FREQUENCY METER SETS

SCR-211-A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL, AND AN

TECHNICAL MANUAL

CHANGES No. 1

WAR DEPARTMENT
WASHINGTON 25, D. C., 25 February 1946

TM 11-300, 20 July 1944, is changed as follows:

The title of the manual is changed to read: FREQUENCY METER SETS, SCR-211-A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL, and AN.

1. Introduction

a. This manual is * * * Frequency Meter Set SCR-211-(&). The models covered are as follows: SCR-211-A, B, C, D, E, F, J, K, L, M, N, O, P, Q, R, T, AA, AC, AE, AF, AG, AH, AJ, AK, AL, and AN. Each model letter * * * vacuum tube arrangements.

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9. Antenna

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c. (Added). In some Frequency Meters BC-221-M, -R, and -T, part of Frequency Meter Sets SCR-211-M, -R, and -T, an insulating bushing has been installed in accordance with MWO SIG 11-300-1. Equipments so modified are marked "MWO SIG 11-300-1" on the upper right-hand corner of the front of the case. The insulating bushing has been installed on the antenna connector (lead-out stud) to prevent the antenna from shorting to the chassis.

22. Crystal Circuit

Note (Added). Certain modifications have been made in some Frequency Meter Sets SCR-211-A to -F in accordance with MWO SIG 11-300-2. If this has been done, the letters MWO should appear painted upon the meter. The crystal circuit of the meter has been modified to permit the use of crystals other than the unit type originally furnished. A new variable capacitor, or air padder, has been mounted, adjusted, and locked in position. The wiring of the crystal socket has been altered to accommodate this new capacitor.

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*These changes supersede TB 11-300-1, 15 April 1944, and TB 11-300-2, April 1945.

23. Variable Frequency Oscillator Circuit

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e. TRIMMER CAPACITORS. To insure a * * * variable tuning capacitor.

(1) *General* (Added). Under high temperature and high humidity conditions there may be sufficient frequency shift of the heterodyne oscillator of Frequency Meter BC-221-(&) to prevent zero-beat correction by means of the CORRECTOR capacitor. Under these conditions, it is necessary to reset the heterodyne trimmer capacitors. The restrictions against readjusting the trimmer capacitors, stated in the various Technical Manuals, are rescinded. Adjustments in accordance with the following instructions are authorized for third and higher echelons.

(2) *Connections for adjustment of trimmer capacitors* (Added). An extension cable is required so that the frequency meter may be operated when removed from the carrying case. Select three 3-foot lengths of flexible insulated wire, approximately 18 gauge, preferably of different colors. Assemble a cable, using the wire and insulated alligator clips. Clearly identify the respective leads. Connect the clips to the three banana plugs or banana jacks marked B+, −AB, A+, located in the rear of the equipment. Be careful to avoid short circuits. Connect the other ends of the cable to the appropriate battery terminals at the rear of the carrying case. The frequency meter is now ready for operation. A cable can be assembled using banana jacks and plugs salvaged from Frequency Meter BC-221-(&), but it will not fit all

models because of variations in type of terminal assemblies.

(3) *Step-by-step instructions for adjustment of trimmer capacitors* (Added). (*a*) Plug a headset into the phone jack and allow the frequency meter to warm up for at least 20 minutes.

(*b*) Set the DIAL UNITS and DIAL HUNDREDS scales to agree with the reading given for 250 kc. Set the CORRECTOR dial at midscale (5.5 divisions). Turn the lower left knob to XTAL CHECK.

(*c*) Recheck the dial settings to be absolutely sure that they agree with the figures in the calibration book. Insert a small screw driver through the hole marked LCV on the chassis, and rotate the trimmer capacitor until a strong beat note is found. Adjust the trimmer carefully to produce exact zero beat. Check against another frequency meter to make sure the frequency is actually 250 kc.

(*d*) Check the crystal check points to see whether there is sufficient range in the CORRECTOR to reach zero beat at each crystal check point.

(*e*) If the CORRECTOR reaches 10 and there are some crystal check points that cannot be corrected, first substitute new Batteries BA–23 and BA–2. If the condition persists, repeat (*b*), (*c*), and (*d*) above, but set the CORRECTOR one division to the left of center when the trimmer capacitor is adjusted. If zero beat still cannot be reached at all check points, set the CORRECTOR two divisions to the left of center and repeat (*b*), (*c*), and (*d*) above. If the CORRECTOR reaches 1 without producing zero beat at all crystal check points, repeat (*b*), (*c*), and (*d*) above, but set the CORRECTOR one, two, or three divisions to the right of midscale, as required when the capacitor is readjusted.

(*f*) By repetition of this system, an adjustment should be found that will permit the CORRECTOR to produce zero beat at all crystal check points in the LOW band.

(*g*) Repeat this procedure with the FREQUENCY BAND switch set at HIGH and the DIAL UNITS and DIAL HUNDREDS scales set to agree with the reading given for 4,000 kilocycles in the calibration book. Adjust the HIGH capacitor very slowly and carefully until it is possible to adjust the CORRECTOR to zero beat at each of the crystal check points in the HIGH band.

* * * * *

Section IV. MAINTENANCE

NOTE (Superseded). Failure or unsatisfactory performance of equipment used by Army Ground Forces and Army Service Forces will be reported on WD AGO Form 468 (Unsatisfactory Equipment Report); by Army Air Forces, on Army Air Forces Form 54 (Unsatisfactory Report). If either form is not available, prepare letter containing the data elicited by the sample form shown in figure 109 or figure 109.1 without reproducing copies of the form.

26. General Instructions

* * * * *

a. REPLACEMENT OF PARTS.

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(1) *Zone of the interior.*

* * * * *

(*c*) **When** Frequency Meter Set SCR–211–(&) **is** in need of repairs **within the audio-amplifier stage and when replacement of tubes in all circuits is necessary,** normal echelons of maintenance will be followed.

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28. Moistureproofing and Fungiproofing (Superseded). (See appendix III.)

53. Variable Frequency Oscillator Circuit (par. 23)

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d. TRIMMING CAPACITORS. The trimming capacitors * * * variable tuning capacitor. **For proper adjustment of trimmer capacitors, see paragraph 23e.**

Caution: Rescinded.

* * * * *

83. Variable Frequency Oscillator Circuit (par. 23)

* * * * *

d. TRIMMING CAPACITORS. The trimming capacitors * * * variable tuning capacitor. **For proper adjustment of trimmer capacitors, see paragraph 23e.**

Caution: Rescinded.

* * * * *

113. Variable Frequency Oscillator Circuit (par. 23)

* * * * *

d. TRIMMING CAPACITOR. The trimming capacitors * * * variable tuning capacitor. **For proper adjustment of trimmer capacitors, see paragraph 23e.**

Caution: Rescinded.

* * * * *

143. Variable Frequency Oscillator Circuit (par. 23)

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d. TRIMMING CAPACITORS. The trimming capacitors * * * variable tuning capacitor. **For proper adjustment of trimmer capacitors, see paragraph 23e.**

Caution: Rescinded.

* * * * *

173. Variable Frequency Oscillator Circuit (par. 23)

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d. TRIMMING CAPACITORS. The trimming capacitors * * * variable tuning capacitor. **For proper adjustment of trimmer capacitors, see paragraph 23e.**

Caution: Rescinded.

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203. Variable Frequency Oscillator Circuit (par. 23)

* * * * *

d. TRIMMING CAPACITORS. The trimming capacitors * * * variable tuning capacitor. **For proper adjustment of trimmer capacitors, see paragraph 23e.**

Caution: Rescinded.

* * * * *

233. Variable Frequency Oscillator Circuit (par. 23)

* * * * *

d. TRIMMING CAPACITORS. The trimming capacitors * * * variable tuning capacitor. **For proper adjustment of trimmer capacitors, see paragraph 23e.**

Caution: Rescinded.

* * * * *

263. Variable Frequency Oscillator Circuit (par. 23)

* * * * *

d. TRIMMING CAPACITORS. The trimming capacitors * * * variable tuning capacitor. **For proper adjustment of trimmer capacitors, see paragraph 23e.**

Caution: Rescinded.

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276. Initial Procedure (par. 7)

Make sure a * * * the space provided. **Frequency Meter Set SCR–211–AK is shipped in one crate, 20⅜ by 17½ by 14⅞ inches. The total weight of the packed crate is 52.3 pounds, and its volume is 3 1/16 cubic feet.**

292. Crystal Circuit

The crystal circuit * * * see paragraph 22. **A shield has been added to the crystal socket to reduce crystal-oscillator signal strength. Without the shield, zero beat produced by heterodyne action between the crystal oscillator and the variable frequency oscillator may cover three divisions of the dial vernier. This is particularly true when the tuning dial is set at the CRYSTAL CHECK POINT that corresponds to 2 megacycles. With the shield, zero beat coverage on the vernier is reduced to one division. This results in improved accuracy of the meter.**

293. Variable Frequency Oscillator Circuit (par. 23)

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c. CORRECTOR CONTROL. Capacitor 2, the CORRECTOR control, enables the operator to control the variable capacitance of the tuned circuits to compensate for slight changes in these circuits. (See par. 274*f*.) **In serial Nos. 1 through 6000 (Order No. 17527–Phila–45–07), this capacitor is a 1.8- to 3-micromicrofarad (μμf) variable capacitor (Philco part No. 361–1011). Effective with serial No. 6001, the capacitor was changed to a 2.4- to 4.5-μμf variable capacitor (Philco part No. 351–1006), thereby increasing the range of the CORRECTOR adjustment necessary to overcome the drift in frequency encountered in the field. When the 1.8–3.0 μμf capacitor is replaced by the 2.4–4.5 μμf capacitor, the frequency meter must be recalibrated.**

d. TRIMMING CAPACITORS. The trimming capacitors * * * variable tuning capacitor. **For proper adjustment of trimmer capacitors, see paragraph 23e.**

Caution: Rescinded.

* * * * *

Add the following note under the table of parts in figure 94:

Note. Ref. 2 in the table of parts should read 1.8 to 3 μμf in serial Nos. 1 through 6000 (Order No. 17527–Phila–45–07), and 2.4 to 4.5 μμf, beginning with serial No. 6001.

tubes is closed and remains closed for all succeeding positions of the switch. The B battery circuit is closed to all tubes except the variable frequency oscillator.

(4) At OPER the B battery circuit is closed to all tubes except the crystal-oscillator portion of the detector-converter tube. At CHECK the audio-amplifier circuit is restored to normal conditions, and the B battery circuit is closed to all tubes. This control when set at OPER places maximum load on the batteries; at STAND-BY, minimum load on the batteries.

d. The FREQ. BAND LOW-HIGH switch permits the selection of the appropriate band of operation of the variable frequency oscillator, as indicated by the frequency being checked or calibrated.

e. The frequency of the variable frequency oscillator is controlled by the setting of the dial labelled DIAL UNITS which is graduated into 100 divisions. One revolution of the DIAL UNITS dial moves the DIAL HUNDREDS scale one division. (See par. 11.)

f. The CORRECTOR knob controls a small variable capacitor across the variable frequency oscillator tuned circuit, and is used to compensate for small changes in capacitance brought about by temperature, humidity, and mechanical changes. It is adjusted at each CRYSTAL CHECK POINT to make calibration of the instrument as accurate as possible over that part of the scale centered at a given CRYSTAL CHECK POINT and extending halfway to the next higher and next lower CRYSTAL CHECK POINTS.

g. The MODULATION switch applies an audio tone for modulating either the oscillator or crystal circuit.

337. Vacuum Tubes

The vacuum tubes used in Frequency Meter Set SCR-211-AN are shown in the following table:

Tube	Ref symbol	Function
JAN-6SJ7-----	VT-116----	Variable frequency oscillator.
JAN-6K8-----	VT-167----	Crystal oscillator and detector.
JAN-6SJ7-----	VT-116----	A-f amplifier and oscillator

Section II. INSTALLATION AND OPERATION

338. Initial Procedure (par. 7)

Make sure a spare set of tubes is installed in the space provided.

339. Installation of Batteries

See paragraphs 8 and 187*b*.

340. Antenna

See paragraph 9.

341. Headset (par. 10)

The headset necessary to operate Frequency Meter Set SCR-211-AN is kept in the compartment at the lower front of the cabinet. (See fig. 25.) A headset plug must be inserted into one of the PHONES jacks before the meter will operate.

342. Preparation for Use

a. Set the meter in operation, insert the headset plug into a PHONES jack, and turn the operation switch to STAND-BY.

b. Allow 15 minutes for the variable frequency oscillator to warm up.

c. To test for normal operation, set the operation control switch at CHECK. Rotate the DIAL UNITS dial and listen in the headset for tones of increasing and decreasing pitch. These different tones are produced by the changing variable oscillator frequency beating with various crystal harmonics. The presence of these tones indicates normal operation.

343. Reading the Dial

See paragraph 11.

344. Calibration Book MC-177

See paragraph 12.

345. Operating Circuits (par. 13)

Frequency Meter BC-221-AN contains one principal operating part in addition to the parts described in paragraph 13: the audio oscillator-modulator, which generates an audio voltage for modulating the r-f signal output of the variable frequency oscillator.

346. Zero Beat Detection

See paragraph 14.

347. Correction in Calibration

See paragraph 15.

348. Crystal Check Points

See paragraph 16.

349. Frequency Measurements (par. 17)

Set the operation switch at OPER for making frequency measurements described in paragraph 17. The modulation feature, provided in Frequency Meter BC-221-AN makes possible the following additional measurements:

a. Measuring Frequency to Which a Receiver Is Tuned When Receiver Is Not Equipped With a C-W Oscillator. (1) Put the meter in operation as described in paragraph 342.

(2) Place the antenna of the frequency meter near and parallel to the antenna of the receiver.

(3) Turn the MODULATION switch ON.

(4) Vary the main tuning dial of the frequency meter until an audio tone of constant pitch is heard in the speaker or headset of the receiver.

(5) Determine the frequency at the dial setting ((4) above) from the calibration book, and calibrate the meter at the nearest CRYSTAL CHECK POINT. Turn the MODULATION switch OFF before calibrating.

(6) Reset the MODULATION switch at ON, and adjust the main tuning dial until the audio tone is heard again in the speaker of the receiver.

(7) If the signal tunes broadly, that is, if the signal is audible over several divisions of the DIAL UNITS dial of the frequency meter, decrease the coupling between the frequency meter and the receiver by moving the frequency meter antenna farther away from the antenna of the receiver. As the coupling is decreased, the signal will tune more sharply, and will be audible over a very small portion of the DIAL UNITS dial. The sharper the tuning, the greater the accuracy of the measurement.

(8) Adjust the DIAL UNITS dial for maximum signal in the speaker or headset of the receiver, and lock the dial by turning the dial lock to the right.

(9) Observe the dial setting and, from the calibration book, determine the frequency corresponding to this setting. If the exact frequency is not given, determine it by interpolation as instructed in paragraph 12*e*.

b. Tuning Receiver, Not Equipped With C-W Oscillator, to a Desired Frequency.—(1) Put the meter in operation as outlined in paragraph 342.

(2) Turn receiver on and set dial approximately to desired frequency.

(3) Place the antenna of the frequency meter near and parallel to the antenna of the receiver.

(4) Turn the operation switch to CHECK.

(5) Set the FREQ. BAND LOW-HIGH switch to the proper band.

(6) Select the proper dial setting for the desired frequency from the calibration book. Then set the DIAL UNITS dial of the meter to the CRYSTAL CHECK POINT nearest this frequency.

(7) Correct the frequency meter by adjusting the CORRECTOR control until zero beat is obtained.

(8) Turn MODULATION switch ON.

(9) Set the DIAL UNITS dial of the frequency meter to the desired frequency point. Lock the dial by turning the dial lock to the right.

(10) Rotate the receiver tuning dial until the signal from the frequency meter is picked up, as indicated by a constant frequency note in the speaker or headset.

(11) For greatest accuracy, the coupling between the receiver and frequency meter should be adjusted so that the signal tunes sharply on the receiver. At this point, the receiver will be tuned to within a few cycles of the frequency being generated by the frequency meter.

c. Miscellaneous Measurements. Other uses of the modulated output of the frequency meter may occur to the operator. For example, the frequency meter may be used to perform an emergency alignment on a receiver when a regular signal generator is not available. No attenuator is included in the frequency meter, and, therefore, the only means of controlling the input signal to the receiver being aligned is to vary the coupling between the frequency meter and the antenna attached to the receiver. Thus, the frequency meter may be used conveniently as a signal generator. The output frequencies obtained will be more accurate than can be expected from the average signal generator.

350. Precautions During Operation

See paragraph 18.

351. Adjustments for Field Upkeep

See paragraph 19.

Section III. FUNCTIONING OF PARTS

352. General

Frequency Meter BC–221–AN is similar to Frequency Meter BC–221–Q (ch. 3) with regard to the operation of the variable frequency oscillator, the detector and crystal oscillator, and the audio-amplifier circuits. A five-position operation switch is used, however, instead of the four-position switch which was used on earlier models. This five-position switch controls one additional circuit; the filament of the variable frequency oscillator tube. At the STAND-BY position of the switch, only the filament of variable frequency oscillator Tube JAN–6SJ7 (VT–116) draws current. When the toggle switch labeled MODULATION is at ON, it provides audio modulation in either the CRYSTAL or OPER position of the operation control switch. At ON position, the circuit of the audio-amplifier stage is changed to that of an audio oscillator which is coupled to the plate circuit of the variable frequency oscillator so that modulation of the r-f output will take place. (See fig. 104.)

353. Circuit Components (par. 21)

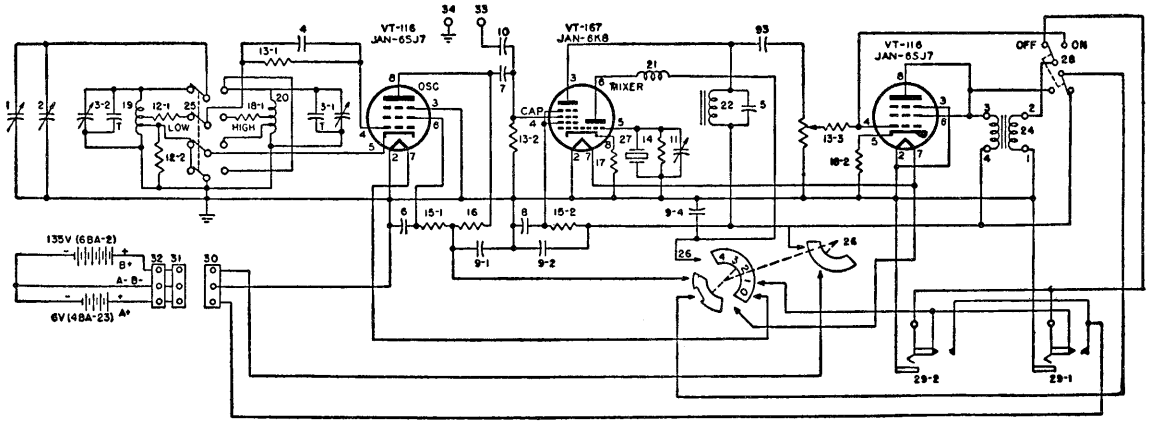
The circuit of Frequency Meter BC–221–AN contains one stage in addition to those given in paragraph 21: the audio oscillator-modulator circuit, which generates an a-f voltage for the modulation of the r-f output of the meter.

354. Crystal Circuit

The crystal circuit uses the triode section of Tube JAN–6K8 (VT–167) shown in figure 105. The oscillator operates at the fixed frequency of 1,000 kilocycles (kc) when operation switch 26 (fig. 104) is set at either CRYSTAL or CHECK. The operation switch controls the crystal oscillator by opening or closing its plate voltage circuit. The oscillator circuit is designed to generate considerable harmonic energy so that it can be used to calibrate the variable frequency oscillator at several points over its entire range, as well as to supply whole multiples of 1,000 kc for the calibration of receivers and similar equipment. The necessary plate circuit impedance is built up across choke coil 21. Resistor 14 is the oscillator grid leak and works in conjunction with tube cathode resistor 17. Variable capacitor 11 is connected across crystal 27 for the purpose of adjusting the frequency of the crystal to a closer point than can be economically obtained by grinding alone. When the frequency meters are adjusted during manufacture, the variable capacitor is set so that the oscillator produces a frequency of 1,000 kc±5 cycles at 20° centigrade. For further details on the crystal oscillator, see paragraph 22.

355. Variable Frequency Oscillator Circuit (par. 23)

Tube VT–116 (6SJ7) is used in an electron-coupled circuit as a variable frequency oscillator. (See fig. 106.)



NOTE: ⏚ IS SYMBOL FOR FIXED CAPACITOR.

REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION	REF	DESCRIPTION
1	21-220 mmf	9-1	0.05 mf	13-2	0.15 meg	19	6.5 mhy	28	MOD SWITCH
2	3-9.5 mmf	9-2	0.05 mf	13-3	0.15 meg	20	0.025 mhy	29-1	HEADSET JACK
3-1	3-25+6 mmf	9-3	0.05 mf	14	1 meg	21	0.735 mhy	29-2	HEADSET JACK
3-2	3-25+6 mmf	9-4	0.05 mf	15-1	8,750 ohms	22	300 henries	30	PLUGS (POWER)
4	100 mmf	10	12 mmf	15-2	8,750 ohms	23	1 meg	31	JACK (POWER)
5	0.002 mf	11	3-25 mmf	16	50,000 ohms	24	TRANSFORMER	32	BATTERY TERM
6	0.01 mf	12-1	9,500 ohms	17	75 ohms	25	SWITCH (BAND)	33	ANTENNA
7	50 mmf	12-2	9,500 ohms	18-1	350 ohms	26	SWITCH (POWER)	34	GROUND POST
8	0.001 mf	13-1	0.15 meg	18-2	350 ohms	27	CRYSTAL		

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Figure 104. Frequency Meter BC–221–AN, schematic diagram.

a. Coils. The two inductors, 19 and 20, in the tuned circuits are entirely inclosed in individual ceramic containers to prevent mechanical injury, and to minimize the influence of changing atmospheric conditions on the stability of the meter. (See fig. 106.) The active terminals of these coils are connected across the terminals of the main tuning capacitor 1 by means of the band selector (FREQ. BAND LOW-HIGH) switch 25. Each coil and the tuning capacitor, together with other capacitors mentioned below, constitute the resonant circuit that determines the output frequency. The correct operating bias on the control grid of the oscillator tube is provided by the capacitor and resistor combination 4 and 13 which connects to a tap on either coil through band selector switch 25. The frequency of oscillation is made relatively independent of variations in tube characteristics when the grid connection is tapped down an appreciable distance from the high potential end of

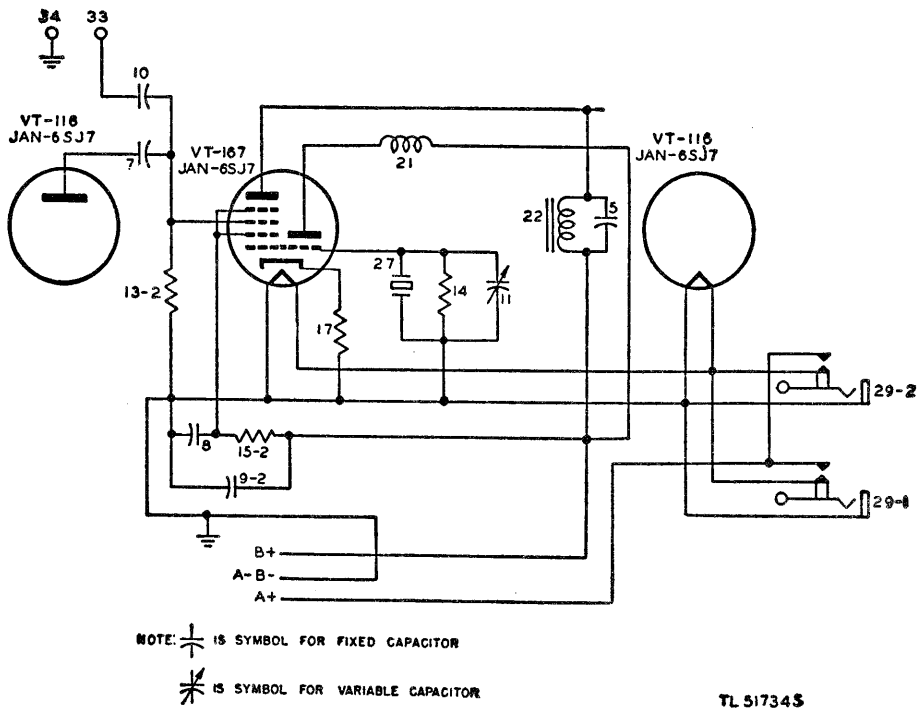

Figure 105. Frequency Meter BC-221-AN, crystal oscillator circuit.

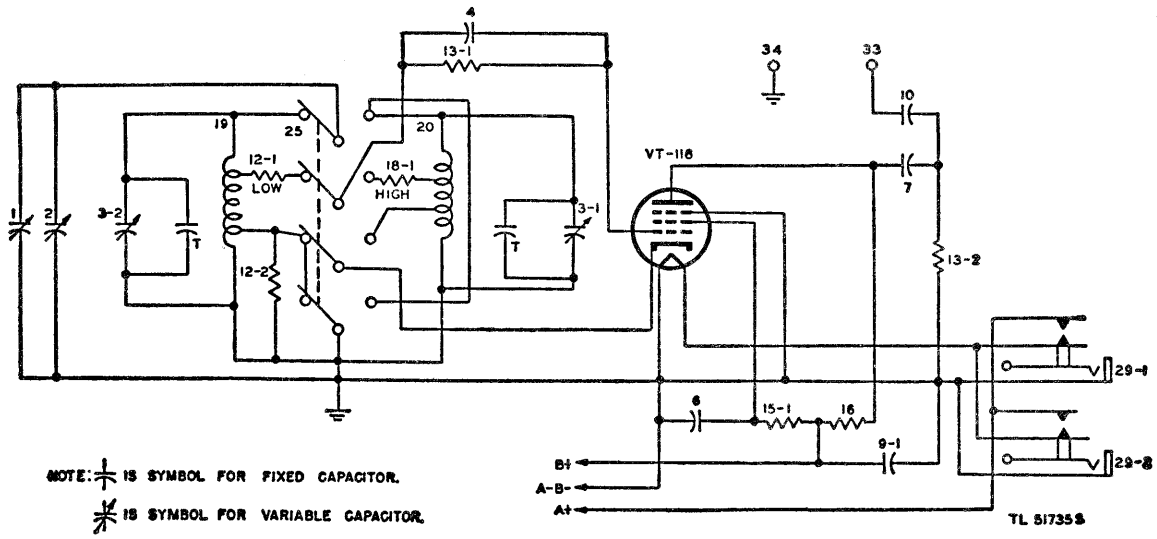

Figure 106. Frequency Meter BC-221-AN, functional diagram, variable frequency oscillator circuit.

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the coil. Resistors 12 and 18, which carry little current, are connected in series with the taps and serve to stabilize the operation of the oscillator circuit by suppressing undesirable oscillations. These resistors are mounted inside of the coil containers and seldom require replacement. The second coil tap, located near the grounded end of each coil, and connected to the cathode of the oscillator tube through another set of contacts on switch 25 serves to control the amount of feedback in the oscillator circuit. Resistor 16 is the oscillator tube plate circuit load. The voltage developed across it is coupled to detector-converter Tube VT-167 (6K8) (fig. 2) through capacitor 7, or to the antenna through capacitors 7 and 10 in series. Part 15-1 is the screen grid dropping resistor, and part 6 is the screen grid bypass capacitor to ground. Capacitor 9-1 bypasses the plate voltage supply.

b. Band Selector Switch. Switch 25 is a double-throw, four-pole switch with all contacts mounted on ceramic plates. To minimize abnormal capacitive effects, all contacts are made as small as possible and are of the self-aligning, self-wiping type with dual contacts. The switch has a heavy detent which locates the rotor plate accurately in either the LOW or HIGH frequency position.

c. Corrector Control. Capacitor 2, the CORRECTOR control, with a range of 2.5 $\mu\mu$f enables the operator to control the variable capacitance of the tuned circuit to compensate for slight changes in the circuit. (See par. 64.)

d. Trimming Capacitors. Trimming capacitors 3-1 and 3-2 are adjusted during manufacture to build up the fixed capacitance of the LOW and HIGH frequency circuits to the exact values called for by the design of the variable tuning capacitor. For proper adjustment of trimmer capacitors, see paragraph 23*e*.

e. Oscillator Function. (1) The variable frequency oscillator is in operation at the CHECK and OPER positions of operation switch 26. (See fig. 104.)

(2) At CHECK, the output of oscillator Tube JAN-6SJ7 (VT-116) is applied to one of the grids of detector-converter Tube JAN-6K8 (VT-167) where it is mixed with the output frequency of the crystal circuit. The output of this stage has a frequency equal to the difference between the two input frequencies. The CORRECTOR control is used to tune the signal to zero beat, so that the accuracy of the variable frequency oscillator approximates the accuracy of the crystal oscillator at the check frequency.

(3) At OPER, the variable frequency oscillator operates and the crystal oscillator does not. If the antenna is connected, the frequency meter may be used to receive or send any frequency in its range; that is, it may be used as a receiver or transmitter.

356. Detector Tube Circuit

It has been stated that the triode section of Tube JAN-6K8 (VT-167) is used in the crystal-oscillator circuit. The remaining hexode section of this tube, with the No. 1 grid tied to the control grid of the triode section, is used as a high-gain screen grid detector. Hexode grid No. 3 acts as the control grid. The joint action of grids Nos. 1 and 3 produces electron coupling of the signals on the two grids. (See fig. 107.) Resistor 13-2, part 14-2 in the early model of Frequency Meter BC-221-B, is the detector tube grid leak. Resistor 15-2 supplies voltage to the screen grid of Tube JAN-6K8 (VT-167). Capacitor 8 bypasses the screen grid to ground. Capacitor 9-2 is a bypass capacitor across the plate voltage. The r-f voltage developed across load resistor 16 in the plate output circuit of the variable frequency oscillator is coupled to the No. 3 grid of this detector through small fixed capacitor 7. Antenna connection 33 is also coupled to the No. 3 grid through coupling capacitor 10. When operation switch 26 is at CHECK, the detector mixes the variable frequency oscillator output with the fundamental and harmonics of the crystal oscillator. When the operation switch is at OPER, the detector mixes the variable frequency oscillator output with the radio transmitter frequency to be measured. By reference to figures 106 and 107, it can be seen that antenna connection 33 is also coupled to the variable frequency oscillator output through capacitors 10 and 7 in series. Thus antenna connection 33 acts as a detector input terminal for the measurement of frequencies of external origin and as a variable frequency oscillator output terminal for use in calibrating receivers. When the unit is used for calibration of receivers, a minimum of 2,000 microvolts of r-f energy will be available between the antenna terminal and ground (the chassis) at any frequency within the calibrated range.

357. Audio-amplifier Circuit (par. 25)

The detector plate works into a-f choke coil 22 which is tuned by capacitor 5 to resonate the re-

sponse to low frequencies. The beat-frequency voltages built up across the choke coil are coupled through capacitor 9–3 and GAIN control potentiometer 23 to the grid of Tube JAN-6SJ7 (VT-116) connected as a triode. The grid of Tube JAN-6SJ7 returns to ground through potentiometer 23, and the necessary grid-bias voltage is obtained by means of the cathode dropping resistor 18–2. The plate (tied to the screen grids) of Tube JAN-6SJ7 returns to the positive plate supply voltage through the primary winding of transformer 24. The plate of this tube is coupled also to PHONES jacks 29–1 and 29–2 through transformer 24, in order to match the high impedance plate circuit to the low impedance headset.

358. Audio Oscillator-modulator Circuit

A functional diagram of the modulator and variable frequency oscillator circuits, together with the connection of the variable frequency oscillator to the detector tube is shown in figure 108. The audio oscillator-modulator unit provides a source of a-f voltage for modulating the r-f output signal from the variable frequency oscillator. When MODULATION switch 28 (fig. 107) is at ON the

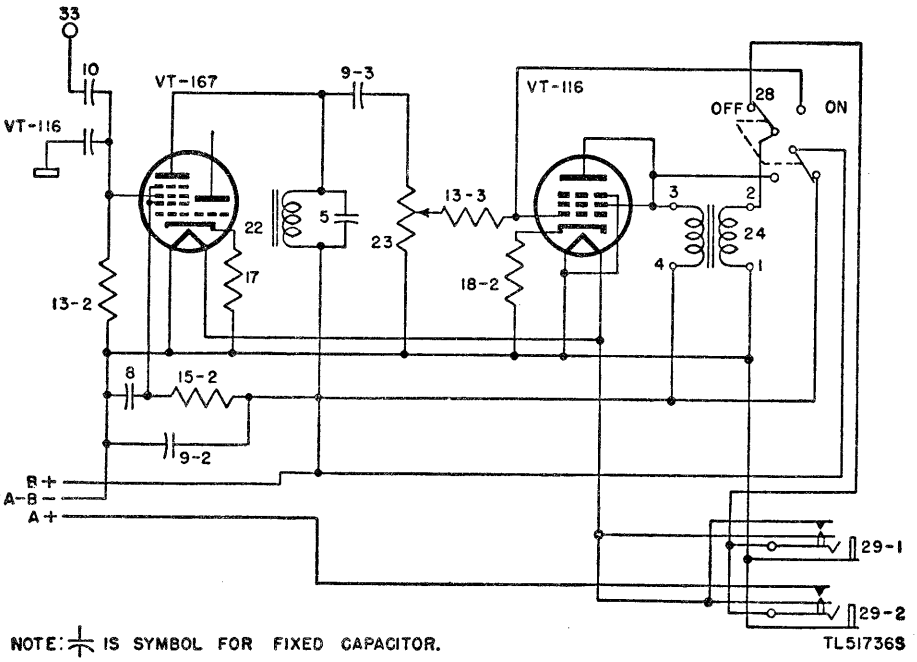


Figure 107. Frequency Meter BC-221-AN, functional diagram, detector and audio-amplifier circuits.

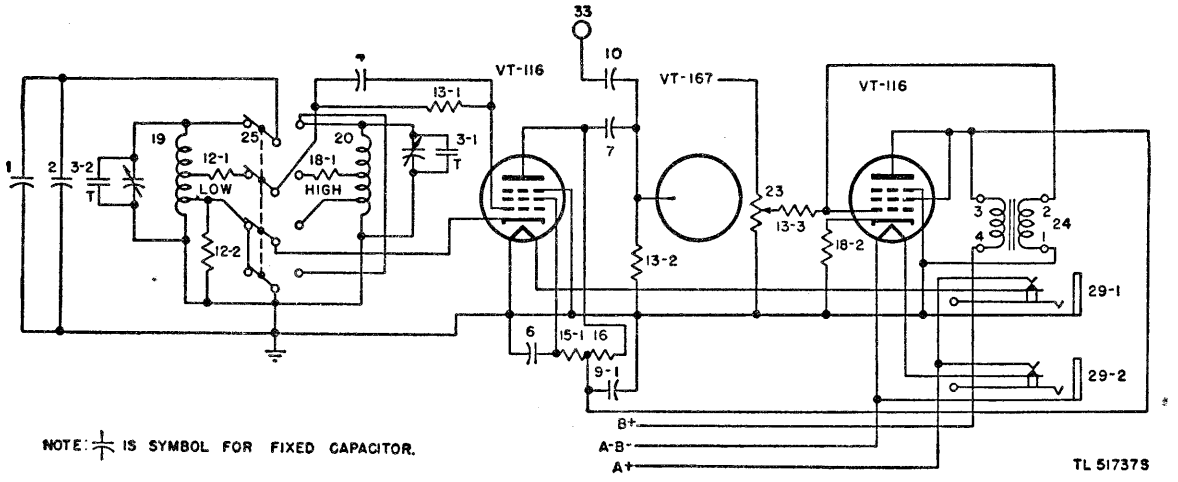


Figure 108. Frequency Meter BC-221-AN, functional diagram, variable frequency oscillator and audio-amplifier circuits.

circuits are so arranged that energy is fed back to the grid circuit of audio Tube JAN-6SJ7 from the secondary of audio-output transformer 24. The primary winding in the plate circuit of the audio tube, coupled to the secondary winding, completes the oscillating circuit. The plate voltage of the audio oscillator-modulator tube is obtained from operation switch 26. The output of the audio oscillator-modulator is placed in series with the voltage supply of the variable oscillator plate and the crystal-oscillator plate so that the supply voltage varies at an audio frequency and causes the output of either the variable oscillator or the crystal oscillator (depending on setting of operation switch) to be modulated. Since the phone lead is open in this action, no audio tone of any sort should appear at the headset jacks.

359. Power Supply Circuit (fig. 104)

All power required for the operation of the meter is introduced through battery terminal board 32, located at the end of the battery cable. The common negative filament and negative plate battery leads are connected to the middle terminal which is grounded to the chassis. A fabricated wiring harness and a fiber terminal board used with the battery harness are provided for terminal board connections. Operation switch 26 closes both the positive 6-volt supply (A+) and the positive 135-volt supply (B+). The positive 6-volt supply (A+) passes through the auxiliary switches on PHONES jacks 29-1 and 29-2 before going through operation switch 26 to the vacuum tube filaments. The circuit is complete only when a headset plug is inserted in one of the jacks. Since the door covering the control panel cannot be closed with a headset plug in place, the A and B batteries cannot be discharged even though the operation switch is left in an active position so long as the door is closed.

Section IV. MAINTENANCE

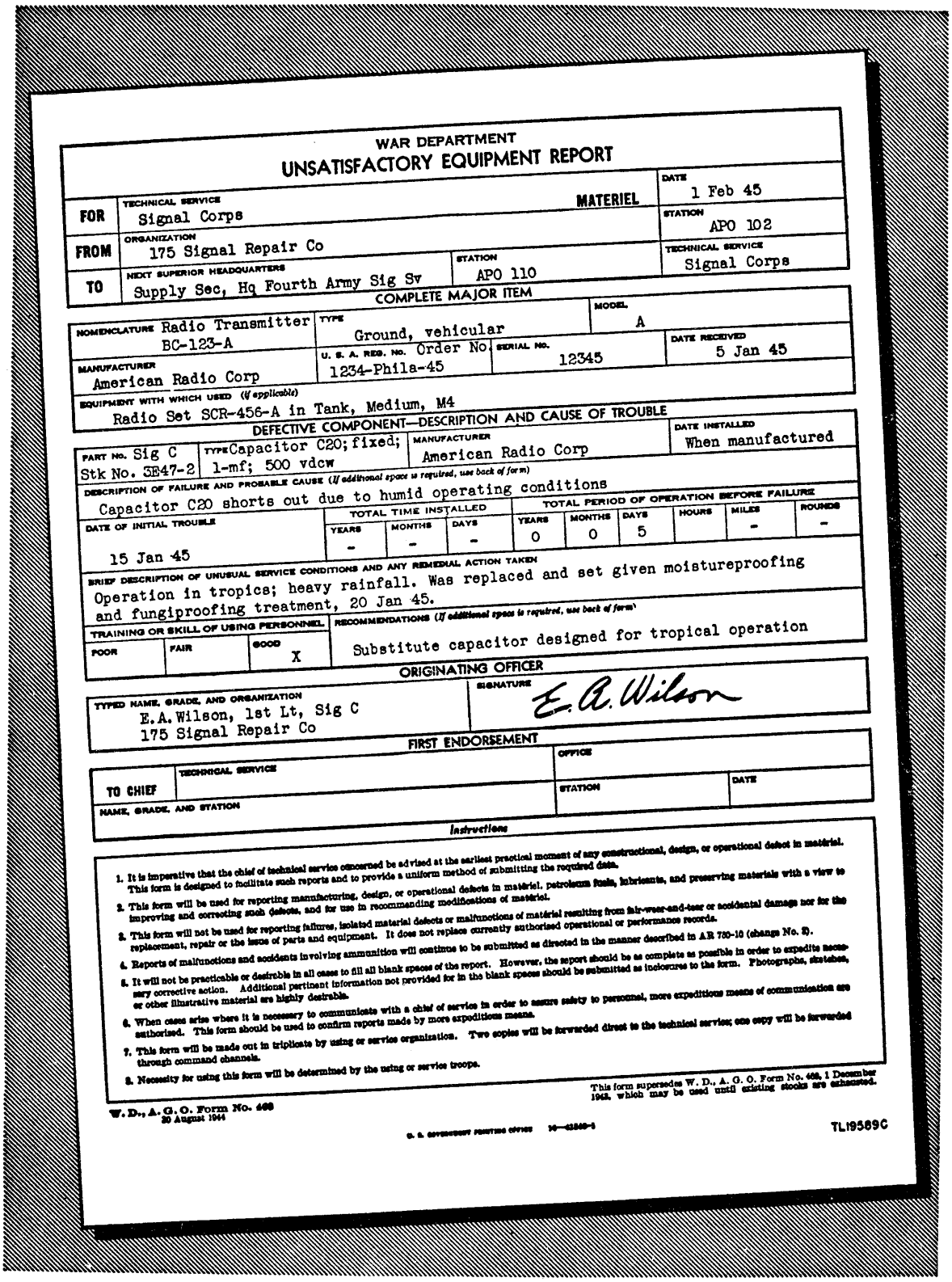
360. General

For all details of field maintenance, see paragraphs 26, 27, and 28.

361. Unsatisfactory Equipment Report

a. When trouble in equipment used by Army Ground Forces or Army Service Forces occurs more often than repair personnel feel is normal, WD AGO Form 468 (Unsatisfactory equipment report) should be filled out and forwarded through channels to the Office of the Chief Signal Officer, Washington 25, D. C. If form is not available, prepare letter containing the data elicited by the sample form shown in figure 109 without reproducing copies of the form.

b. When trouble in equipment used by Army Air Forces occurs more often than repair personnel feel is normal, Army Air Forces Form 54 (Unsatisfactory Report) should be filled out and forwarded to the Commanding General, Air Technical Service Command, Wright Field, Dayton, Ohio, in accordance with AAF Regulation 15-54. If form is not available, prepare letter containing the data elicited by the sample form shown in figure 109.1 without reproducing copies of the form.



WAR DEPARTMENT

UNSATISFACTORY EQUIPMENT REPORT

FOR	TECHNICAL SERVICE: Signal Corps	MATERIEL	DATE: 1 Feb 45
FROM	ORGANIZATION: 175 Signal Repair Co		STATION: APO 102
TO	NEXT SUPERIOR HEADQUARTERS: Supply Sec, Hq Fourth Army Sig Sv	STATION: APO 110	TECHNICAL SERVICE: Signal Corps

COMPLETE MAJOR ITEM

NOMENCLATURE	TYPE	MODEL	
Radio Transmitter BC-123-A	Ground, vehicular	A	
MANUFACTURER: American Radio Corp	U. S. A. REG. NO.: Order No. 1234-Phila-45	SERIAL NO.: 12345	DATE RECEIVED: 5 Jan 45

EQUIPMENT WITH WHICH USED (*If applicable*): Radio Set SCR-456-A in Tank, Medium, M4

DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE

PART NO.	TYPE	MANUFACTURER	DATE INSTALLED
Sig C Stk No. 3E47-2	Capacitor C20; fixed; 1-mf; 500 vdcw	American Radio Corp	When manufactured

DESCRIPTION OF FAILURE AND PROBABLE CAUSE (*If additional space is required, use back of form*)

Capacitor C20 shorts out due to humid operating conditions

DATE OF INITIAL TROUBLE	TOTAL TIME INSTALLED			TOTAL PERIOD OF OPERATION BEFORE FAILURE					
	YEARS	MONTHS	DAYS	YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS
15 Jan 45	-	-	-	0	0	5		-	-

BRIEF DESCRIPTION OF UNUSUAL SERVICE CONDITIONS AND ANY REMEDIAL ACTION TAKEN

Operation in tropics; heavy rainfall. Was replaced and set given moistureproofing and fungiproofing treatment, 20 Jan 45.

TRAINING OR SKILL OF USING PERSONNEL			RECOMMENDATIONS (*If additional space is required, use back of form*)
POOR	FAIR	GOOD	
		X	Substitute capacitor designed for tropical operation

ORIGINATING OFFICER

TYPED NAME, GRADE, AND ORGANIZATION	SIGNATURE
E.A.Wilson, 1st Lt, Sig C 175 Signal Repair Co	E.A. Wilson

FIRST ENDORSEMENT

TO CHIEF	TECHNICAL SERVICE	OFFICE	
NAME, GRADE, AND STATION		STATION	DATE

Instructions

1. It is imperative that the chief of technical service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in material. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.
2. This form will be used for reporting manufacturing, design, or operational defects in material, petroleum fuels, lubricants, and preserving materials with a view to improving and correcting such defects, and for use in recommending modifications of material.
3. This form will not be used for reporting failures, isolated material defects or malfunctions of material resulting from fair-wear-and-tear or accidental damage nor for the replacement, repair or the issue of parts and equipment. It does not replace currently authorized operational or performance records.
4. Reports of malfunctions and accidents involving ammunition will continue to be submitted as directed in the manner described in AR 750-10 (change No. 2).
5. It will not be practicable or desirable in all cases to fill all blank spaces of the report. However, the report should be as complete as possible in order to expedite necessary corrective action. Additional pertinent information not provided for in the blank spaces should be submitted as inclosures to the form. Photographs, sketches, or other illustrative material are highly desirable.
6. When cases arise where it is necessary to communicate with a chief of service in order to assure safety to personnel, more expeditious means of communication are authorized. This form should be used to confirm reports made by more expeditious means.
7. This form will be made out in triplicate by using or service organization. Two copies will be forwarded direct to the technical service; one copy will be forwarded through command channels.
8. Necessity for using this form will be determined by the using or service troops.

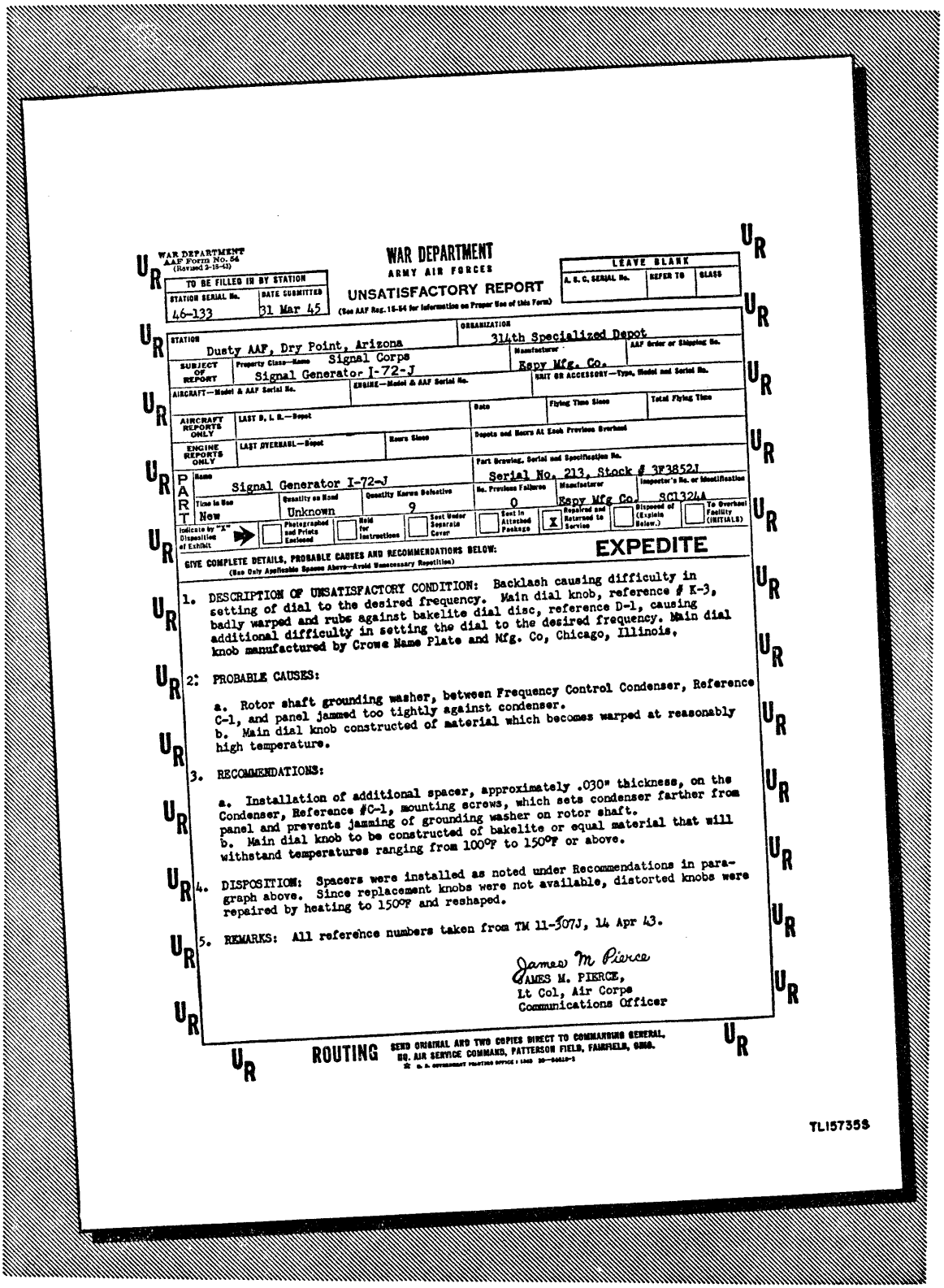
This form supersedes W. D., A. G. O. Form No. 468, 1 December 1943, which may be used until existing stocks are exhausted.

W. D., A. G. O. Form No. 468
30 August 1944

U. S. GOVERNMENT PRINTING OFFICE 16—42849-2

TL19589C

Figure 109. WD AGO Form 468, with sample entries.



WAR DEPARTMENT
AAF FORM NO. 54
(Revised 2-15-43)

WAR DEPARTMENT
ARMY AIR FORCES
UNSATISFACTORY REPORT
(See AAF Reg. 15-54 for Information on Proper Use of this Form)

LEAVE BLANK

A. S. C. SERIAL No.	REFER TO	CLASS

TO BE FILLED IN BY STATION

STATION SERIAL No.	DATE SUBMITTED
46-133	31 Mar 45

STATION: Dusty AAF, Dry Point, Arizona
ORGANIZATION: 314th Specialized Depot

SUBJECT OF REPORT — Property Class—Name: Signal Corps
Signal Generator I-72-J
Manufacturer: Espy Mfg. Co.
AAF Order or Shipping No.:

AIRCRAFT—Model & AAF Serial No.:
ENGINE—Model & AAF Serial No.:
UNIT OR ACCESSORY—Type, Model and Serial No.:

AIRCRAFT REPORTS ONLY — LAST D. I. S.—Depot:
Date:
Flying Time Since:
Total Flying Time:

ENGINE REPORTS ONLY — LAST OVERHAUL—Depot:
Hours Since:
Depots and Hours At Each Previous Overhaul:

PART
Name: Signal Generator I-72-J
Part Drawing, Serial and Specification No.: Serial No. 213, Stock # 3F3852J
Time in Use: New
Quantity on Hand: Unknown
Quantity Known Defective: 9
No. Previous Failures: 0
Manufacturer: Espy Mfg Co.
Inspector's No. or Identification: SC1324A

Indicate by "X" Disposition of Exhibit:
- Photographed and Prints Enclosed
- Held for Instructions
- Sent Under Separate Cover
- Sent in Attached Package
- X Repaired and Returned to Service
- Disposed of (Explain Below.)
- To Overhaul Facility (INITIALS)

GIVE COMPLETE DETAILS, PROBABLE CAUSES AND RECOMMENDATIONS BELOW:
(Use Only Applicable Spaces Above—Avoid Unnecessary Repetition)

EXPEDITE

1. DESCRIPTION OF UNSATISFACTORY CONDITION: Backlash causing difficulty in setting of dial to the desired frequency. Main dial knob, reference # K-3, badly warped and rubs against bakelite dial disc, reference D-1, causing additional difficulty in setting the dial to the desired frequency. Main dial knob manufactured by Crowe Name Plate and Mfg. Co, Chicago, Illinois.

2. PROBABLE CAUSES:

a. Rotor shaft grounding washer, between Frequency Control Condenser, Reference C-1, and panel jammed too tightly against condenser.
b. Main dial knob constructed of material which becomes warped at reasonably high temperature.

3. RECOMMENDATIONS:

a. Installation of additional spacer, approximately .030" thickness, on the Condenser, Reference #C-1, mounting screws, which sets condenser farther from panel and prevents jamming of grounding washer on rotor shaft.
b. Main dial knob to be constructed of bakelite or equal material that will withstand temperatures ranging from 100°F to 150°F or above.

4. DISPOSITION: Spacers were installed as noted under Recommendations in paragraph above. Since replacement knobs were not available, distorted knobs were repaired by heating to 150°F and reshaped.

5. REMARKS: All reference numbers taken from TM 11-307J, 14 Apr 43.

James M Pierce
JAMES M. PIERCE,
Lt Col, Air Corps
Communications Officer

ROUTING: SEND ORIGINAL AND TWO COPIES DIRECT TO COMMANDING GENERAL, HQ. AIR SERVICE COMMAND, PATTERSON FIELD, FAIRFIELD, OHIO.

TL15735S

Figure 109.1. Army Air Forces Form 54, with sample entries.

APPENDIX I (Added)

PREVENTIVE MAINTENANCE TECHNIQUES

1. Meaning of Preventive Maintenance

Preventive maintenance is a systematic series of operations performed at regular intervals on equipment, when turned off, to eliminate major breakdowns, unwanted interruptions in service, and to keep equipment operating at top efficiency. To understand what is meant by preventive maintenance, it is necessary to distinguish between preventive maintenance, trouble shooting, and repair. The prime function of preventive maintenance is to *prevent break-downs* and, therefore, the need for repair. On the other hand, the prime function of trouble shooting and repair is to locate and correct *existing* defects. The importance of preventive maintenance cannot be overemphasized. The entire system of communications depends upon the operating efficiency of each item of equipment when it is needed. Therefore, test equipment that is used to test and repair communications equipment must be kept in excellent operating condition at all times.

Note. The operations in this appendix and in appendix II are considered user maintenance operations. Some operations in appendix III are higher echelon maintenance.

2. Description of Preventive Maintenance Techniques

a. GENERAL. Most of the electrical parts used in Frequency Meter Set SCR-211-(&) require routine preventive maintenance. This preventive maintenance varies. Some parts require a different kind of maintenance than others. Some require more, some less. Definite and specific instructions must be followed. Hit-or-miss techniques cannot be applied. This appendix of the manual contains specific instructions to guide personnel assigned to perform the six basic maintenance operations: Feel, Inspect, Tighten, Clean, Adjust, and Lubricate. Throughout this manual the lettering system for the six operations will be as follows:

F—Feel*	C—Clean
I—Inspect	A—Adjust
T—Tighten	L—Lubricate*

*The Feel and Lubricate operations do not apply to Frequency Meter Set SCR-211-(&).

The first two operations show if the other four are needed. Selection of operations is based on a knowledge of field needs. For example, dust encountered on dirt roads during cross-country travel filters into equipment no matter how much care is taken to prevent it. Rapid changes in weather (such as heavy rain followed by blistering heat), excessive dampness, snow, and ice tend to cause corrosion of exposed surfaces and parts. Without frequent inspections and the necessary tightening, cleaning, and lubricating operations, equipment becomes undependable and subject to break-down when it is needed most.

b. FEEL. The feel operation is used most often to check rotating machinery, such as dynamotors, blower motors, and drive motors, also to determine whether electrical connections and bushings are overheated. Feeling will show the need for lubrication or the existence of other defects requiring correction. The maintenance man *must* become familiar with the normal operating temperatures of motors, transformers, and other parts, to recognize signs of overheating.

Note. It is important to perform the feel operation as soon as possible after shut-down and always before any other maintenance is done.

c. INSPECT. Inspection is the most important operation in preventive maintenance. A careless observer will overlook evidences of minor trouble. Although these defects may not at the moment interfere with performance of the equipment, invaluable time and effort can be saved if they are corrected *before* they lead to major and costly breakdowns. To be able to recognize the signs of a defective set, make every effort to become thoroughly familiar with indications of *normal* functioning. Inspection consists of *carefully* observing all parts of the equipment, noticing their color, placement, state of cleanliness, etc. Inspect for the following conditions:

(1) Overheating, as indicated by discoloration, blistering, or bulging of the parts or surface of the container; leakage of insulating compounds; and oxidation of metal contact surfaces.

(2) Placement, by observing that all leads and cabling are in their original positions.

(3) Cleanliness, by carefully examining all re-

cesses in the units for accumulation of dust, especially between connecting terminals and binding posts. Parts, connections, and joints should be free of dust, corrosion, and other foreign matter. In tropical and high-humidity areas, look for fungus growth and mildew.

(4) Tightness, by testing any connection or mounting which appears to be loose.

d. TIGHTEN, CLEAN, AND ADJUST. These operations explain themselves. Specific procedures to be followed in performing them are given wherever necessary throughout this appendix and Appendix II.

Caution: Screws, bolts, and nuts should not be tightened carelessly. Fittings tightened beyond the pressure for which they are designed will be damaged or broken.

Whenever a loose connection is tightened, it should be moistureproofed and fungiproofed again by applying the varnish with a small brush. See Appendix III for details of moistureproofing and fungiproofing.

e. LUBRICATE. Lubrication refers to the application of grease or oil to the bearings of motors or rotating shafts. It may mean the application of a light oil to door hinges or other sliding surfaces on equipment. Frequency Meter Set SCR-211-(&) requires no lubrication except for two or three drops of special preservative all-temperature lubricating oil (PS) applied to worm and worm gear of the main tuning capacitor after each 6 months of operation or whenever the set is being serviced at Signal Corps repair depots.

3. Switches

a. INSPECT (I). (1) Inspect the mechanical action of each switch and, while so doing, look for signs of dirt or corrosion on all exposed elements. In some cases, it will be necessary to examine the elements of the switch visually; in others, the action of the switch is checked by flipping the control knob or toggle, or pressing the switch button and noting the freedom of movement and amount of spring tension. *Do not disconnect, disassemble, or move wiring on waveband switch.*

(2) Examine ganged switches to see that the contacts are clean. Inspection is visual. Do not pry the leaves of the switch apart. The rotary members should make good contact with the stationary members; and as the former slides into the latter, a spreading of the stationary contact leaves should be visible. Switch action should be free. Wiping action of contacts usually removes any dirt at the point of contact.

b. CLEAN (C). Clean the exterior surfaces of switches with a stiff brush, moistened with dry-cleaning solvent (SD), using care not to disturb the wiring to the waveband switch.

4. Terminal Blocks

a. INSPECT (I). (1) Inspect terminal blocks for cracks, breakage, dirt, loose connections, and loose mounting screws.

(2) Carefully examine connections for mechanical defects, dirt, and corrosion.

b. TIGHTEN (T). Tighten loose screws, lugs, and mounting bolts. When tightening screws, be sure to select a screw driver of correct size. Do not exert too much pressure. Tighten loose connections.

c. CLEAN (C). Clean terminal blocks, when they require it, with a dry brush. When necessary, use a cloth moistened with dry-cleaning solvent (SD). Thoroughly wipe the block with a cloth and then brush it to remove any lint.

5. Jacks and Plugs

Jacks require very little attention, and then only at infrequent intervals. Occasionally it will be necessary to tighten the mounting nut, clean the contacts, or increase the spring tension. Remove dirt with a brush and carbon tetrachloride; remove corrosion with a piece of crocus cloth followed by a clean cloth. Increase spring tension, when necessary. Try the action of the jack after each adjustment. Be sure to keep all soldered connections intact. To clean dirty or corroded telephone type plugs, use paste metal polish (Signal Corps stock No. 6G1516). After cleaning, remove all traces of polish remaining with carbon tetrachloride. Finish off with a clean dry cloth.

6. Cabinets and Chassis

a. INSPECT (I). Inspect the outside and inside of the cabinet thoroughly, paying strict attention to every detail. Inspect the panels for loose knobs, switches, jacks, and screws.

b. CLEAN (C). Clean the cabinets, outside and in, with a clean, dry cloth. Use dry compressed air to blow out all accumulated dirt and dust. Repaint any surface that is found scratched, rusted, or chipped.

c. TIGHTEN (T). Tighten all loose panel screws, plugs, and control knobs.

7. Headset

The headset is essential to the operation of the frequency meter set. The operator must therefore give it the same care as the frequency meter set itself.

a. INSPECT (I). Inspect all external surfaces for dirt and corrosion. See that all cable connections are tight and the plugs and jacks fit together properly.

b. CLEAN (C). Clean all items of the equipment in accordance with the instructions outlined previously for jacks and cabinets.

8. Coupling Shafts and Control Knobs

The control of various capacitors, switches, and resistors, found throughout the set is effected through coupling shafts that connect these items to control knobs located on the front panels. It is important that these shafts and control knobs be kept tight at all times. Use the No. 8 Bristo wrench in the spare parts compartment to tighten these items whenever they are found loose.

9. Batteries

a. GENERAL. Under extreme conditions of temperature and humidity, dry-cell batteries are very perishable. Moisture may enter the cell through the cardboard at points where waxing is incomplete or cracked. Heat accelerates the internal chemical action of the cell even while it is not in use, and thereby causes the dry-cell to become useless during improper storage. Extremely cold temperatures will reduce the voltage and power available. Dry-cells should be stored in a cool, dry place.

b. INSPECT (I). Inspect regularly for signs of deterioration such as bulging, leakage of compound, or visible chemical action. When the set is not to be used for a period of 2 weeks the batteries should be removed from the compartment.

c. TIGHTEN (T). Tighten the nuts to which the connector assembly is fastened.

d. CLEAN (C). Clean connectors and pins with a cloth or, if necessary, with metal polish or emery cloth. If metal polish is used, be sure to remove all residue of the polish after the cleaning operation in order to maintain good contact.

APPENDIX II (Added)

ITEMIZED PREVENTIVE MAINTENANCE

1. Introduction

For ease and efficiency of performance, preventive maintenance on Frequency Meter Set SCR-211-(&) will be broken down into operations that can be performed at different time intervals. In this appendix the preventive maintenance work to be performed on the equipment at the specific time intervals is broken down into units of work called items. The general techniques involved and the application of the FITCAL operations in performing preventive maintenance on individual parts are discussed in appendix I. These general instructions are not repeated in this appendix. When performing preventive maintenance, see appendix I if more information is required for the following items. Perform all work with the equipment disconnected from the power source. After preventive maintenance has been performed on a given day, put the equipment into operation and check it for satisfactory performane.

2. Preventive Maintenance Tools and Materials

The following preventive maintenance tools and materials will be needed:

Common hand tools.
Clean cloth.
#0000 sandpaper.
Crocus cloth.
Paste metal polish (Signal Corps stock No. 6G1516).
Dry-leaning solvent (SD).
Carbon tetrachloride.
Contact burnishing tool.
Screw driver, 3/8" tip.
Screw driver 1/8" tip.
Assorted brushes, 1/2", 1".
Enamel (color of cabinet).

Note. Gasoline will not be used as a cleaning fluid for any purpose. Solvent, dry-cleaning, is available as a cleaning fluid through established supply channels. Oil,

Fuel, Diesel, may be used for cleaning purposes when dry-cleaning solvent (SD) is not at hand. Carbon tetrachloride will be used as a cleaning fluid only in the following cases: on electrical equipment where inflammable solvents cannot be used because of the fire hazard, and for cleaning electrical contacts including relay contacts, plugs, commutators, etc.

3. Item 1, Exterior of Frequency Meter Set SCR-211-(&)

OPERATIONS.

ITC Cabinet.
ITC Knobs, control, switches.
ITC PHONES jack.

4. Item 2, Battery Compartment of Frequency Meter Set SCR-211-(&)

OPERATIONS.

ITCA Battery terminal strips.
ITCA Battery tray and wiring harness.
ITC Batteries.

5. Item 3, Spare Parts Compartment of Frequency Meter Set SCR-211-(&)

OPERATIONS.

ITC Spare parts.

6. Item 4, Headset

OPERATIONS.

ITCA Headset and plug.

7. Preventive Maintenance Check List

The following check list is a summary of the preventive maintenance operations to be performed on Frequency Meter Set SCR-211-(&). The time intervals shown on the check list may be reduced at any time by the local commander. For best performance of the equipment, perform operations at least as frequently as called for in the check list. The echelon column indicates which operations are first echelon maintenance and which operations are second echelon maintenance. Operations are indicated by the letters of the word FITCAL. For example, if the letters ITCA appear in the operations column, the item to be treated must be inspected (I), tightened (T), cleaned (C), and adjusted (A).

Item No.	Operations	Item	When performed		Echelon
			Weekly	Monthly	
1	ITCA-----	Exterior of Frequency Meter Set SCR-211-(&).	---	X	1st
2	ITCA-----	Battery compartment of Frequency Meter Set SCR-211-(&).	X	---	1st
3	ITC------	Spare parts compartment of Frequency Meter Set SCR-211-(&).	---	X	1st
4	ITCA-----	Headset----------	---	X	1st

Note. X indicates when operations are to be performed.

F Feel* I Inspect T Tighten C Clean A Adjust L Lubricate*

APPENDIX III (Added)

MOISTUREPROOFING AND FUNGIPROOFING

1. General

a. Excessive failure of parts and loss of operating efficiency are usually caused, not by inferior parts or equipment, but by the accumulated effects of moisture in high-humidity areas. Rapid temperature changes coupled with conditions of fog, rain, and dew or high humidity promote such failures.

b. The effects of moisture (and fungus growth) on resistors, capacitors, coils, chokes, transformer windings, terminal boards, and insulating strips can be recognized in the form of corrosion, low insulation resistance, flashovers, and crosstalk.

2. Treatment to Reduce Failures

a. To reduce the above failures, a moistureproofing and fungiproofing treatment has been devised which, if properly applied, provides a reasonable degree of protection. The treatment consists of applying a film of moisture- and fungi-resistant varnish to all susceptible parts of the equipment. This film provides a nonwetting surface which forms a moisture barrier. Fungus growth is prevented by a fungicide in the varnish. Equipments which have been so treated are marked

*The Feel and Lubricate operations do not apply to Frequency Meter Set SCR-211-(&).

"MFP," and dated. Equipments not so marked should be examined and if it is obvious that the treatment has not been applied, the equipment should be returned at the first opportunity to third or higher echelon maintenance units for treatment.

b. Retreatment may be required after a period of use. The need for this retreatment will be indicated by excessive failures or the effects outlined above. (See par. 1 *b* above.)

3. Moistureproofing and Fungiproofing Procedure

a. For a detailed description of the varnish-spray method of moistureproofing and fungiproofing, see TB SIG 13. This Technical Bulletin, together with the following information, gives the necessary procedure for treating the equipment.

b. It is not necessary to remove crystals when treating the set. To prevent the wax finish on the coils from melting when drying the set, the temperature should not exceed 135° F.

c. If, during repair, the coating of protective varnish has been punctured or broken, and if complete treatment is not needed to reseal the equipment, apply a brush coat to the affected part. Be sure the break is completely sealed.

APPENDIX IV (Added)

MAINTENANCE PARTS FOR FREQUENCY METER SET SCR-211-(&)

The following information was compiled on 14 July 1945. The appropriate pamphlets of the ASF Signal Supply Catalog for Frequency Meter Set SCR-211-(&) are:

Organizational spare parts: SIG 7-SCR-211.
Higher echelon spare parts: SIG 8-SCR-211.
Fixed plant maintenance list: SIG 10-427, Radio Frequency Meter SCR-211-( ).

For the index of available catalog pamphlets, see the latest issue of ASF Signal Supply Catalog SIG 2.

[AG 300.7 (2 Nov 45)]

BY ORDER OF THE SECRETARY OF WAR:

DWIGHT D. EISENHOWER
Chief of Staff

OFFICIAL:
EDWARD F. WITSELL
Major General
The Adjutant General

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Refer to FM 21-6 for explanation of distribution formula.

U. S. GOVERNMENT PRINTING OFFICE : O—1948

WAR DEPARTMENT
UNSATISFACTORY EQUIPMENT REPORT

FOR	TECHNICAL SERVICE: MATÉRIEL		DATE
FROM	ORGANIZATION		STATION
TO	NEXT SUPERIOR HEADQUARTERS	STATION	TECHNICAL SERVICE

COMPLETE MAJOR ITEM

NOMENCLATURE	TYPE	MODEL	
MANUFACTURER	U. S. A. REG. No.	SERIAL No.	DATE RECEIVED
EQUIPMENT WITH WHICH USED *(if applicable)*			

DEFECTIVE COMPONENT—DESCRIPTION AND CAUSE OF TROUBLE

PART No.	TYPE	MANUFACTURER	DATE INSTALLED
DESCRIPTION OF FAILURE AND PROBABLE CAUSE *(If additional space is required, use back of form)*			

DATE OF INITIAL TROUBLE	TOTAL TIME INSTALLED			TOTAL PERIOD OF OPERATION BEFORE FAILURE					
	YEARS	MONTHS	DAYS	YEARS	MONTHS	DAYS	HOURS	MILES	ROUNDS

BRIEF DESCRIPTION OF UNUSUAL SERVICE CONDITIONS AND ANY REMEDIAL ACTION TAKEN

TRAINING OR SKILL OF USING PERSONNEL			RECOMMENDATIONS *(If additional space is required, use back of form)*
POOR	FAIR	GOOD	

ORIGINATING OFFICER

TYPED NAME, GRADE, AND ORGANIZATION	SIGNATURE

FIRST ENDORSEMENT

TO CHIEF	TECHNICAL SERVICE	OFFICE	
NAME, GRADE, AND STATION		STATION	DATE

Instructions

1. It is imperative that the chief of technical service concerned be advised at the earliest practical moment of any constructional, design, or operational defect in matériel. This form is designed to facilitate such reports and to provide a uniform method of submitting the required data.
2. This form will be used for reporting manufacturing, design, or operational defects in matériel, petroleum fuels, lubricants, and preserving materials with a view to improving and correcting such defects, and for use in recommending modifications of matériel.
3. This form will not be used for reporting failures, isolated material defects or malfunctions of matériel resulting from fair-wear-and-tear or accidental damage nor for the replacement, repair or the issue of parts and equipment. It does not replace currently authorized operational or performance records.
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W. D., A. G. O. Form No. 468
30 August 1944

This form supersedes W. D., A. G. O. Form No. 468, 1 December 1943, which may be used until existing stocks are exhausted.

U. S. GOVERNMENT PRINTING OFFICE 16—41543-1