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REPORT NO. R-1673

DATE 19 December 1940

SUBJECT

FR-1673

Test of Jefferson-Travis Model 250B, 25-Watt Radio Telephone Equipment.

BY

NAVAL RESEARCH LABORATORY

BELLEVUE, D. C.

NRL Report No. R-1673
Test of Jefferson-Travis Model 250B,
25-Watt Radio Telephone Equipment.

REPLY IN DUPLICATE
AND REFERENCE TO
CS67/43
WILL BE APPRECIATED

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NAVAL RESEARCH LABORATORY

ANACOSTIA STATION

WASHINGTON, D. C.

RBM/np

[redacted]

24 January 1941

From: Director.
To: Chief of the Bureau of Ships.

Subject: Radio - Commercial Radio Telephone Equipments - Tests to determine suitability for Naval Use. (BuShips Prob. T5-34C, T5-35C, and T5-36C.)

Reference: (a) BuShips let. S67/43 (10-19-DR6) of 23 October 1940.

Enclosure: (A) 10 copies of NRL Report No. R-1672.
(B) 10 copies of NRL Report No. R-1676.
(C) 10 copies of NRL Report No. R-1673.
(D) 10 copies of NRL Report No. R-1685.

1. In accordance with reference (a), the Naval Research Laboratory has subjected the following commercial type radio telephone equipments to tests to determine their suitability for Naval use:

(a) Western Electric Company Type 226C.
(b) Radiomarine Corporation Type ET-8021.
(c) Jefferson Travis Company Model 250.
(d) Jefferson Travis Company Model 500.

2. Reports covering items 1(a), 1(b), and 1(c) above are forwarded herewith, together with a comparison report covering these three equipments. The report covering tests of the Jefferson-Travis Model 500 will be forwarded by separate correspondence.

3. The Bureau is advised that the Jefferson Travis Models 250 and 500 were returned to the manufacturer on December 19, 1940. The Western Electric Model 226 was returned to the manufacturer on January 22, 1941. The two Radiomarine equipments Type ET-8021 are still on hand at the Naval Research Laboratory awaiting the instructions of the Bureau of Ships.

H. G. Bowen

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19 December 1940

NRL Report No. R-1673
BuShips Problem No. T5-36C

NAVY DEPARTMENT

Report

on

Test of Jefferson-Travis Model 250B, 25-Watt Radio Telephone Equipment.

NAVAL RESEARCH LABORATORY
ANACOSTIA STATION
WASHINGTON, D.C.

Number of Pages: Text - 24 Tables - 15 Plates - 9

Authorization: BuShips ltr. S67/43 (10-19-DR6) of 23 October 1940.

Date of Test: October 1940.

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Distribution: BuShips (10)

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AUTHORIZATION

1-1. The tests herein reported were authorized by Bureau of Ships letter S67/43 (10-19-DR6) of 23 October 1940. The above letter assigned Bureau of Ships Problem T5-36C, priority A, to cover the tests of the Jefferson Travis Model 250B, 25 watt radio telephone equipment.

OBJECT OF TEST

1-2. The object of the test was:

(a) To examine the equipment for the purpose of determining its ability to withstand the rigors of Naval usage.

(b) To determine the performance of the equipment when it was subjected to the various conditions likely to be encountered in the Naval Service.

(c) To ascertain what changes or modifications are necessary or desirable in the equipment to insure satisfactory operation under Naval service conditions.

ABSTRACT OF TESTS

1-3. The tests herein reported were conducted with a view of determining the potentialities of the equipment under Naval conditions of operation. Briefly, inspection and tests were conducted as follows:

(a) Transmitter

General examination of equipment.

(1) Check of vacuum tubes employed and method of mounting.
(2) Inspection of panel controls.
(3) Investigation of tuning methods.
(4) Accessibility, ease of adjustment and protective features.
(5) Wiring.
(6) Insulation.
(7) Weight and dimensions.
(8) Physical construction, ventilation, corrosion-resisting measures.
(9) Check of meters, switches, resistors, fuses, capacitors, etc.
(10) Mounting and shock proofing methods.
(11) Hand-set, controls and mounting.
(12) Connection facilities.
(13) Power equipment.

Operational data and tests.

(1) Power output determination.
(2) Effect of temperature variations.
(3) Effect of humidity.
(4) Effect of vibration.

[redacted]

(5) Locked key operation.
(6) Local and remote control features.
(7) Modulation characteristics.
(8) Break-in method.
(9) Power required for operation.
(10) Instruction book.

(b) <u>Receiver</u>

<u>General examination of equipment.</u>

(1) Electrical inspection of circuits, etc.
(2) Mechanical inspection of components, controls, etc.
(3) Instruction book.
(4) Spare parts.

<u>Operational data and tests.</u>

(1) Listening tests on antenna.
(2) Laboratory measurements in shielded room.
   A. Sensitivity and noise output.
   B. Image ratio.
   C. I.F. response.
   D. Selectivity.
   E. Resonant overload.
   F. Effect of modulation depth.
   G. Gain control range.
   H. Radiation of oscillator frequency.
(3) Effects of temperature variations.
(4) Effects of humidity variations.
(5) Effects of vibration.

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Conclusions

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(a) The general appearance and construction of the Model 250B equipment are not very satisfactory. In both respects the equipment is below the standards which Navy apparatus has been required to meet in the past.

(b) Component parts of standard manufacture have been used in most cases, although not all parts would comply with the usual requirement of Naval specifications. Not all tubes are standard Navy types. Accessibility of transmitter parts is good but certain modifications are suggested in connection with the transmitter dynamotor. Accessibility of the parts within the band switch compartment is rather poor. Changes in wiring, design of the selector switch, markings, materials of construction, ventilation, and shock mounting are considered necessary. In addition, mounting facilities for the hand-set are required. Protection against overloads is considered inadequate.

(c) The tuning adjustments provided allow optimum conditions to be attained on but three frequencies, operation on all other channels being a compromise. Certain changes in the means of adjustment were found desirable. Tuning is quite laborious and in the event the equipment is used under conditions requiring frequent adjustment of the circuits the present arrangement would be quite unsuitable.

(d) In its present form the Model 250B equipment is unsuitable for Naval use. Extensive redesign would be necessary in order to assure safe and satisfactory performance with maximum reliability under the severe conditions encountered in Naval service.

(e) The receiver has high sensitivity. It has image ratios above 1000 on bands 1 and 10, and a relatively poor ratio on band 2. The selectivity is not as good as that of other equipments tested.

(f) The receiver apparently has non-linear response below the AVC threshold on the resonant overload curve.

(g) The receiver sensitivity decreased with increase in humidity. When started cold under a condition of high humidity (97%), its sensitivity recovery was slow.

(h) Variations in temperature did not appear to have any serious effect on receiver gain. The band-switch control was immovable at low temperatures (-17°C.).

(i) Many changes would have to be made to bring the receiver close to meeting the requirements of the Naval Service.

(j) The relatively poor speaker quality during listening tests is undesirable. Modulation measurements indicate linear response only up to about 60% modulation, and the resonant overload curve at 1/4 maximum setting of the gain control indicates relatively poor AVC action.

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(k) Vibration had no marked effect on the performance of the receiver.

(l) The receiver has excessive radiation of the oscillator frequency at the antenna terminals.

[redacted]

It is recommended:

(1) That the dynamotor be relocated to permit removal of the end bells and access to the brushes (Par. 2-4 and 2-8-g).

(2) That line fuses and a high voltage fuse in the dynamotor output be included in the design. Fuses should be Navy standard types (Par. 2-9-d).

(3) That meters be used which are replaceable by Navy standard types (Par. 2-9-a).

(4) That the station selector switch and volume control knobs be more securely fastened to their shafts, either by means of a taper pin or two set screws 120 degrees apart (Par. 2-2).

(5) That more suitable means be employed to secure the translucent station selector switch position markings (Par. 2-2).

(6) That the "on-off" switch be more suitably marked to indicate its true function as a stand-by switch (Par. 2-2 and 3-2-e).

(7) That provision be made for servicing the push-to-talk switch in the hand-set (Par. 2-11).

(8) That the design of the station selector switch be altered to prevent this control from becoming inoperative at low ambient temperatures (Par. 2-15).

(9) That the same type of toggle switch be used for all applications where required to reduce the number of replacement parts (Par. 3-9-k).

(10) That a suitable device be provided to hold the front panel in the proper position during tuning operations and that a knob or other grip be supplied on the front panel to facilitate opening the set (Par. 2-4 and 2-8-d).

(11) That front panel screws be of the non-detachable type (Par. 2-8-b).

(12) That the use of steel be kept to a minimum and where its use is necessary that it be plated or otherwise protected against the effects of corrosion (Par. 2-8-c).

(13) That ventilation be provided in the chassis to prevent damage to component parts mounted in the enclosed compartment beneath it (Par. 2-8-e and 3-2-n).

(14) That the shock mounting supplied be altered to eliminate excessive movement of the top of the chassis when the equipment is subjected to vibration (Par. 2-10-a and 2-17).

[redacted]

the unit against pitch and roll and that a spring clamp to prevent loss of the hand-set also be incorporated (Par. 2-10-b).

(16) That suitable methods for clamping the power leads be provided; that studs equipped with soldering lugs be substituted for the present solderless clamp connectors (Par. 2-12).

(17) That components be more rigidly mounted (Par. 3-9-1-n).

(18) That the power amplifier tube sockets be relocated to avoid the possibility of the tubes striking together (Par. 2-1).

(19) That all tube and crystal sockets be identified by means other than colors to indicate the type of tube or the crystal required (Par. 2-1, 3-9-p).

(20) That the terminal strip be treated to prevent creepage (Par. 3-9-m).

(21) That both quality and workmanship of the wiring be improved and that cabling of R.F. leads with other circuits be avoided (Par. 2-5).

(22) That protection be afforded against moisture affecting wire leads (Par. 3-9-f).

(23) That location of components under chassis be changed so that all crystal and tube sockets may be serviced (Par. 3-9-d).

(24) That transformers meeting Naval requirements be used (Par. 3-2-s).

(25) That while phenolic insulation is employed in the transmitter in locations normally prohibited by Navy standard practice, the use of this material be considered acceptable in the equipment in question; in the receiver, however, it is recommended that ceramic insulation, or suitably waxed phenolic insulation, be used for sockets (Par. 2-6 and 3-9-y).

(26) That tuning adjustments of the power amplifier and antenna circuits be improved both electrically and mechanically (Par. 2-3-b and 2-14).

(27) That the paper container electrolytic condenser be replaced by one meeting Naval specifications (Par. 3-9-j).

(28) That proper crystals be furnished to assure that the correct intermediate frequency is obtained (3-9-z).

(29) That the audio system be made capable of handling the audio power output without distortion (Par. 3-9-r).

(30) That the necessary changes be made for reduction of distortion in the receiver output (Par. 3-9-g and s).

(31) That steps be taken to reduce the excessive radiation voltages appearing at the antenna terminals (Par. 3-9-t).

[redacted]

(33) That the cause of variation of receiver output termination with temperature be determined and corrected, if possible (Par. 3-9-v).

(34) That the Bureau give consideration to approving those tubes of the equipment which are not of Navy standard type (Par. 2-1, 3-1-g).

(35) That the instruction book be revised and rearranged to facilitate operation and maintenance of the equipment (Par. 2-23).

(36) That consideration be given to providing sufficient and suitable spare parts (Par. 2-24).

MATERIAL UNDER TEST

1-4. The material under test consisted of the following:

1 - Model 250B 25-watt radio telephone equipment, Jefferson Travis Radio Manufacturing Corporation, Serial No. 1435, equipped with the following vacuum tubes:

4 - 6L6G
1 - 6V6
1 - 6J5
2 - 6K7
1 - 6K8
1 - 6SQ7
1 - 6V6G
1 - 0Z4

1 - Crystal unit, Serial No. 643.
2350 kilocycles (transmitter).
2806 kilocycles (receiver).

1 - Crystal unit, Serial No. 316.
2738 kilocycles (transmitter).
3194 kilocycles (receiver).

1 - Crystal unit, Serial No. 567.
2670 kilocycles (transmitter).
3122 kilocycles (receiver).

1 - Hand-set and mount.

1 - Instruction pamphlet.

1-5. Plates TR-1 and TR-2 are views showing the construction of the Model 250B equipment.

1-6. The Model 250B equipment was received at the Naval Research Laboratory on 30 September 1940.

METHOD OF TEST

1-7. The equipment, when received, was carefully unpacked and examined. Adequate precautions had been taken in preparing the equipment for shipment and no damage had occurred during transit. With the aid of the instruction pamphlet furnished the equipment was placed into commission.

Transmitter

1-8. The general construction of the transmitter was examined and the component parts were inspected as completely as possible without resorting to complete disassembly or destruction of the various parts.

[redacted]

contained in the instruction pamphlet to operate at several frequencies, governed by the crystals furnished. Measurements of power output (carrier power) were made by means of a lamp load and a photronic cell. Two 15-watt, 32-volt lamps connected in parallel were used as a load resistance. A capacitor of 300 micromicrofarads was connected in series with this load. The bases of the lamps were removed to minimize capacity losses. A photronic cell, rigidly anchored at a definite distance from the lamp load, and a microammeter were used to determine the power dissipated. A quick acting, low capacity switch was used to transfer the lamp load from the R.F. source to a 60-cycle calibrating source in order that the various parts of the load and measuring circuit might be maintained at temperature equilibrium. A precision type watt meter (Weston Model 310, Serial No. 7966) was used to determine the exact power required to produce the same photronic cell deflection which was obtained from the output of the transmitter.

1-10. The complete equipment was placed within a test chamber and subjected to variations in ambient temperature and relative humidity. A crystal controlled receiver was used to monitor the output frequency of the transmitter under test. The Model 250B transmitter was loaded into a dummy antenna consisting of a 300 micromicrofarad capacitor and a 25 ohm low inductance plaque resistor. Provision was made to check the power output of the transmitter under test at stated intervals during the course of the various tests conducted in the test chamber. The ambient temperature was varied between the limits of +50°C. and approximately -15°C. The relative humidity was varied between the limits of approximately 30 per cent and 95 per cent at a temperature of 40°C.

1-11. The ability of the equipment to withstand vibration was determined by mounting the unit on a vibration platform which was capable of producing vibration of varying degrees of amplitude and frequency. The equipment under test was kept under constant observation and voice signals were monitored and observed by means of a nearby receiver.

1-12. The Model 250B equipment was operated into an actual antenna whose quarter wave resonance point was approximately 2900 kilocycles. The resistance of this antenna ranged between 5 ohms at 2100 kilocycles and 9 ohms at 2800 kilocycles. The capacity of the antenna fell between the limits of 550 micromicrofarads at 2100 kilocycles and approximately 2000 micromicrofarads at 2700 kilocycles. When operating into this antenna a 300 micromicrofarad series condenser was used.

Receiver

1-13. The receiver section of the equipment was examined: first, from the electrical viewpoint with most of the information being derived from the circuit schematic diagram and other parts of the instruction book; second, from the mechanical and structural viewpoint by direct visual inspection. The results of these examinations are given in paragraphs 3-1 and 3-2.

1-14. The equipment was operated on an antenna (described in paragraph 1-12) for listening tests. A controllable standard signal was provided from an antenna about 1000 feet away, and tests were made at various levels, with and without modulation. The results of these tests are described in paragraph 3-5 and are shown in Tables R-1 and R-2.

1-15. The receiver characteristics were measured in a shielded room, using a standard signal generator (Measurements, Inc. Model 65, Serial No. 70) and a standard dummy antenna (General Radio Type 418G). The audio output was measured by means of an output meter (General Radio Type 583A, Serial No. 64). The sensitivity of the receiver was measured at full gain, since the noise level on loud-speaker operation was very low. A value of signal plus noise output of 40 milliwatts was chosen as being far enough below the AVC threshold point at 30 per cent modulation. Noise output was also measured, both with modulation off and carrier off. Selectivity was measured at the same constant output level, with the input frequency varied at various input levels to give the same output reading on both sides of the frequency of maximum response. Image ratio was determined by measurement of the input at the image frequency necessary to give 40 milliwatts output. This value of input was divided by the input (for 40 milliwatts output) at the desired frequency to obtain the image ratio. The I.F. response was measured as the antenna input at the I.F. peak frequency (456 kilocycles) necessary to give 40 milliwatts output.

A resonant overload characteristic measurement was made with inputs from 0.4 microvolt to 2 volts. Noise level with modulation off was measured at each point. The effect of various carrier modulation percentages was determined in terms of A.F. output at 400 cps. The attenuation of the gain control was measured at the point of minimum output.

The voltage appearing at the antenna binding post due to the receiver oscillator was measured by substitution. The output caused by this undesired voltage in another receiver, coupled to the antenna post of the Jefferson Travis equipment through 5000 ohms resistance, was measured. The standard signal generator was then substituted for the Jefferson Travis receiver, and the input necessary to give the same output from the measuring receiver was determined. This measurement was made at the fundamental, second harmonic, third harmonic, etc., of the oscillator frequency.

The results of the above measurements are described in paragraph 3-6 (a to f) and are shown on Plates R-1, R-2, and R-3 and Tables R-3, R-4, R-5 and R-6.

1-16. The equipment was set up in the temperature and humidity chamber, as described in paragraphs 1-10, 2-15, and 2-16. Signal generator and output meter connections were made as shown in Plate TR-5. Since the transmitter output load was left connected to the antenna post of the equipment throughout the temperature-humidity tests, 1000 ohm non-inductive resistors were used to isolate the equipments under test from each other, and also to protect the signal generator from the transmitter antenna voltage during operation of each transmitter. Changes in gain and noise level were measured during the course of the tests described in the above-mentioned paragraphs and as given in paragraph 3-7. Results of the tests are shown on Plates R-7, R-8 and R-9, and Tables R-7, R-8 and R-9.

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1-17. The equipment was set up for vibration test, as described in paragraphs 1-11 and 2-17. The receiver was checked for changes in gain or functioning, with the results given in paragraph 3-8.

1-18. No receiver frequency measurements were made during the temperature, humidity, and vibration tests other than the signal generator dial settings, due primarily to lack of time and the unavailability of precision frequency measuring equipment during the test period.

DATA RECORDED

1-19. The data recorded during the test are shown in the appended tables and plates. Tables or plates with the prefix "TR" refer to the equipment as a whole; the prefix "T" refers to the transmitter; and the prefix "R" covers receiver data.

SECTION II

TRANSMITTER - MECHANICAL DESIGN AND CONSTRUCTION

2-1. Vacuum Tubes. The Jefferson-Travis Model 250B marine radio telephone employs the following six tubes in the transmitter section of the equipment.

(a) One Type 6V6 oscillator.
(b) Two Type 6L6G power amplifiers.
(c) One Type 6J5 speech amplifier.
(d) Two Type 6L6G modulators.

Of these tubes, only the Type 6J5 has received Navy approval, although the equivalent Types 6V6G and 6L6 have been accepted for Naval use. Molded bakelite tube sockets are used, which are secured to the metal chassis by means of spring retaining rings. The sockets for the Type 6L6G tubes are so located that the glass envelopes of adjacent tubes strike together if the tubes are not centered properly. Although no breakage resulted during vibration tests, this condition is considered undesirable. Tube sockets are not shock mounted, and no tube base clamping devices are provided; however, no trouble due to loosening of tubes in their sockets was encountered, and the tube socket contacts grip the base pins firmly. Tube socket positions are not marked with the type tube required, and it is suggested that this be done, since there is considerable danger of confusion at present.

2-2. Panel Controls. The following controls located on the front panel of the equipment are provided:

(a) Station selector switch, 10-position. A bakelite knob 1-5/8 inches in diameter is equipped with a celluloid pointer and secured to the shaft by means of a single set screw.

(b) "Speaker-Ringer" switch, 2-position, nickel-plated, toggle switch.

(c) "On-Off" switch, 2-position, nickel-plated, toggle switch.

[redacted]

(d) "Volume" control and switch. A bakelite knob 1-1/8 inches in diameter is equipped with a celluloid pointer and secured to the shaft by means of a single set screw.

The marking of the "On-Off" switch listed above is misleading, since this switch controls only the transmitter filaments. It is recommended that some more descriptive marking be provided, such as "Stand-by - Transmit." The switch on the volume control is the actual power switch, but no marking except that listed above identifies the control. The station selector switch positions are provided with a translucent backing illuminated from the rear by four dial lights. The backing, consisting of clear celluloid cemented to paper, came loose from the rear of the panel during humidity and temperature tests to which the equipment was subjected.

2-3. <u>Tuning</u>. All tuning adjustments are accomplished by tilting the front panel of the equipment forward. The means of adjustment are as given below:

(a) <u>Crystal oscillator.</u> This circuit is untuned.

(b) <u>Power amplifier, antenna tuning and coupling</u>. A common coil equipped with six adjustable clip leads is provided for tuning. In addition, a small variable condenser assists in determining the correct tap adjustment, although it has small effect on the final result, since instructions direct the operator to return the condenser to minimum capacity before considering the tuning of each channel complete. The six clips are color coded into three pairs. One pair serves to tune the transmitter on channels 1 and 2, another tunes channels 3 to 6 inclusive, and the third pair is used with channels 7 to 10 inclusive. It will thus be observed that tuning and coupling tap settings must serve from two to four frequencies, and individual adjustment for optimum conditions on each channel is not provided. Several difficulties were found to exist in this tuning arrangement.

(1) Considerable reaction in tuning between the different frequency groups was observed.

(2) Coupling could not be adjusted to a sufficient degree to keep the plate loading down to 120 milliamperes as recommended by the manufacturer.

(3) Clips cannot be used on adjacent turns without shorting.

(4) Only one clip can be fastened to any single turn, although conditions were found which required more than one on the same turn for best results.

(5) Clips may fall over sufficiently to short to the next turn.

(6) The variable condenser was found to be of very little assistance.

[redacted]

(7) Proper adjustment of the transmitter requires the addition of an R.F. ammeter, since none is included in the design. A suitable meter was not furnished with the equipment.

2-4. Accessibility and Protection of Personnel. As mentioned in the previous paragraph, tuning adjustments are accomplished with the front panel of the equipment tilted forward. The panel is secured in the closed position by means of four screws along the upper edge. No handle, or other device, is provided for a grip in opening the panel, and consequently the control knobs must be used for this purpose, or a screwdriver must be employed to act as a pry at the top of the panel. No chain or other retaining feature is provided for holding the equipment in the forward tilted position for tuning or other adjustments. As a result, the present design requires the operator to support the panel in the proper position by some makeshift arrangement, such as string or wire, to prevent the weight of the unit from damaging the internal antenna lead. Other components, such as tubes, crystals, and dynamotor, may be reached by disconnecting the internal antenna lead and dropping the panel and its associated apparatus to a horizontal position. No chain or other device is supplied to support the equipment in this manner, however. When thus exposed, all tubes may be readily replaced. Due to the proximity of the receiver vibrator pack, the inner, high-voltage, end-bell of the dynamotor cannot be removed. Since brushes and commutator will certainly require attention during service, it is suggested that the position of the dynamotor be changed sufficiently to allow removal of the end-bell. Most of the components in the 250B equipment can be reached only by removing the entire unit from the cabinet. This is accomplished by removing four nickeled nuts on the front panel attached to studs which support the transmitter-receiver chassis. Most of the parts are then accessible. Servicing of the selector switch assembly, or replacement of the dial lights, will require the removal of the control panel in addition. Two Leach relays located in this compartment cannot be serviced or their operation observed without removal of the front panel. Meters may be replaced only when this is done also. No interlock is provided for protection when the panel is tilted forward, but it is pointed out that the tuning coil is isolated from d-c potentials by means of C27 (schematic diagram) and that no other dangerous potentials may be reached without disassembly.

2-5. Wiring. In general, wiring is of poor quality and does not present a satisfactory appearance. Specific objectionable items are listed below:

(a) Braid-insulated, solid tinned wire is used in most instances, although some stranded wire is employed. Leads are not cabled together in many cases where this is possible.

(b) Many items depend on wiring for mechanical support.

(c) Solder is used for mechanical strength in some joints.

(d) Long runs of wire are made without any securing means to prevent wire from shifting, with consequent damage to insulation.

[redacted]

(e) R.F. leads are cabled with other circuits.

(f) One lead became detached during the test period.

2-6. Insulation. The silver-plated P.A.-Antenna tuning coil utilizes molded styrene supports. Ceramic, apparently Isolantite, has been used for antenna terminal insulators, stand-off insulators, station selector switch parts, and the P.A. variable condenser. Phenolic insulation is employed for tube sockets, crystal sockets and holders, relays, terminal strips, molded condensers, and fuse holder. It will be observed that phenolic insulation has been used in some applications where prohibited in standard Naval equipment. These are its use in tube and crystal sockets, crystal holders, antenna transfer relay, and terminal strips for radio frequency circuits.

2-7. Weight and Dimensions. The weight and dimensions of the Model 250B equipment are given in Table TR-1 appended to this report.

2-8. General Physical Construction.

(a) The transmitter and receiver are assembled on a common chassis of painted steel. A steel cabinet equipped with a hinged front panel encloses the entire unit. All exterior and interior surfaces of both cabinet and chassis are finished in blue-gray wrinkle.

(b) Screws which may be removed in service are as follows:

Front panel: Four nickel-plated brass nuts (for removal of complete chassis from cabinet). The studs which the nuts fit are unplated steel.

Components: Most components are secured in position by means of nickel-plated brass screws. However, unprotected steel screws and nuts are used in some cases. (Vibrapack, fuse holder, I.F. transformers, etc.)

(c) Steel has been used in many instances where it has been the practice in Navy apparatus to use other materials. In several applications, the steel is not protected, or is incompletely protected, against the effects of corrosion. The continuous type hinge at the lower edge of the front panel is of steel. Much of the paint originally applied to this hinge has been scraped away by the normal hinge action and some rusting has resulted. It is recommended that a hinge of corrosion-resistant metal be supplied. Some other points where the use of steel is particularly undesirable are its employment for control shafts, connection studs, and soldering lugs of many components, dial lamp assemblies and supports, station selector switch assembly, tube grid clips, and trimmer condenser assemblies. Metal portions of the Lord mounts used to support the equipment are of plated steel. It has been found that this type of mount should have unplated parts of non-corrosive metal if long life is to be attained.

[redacted]

It is therefore recommended that Monel metal be substituted for steel in this application.

(d) As previously pointed out in paragraph 2-4, the front panel is retained in a closed position by four nickel-plated screws, and no handle is provided for opening the front. It is recommended that thumbscrews of the non-detachable type secured to the panel be substituted for the present screws. Such thumbscrews will also act as handles by means of which the panel may be opened.

(e) Louvres at top and bottom of the sides of the cabinet provide ventilation. The ventilation obtained in this manner is not effective in cooling components (such as chokes, resistors, and relays) mounted immediately behind the front panel, since this compartment is completely enclosed. It was noted that temperatures in this region became high enough during operation to cause some flow of impregnating wax from small R.F. chokes. No failure or difficulty of any kind resulted, however. It is considered that the inclusion of dry electrolytic condensers in this compartment, as has been done in this equipment, is undesirable owing to the detrimental effects of high temperatures on these units. The dynamotor is not provided with fan ventilation, the case being entirely closed. No failure due to overheating occurred during the test period.

(f) No attempt has been made in the construction of the equipment to render it drip-proof.

(g) The dynamotor is provided with grease-packed ball bearings. End-bells and grease retainer caps must be removed before grease can be added. Directions as to type of lubricant, frequency of lubrication, and disassembly necessary should be included in the instruction book. The difficulty encountered in removing the end-bells has been pointed out in paragraph 2-4.

2-9. Component Parts.

(a) Meters are provided on the front panel to read power amplifier grid current and power amplifier cathode current. Both meters are manufactured by Simpson Electric Company. The grid milliammeter is a 0-10 milliampere instrument, and the cathode current meter is 0-250 milliamperes. Both meters are Model 125, provided with zero adjustment screws and black bakelite cases. Chief differences between these meters and the Navy specifications are shown below, and it will be noted that replacement with Navy meters is not possible.

	Instruments	Navy Limits (17-I-12)	
	Employed	Maximum	Minimum
Diameter of flange	2-3/4	2-9/16	2-1/2
Diameter of body	2-3/16	2-1/16	-
Depth of case	1-3/8	1-3/4	-
Radius of mounting screw circle	1-7/32	1-5/32	1-5/32
Mounting screws	4-36	4-40	

Mounting screws are not tapped into the panel, nuts and lock washers being employed instead. Removal and replacement of the meters is attended by considerable difficulty and removal of the front panel is necessary.

(b) Switches employed in the transmitter are as follows:

- 1 SPST nickel-plated toggle switch (On-Off).
- 1 DPDT nickel-plated toggle switch (Speaker-Ringer).
- 1 DPDT switch incorporated in the volume control (Off-On).
- 1 7-Section, 10-position station selector switch.
- 1 Push-button switch in the hand-set.
- 1 Hand-set cradle switch.
- 1 SPDT nickel-plated toggle switch in hand-set cradle stand (Speaker-Phone).

(c) Various types of resistors are used in the equipments, none of them being equipped with ferrule mountings. Composition resistors of 1/2 and 1-watt ratings are included, all larger resistors being of the wire-wound, coated variety (IRC, Type AB) except for one variable tap resistor (IRC, Type ABA) with exposed resistance wire. Leads are depended upon for mechanical support in all cases.

(d) *Only one fuse is used in the equipment. This is in the vibra*pack receiver power supply input. A 10-ampere automobile type, glass-body fuse is employed in this position. Neither line fuses nor high-voltage fuses are provided for the protection of the transmitter. The protection provided is therefore considered inadequate. The position of the receiver fuse is not marked with the rating of the fuse required, and its circuit position is not shown on the schematic diagram of the equipment.

(e) Capacitors used in the transmitter section of the equipment include small molded, bakelite-encased, mica condensers (Cornell-Dubilier); metal-encased, paper dielectric by-pass condenser (Cornell-Dubilier); paper-encased, cartridge type, paper dielectric, by-pass condensers (Cornell-Dubilier and Miller); metal-encased, dry electrolytic filter condensers (Mallory); and paper cartridge dry electrolytic filter condensers (Cornell-Dubilier). The location of many condensers is such that replacement would be difficult.

(f) The antenna terminal is located on the top surface of the cabinet. An Isolantite insulator post is used. This post is connected to the transmitter itself inside the cabinet by means of a flexible, braid-covered wire, which permits the front panel to be tilted forward for adjustments.

2-10. Mounting and Shock-Proofing.

(a) Transmitter-Receiver Unit. Four No. 35 Lord mounts on the rear of the cabinet permit the equipment to be mounted on a vertical surface. Several inches clearance must be left at the bottom

[redacted]

of the cabinet for proper operation of the loud speaker. The Lord mounts may be replaced by removing the entire equipment from its support. The shock mounting provided adequate protection during the vibration test, and no damage resulted. However, at certain frequencies movement at the upper end of the cabinet appeared excessive. It is suggested that the shock mounting be made "stiffer" at the top to reduce this tendency.

(b) Hand-Set. No method for mounting or securing the hand-set is provided. In its present form this unit is not considered satisfactory. It is recommended that means be provided for fastening the cradle switch to the table top and that some spring clip or clamping device be supplied to retain the hand-set itself in position.

2-11. Hand-Set. A Western Electric Type F3W hand-set and cradle switch are supplied. This unit is equipped with about six feet of rubber-covered cord and a standard six-pin plug for connection to the transmitter-receiver unit. A SPDT nickel-plated toggle switch on the cradle stand permits selection of either "speaker" or "phone" operation. The button switch of the hand-set cannot be removed without special tools, and since this switch is in more constant use than any other in the equipment, it is believed that such construction is undesirable.

2-12. Method of Connection. Power connections are made to a bakelite terminal strip at the bottom of the transmitter-receiver chassis, a 2-1/8 inch diameter hole being provided in both bottom and rear panels of the cabinet for entrance of cables. The terminals consist of copper solderless clamping devices. It is considered that such terminals are less desirable than plain studs equipped with soldering lugs, and hence substitution of the latter is recommended. No cable clamp is provided to prevent direct stress on the terminals. The telephone hand-set is connected by means of a six-pin plug as described in paragraph 2-11.

2-13. Power Unit. The Model 250B radio telephone is not equipped with a separate power unit. It is pointed out, however, that 32-volt and 110-volt models of this series do employ external power units which were not available for inspection and test. The source of transmitter plate power in the Model 250B consists of a dynamotor mounted on the transmitter-receiver chassis inside the cabinet. Extensive tests on the dynamotor were not conducted, but operation was satisfactory under all conditions to which the equipment was subjected. The nameplate rating of the dynamotor is given below:

Eicor, Inc.	Type 4120
Temp. Rise 50° C.	R.P.M. 5000 Duty Int.
Input Volts 12	Output Volts 400
Input Amps. 13	Output Amps. 0.250

OPERATIONAL DATA AND TESTS

2-14. Power Output and Operation into an Actual Antenna. Table T-1 shows the power output obtained from the Jefferson Travis Model 250B transmitter. The outputs were obtained with the equipment tuned up on each

[redacted]

of three channels, for which crystals were available simultaneously, so that operation on any one could be selected by manipulation of the station selector switch only. The dummy antenna constants are given in the same table, while the method of measurement has been described in paragraph 1-9. The power outputs listed in Table T-1 are the values obtained without modulation. Outputs varied from 16.3 to 22.7 watts, depending on frequency as compared to the manufacturer's rating of 25 watts. It should be noted that it was impossible to obtain the correct P.A. load adjustment. The proper loading is given as 120 milliamperes in the instruction book. However, plate currents of 140 to 160 milliamperes are listed in the sheet of typical test data of the instruction book, and an inspection of Table T-1 will reveal that the values obtained fall within this range. Operation with an actual antenna, described in paragraph 1-12, was also accomplished. Performance was found to be satisfactory, and emitted signals of good quality and adequate signal strength were obtained.

2-15. Variation of Ambient Temperature. Table T-2 lists information obtained during the course of this test. The temperature was held at 50°C. for a period of approximately two hours while readings were taken at about 15-minute intervals. During this period the receiver was operated continuously, whereas the transmitter was on only long enough to enable readings to be made. The humidity was held at a low value throughout the test. At the end of the two-hour period the entire equipment was shut down and allowed to stand idle. The ambient temperature was meanwhile reduced to -15°C. and was held between -15 and -17.5°C. for the remainder of the test. After an idle period of about one hour at this low temperature the equipment was restarted without difficulty and readings made. The receiver was then turned on continuously and the test proceeded as described for the first period. An examination of the data of Table T-2 reveals no serious change in the output, or other values, as a result of the temperature change. An increase in P.A. plate current of about 18 milliamperes at the low temperatures was accompanied by a corresponding rise in power output amounting to about four watts. The equipment could be started without difficulty at the lowest ambient temperature attained, but it was noted that the station selector switch was adversely affected by the temperature and could not be operated under this condition. It is recommended that steps be taken to reduce or eliminate freezing of this control at low temperatures.

2-16. Variation of Humidity. Two humidity tests were conducted on the Jefferson Travis Model 250B equipment. The data obtained in the first test are shown in Table T-3. The receiver was operated continuously during the entire test, while the transmitter was on only long enough to obtain readings. This humidity test followed the usual pattern of such tests to which standard Navy apparatus is subjected. The humidity was held at a low value for one hour, raised to 97 per cent, where it was maintained for one hour, then dropped to less than 30 per cent for the remaining hour of the test. No difficulties of any kind were encountered during the test, the equipment performing satisfactorily at all times. In the second of the humidity tests, conducted to determine the ability of the equipment to operate after being idle, the humidity was raised to 97 per cent at a temperature of 40°C. and maintained in this condition for two hours, 43 minutes. The entire equipment was idle during this period. At the end of this time the equipment was started and its performance checked against that observed under the low humidity conditions existing previous to the test. It was found that no serious change had occurred due to the high humidity and operation was satisfactory in every respect.

2-17. Vibration Test. The entire equipment was subjected to a vibration test. The transmitter-receiver was secured to a vertical surface by means of the four Lord mounts provided. The hand-set stand was tied to the horizontal surface of the vibration table. The data obtained during the test are listed in Table T-4. No signs of abnormal operation or failure were observed. The signal emitted during vibration was monitored at short intervals on another radio telephone receiver and proved to be satisfactory throughout the test. Although no damage resulted, considerable amplitude of vibration occurred at the top of the set at some frequencies, and it is recommended that stiffer and more sturdy shock mounts be used at this point. The advisability of using Lord mounts in shear or vertically is also questioned. During the short test period there was no evidence of damage due to their employment in this manner, however. The vibration test lasted for approximately one-half hour. While no damage or faulty operation was noted during the test, this does not constitute definite assurance that failure of parts will not occur if the equipment is subjected to lengthy periods of vibration in actual service.

2-18. Locked-Key Operation. Table T-5 shows data obtained when the Jefferson-Travis transmitter was operated under locked-key, full power, output conditions for one hour. Inspection of the data reveals no unsatisfactory or undesirable characteristics. The emitted signal was observed with another radio telephone receiver and was clear and intelligible throughout the test. Although the dynamotor which supplies transmitter plate power is rated for intermittent duty as noted in paragraph 2-13, locked key operation for one hour did not cause failure or apparent overheating of this component.

2-19. Control. No remote control unit was furnished with the Jefferson-Travis Model 250B equipment. The unit is intended for local control; but, according to the instruction book, remote stations can be supplied, although none was submitted for test. The carrier is controlled by means of the hand-set push-to-talk switch, which is effective only when the stand-by switch on the front panel of the transmitter-receiver is in the "On" position.

2-20. Modulation. Quantitative tests on the modulation capabilities of this transmitter were not conducted. However, listening tests on other radio telephone receivers revealed that transmitted speech was at all times clear and intelligible.

2-21. Break-in. Break-in operation is accomplished by means of two Leach relays No. 1057 actuated by the push-to-talk button of the hand-set. One of these relays serves to start the dynamotor which supplies plate voltage to the transmitter, while the other is the antenna transfer relay. Power to operate both relays is obtained directly from the 12-volt supply.

[redacted]

2-22. Power Input. The power input is given by the manufacturer on Page 3 of the instruction book as 48 watts for the receiver. The power required for transmitting purposes is stated as being about 300 watts.

2-23. Instruction Book. The instruction book furnished with the Model 250B equipment was found to be quite difficult to use and incomplete in many respects. A few inconsistencies were also noted. The proper P.A. plate current is listed as about 100 to 120 milliamperes in the instructions, while the typical data sheet shows currents from 140 to 160 milliamperes. The adjustment of the speech gain control is not described. The parts list does not give the manufacturers of most of the components and is incorrect and incomplete in several cases. For instance, tubes used in the equipment are incorrectly listed, and the Type 0Z4 receiver rectifier tube is omitted. Pages are not numbered, and no index or table of contents is provided, hence difficulty is experienced in locating any particular section. Related information is not collected together. The schematic diagram is not of a type to which Naval operators are accustomed. It is recommended that the instruction book be rewritten so as to provide complete, concise operating and maintenance information, that a more descriptive and correct parts list be furnished, and that the schematic diagram be redrawn to conform with the simpler Navy type.

2-24. Spare Parts. No spare parts accompanied the Jefferson-Travis radio telephone equipment. Since numerous component parts are of such design and manufacture that they are not likely to be available within the Naval organization, it is deemed advisable that some definite provision be made to permit repairs by operating personnel. It may be pointed out that many of the parts used would fail to comply with Navy standards, and hence disruptions and failures under the rigors of Naval service will undoubtedly occur. It is suggested that the manufacturer be consulted to determine which parts are most subject to failure based on service records of the Model 250B equipments, or equipments of similar construction.

2-25. Summary of Defects and Suggested Changes. Such items as appear definitely defective, together with suggestions for improvement and modification, are listed below. At the end of each of the statements there appears the paragraph number in the body of the report wherein each matter is discussed in detail.

(1) Spacing of power amplifier tube sockets is such that the glass envelopes of 6L6G tubes can come in contact with each other; tube sockets not marked to indicate type of tube required. (2-1)

(2) Single set screw is used to secure selector switch knob and volume control knob; marking of "On-Off" switch is misleading; selector switch markings became loose. (2-2)

(3) The power amplifier and antenna tuning adjustments contain undesirable characteristics. (2-3-b and 2-14)

(4) No satisfactory means are provided for opening or securing chassis in the proper position for tuning; access to dynamotor

brushes is difficult with present arrangement. (2-4 and 2-8-d).

(5) General quality, workmanship and appearance of wiring are not satisfactory. (2-5)

(6) Phenolic insulation is used in applications where normally prohibited in standard Naval equipment. (2-6)

(7) Front panel screws of detachable type are employed (2-8-b); steel, in some instances uncoated, is used in applications where its use is undesirable. (2-8-c).

(8) Ventilation is insufficient to prevent adverse effects on certain component parts. (2-8-e).

(9) Meters used are not replaceable by Navy standard meters. (2-9-a)

(10) Inadequate fuse protection is provided. (2-9-d).

(11) Shock mounting provided appears to be too flexible. (2-10-a and 2-17)

(12) Hand-set is not provided with securing means. (2-10-b)

(13) Servicing of hand-set push-to-talk switch would be difficult to accomplish. (2-11)

(14) A modified method for making power connections, equipped with cable clamping device, is recommended. (2-12)

(15) Station selector switch became inoperative when the equipment was subjected to low ambient temperatures. (2-15)

(16) Instruction book is incomplete and incorrect in many respects. (2-23)

(17) No spare parts are provided. Due to the comparatively fragile nature of many components as compared with Navy standard apparatus, it is recommended that consideration be given to providing adequate spares. (2-24)

SECTION III

RECEIVER SECTION OF EQUIPMENT

3-1. Electrical Inspection. The equipment was given an electrical inspection and the following information obtained, in large part from the schematic circuit diagram and the instruction book.

(a) Type of circuit: Superheterodyne.

(b) Frequency range: 2100 to 2800 kilocycles (not continuously variable).

(c) Number of bands: 10 fixed crystal frequencies, on switch.

(d) Crystals: Crystal oscillator control at each frequency.

(e) Crystal mounting: Common holder with transmitter crystal for each frequency. Each crystal frequency marked and identified on the holder by "T" for transmitter crystal and "R" for receiver crystal.

(f) Total number of tubes: 6.

(g) Tube types used: 6K7, 6K8, 6SQ7, 6V6, OZ4.

(h) Power supply required: 12 volts, d.c., 85 watts.

(i) Type of B supply and maximum B+ voltage at receiver: Vibrator power supply; 230 volts.

(j) Antenna required: 30-foot vertical recommended; others may be used.

(k) Antenna input circuit: Single tuned circuit (secondary), with antenna primary winding.

(l) Radio-frequency amplifier: one stage (6K7), with primary winding in plate circuit and tuned secondary.

(m) Radio-frequency tuning: R.F. circuits tuned by capacity trimmers on switch ganged to oscillator switch.

(n) Converter: Pentode section of 6K8.

(o) Oscillator: 6K8 (triode section), crystal control.

(p) Intermediate-frequency amplifier: one stage (6K7); tuning frequency = 456 kilocycles; two transformers = 4 tuned circuits.

(q) Second detector: Conventional diode - both plates of 6SQ7 diode section.

(r) AVC system: Rectified carrier from detector diode fed to controlled tubes. Tubes on control = R.F. amplifier, converter, and I.F. amplifier.

(s) CW oscillator: None.

(t) Noise limiter: None evident.

(u) Audio-frequency amplifier: First stage triode section of 6SQ7 resistance coupled to 6V5 output stage. Output = 3 watts maximum.

(v) Audio output circuit: Output transformer with 50-ohm secondary feeding loud-speaker and hand-set phone.

[redacted]

(w) Gain control: A.F. gain only; potentiometer input to first A.F. amplifier grid.

(x) Safety devices: None apparent.

(y) Changeover means: Hand-set push button actuates power and antenna transfer relays.

(z) Remote control: Remote hand-set and ringer stations obtainable.

(aa) Receiver sensitivity: (From instruction book) 2 microvolts at 2500 kilocycles; output, etc. not given.

(bb) Miscellaneous: Speaker switch turns hand-set phone off in speaker position.

3-2. Mechanical Inspection. The equipment was given a mechanical inspection and the following information obtained.

(a) Number of units comprising equipment: Two. Transmitter, receiver, and power supply in cabinet; hand-set on separate base.

(b) Size: Shown in Table TR-1.

(c) Weight: Shown in Table TR-1.

(d) General type of construction: Single chassis for transmitter, receiver and power supply. Entire equipment mounted as unit in metal cabinet. All operating controls on front panel, with exception of speaker-phone switch on hand-set base. Hand-set rests on a separate base from that of rest of equipment, connected by cable to equipment. Loudspeaker unit mounted with loudspeaker cone axis vertical and radiating out of bottom of chassis.

(e) Number of front panel controls and function: Four. Combined power switch and gain control, "On-Off" switch controlling the filament power of the transmitter, station selector (10 stations), and "Speaker-Ringer" switch.

(f) Other controls: Lifting hand-set off hook connects hand-set circuits to transmitter and receiver. Hand-set push-button switches from receiver to transmitter operation. Speaker-phone switch on hand-set base.

(g) General layout and accessibility of controls: Symmetrical layout. Controls very accessible.

(h) Ease of control and operation: Operation is simple, all controls working easily.

(i) Accessibility for servicing: Fair. The entire unit may be serviced only by tilting the panel forward by the method described in paragraph 2-4. The dial lights can be replaced only after removing the control panel.

[redacted]

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(j) Accessibility for repair: Poor. All of the wiring is inaccessible unless the front panel is removed, as explained in paragraph 2-4. Some components are behind the dial sub-panel which must be removed, together with the crystal switching unit, in order to make those parts accessible. Some crystal and tube sockets are inaccessible without disassembly.

(k) Power indicator: Power "on" is indicated by the panel dial lights and by the marking of the power switch on the panel.

(l) Materials used and finishes: The chassis and cabinet are of steel, finished in a blue-gray wrinkle. Transformer cases and the vibrator power unit on the chassis have a smooth gray finish. All other chassis components have a gray wrinkle finish. A list of ferrous parts employed is given in paragraphs 2-8-c. Nickel-plated brass screws are used to secure components. Unprotected steel screws, however, are also used in some cases. (Vibrator power unit, fuse holder, I.F. transformers, etc.)

(m) General insulation to moisture: There is no apparent protection (such as waxing) against moisture. Wire is apparently synthetic resin with fabric wrap, not believed to be sufficiently moisture proof for AVC leads, etc.

(n) General protection against high temperature: Numerous paper shell condensers with wax seal ends are used. Wax is used on open transformer coils and may drip off. Ventilation is provided by louvres at top and bottom of the sides of the cabinet. This is ineffective in cooling components (such as chokes, resistors, and relays) mounted immediately behind the front panel, since this compartment is completely closed.

(o) Ability to withstand vibration and shock: The chassis is not particularly sturdy. It has a tendency to weave if lifted from one end. The entire cabinet is mounted on four No. 35 Lord mounts as described in paragraph 2-10(a). The hand-set is unsecured, as explained in paragraph 2-10(b). Condensers and resistors in a few cases can vibrate due to insecure mounting.

(p) General ruggedness: Fair.

(q) Tube mounting, sockets, etc.: Tubes are mounted horizontally in molded bakelite sockets secured to the chassis by spring retaining clips. Sockets are replaceable, but will require disturbing of wiring and components. Tube sockets are not identified.

(r) Tube shields: None. (metal tubes used.)

(s) Transformers, chokes, etc.: Three unpotted transformers are used, with exposed windings. There are wax coatings on coils. One unit was loose in mounting.

(t) Crystal mounting: Receiver crystal mounted in common plastic holder with transmitter crystal for each operating frequency;

[redacted]

holder plugs into bakelite tube socket. Fairly accessible.

(u) R.F. transformer structure: Antenna transformer on bakelite tubes, long leads, unprotected in aluminum shield can.

(v) I.F. transformer structure: Units in aluminum can shields.

(w) Variable condensers: None.

(x) Fixed condensers: Moulded mica or paper condensers mounted on pigtails; one small paper tube electrolytic used; also one quadruple section paper condenser mounted in a can.

(y) Switch construction: Transmitter filament "On-Off" switch and "Speaker-Phone" switch are of bakelite housing, toggle type; band switch is of ceramic wafer construction, with silver-plated contacts.

(z) Resistors: Mostly 1/2 watt pigtail type of unknown make, haphazard mounting. Some IRC, Type AB wire wound resistors are mounted on socket terminals, etc.; a few not rigidly enough.

(aa) Terminal strips: Only one used, not impregnated, creepage path about 0.1"; four terminals on strip.

(bb) Mounting of components: Screws, nuts, and lock washers used throughout. Accessibility good. Components generally are mounted on sockets or other component terminals, but mostly rigidly enough, except for one choke, one resistor, and one paper condenser.

(cc) Wiring: Neat - well arranged but not well enough secured in long lengths. Wire is synthetic covered with fabric wrap, not believed to be sufficiently moisture-proof for AVC leads, etc. Soldering neat, joints covered with red enamel.

(dd) Miscellaneous: Antenna connection (on stand-off insulator) on top of cabinet, connected by a flexible lead to antenna post in center of chassis. Crystals must be matched by color markings to their respective sockets. Crystal set No. 2 marked "2670R - 3122T" is 4 kilocycles off the receiver oscillator frequency required for proper operation.

3-3. <u>Examination of Instruction Book</u>: The comments in paragraph 2-23 apply.

3-4. <u>Spare Parts</u>: The comments in paragraph 2-24 apply.

3-5. <u>Listening Tests</u>: The equipment was set up in the transmitter building and connected to an outside antenna. A standard signal generator was set up in the Laboratory Annex Building, about 1000 feet away, and its output connected to an outside antenna for the purpose of radiating a readily controllable field at the frequency of test. Tests were made with and without 30 per cent modulation at various carrier levels, and voice modulation was also made available, by means of a suitable microphone and audio amplifier modulating the signal generator.

The presence of a strong variable noise field in the transmitter building location made it difficult to get consistent results at the lower levels of signal generator input. The results tabulated in Table R-1 were obtained in the first listening test.

The listening test was repeated on the following day in an attempt to obtain more favorable noise conditions. The results are shown in Table R-2.

3-6. Laboratory Measurements: The receiver section of the Jefferson-Travis equipment was measured in a shielded room (as per paragraph 1-15), with the following results.

(a) Sensitivity, noise output, image ratio, and I.F. response: These are shown in Table R-3.

(b) Selectivity: The selectivity characteristic of the receiver is shown on Plate R-1. Tabulation R-4 summarizes this characteristic.

(c) Resonant overload and carrier noise: The resonant overload characteristics are shown in graph form on Plate R-2. The data for Table R-5 have been derived from this graph. The graph of the resonant overload characteristic has substantially no straight portions below the threshold of AVC action.

(d) Effect of modulation depth on output: Plate R-3 shows the effect of varying the signal modulation depth on the audio output from the receiver. The curve departs from linearity above about 60 per cent modulation.

(e) Gain control range: The maximum attenuation of the volume or gain control of the receiver is over 120 decibels.

(f) Radiation of oscillator frequency: The voltages appearing at the antenna terminal due to the local crystal oscillator of the receiver were measured in terms of the microvolts input from a standard signal generator required to give the same output from another receiver tuned to the oscillator frequency. Both the receiver under test and the standard signal generator were connected, in turn, to the input terminals of the measuring receiver. The resulting data are shown in Table R-6.

3-7. Temperature and Humidity Tests. The equipment was set up in the large temperature-humidity chamber and was tested under the conditions described in paragraph 2-15 and 2-16. The circuit arrangement is shown schematically in Plate TR-5.

(a) Effect of humidity on gain and noise level of receiver: The receiver noise output level was set by means of the gain control at 0.4 milliwatt prior to the beginning of test, with no carrier input. A drop in the local noise level, however, brought this output down to about 0.03 milliwatt by the time the test was actually started, and this lower noise level was obtained throughout most of the test. The change in receiver gain with variation of humidity was measured in terms of the carrier input voltage required to maintain an arbitrary standard output of 10 milliwatts (signal plus noise) with the standard signal generator modulated 30 per cent at 400 cps. Noise outputs with modulation off, and with carrier off, were also measured. Readings were taken at approximately 15 minute intervals. The results of the test are shown on Plate R-4. Tabulation R-7 was derived from these graphs.

(b) Effect of temperature on gain, noise level, and control operation: The change in receiver gain with variation of temperature was measured, in a way similar to that in the previous test. In this test, however, the signal generator was modulated 90 per cent at 400 cps. Due to better local noise conditions (i.e., lower electrical interference noise) during this test, the receiver gain was raised to maximum and the input for a constant output of 100 milliwatts measured at about 15 minute intervals. Noise outputs were also checked, as well as signal generator dial settings.

The equipment was operated while at high temperature (50°C.) and shut down while the temperature was being lowered, except that one check was made when the ambient temperature was about 0°C. The equipment was turned on again after about 60 minutes at -17°C. The controls were checked at -17°C. for operation. It was found that all controls were workable, except for the band switch, which was immovable without excessive force. Receiver operation seemed otherwise normal. Table R-8 shows the results of this test. During the temperature test, it was noted that the output termination for maximum output from the receiver changed from 50 to 8 ohms at the highest temperatures. This value came back to 50 ohms at room temperature at the end of the test.

(c) Effect of humidity on cold start gain and noise characteristics: For this test, the signal generator was modulated 90 per cent at 400 cps and the input for 100 milliwatts output, with gain control on maximum, was measured at 40°C. and 23 per cent humidity. Noise was also measured and signal generator dial readings noted. The receiver was then turned off and the humidity increased to 97 per cent at the same temperature, as described in paragraph 2-16. The receiver was turned on after 2 hours and 43 minutes, and the input for 100 milliwatts output, and also noise output, was immediately measured. The same measurements were then made at suitable short intervals to show the variations occurring after starting up. These readings are shown in graph form on Plate R-5. The values shown in Table R-9 are derived from the above graphs.

3-8. Effects of Vibration. The equipment was subjected to a vibration test, as described in paragraph 2-17. The receiver was measured for changes in gain, whenever possible, between the intervals of vibration and transmitter operation. Reception of voice modulated signals was satisfactory during vibration. The few figures obtained in the course of the test

[redacted]

indicate if anything, a possible increase in gain after vibration, but are not enough for any definite opinion.

3-9. <u>Summary of Defects</u>. The following defects were found as a result of the examinations and tests listed in paragraphs 3-1 to 3-8.

(a) "On-Off" switch on front panel is not marked so that its true function of putting the transmitter filament power on or off is indicated. (Par. 3-2-e)

(b) No handle or other device is provided for opening the panel, and no support is provided to hold the panel in position so that no strain is brought to bear on the internal antenna lead. (Par. 3-2-i)

(c) The dial lights cannot be conveniently replaced. (Par. 3-2-j)

(d) Some crystal and tube sockets are inaccessible without disassembly. (Par. 3-2-j)

(e) Use of steel for cabinet and chassis is undesirable, although these parts seem to be adequately protected by a good wrinkle finish. Apparently unplated steel screws are used in some cases. (Par. 3-2-l)

(f) There is apparently insufficient protection against moisture. (Par. 3-2-m)

(g) Numerous paper shell condensers with wax ends, which may melt under excessive temperature, are used. There appears to be insufficient ventilation provided for components behind the front panel. (Par. 3-2-n)

(h) The chassis tends to weave if lifted from one end. The hand-set is unsecured. Condensers and resistors in several cases can vibrate. (Par. 3-2-o)

(i) Replacement of sockets will require disturbing of wiring and components. Tube sockets are not identified. (Par. 3-2-q)

(j) One paper tube electrolytic condenser used. (Par. 3-2-x)

(k) Three different types of toggle switches are used. These should preferably be of same type to facilitate replacement. (Par. 3-2-y)

(l) Several resistors are not mounted rigidly enough. (Par. 3-2-z)

(m) Terminal strips are apparently untreated for protection against leakage. (Par. 3-2-aa)

(n) A choke, a resistor, and a paper condenser are not rigidly mounted. (Par. 3-2-bb)

[redacted]

(o) Wire leads, in some cases, are not anchored well enough in long lengths. (Par. 3-2-cc)

(p) Crystal matching to proper socket dependent on color markings on both socket and crystal; no other identification provided for matching. (Par. 3-2-dd)

(q) Quality and intelligibility good during listening tests only when volume control is reduced to give about 50 milliwatts output. (Par. 3-5, Table R-1)

(r) Receiver overloaded more easily than the other receivers tested, adversely affecting the quality. (Par. 3-5, Table R-2)

(s) The graph of the resonant overload characteristic has substantially no straight portions below the threshold of AVC action, indicating possible overloading prior to second detector. (Par. 3-6-c, Table 5)

(t) Radiation voltages are excessive, particularly at the fundamental of the receiver oscillator frequency. (Par. 3-6-f, Table R-6)

(u) There is a marked loss in gain with increase of humidity. (Par. 3-7-a, Table R-7, Plate R-4)

(v) The receiver output impedance seems to be affected at high temperatures. (Par. 3-7-b)

(w) The band switch control freezes at low temperatures and is immovable without excessive force. (Par. 3-7-b, Table R-8)

(x) The unpotted, exposed transformers do not meet Naval specifications. (Par. 3-2-s)

(y) Ceramic insulation should be used in several places. (Par. 3-2-q-t-u)

(z) Crystal set No. 2 is 4 kilocycles off the receiver oscillator frequency required for proper operation. (Par. 3-2-dd)

[redacted]

Table TR-1

Model 250B Jefferson-Travis Marine Radio Telephone
Weight and Dimensions.

Transmitter-Receiver Unit

- Height - 23 inches
- Width - 15-3/4 inches
- Depth - 11 inches

Hand-set

- Height - 5-3/4 inches
- Width - 9-1/4 inches
- Depth - 7-1/2 inches

Weight (entire equipment) - 73-1/2 pounds.

Table T-1

Model 250B Jefferson-Travis Marine Radio Telephone
Measurement of Power Output.

Antenna: 300 micromicrofarads plus two 32-volt, 15-watt lamps in parallel.

	2738 kc	2670 kc	2350 kc
I_g (ma)	3.2	3.6	4.0
I_p (ma)	160.0*	158.0*	160.0*
I_{rf} (external amps.)	0.93	1.03	0.95
E (supply volts)	11.8	11.8	11.8
Selector switch position	Ships	Cst. Grd.	New York
Watts output	16.3	22.7	17.3

* Instruction book limits I_p to 100-120 milliamperes but this condition could not be obtained.

[redacted]

Model 250B Jefferson-Travis Marine Radio Telephone
Variation of Ambient Temperature - 2738 Kc.

Time	Ambient Temp. °C.	Relative Humidity %	Grid Current ma.	Plate Current ma.	I_{rf} External amp.	Emitted Signal	Output Watts
0000	50	17	3.8	104	0.81	Satis-factory	16.4
0020	50	16	3.5	107	.83	"	17.2
0035	49	17	4.0	107	.83	"	17.2
0050	49	17	4.0	103	.80	"	16.0
0105	49.5	17	4.0	105	.81	"	16.4
0127	50	16	4.2	106	.83	"	17.2
0137	49.5	16	4.2	106	.83	"	17.2
0152	49.5	16	4.2	108	.85	"	18.1
0206	50	15	4.3	108	.85	"	18.1
0221	46	17.5					
0236	28	19					
0251	8.5						
0306	-0.5						
0321	-5.0						

Equipment idle from 0210 to 0525

Time	Ambient Temp. °C.	Relative Humidity %	Grid Current ma.	Plate Current ma.	I_{rf} External amp.	Emitted Signal	Output Watts
0336	-9.0						
0400	-12.5						
0415	-14.5						
0432	-15.5						
0450	-17.0						
0505	-17.5						
0526	-17.0		5.8	126	.95	"	22.6
0544	-16.5						
0600	-17.0						
0605	-17.0		5.8	130	.99	"	24.5
0620	-16.5						

Receiver on continuously after 0620.

Time	Ambient Temp. °C.	Relative Humidity %	Grid Current ma.	Plate Current ma.	I_{rf} External amp.	Emitted Signal	Output Watts
0635	-16.5						
0650	-17.5		5.7	123	.93	"	21.6
0705	-16.0		5.6	123	.93	"	21.6
0725	-15.5		5.5	124	.93	"	21.6

[redacted]

Table T-3 DECLASSIFIED

Model 250B Jefferson-Travis Marine Radio Telephone
Variation in Humidity - 2738 Kc.

Time Minutes	Ambient Temp. °C.	Relative Humidity %	Grid Current ma.	Plate Current ma.	I_{rf} External amp.	Emitted Signal	Output Watts
0	40	19	4.2	115	0.85	Satis-factory	18.1
20	39	14.5	2.3	112	.85	"	18.1
35	40	13	3.8	113	.84	"	17.6
50	40	13	3.1	111	.82	"	16.8
80	39	90.5	2.0	111	.83	"	17.2
107	39	97	2.3	108	.82	"	16.8
122	39	97	3.9	108	.82	"	16.8
140	39	97	3.8	106	.81	"	16.4
155	39	97	3.8	106	.81	"	16.4
170	39.5	97	3.6	107	.81	"	16.4
185	39	56.5	3.2	107	.82	"	16.8
200	40	27	3.0	108	.83	"	17.2
215	39.5	26.5	3.5	107	.82	"	16.8
230	40	29	3.0	108	.83	"	17.2
245	40	29	3.0	109	.84	"	17.6
260	40	29	3.1	108	.84	"	17.6

Antenna: 300 micromicrofarads in series with 25 ohm plaque resistors.

Power output at end of first test period - 16.8 watts.
Maximum power decrease noted thereafter - 16.4 watts.
Difference - 0.4 watts or 2.38 per cent.

[redacted]

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Table T-4

Model 250B Jefferson-Travis Marine Radio Telephone.
Vibration Test - 2670 Kc.

Time	I_{rf} External amps.	I_g ma.	I_p ma.	Emitted Signal	Condition
1411	0.87	5.5	105	Satisfactory	Stationary
1412	.88	5.5	105	"	Vibration
1419	.86	5.4	103	"	"
1422	.85	5.4	103	"	"
1427	.85	5.4	103	"	"
1432	.89	5.4	104	"	"
1437	.87	5.1	101	"	"
1442	.86	5.2	100	"	"
1443	.86	5.2	100	"	Stationary

Antenna: 300 micromicrofarads plus 25 ohm non-inductive (plaque) resistor.

Table T-5

Model 250B Jefferson-Travis Marine Radio Telephone
Locked Key Operation for One Hour - 2738 Kc.

Time	Ambient Temp. °C.	Relative Humidity %	Grid Current ma.	Plate Current ma.	I_{rf} External amp.	Emitted Signal	Output Watts
1410	40	25	1.5	118	0.89	Satis-factory	19.8
1420	39.5	24.5	4.1	104	.82	"	16.8
1430	39.5	24.5	4.0	105	.82	"	16.8
1440	39	26	2.6	105	.81	"	16.4
1450	40	25	2.7	104	.81	"	16.4
1500	39	29	3.2	102	.80	"	16.0
1510	40	25	3.4	100	.80	"	16.0

Power output at start of test - 19.8 watts.
Minimum power output observed thereafter - 16 watts.
Difference - 3.8 watts or 19.2 per cent.

Antenna: 300 micromicrofarads in series with 25 ohm plaque resistors.

[redacted]

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Table R-1

Model 250B Jefferson-Travis Marine Radio Telephone
Listening Test - 2738 Kc.
4 October 1940

(1) Signal Generator Input to antenna in Laboratory annex	2 volts	100,000 µv.	10,000 µv.	5000 µv.
(2) Signal + Noise Output (30% modulation)	850 mw	670 mw	130 mw	110 mw
(3) Noise: Carrier on	0.9 mw	21 mw	65 mw	100 mw
(4) Noise: Carrier off	90 mw	100 mw	100 mw	-
(5) Ratio in db. Signal + Noise to Noise, $\frac{(2)}{(3)}$	28.7 db	15.1 db	3 db	0.4 db
(6) Comments on quality and intelligibility	Good when volume control reduced to give 50 mw or less of output.	Same.	Understandable with difficulty.	Inaudible above noise.

Table R-2

Model 250B Jefferson-Travis Marine Radio Telephone
Listening Test - 2738 Kc.
7 October 1940.

(1) Signal Generator Input to antenna in Laboratory annex	2 volts	100,000 µv.	10,000 µv.	5000 µv.
(2) Signal + Noise Output (30% modulation)	780 mw	560 mw	55 mw	17 mw
(3) Noise: Carrier on	0.2 mw	1.7 mw	6 mw	5.5 mw
(4) Noise: Carrier off	8 mw	8 mw	8 mw	8 mw
(5) Ratio in db. Signal + Noise to Noise, $\frac{(2)}{(3)}$	35.9 db	25.2 db	9.6 db	4.9 db
(6) Comments on quality and intelligibility	Speaker overloaded; understandable but quality poor.	Speaker overloaded, but very understandable.	Understandable.	Speech mostly understandable.

[redacted]

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Table R-3

Model 250B Jefferson-Travis Marine Radio Telephone
Sensitivity, Noise Output, Image Ratio and I.F. Response.

Gain control at maximum; input modulated 30% at 400 cps; output impedance, 50 ohms.

Selector switch position	1	2	10
Frequency	2738 kc	2670 kc	2350 kc
Input through standard dummy antenna	1.5 µv.	3.6 µv.	0.77 µv.
A.F. output in 50 ohms	40 mw	40 mw	40 mw
Noise output - modulation off	4.5 mw	1.7 mw	11.0 mw
Noise output - carrier off	0.15 mw	0.04 mw	1.4 mw
Image frequency	3650 kc	3582 kc	3262 kc
Image ratio	1340	425	3270
I.F. response from antenna for 40 mw output, 456 kc	-	60,000 µv.	-

Table R-4

Model 250B Jefferson-Travis Marine Radio Telephone
Selectivity Test - 2738 Kc.

Gain control at maximum; input 30 per cent modulated at 400 cps; constant output = 40 mw.

Ratio $\frac{\text{Input off maximum response}}{\text{Input at maximum response}}$	Ratio in db.	Band Width Kc	Band Width Per Cent
1.4	3	5.1	0.186
2.0	6	8.0	.292
5.0	14	15.2	.555
10.0	20	18.6	.681
100.0	40	35.6	1.30
1000.0	60	59.8	2.18
10000.0	80	94.2	3.44
100000.0	100	154.5	5.65

[redacted]

Table R-5

Model 250B Jefferson-Travis Marine Radio Telephone
Resonant Overload Characteristics.

Gain control on maximum; input 30 per cent modulated at 400 cps.

(1) Threshold of AVC action	Input approximately 10 µv.
(2) Maximum variation of output for +100 db. increase of input	Approximately 1300 to 1900 mw (0.75 db)
(3) Range of linear detection below AVC threshold	Input approximately 3 to 10 µv. Output approximately 300 to 1300 mw.
(4) Carrier noise output (modulation off)	Maximum - 11 mw. Minimum - 0.55 mw. Ratio - 13 db.
(5) Range of input variation to decrease carrier noise from maximum to minimum value.	5 to 10,000 µv. (+66 db)
(6) Maximum power output of receiver.	1900 mw.

Gain control on 1/4 maximum position.

(1) Threshold of AVC action	Input approximately 30 µv. Output approximately 4 mw.
(2) Input for 6 db. increase above AVC threshold output	90 µv.
(3) Maximum power output of receiver	1000 mw at 2 volts input.

[redacted]

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Table R-6

Model 250B Jefferson-Travis Marine Radio Telephone
Radiation Voltage Due to Receiver Oscillation
Appearing at Antenna Terminals.

Gain control on maximum.

Frequency switch position	1	2	10
Receiver oscillator frequency	3194 kc	3122 kc	2806 kc
Radiation voltage - fundamental	Over 100,000 µv.	Over 100,000 µv.	Over 100,000 µv.
Radiation voltage - 2nd harmonic	11,000 µv.	12,000 µv.	8,800 µv.
Radiation voltage - 3rd harmonic	10,000 µv.	15,000 µv.	6,800 µv.
Radiation voltage - 4th harmonic	2000 µv.	1400 µv.	1800 µv.
Radiation voltage - 5th harmonic	400 µv.	300 µv.	350 µv.

Table R-7

Model 250B Jefferson-Travis Marine Radio Telephone
Effect of Humidity on Gain and Noise Level.

Gain control set below maximum level.

Humidity	14% (start)	97%	26% (return)
Time	0	120 minutes	210 minutes
Input for 10 mw output	6600 µv.	11,500 µv.	6100 µv.
Gain ratio	1.0	0.573	1.08
Db. change in initial gain	0	-4.8 db.	+0.7 db.
Noise level	No definite conclusions due to high local noise level.		

[redacted]

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Table R-8

Model 250B Jefferson-Travis Marine Radio Telephone
Effect of Temperature on Gain and Noise Level.

Gain control set at maximum.

Temperature	50°C. (start)	50°C. (end)	1°C.	After 60 min. at approx. -17°C.	-15°C. (end)
Time	0	120 min.	190 min.	315 min.	410 min.
Input for 1400 mw output	300 µv.	280 µv.	360 µv.	360 µv.	260 µv.
Gain ratio	1	1.07	0.84	0.84	1.15
Db. change in initial gain	0 db.	+0.6 db.	-1.34 db.	-1.34 db.	+1.22 db.
Carrier noise level - mod. off	140 mw	150 mw	220 mw	150 mw	370 mw
Carrier noise ratio	1	1.07	1.57	1.07	2.64
Db. change in carrier noise	0 db.	+0.3 db.	+1.95 db.	+0.3 db.	+4.2 db.
Noise output carrier off	27 mw	50 mw	170 mw	120 mw	200 mw
Noise ratio carrier off	1	1.85	6.3	4.45	7.4
Db. change in noise output - carrier off	0 db.	+2.7 db.	+8.0 db.	+6.5 db.	+8.7 db.

[redacted]

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Table R-9

Model 250B Jefferson-Travis Marine Radio Telephone
Effect of Humidity on Cold-Start Gain and Noise
Characteristics.

Gain control on maximum - equipment turned off from 0 to 200 minutes.

Condition	Initial check (a)	Equipment turned on (b)	Reading (c)	Reading (d)	Final Reading (e)
Time	0	200 min.	205 min.	240 min.	300 min.
Humidity	23%	97%	97%	97%	26%
Input for 1400 mw output - 90% mod.	250 µv.	34000 µv.	5900 µv.	1150 µv.	180 µv.
Gain ratio	1	0.00735	0.0423	0.217	1.39
Db. change in gain	0	-42.7 db.	-27.5 db.	-13.3 db.	+2.9 db.
Carrier noise level - mod. off	20 mw	0.02 mw	0.3 mw	2.0 mw	35 mw.
Carrier noise ratio	1	0.001	0.015	0.1	1.75
Db. change in carrier noise	0	-30 db.	-18.5 db.	-10 db.	+2.4 db.
Noise output - carrier off	8 mw	0.02 mw	0.03 mw	0.07 mw	6 mw
Noise ratio - carrier off	1	0.0025	0.00375	0.00875	0.75
Db. change in noise - carrier off	0	-26 db.	-24.3 db.	-20.58 db.	-1.26 db.

[redacted]

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Jefferson-Travis 250
Front View

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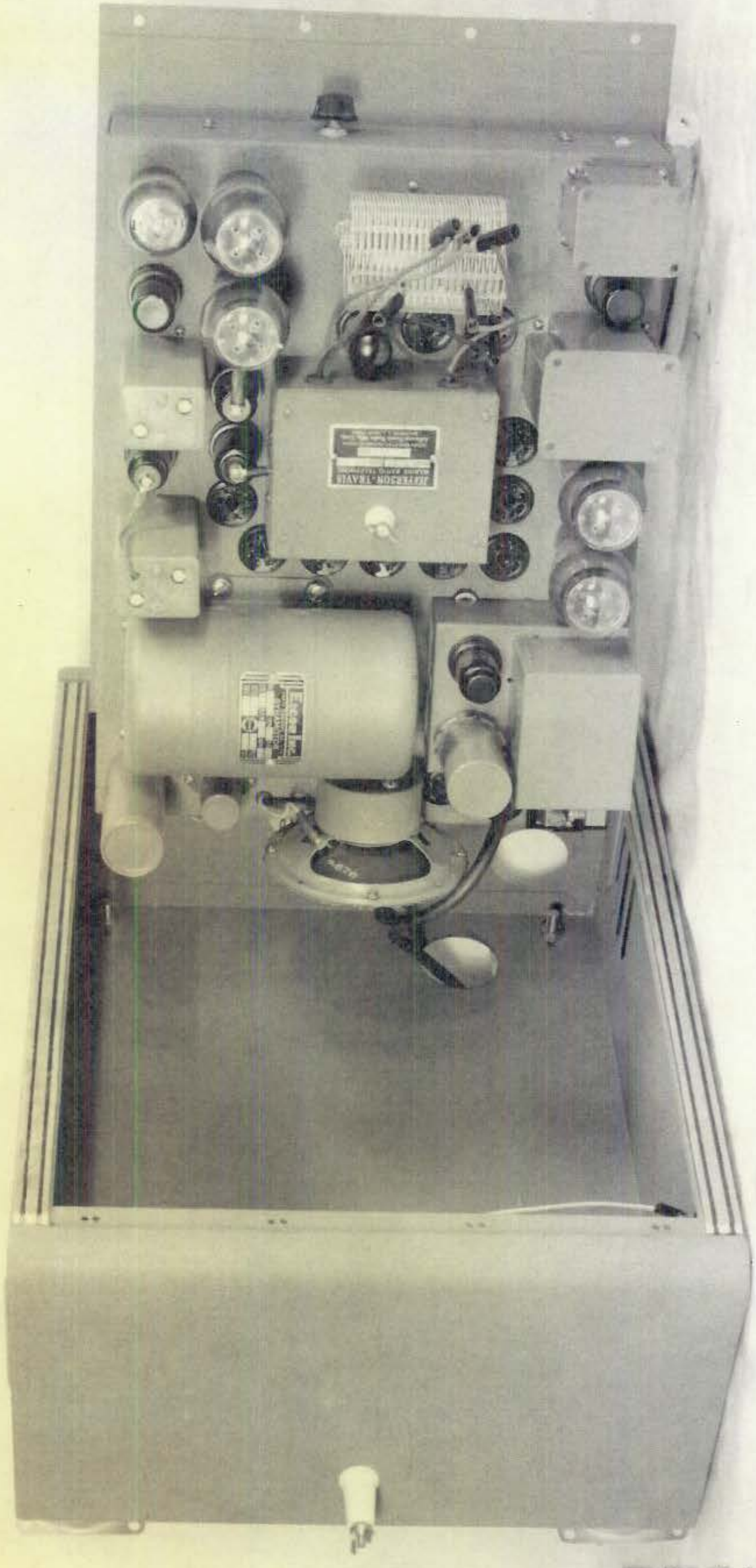
Plate TR-1



Jefferson-Travis 250- Interior View

Plate TR-2

METHOD OF CONNECTING RECEIVER MEASURING EQUIPTMENT FOR TEMPERATURE AND HUMIDITY TESTS

EXTERNAL POWER CONTROL CIRCUITS NOT SHOWN

.0003MFD. CONDENSER AND 24 OHM RESISTOR, TOGETHER WITH AMMETER, FORM TRANSMITTER DUMMY LOAD.

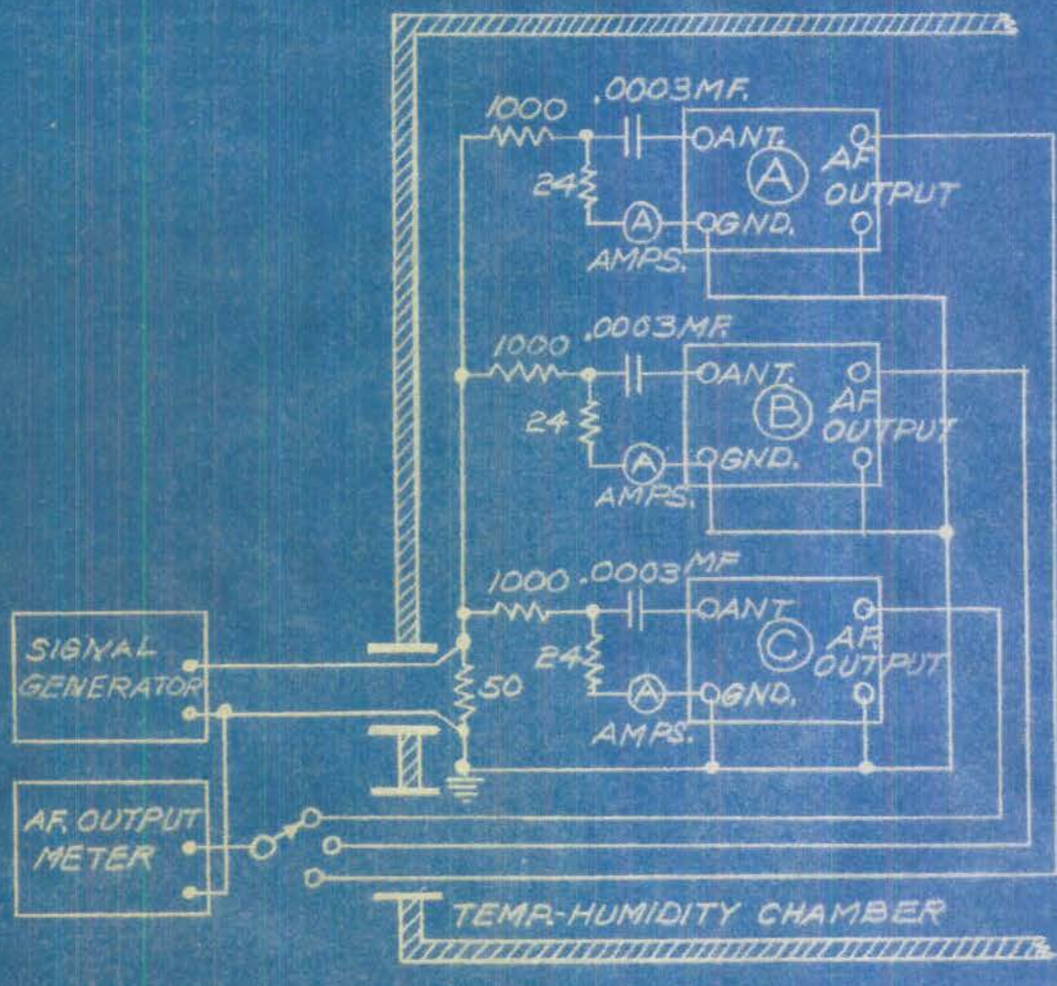
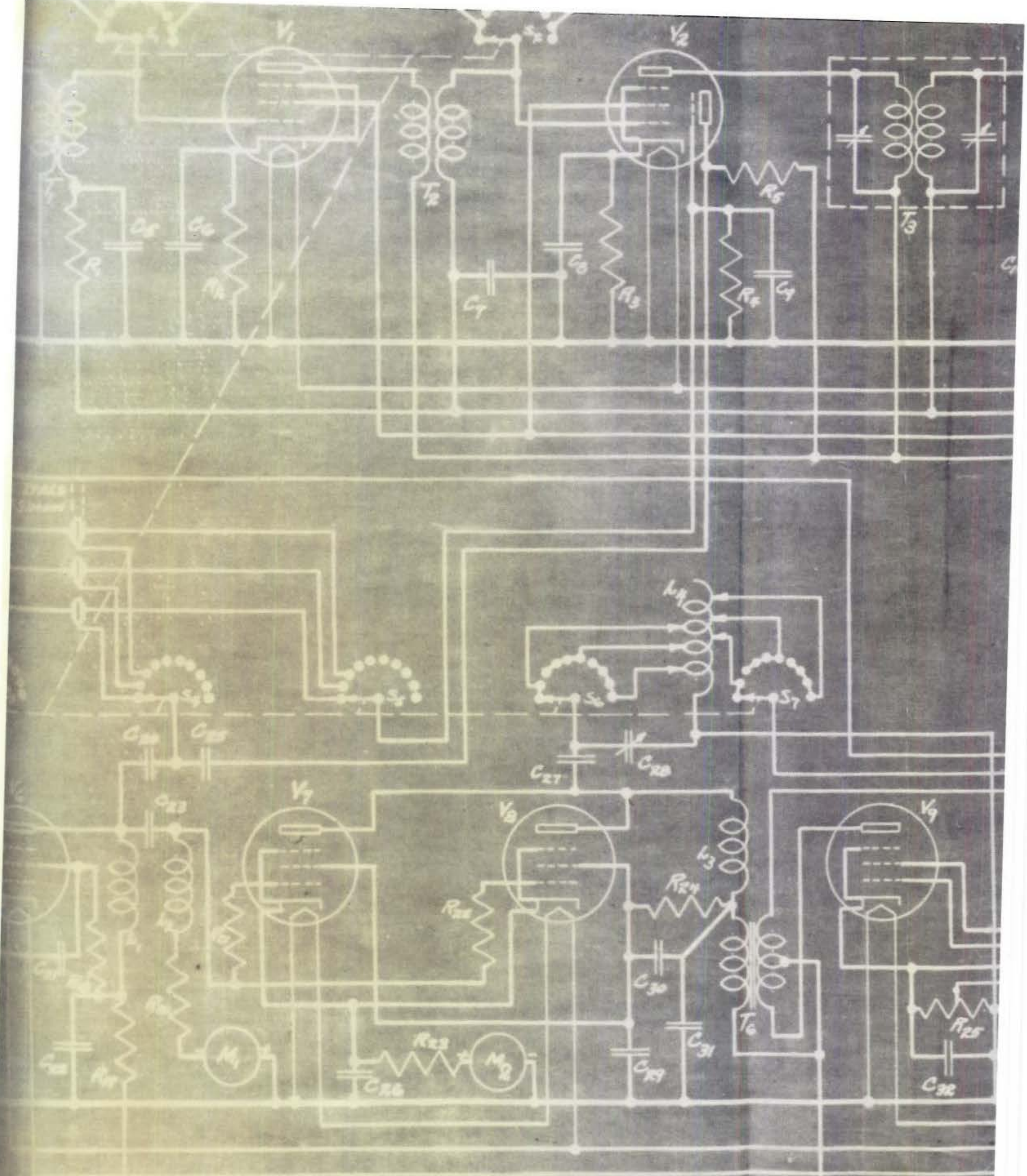


PLATE TR-3



V1
V2
V7
V8
V9
T1
T2
T3
T6
R1
R3
R4
R5
R24
R25
C4
C5
C6
C7
C8
C23
C24
C25
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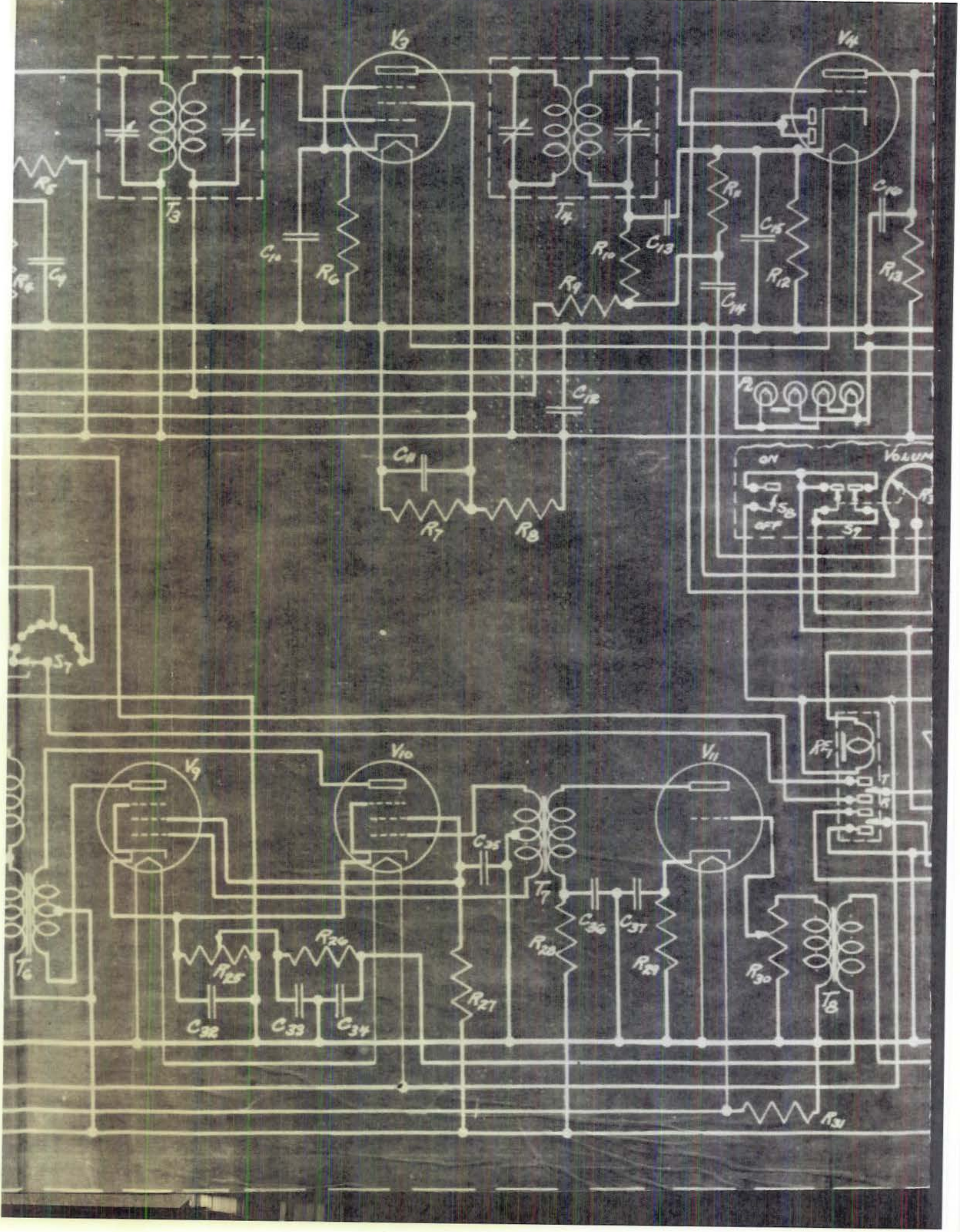
L3
L4
M1
M2



V3
V4
T3
T4
R5
R4
C9
C10
R6
R9
R10
C13
R11
C14
C15
R12
C16
R13
C12
C11
R7
R8
P2
ON
OFF
S8
S9
S7
V9
V10
V11
T6
T7
T8
C35
C36
C37
R25
R26
R27
R28
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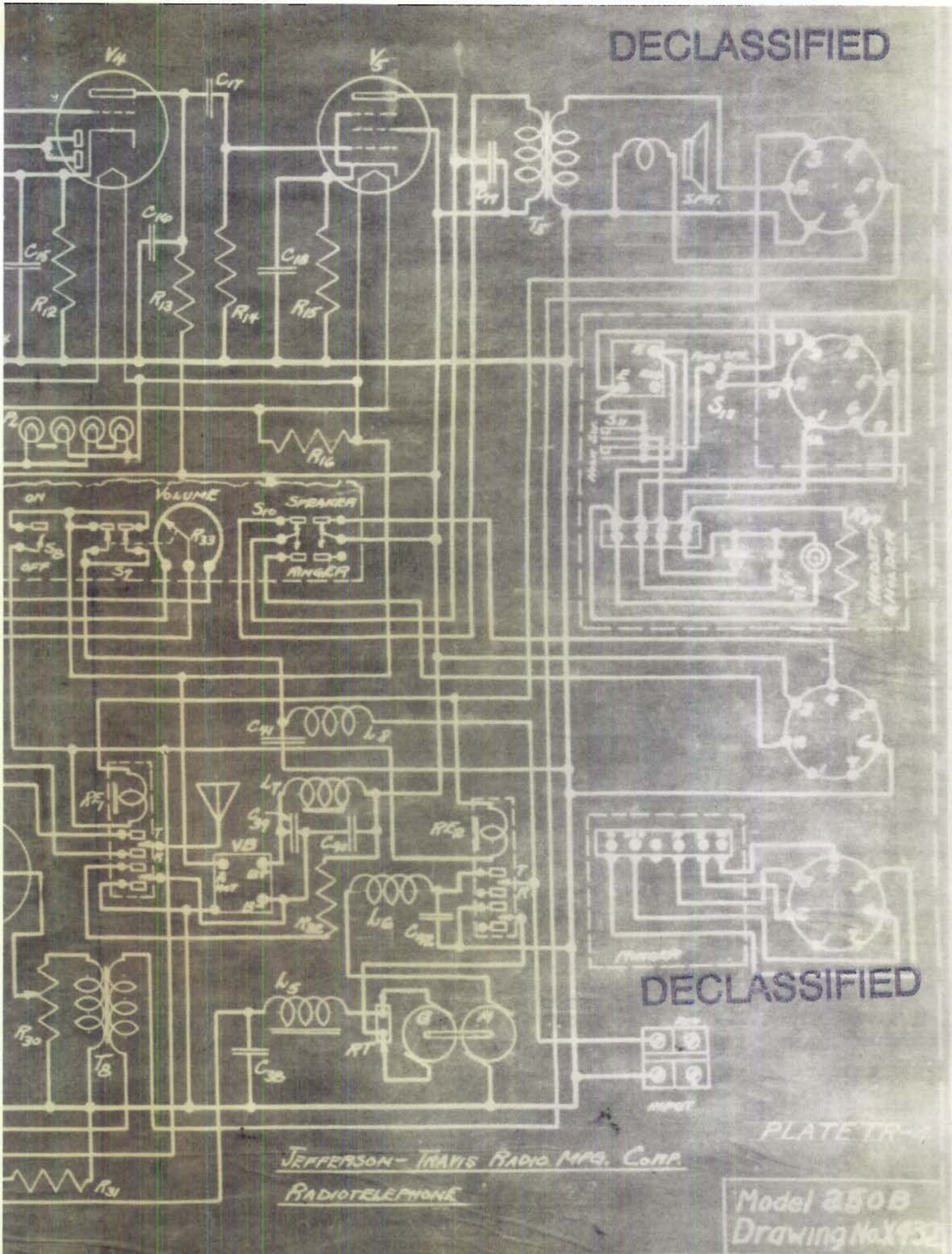
R31
C32
C33
C34



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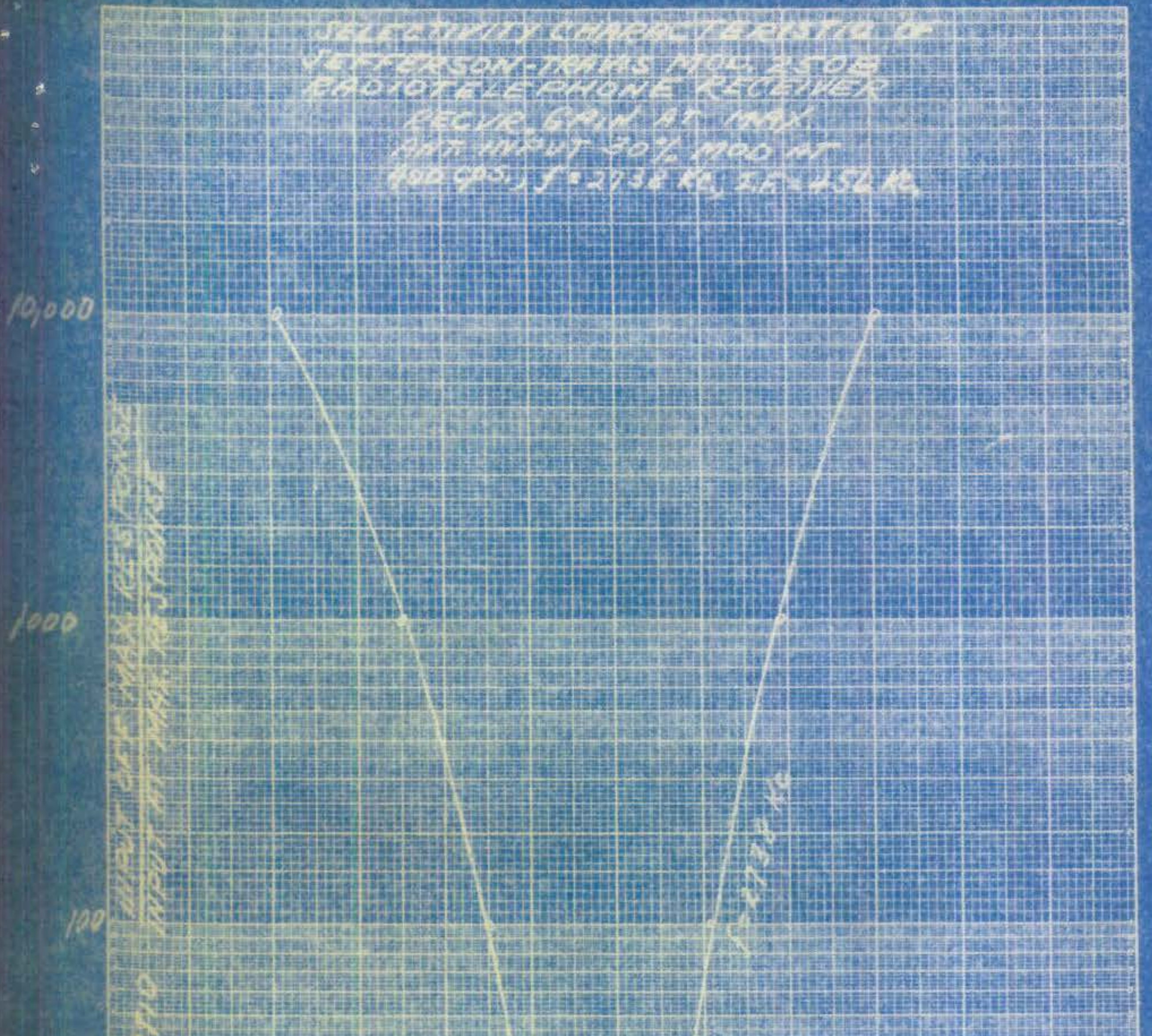
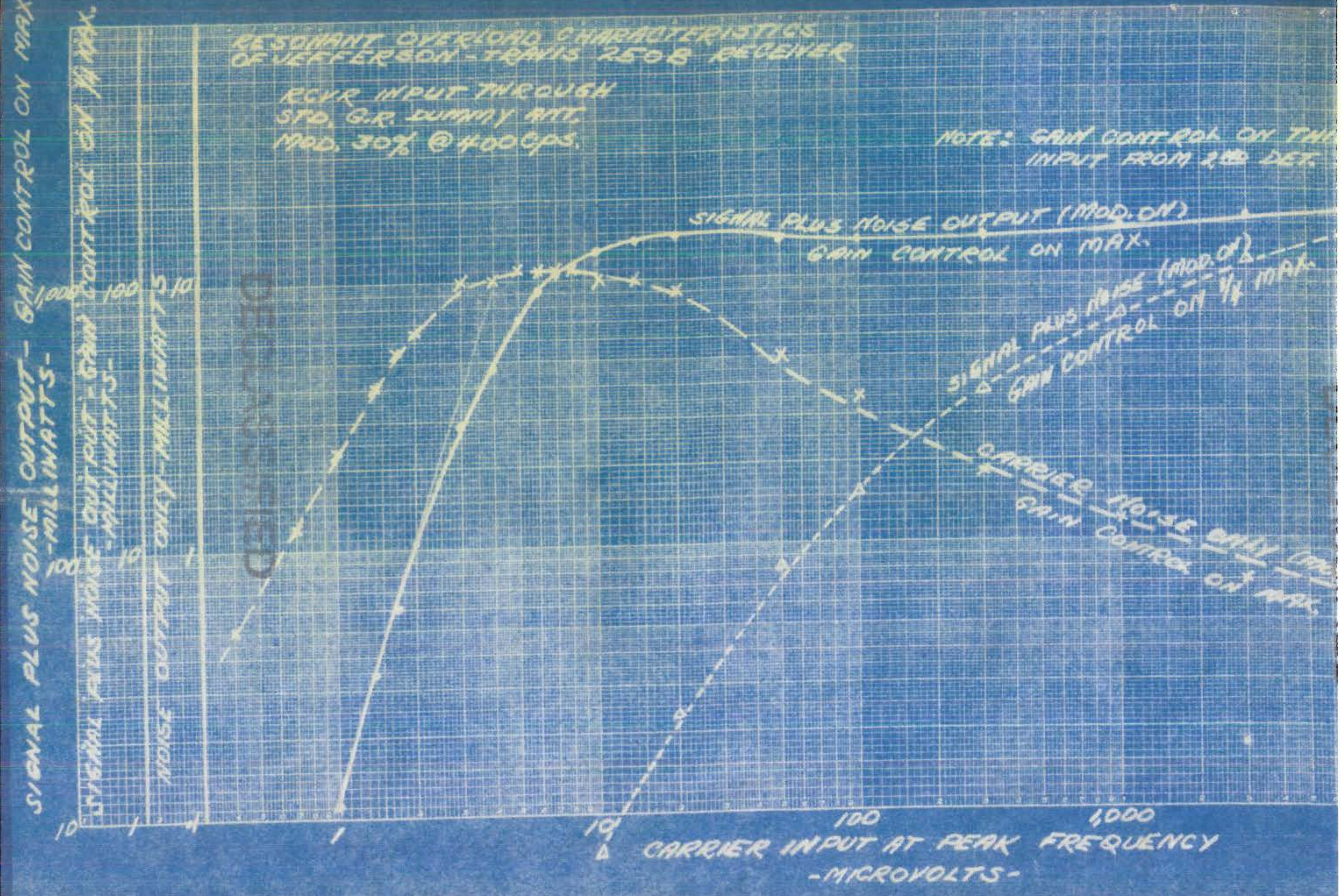

SELECTIVITY CHARACTERISTIC OF
JEFFERSON-TRAVIS MOD. 250B
RADIOTELEPHONE RECEIVER
RECVR. GAIN AT MAX.
ANT. INPUT 30% MOD AT
400 CPS., f = 2738 KC., I.F. = 452 KC.
10,000
1000
100
10
1
RATIO OF INPUT OFF MAX RESPONSE
INPUT AT MAX RESPONSE
-3
-2
-1
0
+1
+2
+3
PERCENT OFF FREQUENCY OF MAX. RESPONSE
10/25/40
ET-SHL

PLATE R-1



RESONANT OVERLOAD CHARACTERISTICS
OF JEFFERSON-TRAVIS 250B RECEIVER
RCVR. INPUT THROUGH
STD. G.R. DUMMY ANT.
MOD. 30% @ 400 CPS.
NOTE: GAIN CONTROL ON THE
INPUT FROM 2ND DET.
SIGNAL PLUS NOISE OUTPUT (MOD. ON)
GAIN CONTROL ON MAX.
SIGNAL PLUS NOISE (MOD. ON)
GAIN CONTROL ON 1/4 MAX.
CARRIER NOISE ONLY
GAIN CONTROL ON MAX.
SIGNAL PLUS NOISE OUTPUT - GAIN CONTROL ON MAX.
-MILLIWATTS-
SIGNAL PLUS NOISE OUTPUT - GAIN CONTROL ON 1/4 MAX.
-MILLIWATTS-
NOISE OUTPUT ONLY - MILLIWATTS
1,000
100
10
1
CARRIER INPUT AT PEAK FREQUENCY
-MICROVOLTS-
DECLASSIFIED

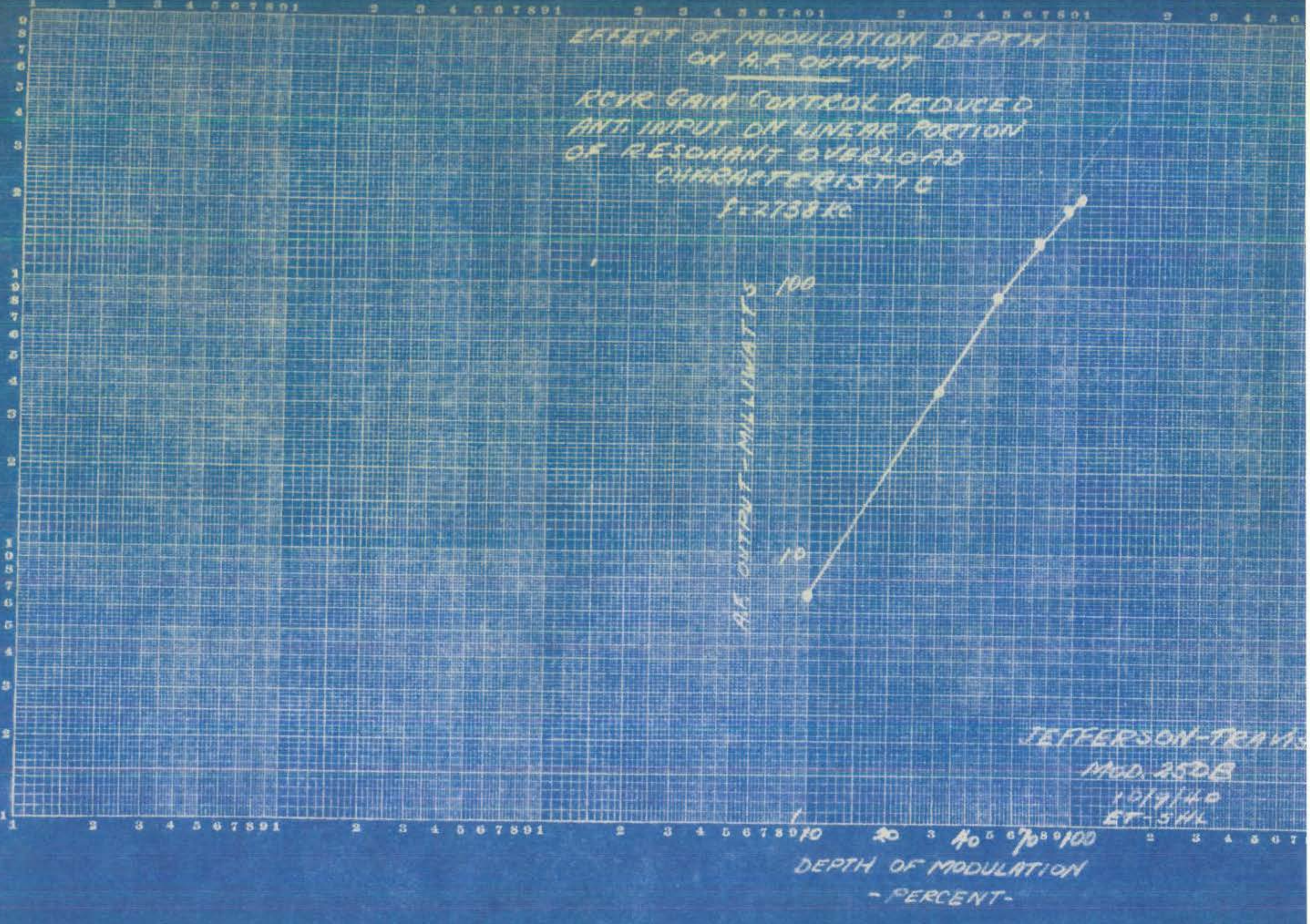
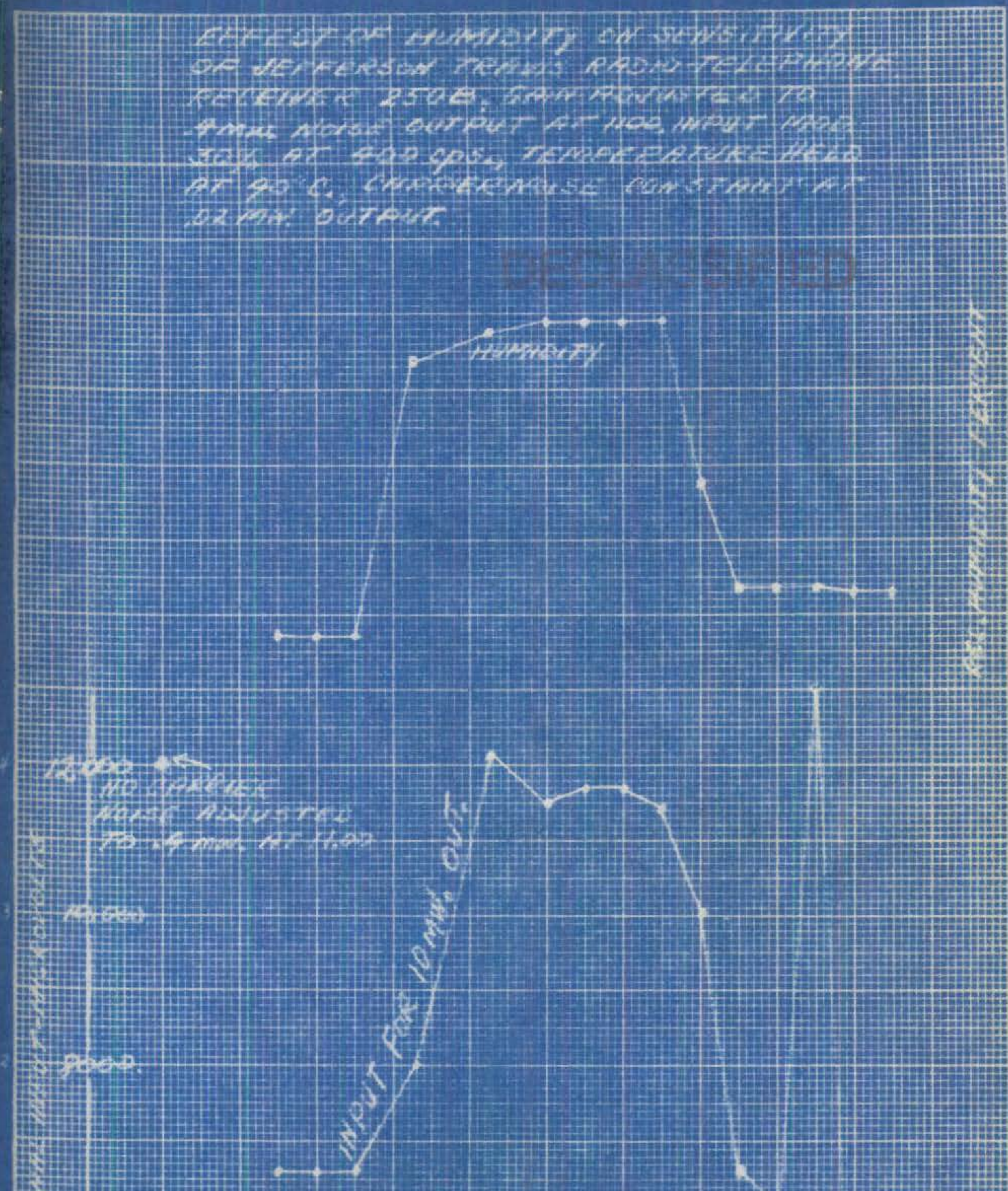

EFFECT OF MODULATION DEPTH
ON A.F. OUTPUT
RCVR GAIN CONTROL REDUCED
ANT. INPUT ON LINEAR PORTION
OF RESONANT OVERLOAD
CHARACTERISTIC
f=2738 kc
A.F. OUTPUT-MILLIWATTS
100
10
1
10
20
40
70
100
DEPTH OF MODULATION
-PERCENT-
JEFFERSON-TRAVIS
MOD. 250B
10/9/40
ET-5HL

PLATE R-


EFFECT OF HUMIDITY ON SENSITIVITY
OF JEFFERSON TRAVIS RADIO TELEPHONE
RECEIVER 250B. GAIN ADJUSTED TO
4 MW. NOISE OUTPUT AT NO INPUT
30% AT 400 CPS., TEMPERATURE HELD
AT 40° C.
HUMIDITY
12,000
NO CARRIER
NOISE ADJUSTED
10,000
8000
6000
INPUT FOR 10 MW. OUT.
NOISE - NO CARRIER
100
0