locked	740	Below 55°
1005		Opened	496	Below 55°
1025		10 sec dash	680	55.2°
		Change:	184 cycles or	0.0041%
1025	Lighted	Locked	680	55.2°
1035		Opened	364	55.4
1055		10 sec dash	418	56.2
		Change:	54 cycles or	0.0012%
1100	Unlighted	Locked	1000	56.2°
1110		Opened	716	56.8
1130		10 sec dash	940	57.2
		Change:	224 cycles or	0.005%
1130	Lighted	Locked	940	57.2°
1140		Opened	620	57.2
1200		10 sec dash	755	58.0
		Change:	135 cycles or	0.003%

Specification requirements: 0.005% when filament lighted
0.01% when filament unlighted.

Note: "Tube Oven Temperature" refers to the temperature of the compartment containing the master oscillator tube and not the compartment containing the inductance and capacity elements of the frequency establishing circuit.

TABLE NO. 21

Test as per paragraph 3-7-6 of Specifications RE 13A 442C

40 w/p/m Keying Test

2000 KC/S

<u>End of 30 min. key</u> <u>period at 40 w/p/m</u>	<u>End of 10 sec. dash</u> <u>20 minutes later.</u>	<u>Change in Freq.</u> <u>Cycles</u>	<u>%</u>
785 cycles	775 cycles	10	0.0005%

4500 KC/S

616 cycles	620 cycles	4	0.0001%
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Filament energized during off period.

Specification requirements: 0.0025%

TABLE NO. 22

Test as per paragraph 3-7-7 of Specifications RE 13A 442C

Change of Tubes in Master Oscillator

<u>Manufacturer</u>	<u>Serial No.</u>	<u>Frequency</u>	<u>Deviation from Avg.</u>	
			<u>Cycles</u>	<u>Percent</u>
Sylvania	1402	4501.00	-780	0.017
R C A	5267	4501.36	-420	0.009
G E	55508	4498.64	-2140	0.048
R C A	5266	4505.90	4120	0.092
G E	734	4499.69	-1090	0.024
R C A	29065	4500.86	- 920	0.020
G E	55528	4500.51	- 270	0.006
Sylvania	1522	4503.31	1530	0.034
Sylvania	1234	4503.88	2100	0.047
Sylvania	1511	4502.65	870	0.019

Mean frequency of 10 tubes - 4501.780

Average variation from mean - 1424 cycles or 0.031%

Permitted by specifications - 0.01%

Note: Ten tubes from one manufactured lot were not available, hence ten tubes produced by various manufacturers were used in this test.

TABLE NO. 23

Test as per paragraph 3-7-7 of Specifications RE 13A 442C

Change of Tubes in 1st Amplifier Circuit

<u>Manufacturer</u>	<u>Serial No.</u>	<u>Frequency</u>	<u>Deviation from Avg.</u>	
			<u>Cycles</u>	<u>Percent</u>
Sylvania	1402	4500.845		
R C A	5267	4500.600	-266	0.0059
G E	55508	4500.214	+214	0.0047
G E	55500	4501.080	+214	0.0047
R C A	5266	4501.030	+164	0.0036
G E	734	4501.050	+184	0.0041
R C A	29065	4500.970	+104	0.0023
G E	55528	4501.100	+234	0.0052
Sylvania	1522	4500.620	-246	0.0055
Sylvania	1234	4500.620	-246	0.0055
Sylvania	1511	4500.510	-356	0.0079

Mean Frequency of 10 tubes - 4500.866

Average variation from mean - 222 cycles or 0.0049%

Permitted by specifications - 0.001%

Note: Ten tubes from one manufactured lot were not available hence ten tubes produced by various manufacturers were used in this test.

TABLE NO. 24

Test as per paragraph 3-7-8 of Specifications RE 13A 442C

Change in frequency during full power run of two hours beginning three hours after voltage was applied to temperature regulating devices and 20 minutes after start of full power key locked condition.

Frequency - 2000 KC

<u>Time</u>	<u>"LH"Freq. Indicator</u>	<u>Temperature of inner Cabinet</u>	<u>Temperature of outer Cabinet</u>	<u>Ambient Temp.</u>	<u>Line Volts</u>
09:30	425	59.8	-	24.0	218
35	500	59.8	-	24.3	218
40	576	59.9	-	24.3	214
45	645	59.7	-	24.4	217
50	630*	59.6	-	24.4	217
55	726	59.9	-	23.9	217
10:00	770	59.6	55.1	23.7	218
05	805	59.7	55.9	23.0	217
10	875	60.0	56.4	23.0	214
15	860	59.6	56.6	23.7	218
20	910	60.0	57.2	24.1	218
25	880	59.6	57.6	23.4	216
30	935	59.9	58.4	23.6	218
35	935	59.6	58.7	23.7	218
40	965*	60.0	59.2	24.2	219
45	910	60.0	59.6	24.5	219
50	906	59.7	60.0	24.7	220
55	945	60.1	60.5	24.8	220
11:00	875	60.0	61.0	24.9	218
05	845	59.8	61.4	25.0	219
10	825	59.7	61.8	25.3	219
15	810	60.2	62.2	25.1	219
20	750	60.2	62.5	25.2	220
25	730	60.0	62.8	24.9	219
30	730	59.9	63.1	24.4	220

*Greatest frequency change between 09:50 and 11:30 - 335 cycles or 0.0167%.

Voltage applied to regulating devices - 06:30
Auxiliary heater turned on at 09:00

TABLE NO. 25

Test as per paragraph 3-7-8 of Specifications RE 13A 442C

Change in frequency during full power run of two hours beginning three hours after voltage was applied to temperature regulating devices and 20 minutes after start of full power key locked condition.

Frequency - 2000 KC

<u>Time</u>	<u>"LH" Freq. Indicator</u>	<u>Temperature of inner Cabinet</u>	<u>Temperature of outer Cabinet</u>	<u>Ambient Temp.</u>	<u>Line Volts</u>
09:30	760	57.9	-	24.1	220
35	780	58.2	-	24.5	222
40	770	57.6	-	24.8	222
45	750	58.1	-	24.7	222
50	780	58.1	-	24.5	219
55	724*	57.9	-	24.7	221
10:00	763	58.3	55.4	24.6	219
05	740	58.0	55.9	24.9	222
10	905	58.3	56.4	24.8	222
15	885	58.0	56.8	24.7	222
20	940	57.8	57.2	24.6	221
25	990	58.4	57.7	24.7	222
30	970	58.1	58.2	24.8	220
35	987	57.9	58.6	24.9	219
40	1045*	58.4	58.8	25.0	222
45	985	58.3	59.2	24.9	221
50	945	58.2	59.4	25.0	220
55	935	58.0	59.6	25.0	221
11:00	920	57.9	59.8	25.0	220
05	955	58.5	59.8	25.0	217
10	910	58.5	59.8	25.0	218
15	880	58.4	59.8	25.0	220
20	845	58.3	59.8	25.0	220
25	842	58.3	59.8	25.0	221
30	822	58.2	59.8	25.0	218

*Greatest frequency change between 09:50 and 11:30 - 321 cycles or 0.016%.

Note: Outer cabinet thermostat was adjusted to 55° C. at the beginning of the test run.

Heat and Oscillator Filament turned on at 06:27.

TABLE NO. 26

Test as per paragraph 3-7-8 of Specifications RE 13A 442C

Change in frequency during full power run of two hours beginning three hours after voltage was applied to temperature regulating devices and 20 minutes after start of full power key locked condition.

Frequency - 4500 KC.

<u>Time</u>	<u>"LH" Freq. Indicator</u>	<u>Temperature of inner Cabinet</u>	<u>Temperature of outer Cabinet</u>	<u>Ambient Temp.</u>	<u>Line Volts</u>
09:30	825	59.2	-	20.0	222
35	686	59.0	-	20.0	223
40	578	59.2	-	19.7	222
45	502	59.1	-	20.2	222
50	490*	59.5	-	20.4	222
55	464	59.2	-	20.5	223
10:00	390	59.2	-	21.1	223
05	330	59.5	-	21.2	222
10	340	59.6	-	21.3	222
15	254	59.2	-	21.5	222
20	243	59.6	55.4	21.5	223
25	210	59.4	56.3	21.9	222
30	140	59.7	57.9	22.2	222
35	41	59.2	57.7	22.2	222
40	48	59.7	58.2	22.4	222
45	-58	59.4	58.8	22.4	222
50	-65	59.9	59.4	22.6	222
55	-175	59.7	59.9	22.7	220
11:00	-235	59.6	60.3	23.2	221
05	-235	59.7	60.7	22.8	220
10	-318	60.0	61.0	23.1	220
15	-390	59.8	61.4	23.1	221
20	-416	59.6	61.7	23.5	221
25	-460*	59.4	62.0	23.3	221
30	-427	59.7	62.2	23.3	221

*Greatest frequency change between 09:50 and 11:30 - 950 cycles or 0.021%.

TABLE NO. 27

Test as per paragraph 3-7-8 of Specifications RE 13A 442C

Change in frequency during full power run of two hours beginning three hours after voltage was applied to temperature regulating devices and 20 minutes after start of full power key locked condition.

Frequency - 4500 KC

<u>Time</u>	<u>"LH" Freq. Indicator</u>	<u>Temperature of inner Cabinet</u>	<u>Temperature of outer Cabinet</u>	<u>Ambient Temp</u>	<u>Line Volts</u>
08:30	1100	59.2	-	23.1	226
35	1044	59.4	-	23.3	224
40	995	59.6	-	23.3	224
45	961	59.5	-	23.4	224
50	928*	59.1	-	23.5	224
09:00	815	59.6	-	23.7	224
05	759	59.5	55.0	23.7	223
10	700	59.4	55.8	23.9	222
15	589	59.7	56.6	24.0	223
20	628	59.4	57.4	24.1	222
25	684	59.7	58.2	24.1	222
30	650	59.5	58.6	24.3	222
35	710	59.6	59.2	24.4	221
40	642	59.7	59.8	24.5	222
45	610	59.4	60.2	24.5	222
50	600	59.8	60.8	24.6	222
55	480	59.8	61.2	24.7	223
10:00	385	59.6	61.5	24.7	222
05	327	59.5	62.0	24.8	221
10	330	59.4	62.4	25.0	221
15	350	59.9	62.6	25.0	222
20	245	60.0	62.9	25.0	221
25	170	60.0	63.2	25.2	222
30	124*	60.0	63.4	25.3	222

*Greatest frequency change between 08:50 and 10:30 - 804 cycles or 0.0179%.

TABLE NO. 28

Test as per paragraph 3-7-9 of Specifications RE 13A 442C

Shock Test to simulate Gun Fire

<u>Frequency 30 sec.</u> <u>before shock</u>	<u>Frequency 30 sec.</u> <u>after shock</u>	<u>Cycles</u> <u>Change</u>	<u>Percentage</u> <u>Change</u>
(4500 KC/S)			
600	550	50	0.0011%
550	564	14	0.0003
564	550	14	0.0003
550	570	20	0.0004
570	530	40	0.0009
530	518	12	0.0003
518	510	8	0.0002
510	440	70	0.0015
440	500	60	0.0013

Avg. of 9 shocks - 32 cycles or 0.0007%

(2000 KC/S)

756	670	86	0.0043%
670	635	35	0.0018
635	720	85	0.0043
720	680	40	0.002
680	668	12	0.0006
668	600	68	0.0034
600	588	12	0.0006
588	590	2	0.0001
590	594	4	0.0002

Avg. of 9 shocks - 38 cycles or 0.0019%

Shift permitted by specifications - 0.002%

TABLE NO. 29

Test as per paragraph 3-17 of Specifications RE 13A 442C

Variation of resonant frequency of Master Oscillator per
division of marking.

Frequency	Control				Divisions Change	KC per Division	% Change per Div.
	B	C	D	E			
1800	1	0	800	0			
1950	1	124.5	800	62			
2000	1	124.5	5100	93	4300	0.012	0.0060
2050	1	124.5	9200	122	4100	0.012	0.0059
2050	1	189.5	2600	122			
2100	1	189.5	6700	153	4100	0.012	0.0057
2100	1	244.5	500	153			
2150	1	244.5	4500	172	4000	0.012	0.0056
2200	1	244.5	8400	195	3900	0.013	0.0059
2200	1	299.5	2000	195			
2250	1	299.5	5900	217	3900	0.013	0.0058
2300	1	299.5	9500	240	3600	0.014	0.0061
2300	1	349.5	2900	240			
2400	1	399.5	3000	274			
2450	1	399.5	6600	293	3600	0.013	0.0053
2450	1	439.5	200	293			
2500	1	439.5	3800	307	3600	0.013	0.0052
2550	1	439.5	7200	321	3400	0.015	0.0059
2550	1	481.5	0	321			
2600	1	481.5	3500	336	3500	0.015	0.0058
2650	1	481.5	6800	349	3300	0.015	0.0057
2650	1	516.5	500	349			
2700	1	516.5	3700	361	3200	0.016	0.0059
2750	1	516.5	6900	371	3200	0.016	0.0057
2750	1	550.5	200	371			
2800	1	550.5	3400	382	3200	0.016	0.0055
2850	1	550.5	6500	395	3100	0.016	0.0054
2900	1	550.5	9400	404	2900	0.017	0.0053
2900	1	584.5	2500	404			
2950	1	584.5	5500	414	3000	0.017	0.0051
3000	1	584.5	8200	424	2700	0.018	0.0060
3000	1	616.5	1400	424			
3050	1	616.5	4100	432	2800	0.018	0.0059
3000	2	124.5	6400	424			
3050	2	124.5	8900	432	2500	0.020	0.0060
3050	2	189.5	2700	432			
3100	2	189.5	5400	443	2700	0.019	0.0061
3150	2	189.5	7800	451	2400	0.021	0.0067
3150	2	244.5	2100	451			
3200	2	244.5	4600	459	2500	0.020	0.0062
3250	2	244.5	6950	467	2350	0.021	0.0065
3300	2	244.5	9400	472	2450	0.020	0.0061
3300	2	299.5	3300	472			
3350	2	299.5	5700	479	2400	0.021	0.0063

TABLE NO. 29 - Cont'd

Frequency	Control				Divisions Change	KC per Division	% Change per Div.
	B	C	D	E			
3400	2	299.5	8000	486	2300	0.022	0.0065
3400	2	349.5	1900	486			
3450	2	349.5	4100	493	2100	0.024	0.0069
3500	2	349.5	6500	498	2400	0.021	0.0060
3550	2	349.5	8600	505	2100	0.024	
3550	2	399.5	2100	505			
3600	2	399.5	4300	512	2200	0.023	0.0064
3650	2	399.5	6500	516	2200	0.023	0.0063
3700	2	399.5	8500	521	2000	0.023	0.0062
3700	2	439.5	2900	521			
3750	2	439.5	5000	527	2100	0.024	0.0064
3800	2	439.5	7100	532	2100	0.024	0.0063
3850	2	439.5	9100	537	2000	0.025	0.0065
3850	2	481.5	2700	537			
3900	2	481.5	4700	541	2000	0.025	0.0064
3950	2	481.5	6800	546	2100	0.024	0.0061
4000	2	481.5	8700	550	1900	0.026	0.0065
4000	2	516.5	2900	550			
4050	2	516.5	4900	555	2000	0.025	0.0062
4100	2	516.5	6900	560	2000	0.025	0.0061
4150	2	516.5	8700	563	1800	0.028	0.0067
4150	2	550.5	2700	563			
4200	2	550.5	4600	566	1900	0.026	0.0062
4250	2	550.5	6500	570	1900	0.026	0.0061
4300	2	550.5	8300	574	1800	0.028	0.0065
4300	2	584.5	2000	574			
4350	2	584.5	3700	577	1700 *	0.029	0.0067
4400	2	584.5	5600	583	1900	0.026	0.0059
4450	2	584.5	7300	586	1700	0.029	0.0065
4500	2	584.5	9000	589	1700	0.029	0.0064
4500	2	616.5	2500	589			
4550	2	616.5	4200	592	1700	0.029	0.0064
4600	2	616.5	6000	595	1800	0.028	0.0061
4650	2	616.5	7700	589	1700	0.029	0.0062
4700	2	616.5	9200	601	1500	0.033	
4700	2	645.5	3200	601			
4750	2	645.5	4900	604	1700	0.029	0.0061
4800	2	645.5	6500	607	1600	0.031	0.0065
4850	2	645.5	8100	609	1600	0.031	0.0064
4850	2	673.5	1700	609			
4900	2	673.5	3250	612	1550	0.032	0.0065
4950	2	673.5	4900	615	1650	0.030	0.0061
5000	2	673.5	6500	617	1600	0.031	0.0062
5050	2	673.5	8000	619	1500	0.033	0.0065
5050	2	699.0	1700	619			
5100	2	699.0	3200	622	1500	0.033	0.0065
5150	2	699.0	4750	625	1550	0.032	0.0062
5200	2	699.0	6360	627	1600	0.031	0.0060

TABLE NO. 29 - Cont'd

Frequency	B	C	D	R	Divisions Change	KC per Division	% Change per Div.
5250	2	699.0	7800	629	1450	0.034	0.0065
5300	2	699.0	9300	631	1500	0.033	0.0064
5300	2	722.0	3100	631			
5350	2	722.0	4500	634	1400	0.036	0.0067
5400	2	722.0	6100	636	1600	0.031	0.0057
5450	2	722.0	7500	639	1400	0.036	0.0066
5500	2	722.0	8900	641	1400	0.036	0.0065
5500	2	745.0	2600	641			
5750	2	745.0	9999	650	7400	0.034	0.0059
5750	2	766.5	3100	650			
6000	2	766.5	9999	658	6900	0.036	0.0060
6000	2	786.5	3400	658			
6250	2	805.0	3500	666			
6500	2	805.0	9999	673	6500	0.038	0.0058
6500	2	823.0	3200	673			
6750	2	823.0	9100	681	5900	0.042	0.0062
6750	2	841.0	2500	681			
7000	2	841.0	8300	685	5800	0.043	0.0061
7000	2	855.0	2300	685			
7250	2	855.0	7800	691	5500	0.045	0.0062
7250	2	870.0	1300	691			
7500	2	870.0	6700	696	5400	0.046	0.0061
7500	2	883.5	800	696			
7750	2	883.5	6100	702	5300	0.047	0.0061
7750	2	896.0	800	702			
8000	2	896.0	4800	706	4000	.063	0.0079
8250	2	909.0	3000	710			
8500	2	909.0	7800	714	4800	0.052	0.0061
8500	2	921.0	1300	714			
9000	2	941.0	7300	727			
9500	2	941	7300	727			

TABLE NO. 30

Test for lost motion and back-lash

2000 KC

Reset of Control "C" - "Oscillator Band" Coil

See "note" below

Reset of Control "D" - "Oscillator Tuning" Condenser

Operator No. 1		Operator No. 2	
<u>Clockwise</u>	<u>Counter-Clock</u>	<u>Clockwise</u>	<u>Counter-Clock.</u>
550	680	550	612
589	682	541	620
580	665	540	619

Avg. Back-lash 103 cycles. Avg. Back-lash 73 cycles

4500 KC

Re-set of Control "C" - "Oscillator Band" Coil

458	608	438	1100 plus
490	526	975	620
350	760	780	542

Avg. Back-lash 199 cycles Erratic - See note below.

Re-set of Control "D" "Oscillator Tuning" Condenser

486	709	710	950
503	699	708	945
516	718	718	958

Avg. Back-lash 207 cycles. Avg. Back-lash 239 cycles.

Note: Control "C" is a rotating inductor with notches cut into the periphery of the edgewise wound flat ribbon. These notches serve as reference points for tuning purposes. The notch which falls at 125 of the dial setting is used for 2000 KC setting. This notch is cut into a portion of the winding where several turns are loose. This tends to give a poor contact and even though the slider is recessed firmly in the notch and locked into position, frequency shifts of 1000 cycles, more or less, occur constantly. This condition is most noticeable in the neighborhood of 2000 KC, and examination showed that 3 or 4 turns in the region of the 125 notch are loose. At times this condition practically prohibits obtaining a good steady signal at 2000 KC. Better stability may be obtained by adjusting close to but not actually in the notch.

TABLE NO. 31

Test as per paragraph 3-24-6 of Specifications RE 13A 418C

Control of Power Output

4500 KC

<u>Rectifier Tap</u>	<u>Photo Cell Current</u>	<u>Watts Output</u>	<u>Percentage</u>
6	193	312	100%
5	142	265	85
4	95	220	70
3	56	175	56
2	28	138	44
1	6	75	24

Antenna load consisted of 230 volts 500 watt Lamp.

Specifications require that the control of power shall be such that the output may be reduced to at least 25% of full power.

TABLE NO. 32

Test to determine temperature at which thermal fuse in coil oven opens heater circuit.

<u>Time</u>	<u>Temperature</u>
14:15	60°C
14:48	76°C

Fuse opened at 76° Centigrade.

TABLE NO. 33

TAZ-1 Transmitter; Serial No. 3

Effect of Change in Ambient Temperature

Frequency - 3000 KC.

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
09:50	26.0	59.6	55.6	3001.346	229
10:00	25.0	59.5	56.4	075	228
10	25.0	59.8	57.6	3000.815	228
20	25.0	59.9	58.8	3001.263	228
30	25.2	60.0	59.4	180	227
40	25.2	60.0	59.5	121	226
50	25.0	59.9	60.5	000	226
11:00	25.0	59.8	60.2	025	226

(Key open 10 minutes while temperature was changed)

11:10	29.8	60.0	60.8	3001.106	225
20	30.0	60.0	61.6	3000.985	226
30	30.0	60.0	62.4	900	226
40	30.0	60.0	63.0	865	226
50	30.0	60.0	63.4	825	226
12:00	30.0	60.2	63.5	800	226
10	30.0	60.3	63.7	760	226
20	30.0	60.5	63.8	750	228

(Key open 10 minutes while temperature was changed)

12:30	34.8	60.6	64.2	3000.760	228
40	35.0	60.8	64.6	708	226
50	35.2	61.0	65.0	682	227
13:00	35.3	61.4	65.4	638	227
10	35.3	61.7	65.8	598	227
20	34.8	62.1	66.2	585	227
30	35.0	62.5	66.4	545	227
40	35.0	62.9	66.6	510	226

(Key open 10 minutes while temperature was changed)

13:50	50.0	63.3	-	3000.604	225
14:00	50.4	63.8	70.5	448	226
10	50.0	64.4	71.5	363	226
20	49.6	65.0	72.5	287	223
30	51.0	67.0	74.0	200	225
40*	50.2	67.0	74.0	290	228
50	51.0	68.0	74.0	241	228
15:00	50.0	68.0	74.2	156	228
10	50.0	68.3	74.4	116	229

(Key open 10 minutes while temperature was changed)

*Between 1430 and 14:40 Relay #E10 fell out and key circuit opened.

TABLE NO.33-Cont'd

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
15:20	26.0	68.2	66.0	3000.316	229
30	24.5	68.0	63.5	222	230
40	25.0	67.5	62.8	2999.986	229
50	25.0	67.0	62.0	656	229
16:00	25.2	66.0	61.8	676	230
10	24.8	65.5	61.8	936	232
20	24.8	64.2	61.6	3000.216	232
30	25.0	63.8	61.7	146	232

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Difference between readings taken at 11:00 and 12:20

Ambient temperature - 5.0° Centigrade

Difference in frequency - 275 cycles

Difference per degree Centigrade - 55 cycles
.0018%

Difference between readings taken at 12:20 and 13:40

Ambient temperature - 5.0° Centigrade

Difference in frequency - 240 cycles

Difference per degree Centigrade - 48 cycles
.0016%

Difference between readings taken at 13:40 and 15:10

Ambient temperature - 15.0° Centigrade

Difference in frequency - 394 cycles

Difference per degree Centigrade - 26.3 cycles
.00087%

Difference between readings taken at 15:10 and 16:30

Ambient temperature - 25.0° Centigrade

Difference in frequency - 30 cycles

Difference per degree Centigrade 1.2 cycles
.0004%

Difference between readings taken at 11:00 and 16:40

Ambient temperature - none

Difference in frequency - 879 cycles
.029%.

TABLE NO. 34

Effect of Change in Ambient Temperature - 3000 KC.

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
08:30	24.8	59.7	-	3000.800	229
40	25.0	59.4	54.6	570	229
50	24.8	59.7	56.2	400	232
09:00	25.0	59.6	57.1	136	230
10	24.8	59.5	58.3	146	229
20	25.0	59.6	59.2	116	230
30	25.2	59.7	59.8	2999.786	230
40	25.0	59.9	60.3	886	230

(Key open 10 minutes while temperature was changed)

09:50	10.8	60.0	59.2	3000.119	230
10:00	10.0	59.7	56.5	036	229
10	10.0	59.8	54.6	116	229
20	10.0	59.7	53.8	176	229
30	10.0	59.5	-	276	232
40	10.0	59.7	-	056	231
50	10.0	59.5	-	236	230
11:00	10.0	59.5	-	2999.836	230

(Key open 10 minutes while temperature was changed)

11:10	5.0	59.5	-	3000.520	230
20	5.0	59.5	-	470	229
30	5.0	59.4	-	2999.982	229
40	4.8	59.4	-	961	229
50	5.0	59.2	-	3000.072	232
12:00	4.8	59.4	-	104	231
10	5.0	59.2	-	196	230
20	5.0	59.2	-	166	230

(Key open 10 minutes while temperature was changed)

12:30	0.4	59.4	48.0	3000.400	230
40	-0.4	59.1	46.0	116	230
50	0.0	59.3	-	032	230
13:00	0.0	59.1	-	051	230
10	0.0	59.3	-	071	230
20	0.0	59.0	-	096	229
30	0.0	59.3	-	131	230
40	0.0	59.0	43.0	136	229

(Key open 10 minutes while temperature was changed)

TABLE NO. 34 Cont'd

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
13:50	24.0	59.3	-	3000.326	229
14:00	24.8	59.2	-	236	230
10	24.8	59.4	-	096	230
20	25.2	59.5	55.3	036	228
30	24.8	59.6	56.7	2999.886	230
40	25.0	59.5	58.0	776	230
50	25.2	59.5	58.8	736	229
15:00	25.0	59.6	58.4	641	230

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Difference between readings taken at 09:40 and 11:00
 Ambient temperature - 15.0° Centigrade
 Difference in frequency - 50 cycles
 Difference per degree Centigrade - 3.3 cycles
 .0001%.

Difference between readings taken at 11:00 and 12:20
 Ambient temperature - 5.0° Centigrade
 Difference in frequency - 330 cycles
 Difference per degree Centigrade - 66 cycles
 .0022%

Difference between readings taken at 12:20 and 13:40
 Ambient temperature - 5.0° Centigrade
 Difference in frequency - 40 cycles
 Difference per degree Centigrade - 8 cycles
 .00026%

Difference between readings taken at 13:40 and 15:00
 Ambient temperature - 25.0° Centigrade
 Difference in frequency - 485 cycles
 Difference per degree Centigrade - 19.4 cycles
 .00065%

Difference between readings taken at 09:40 and 15:00
 Ambient temperature - none
 Difference in frequency - 245 cycles
 .0081%.

(May open 10 minutes while temperature was changed)

TABLE NO. 35

TAZ-1 Transmitter; Serial No. 3

Effect of Change in Ambient Temperature

4500 KC

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
08:20	24.0	59.3	Off scale	4500.900	232
30	25.2	59.5	" "	590	230
40	25.0	59.5	54.8	450	229
50	25.0	59.7	56.1	278	231
09:00	25.0	59.5	57.2	158	231
10	25.0	59.6	58.0	048	232
20	25.0	59.8	58.3	4499.968	232
30	25.0	59.8	58.6	893	232

(Key open 10 minutes while temperature was changed)

09:40	10.0	59.8	57.3	4500.415	230
50	10.0	59.8	54.8	032	230
10:00	9.8	59.6	53.8	006	230
10	10.1	59.5	-	4499.982	230
20	10.0	59.6	-	971	230
30	10.0	59.4	-	743	229
40	10.0	59.6	-	761	228
50	10.0	59.4	51.0	763	229

(Key open 10 minutes while temperature was changed)

11:00	5.2	59.6	51.0	4500.328	228
10	5.0	59.3	-	185	228
20	4.9	59.5	-	278	228
30	5.0	59.3	-	272	229
40	4.9	59.3	-	278	229
50	5.0	59.4	-	288	231
12:00	4.8	59.2	-	298	231
10	5.0	59.3	48.0	302	232

(Key open 10 minutes while temperature was changed)

12:20	1.6	59.4	49.0	4500.660	231
30	0.6	59.1	-	620	230
40	0.0	59.3	-	638	231
50	0.0	59.0	-	682	229
13:00	0.6	59.3	-	728	231
10	-0.3	59.0	-	775	230
20	0.0	59.2	-	805	232
30	0.0	59.0	44.0	755	230

(Key open 10 minutes while temperature was changed)

TABLE NO. 35 Cont'd

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
13:40	24.6	59.2	49.0	4500.875	230
50	24.8	59.1	-	550	229
14:00	24.8	59.5	-	390	230
10	25.2	59.5	55.2	298	230
20	25.0	59.7	56.7	170	229
30	25.0	59.5	57.9	090	230
40	25.0	59.8	58.7	4499.963	230
50	25.0	59.7	59.0	858	230

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Difference between readings taken at 09:30 and 10:50

Ambient temperature - 15.0° Centigrade

Difference in frequency - 130 cycles

Difference per degree Centigrade - 8.6 cycles

.00019%

Difference between readings taken at 10:50 and 12:10

Ambient temperature - 5.0° Centigrade

Difference in frequency - 539 cycles

Difference per degree Centigrade - 107.8 cycles

.0024%

Difference between readings taken at 12:10 and 13:30

Ambient temperature - 5.0° Centigrade

Difference in frequency - 453 cycles

Difference per degree Centigrade - 90.6 cycles

.002%

Difference between readings taken at 13:30 and 14:50

Ambient temperature - 25.0° Centigrade

Difference in frequency - 897 cycles

Difference per degree Centigrade - 35.8 cycles

.0008%

Difference between readings taken at 09:30 and 14:50

Ambient temperature - none

Difference in frequency - 35 cycles

.00078%.

(They open 10 minutes while temperature was changed)

TABLE NO. 36

TAZ-1 Transmitter; Serial No. 3

Effect of Change in Ambient Temperature

Frequency - 4500 KC.

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
08:30	24.8	59.4	-	4500.600	229
40	25.0	59.6	-	314	230
50	25.0	59.4	54.2	158	231
09:00	25.1	59.7	55.6	043	230
10	25.2	59.6	57.0	4499.958	230
20	25.0	59.6	57.9	923	230
30	25.0	59.8	58.3	853	232
40	25.0	59.9	58.6	803	230

(Key open 10 minutes while temperature was changed)

09:50	30.2	59.9	59.8	4499.928	230
10:00	30.0	60.0	60.8	768	230
10	30.2	59.8	61.2	678	228
20	30.0	60.0	62.0	643	228
30	30.0	59.9	62.3	570	229
40	30.0	59.8	62.5	520	229
50	30.0	59.8	62.5	480	229
11:00	30.0	59.8	62.5	470	229

(Key open 10 minutes while temperature was changed)

11:10	35.0	59.9	63.5	4499.903	229
20	35.0	60.0	64.2	460	228
30	35.0	60.3	65.0	417	228
40	35.2	60.6	65.4	350	229
50	35.0	60.0	65.8	245	229
12:00	35.0	60.4	65.8	150	230
10	35.0	60.8	65.8	090	229
20	35.0	60.1	65.9	030	230

(Key open 10 minutes while temperature was changed)

12:30	51.0	62.5	67.3	4499.228	229
40	50.0	63.0	68.8	017	228
50	50.0	63.5	70.1	4498.950	227
13:00	50.0	64.1	71.1	880	227
10	50.2	64.8	71.8	750	228
20	50.0	66.5	72.2	615	229
30	49.9	68.0	72.6	490	229
40	50.0	68.0	72.8	400	230

(Key open 10 minutes while temperature was changed)

TABLE NO.36 - Cont'd

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
13:50	25.0	68.0	69.6	4498.950	230
14:00	24.6	68.0	66.1	770	229
10	25.0	68.0	65.0	535	229
20	25.0	67.3	64.3	550	231
30	25.0	67.0	64.0	600	230
40	25.0	66.5	63.6	645	230
50	25.1	65.3	62.9	725	231
15:00	25.0	64.8	62.9	865	230

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Difference between readings taken at 09:40 and 11:00
 Ambient temperature - 5.0° Centigrade
 Difference in frequency - 333 cycles
 Difference per degree Centigrade - 66.6 cycles
 .0014%

Difference between readings taken at 11:00 and 12:20
 Ambient temperature - 5.0° Centigrade
 Difference in frequency - 440 cycles
 Difference per degree Centigrade - 88 cycles
 .0019%

Difference between readings taken at 12:20 and 13:40
 Ambient temperature - 15.0° Centigrade
 Difference in frequency - 630 cycles
 Difference per degree Centigrade - 42 cycles
 .0009%

Difference between readings taken at 13:40 and 15:00
 Ambient temperature - 25.0° Centigrade
 Difference in frequency - 465 cycles
 Difference per degree Centigrade 18.6 cycles
 .0004%

Difference between readings taken at 09:40 and 15:00
 Ambient temperature - none
 Difference in frequency - 938 cycles
 .021%.

TABLE NO. 37

TAZ-1 Transmitter; Serial No. 3

Effect of Change in Ambient Temperature

Frequency - 2000 KC.

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
08:30	25.0	59.8	53.6	2000.825	230
40	25.0	59.6	54.6	160	230
50	25.0	59.8	55.8	2001.065	230
09:00	25.0	59.8	56.9	075	230
10	24.8	59.6	57.6	075	232
20	25.0	59.6	58.6	030	231
30	25.0	59.7	59.2	010	232
40	25.0	59.7	59.7	2000.900	230

(Key open 10 minutes while temperature was changed)

09:50	11.0	59.7	58.4	2001.000	228
10:00	10.0	59.6	56.1	025	230
10	10.0	59.5	53.8	020	228
20	10.0	59.5	-	2000.645	228
30	10.2	59.5	-	595	228
40	10.2	59.8	-	590	228
50	10.0	60.0	52.8	604	229
11:00	10.0	60.0	52.8	568	229

(Key open 10 minutes while temperature was changed)

11:10	5.8	59.9	51.8	2000.630	229
20	5.0	59.6	49.8	825	230
30	5.2	59.4	49.3	500	229
40	5.0	59.9	49.0	400	229
50	5.2	59.7	48.8	320	230
12:00	5.2	59.3	48.8	210	230
10	5.0	59.8	48.8	1999.970	230
20	5.0	59.7	48.3	965	230

(Key open 10 minutes while temperature was changed)

12:30	1.0	59.3	48.8	2000.680	229
40	0.8	59.9	48.8	1999.745	230
50	0.0	59.4	47.8	900	230
13:00	-0.2	59.7	45.3	910	231
10	0.0	59.3	-	865	230
20	0.0	59.8	-	795	230
30	0.0	59.2	-	805	230
40	0.0	59.8	44.8	2000.110	230

(Key open 10 minutes while temperature was changed)

TABLE NO. 37 - Cont'd

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
13:50	25.0	59.2	47.8	2000.900	230
14:00	24.8	59.9	50.8	600	230
10	25.0	59.8	53.3	1999.995	230
20	25.2	59.6	55.8	855	230
30	25.0	59.7	56.8	845	230
40	25.2	59.9	58.8	845	229
50	25.0	60.1	58.3	2000.510	230
15:00	25.0	60.1	58.8	660	230

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Difference between readings taken at 09:40 and 11:00

Ambient temperature - 15.0° Centigrade

Difference in frequency - 332 cycles

Difference per degree Centigrade - 21.1 cycles
.001%

Difference between readings taken at 11:00 and 12:20

Ambient temperature - 5.0° Centigrade

Difference in frequency - 603 cycles

Difference per degree Centigrade - 120.6 cycles
.006%.

Difference between readings taken at 12:20 and 13:40

Ambient temperature - 5.0° Centigrade

Difference in frequency - 145 cycles

Difference per degree Centigrade - 29 cycles
.0014%.

Difference between readings taken at 13:40 and 15:00

Ambient temperature - 25.0° Centigrade

Difference in frequency - 550 cycles

Difference per degree Centigrade - 22 cycles
.0011%

Difference between readings taken at 09:40 and 15:00

Ambient temperature - none

Difference in frequency - 240 cycles

.012%.

TABLE NO. 38

TAZ-1 Transmitter; Serial No. 3

Effect of Change in Ambient Temperature

Frequency - 2000 KC

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
08:20	25.2	60.0	50.8	2000.850	226
30	25.3	59.8	52.3	500	227
40	25.2	59.6	53.8	390	226
50	25.0	59.5	55.3	570	227
09:00	25.2	59.8	56.3	1999.970	227
10	25.0	59.8	57.3	245	227
20	24.8	59.7	57.8	150	227
30	25.0	59.6	58.3	085	228
(Key open 10 minutes while temperature was changed)					
09:40	29.8	59.6	59.3	1999.500	227
50	30.4	59.7	59.8	2000.100	228
10:00	30.0	59.8	60.8	1999.710	226
10	30.0	60.0	61.3	2000.000	224
20	30.0	59.8	61.8	1999.420	226
30	30.2	60.0	61.8	370	223
40	30.0	60.0	61.8	395	225
50	30.0	60.0	61.8	405	225
(Key open 10 minutes while temperature was changed)					
11:00	34.6	60.0	62.8	1999.100	224
10	35.2	60.0	63.3	195	225
20	35.0	60.2	63.8	195	225
30	35.0	60.2	64.3	270	224
40	35.0	60.7	64.8	370	226
50	35.2	61.0	65.3	560	226
12:00	34.8	61.4	64.8	320	227
10	35.0	61.8	64.8	310	225
(Key open 10 minutes while temperature was changed)					
12:20	50.0	62.2	67.8	1999.245	224
30	50.0	62.7	68.8	270	225
40	50.0	63.2	69.8	220	226
50	50.0	63.8	70.8	305	225
13:00	50.0	64.5	70.8	220	227
10	50.1	65.2	71.8	170	223
20	50.0	67.5	71.8	1998.980	223
30	50.0	68.0	72.3	675	224
(Key open 10 minutes while temperature was changed)					

TABLE NO. 38 Cont'd

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Coil Oven Deg. C.</u>	<u>Tube Oven Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
13:40	24.6	68.0	68.8	1998.600	224
50	25.0	68.0	65.8	650	223
14:00	24.8	68.0	64.2	1999.195	223
10	25.0	67.5	63.3	210	223
20	25.0	67.0	62.8	220	224
30	25.2	66.0	62.3	240	224
40	25.0	66.0	62.2	255	223
50	25.0	65.0	62.3	270	223

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Difference between readings taken at 09:30 and 10:50
 Ambient temperature - 5.0° Centigrade
 Difference in frequency - 320 cycles
 Difference per degree Centigrade - 64 cycles
 .0032%.

Difference between readings taken at 10:50 and 12:10
 Ambient temperature - 5.0° Centigrade
 Difference in frequency - 5 cycles
 Difference per degree Centigrade - 1 cycle
 .00005%.

Difference between readings taken at 12:10 and 13:30
 Ambient temperature - 15.0° Centigrade
 Difference in frequency - 735 cycles
 Difference per degree Centigrade - 49 cycles
 .0024%.

Difference between readings taken at 13:30 and 14:50
 Ambient temperature - 25.0° Centigrade
 Difference in frequency - 595 cycles
 Difference per degree Centigrade - 23.8 cycles
 .0012%.

Difference between readings taken at 09:30 and 14:50
 Ambient temperature - none
 Difference in frequency - 185 cycles
 .0092%.

TABLE NO. 39

TAZ-1 Transmitter; Serial No. 3

Effect of Change in Ambient Temperature

Frequency - 500 KC

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
08:10	24.2	500.500	228
20	24.8	750	231
30	24.8	566	230
40	25.0	415	230
50	24.8	215	228
09:00	25.0	158	231
10	25.0	090	230
20	25.0	033	230

(Key open 10 minutes while temperature was changed)

09:30	10.0	500.310	231
40	9.8	210	230
50	9.8	230	229
10:00	10.2	240	229
10	10.0	254	229
20	10.0	275	229
30	10.0	300	229
40	10.0	315	229

(Key open 10 minutes while temperature was changed)

10:50	5.2	500.600	228
11:00	5.0	490	228
10	4.8	490	227
20	5.2	500	227
30	5.0	520	227
40	4.8	535	227
50	5.0	550	227
10:00	5.0	565	226

(Key open 10 minutes while temperature was changed)

12:10	0.0	500.800	230
20	0.2	690	230
30	0.0	675	228
40	0.0	680	228
50	0.0	690	226
13:00	0.0	702	227
10	0.0	714	227
20	0.0	720	227

(Key open 10 minutes while temperature was changed)

TABLE NO.39 Cont'd

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
13:30	25.6	500.820	227
40	24.8	580	226
50	24.4	440	225
14:00	25.2	350	225
10	25.0	255	225
20	25.0	194	225
30	25.0	152	225
40	25.0	132	225

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Difference between readings taken at 09:20 and 10:40
 Ambient temperature - 15.0° Centigrade
 Difference in frequency - 282 cycles
 Difference per degree Centigrade - 18.6 cycles
 .0036%.

Difference between readings taken at 10:40 and 12:00
 Ambient temperature - 5.0° Centigrade
 Difference in frequency - 250 cycles
 Difference per degree Centigrade - 50 cycles
 .01%.

Difference between readings taken at 12:00 and 13:20
 Ambient temperature - 5.0° Centigrade
 Difference in frequency - 155 cycles
 Difference per degree Centigrade - 31 cycles
 .0062%.

Difference between readings taken at 13:20 and 14:40
 Ambient temperature - 25.0° Centigrade
 Difference in frequency - 588 cycles
 Difference per degree Centigrade - 23.5 cycles
 .0047%.

Difference between readings taken at 09:20 and 14:40
 Ambient temperature - none
 Difference in frequency - 99 cycles
 .019%.

TABLE NO. 40

Effect of Change in Ambient Temperature - 500 KC.

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
08:20	24.4	500.870	227
30	24.8	501.110	230
40	25.0	500.890	228
50	25.0	722	231
09:00	25.1	540	228
10	25.1	380	230
20	25.0	320	229
30	25.0	265	230

(Key open 10 minutes while temperature was changed)

09:40	29.5	500.430	227
50	30.0	190	223
10:00	30.0	134	222
10	29.8	100	222
20	30.0	090	219
30	30.0	080	221
40	30.0	064	223
50	30.0	050	223

(Key open 10 minutes while temperature was changed)

11:00	34.4	500.165	223
10	35.0	008	222
20	35.0	000	222
30	35.0	015	222
40	35.2	015	222
50	35.2	014	222
12:00	35.0	499.994	223
10	35.0	990	223

(Key open 10 minutes while temperature was changed)

12:20	49.5	500.170	223
30	50.0	499.932	223
40	50.0	982	222
50	50.0	970	222
13:00	50.2	915	223
10	49.8	940	222
20	50.0	915	222
30	50.0	900	223

(Key open 10 minutes while temperature was changed)

TABLE NO. 40 Cont'd

<u>Time</u>	<u>Ambient Deg. C.</u>	<u>Actual Frequency</u>	<u>Line Volts</u>
13:40	25.8	499.990	220
50	25.0	930	222
14:00	25.0	970	222
10	25.0	500.016	223
20	25.2	042	220
30	25.0	170	223
40	25.0	090	223
50	25.0	094	222

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Difference between readings taken at 09:30 and 10:50

Ambient temperature - 5.0° Centigrade

Difference in frequency - 215 cycles

Difference per degree Centigrade - 43 cycles
.0086%.

Difference between readings taken at 10:50 and 12:10

Ambient temperature - 5.0° Centigrade

Difference in frequency - 60 cycles

Difference per degree Centigrade - 12 cycles
.0024%.

Difference between readings taken at 12:10 and 13:30

Ambient temperature - 15.0° Centigrade

Difference in frequency - 90 cycles

Difference per degree Centigrade - 6 cycles
.0012%.

Difference between readings taken at 13:30 and 15:00

Ambient temperature - 25.0° Centigrade

Difference in frequency - 194 cycles

Difference per degree Centigrade - 7.7 cycles
.0015%.

Difference between readings taken at 09:30 and 15:00

Ambient temperature - none

Difference in frequency - 171 cycles
.034%.

TABLE NO. 42

TAZ-1 Transmitter; Serial No. 3

Average percentage frequency drift per degree
Centigrade from 0 to 50.

<u>Frequency KCS</u>	<u>Average percentage frequency drift per ° C.</u>
500	.0048
2000	.0020
3000	.0009
4500	.0012

TABLE NO. 43

TAZ-1 Transmitter; Serial No. 3

Maximum variation from frequency to which trans-
mitter is tuned.

(Ambient temperature - 0 to 50°C)

<u>Frequency</u>	<u>Temperature range °C.</u>	<u>Variation cycles</u>	<u>Variation %</u>
500	25-50	970	.194
500	25-0	368	.093
2000	25-50	2250	.113
2000	25-0	1080	.054
3000	25-50	1690	.056
3000	25-0	1159	.038
4500	25-50	2200	.049
4500	25-0	1157	.026